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SCIENTIFIC PAPERS

**SERIES “MANAGEMENT, ECONOMIC
ENGINEERING IN AGRICULTURE AND RURAL
DEVELOPMENT”**

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C O N T E N T S

1.ANALYSIS OF INCOME INEQUALITIES AND FOOD SECURITY AMONG FARMERS IN ABIA STATE, SOUTH EASTERN NIGERIA	
Nnanna M. AGWU, Ogbonnaya Ukeh OTEH.....	7
2.THE ECONOMIC IMPORTANCE OF THE BIODIVERSITY OF THE INVERTEBRATES FAUNA IN THE CORN CULTURE SOIL IN COPȘA MICĂ (SIBIU COUNTY) ROMANIA	
Iuliana ANTONIE.....	15
3.DETERMINANTS OF WOMEN’S PARTICIPATION IN SELF HELP GROUP LED MICRO-FINANCING OF FARMS IN ISUIKWUATO LOCAL GOVERNMENT AREA OF ABIA STATE, NIGERIA	
Chidozie Onyedikachi ANYIRO, Paschal Nnaemeka AJUKA, Christopher Ogbonna EMEROLE, Ijeoma Esther ORJI.....	21
4.MANAGEMENT ISSUES OF THE CORN CROP ON THE EUTRICAMBOILS FROM BREBU AREA (PRAHOVA COUNTY)	
Mihai BERCA, Valentina Ofelia ROBESCU, Roxana HOROIAȘ.....	31
5.STUDIES AND RESEARCHES CONCERNING THE POSSIBILITY OF USING HYDROGEN IN TURBO ENGINES	
Marius BIBU, Mariana DUMITRU.....	35
6.RISK ASSESSMENT IN PROJECT PLANNING USING FMEA AND CRITICAL PATH METHOD	
Sandra Milena CHOLES ARVILLA.....	39
7.ETHICS AND COMMUNICATION IN MANAGEMENT	
Reta CONDEI, Ioana NICULAE, Petrică ȘTEFAN, Agatha POPESCU.....	47
8.THE MANAGEMENT OF RISKS IN BUSINESS AND IN THE MANAGEMENT OF HUMAN RESOURCES	
Reta CONDEI, Ioana NICULAE, Georgiana Melania COSTAICHE, Agatha POPESCU.....	55
9.RESEARCHES ON THE DIGESTERS AND REACTORS WHICH CAN BE USED IN A FARM SCALE BIOGAS PLANT	
Mariana DUMITRU, Marius BIBU.....	63

10.THE MAIN STATISTIC INDICATORS ANALYSIS THAT CHARACTERIZE THE MAIZE CROP IN ROMANIA, IRAK AND WORLDWIDE

Mohamed Dhary Yousif EL-JUBOURI, Manea DRĂGHICI..... 69

11.RISKS, VULNERABILITY AND DETERMINANTS OF WOMEN FARMERS' PARTICIPATION IN SELF-HELP-GROUP (SHG)-LED MICROFINANCING IN ISUIKWUATO, ABIA STATE, NIGERIA

**Christopher Ogbonna EMEROLE, Charles Kelechi OSONDU,
Chidozie Onyedikachi ANYIRO..... 75**

12.USING IMAGING ANALYSES TO PREDICT CHEMICAL PROPERTIES OF ORANGE FRUITS

Tarek FOUDA, Shimaa SALAH..... 83

13.DETERMINANTS OF CHANGES IN WORK PROFITABILITY IN POLISH AGRICULTURE IN 2004-2013

Zbigniew GOŁAŚ..... 86

14.DAIRY BUSINESS: THE CASE OF BULGARIAN DAIRY CATTLE FARMERS

Tsvetana HARIZANOVA-METODIEVA..... 95

15.EFFECT OF REFLECTOR APPLICATION ON PV PANEL PERFORMANCE UNDER EGYPTIAN CONDITIONS

**Mamdouh Abbas HELMY, E. M. KHALIFA, A. M. OKSHA,
A. W. ELHADDAD..... 103**

16.ENDOGENOUS DETERMINANTS OF INVESTMENTS IN FARMS OF SELECTED COUNTRIES OF CENTRAL AND EASTERN EUROPE

Dariusz KUSZ, Stanisław GEDEK, Maria RUDA, Stanisław ZAJĄC..... 107

17.ECONOMIC ANALYSIS OF SELECTED OPTIONS OF STRAW USE DEPENDING ON HARVESTING TECHNOLOGY

Łukasz KUTA, Izabela GOŁĄB..... 117

18.PRODUCTION COSTS AND PROFITABILITY OF THREE POTATO VARIETIES: LORD, VINETA AND JELLY IN YEARS 2011-2012

Łukasz KUTA, Izabela GOŁĄB..... 123

19.MARKETING RESEARCH ON WINE CONSUMERS PREFERENCES IN ROMANIA

Raluca Georgiana LĂDARU, Silviu BECIU..... 127

20.ASPECTS REGARDING WINE PRODUCTION AND WINE SECTOR COMPETITIVENESS IN ROMANIA

**Georgiana-Raluca LĂDARU, Silviu BECIU, Ionela Mițuko VLAD,
Maria-Cristina PĂDURE..... 131**

21.THE ANALYSIS OF THE RURAL INFRASTRUCTURE DEVELOPMENT IN SOUTH-MUNTENIA REGION

Elena LASCĂR..... 135

22.AGROCHEMICAL SERVICE OF AGRICULTURE IN THE REPUBLIC OF MOLDOVA: PAST AND PRESENT

Tamara LEAH..... 139

23.COMPETITIVENESS AND QUALITY OF AGRIFOOD PRODUCTS - KEY FACTORS FOR THE SUCCESS OF EXPORT PROMOTION

Aurelia LITVIN, Cornel COȘER..... 147

24.THE FOREIGN ECONOMIC ACTIVITY - AN IMPORTANT FACTOR IN SUSTAINABLE DEVELOPMENT OF THE REPUBLIC OF MOLDOVA

Aurelia LITVIN, Svetlana PETRASCU..... 155

25.A SOCIO-ECONOMIC ANALYSIS OF THE RURAL AREA IN THE WESTERN REGION

**Nicoleta MATEOC-SIRB, Teodor MATEOC, Camelia MĂNESCU,
Ada-Flavia CRISTINA, Caius GOȘA, Ioan GRAD..... 163**

26.INTERNATIONAL TRADE WITH WHEAT (2009-2011)

Dragoș Mihai MEDELETE, Radu Lucian PÂNZARU..... 169

27.INTERNATIONAL COMMERCIAL TRADE WITH POTATOES (2009 - 2011)

Dragoș Mihai MEDELETE, Radu Lucian PÂNZARU..... 175

28.STUDIES ON THE FORMATION AND SPREADING OF THE MINERAL SOIL SLOPES IN CARAS-SEVERIN

**Casiana MIHUȚ, Anișoara DUMA-COPCEA, L. NIȚĂ,
Olimpia Alina IORDĂNESCU..... 181**

29.STUDIES AND RESEARCH ON THE SOILS COATING FROM ZAVOI COMMUNE, CARAS - SEVERIN COUNTY

Casiana MIHUȚ, Anișoara DUMA-COPCEA, R. MUNEAN..... 187

**30.ELECTROCHEMICAL METHODS DETERMINATION OF HEAVY METALS
IN WINE BEVERAGE ACHIEVING ECOSANOGENE**

George MOISE..... 191

**31.INFLUENCE OF COMMERCIALIZATION ON FOOD SECURITY STATUS OF
CASSAVA PRODUCING HOUSEHOLDS IN ABIA STATE, NIGERIA**

Chibuzor NWACHUKWU, Chima EZEH, Ifeanyi NWACHUKWU..... 195

**32.CONTRIBUTIONS OF MICROFINANCE INSTITUTIONS TO ECONOMIC
EFFICIENCY OF CASSAVA FARMERS IN ABIA STATE, NIGERIA**

**Kingsley Chukwuemeka OBIKE, Charles Kelechukwu OSONDU,
Christopher Ogbonna EMEROLE..... 201**

**33.EFFECT OF COMMERCIALIZATION ON PRODUCTIVE CAPACITY AMONG
CASSAVA PRODUCING HOUSEHOLDS IN IKWUANO LOCAL GOVERNMENT
AREA OF ABIA STATE, NIGERIA**

Ogbonnaya Ukeh OTEH, Ifeanyi N. NWACHUKWU..... 213

**34.DETERMINANTS OF MARKETING EFFICIENCY FOR PACKAGED WATER
IN IMO STATE, NIGERIA: MAXIMIZING FIRMS ASSETS TO IMPROVE
CONSUMER WELFARE**

Ogbonnaya Ukeh OTEH, Etomchi Maria-stella, NJOKU..... 221

**35.ECONOMIC AND FINANCIAL ASPECTS OF ACTIVITY IN S. C. "AL THEO &
DEA" S. R. L. - SALCIA COMMON, TELEORMAN COUNTY (2011 – 2013)**

Radu Lucian PÂNZARU, Dragoş Mihai MEDELETE..... 231

**36.ECONOMIC AND FINANCIAL ASPECTS OF ACTIVITY IN SC "AGRO
ANCA" SRL, ROŞIORII DE VEDE, COUNTY TELEORMAN (2011-2012)**

Radu Lucian PÂNZARU, Dragoş Mihai MEDELETE..... 239

**37.FACTOR ANALYSIS OF LABOR PRODUCTIVITY IN AGRICULTURE IN
TERMS OF SUSTAINABLE DEVELOPMENT**

Irina Elena PETRESCU..... 247

**38.CONSIDERATIONS REGARDING THE CRITERIA OF EFFICIENCY FOR THE
CLASSIFICATION OF DAIRY FARMS**

Agatha POPESCU, Reta CONDEI..... 253

39.RESEARCH ON A SIMPLIFIED MIXED MODEL VERSUS CONTEMPORARY COMPARISON USED IN BREEDING VALUE ESTIMATION AND BULLS CLASSIFICATION FOR MILK PRODUCTION CHARACTERS

Agatha POPESCU..... 263

40.RESEARCH ON THE BREEDING VALUE ESTIMATION FOR BEEF TRAITS BY A SIMPLIFIED MIXED MODEL

Agatha POPESCU..... 271

41.RESEARCH ON THE NORMAL DISTRIBUTION OF VARIABLES AS A CONDITION FOR THE CORRECT APPLICATION OF THE STATISTICAL MODELS FOR PROCESSING DATA

Agatha POPESCU..... 277

42.RESEARCH ON THE MULTITRAIT ASSESSMENT OF THE GENETIC MERIT FOR MILK AND MEAT PRODUCTION IN THE ROMANIAN FRIESIAN USING A BLUP SIMPLIFIED MODEL

Agatha POPESCU..... 283

43.SOME CONSIDERATIONS ON THE PROSPECTS OF SORGHUM CROP

Agatha POPESCU, Reta CONDEI..... 295

44.ECONOMIC GROWTH OF THE AGRICULTURAL SECTOR OF MOLDOVA COMPARED TO CENTRAL AND EASTERN COUNTRIES OF EUROPE

Aliona ȘARGO 305

45.SYSTEMS OF SOCIAL PROTECTION IN THE ROMANIAN RURAL AREA

Elena SIMA..... 311

46.GREEN PRICES – A REFLECTION OF ENVIRONMENTAL PROTECTION

Daniela SIMTION..... 315

47.STUDY ON NOISE LEVEL GENERATED BY HUMAN ACTIVITIES IN SIBIU CITY, ROMANIA

Cristina STANCĂ-MOISE..... 319

48.DIVERSITY AND THE MAIN ECOLOGICAL REQUIREMENTS OF THE EPIGEIC SPECIES OF FOREST ECOSYSTEMS IN THE SIBIU COUNTY, IN THE YEARS 2013-2014

Cristina STANCĂ-MOISE..... 323

49.PROMOTION AND MARKETING OF BUCHAREST - PRAGUE TOURS

Petrică ȘTEFAN, Reta CONDEI..... 327

50.QUANTITATIVE RESEARCH ON CONSUMER BEHAVIOR BY OPTICAL RED WINE MARKETING

Roxana STOIAN..... 331

51.MOLDOVAN AGRI-FOOD TRADE UNDER THE INFLUENCE OF INTEGRATION PROCESSES

Alexandru STRATAN..... 339

52.VULNERABILITIES IN ACHIEVING AGRICULTURAL POTENTIAL OF ROMANIA

Cristian TEODOR..... 345

53.ONLINE PLATFORM AND TRAINING METHODOLOGY IN MOBIVET 2.0: THE OPTIMUM TOOL FOR SELF-DIRECTED LEARNERS AND TRAINERS IN VOCATIONAL EDUCATION AND TRAINING

**Sorin IONITESCU, Dorina Adriana POPOVICI, Ioannis HATZILYGEROUDIS, 351
Andreea Elena VOROVENCI, Annalise DUCA**

ANALYSIS OF INCOME INEQUALITIES AND FOOD SECURITY AMONG FARMERS IN ABIA STATE, SOUTH EASTERN NIGERIA

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Abstract

The study analysed income inequalities and food security status of farmers in South Eastern Nigeria, using Abia State. Specifically, the study accessed the income inequalities of the farmers; determine the food security status of the farmers; estimate the factors that influence food security among the farmers in the study area. Multi-stage sampling technique was adopted in the selection of location and 180 respondents used for the study. The study employed Gini-coefficient, food security index and multiple regressions in the analysis of the data collected. Result shows that Gini coefficient value was 0.67, showing that there was high income inequality in the study area. Majority of the respondents, constituting about 68.57 percent were food insecurity in the study area. The regression results showed that age of the household head, educational attainment of the household head and monthly income of the head were the major determinants of food security status in the study area. The study recommends that government policies targeted at farmers should be strengthened, in order to bridge the gap in farmers' income. Government should also create opportunities for small scale businesses to flourish in rural areas. This will provide the people the much needed income, amongst other things.

Key words: farmers, food security, Income, inequalities, South Eastern Nigeria

INTRODUCTION

Income distribution pattern over the years has been a major concern in the determination of the level of economic growth and development of any country. Specifically, the 19th century witnessed resurgence in theoretical and empirical attention by economists to the distribution of income and wealth [13]. In Nigeria, between 1965 and 1975 serious income disparity widened substantially [22, 11, 18]. This means that though the economy seemed to be performing strongly, the gap between the lower income households and the upper income households widened, which was an indication that the rapid economic growth experienced had only resulted in further concentration of national income in the hands of few proportion of the population [22, 16]. The level of income inequality according to [11] worsened after the Structural Adjustment Programme (SAP) of 1986.

Using the National Living Standard Survey

(NLSS) data, [32] found out that the overall Gini-index for Nigeria was 0.580. Sectorically, income inequality was seen to be higher in the rural areas when compared with the urban areas; and that employment income increases income inequality while agricultural income decreases it. Income inequality has been known to be closely related to poverty [5, 2, 1]. As a result, income inequality can be detrimental to economic growth and development of any country.

Although predicted poverty reduction scenarios vary greatly depending upon the rate and nature of poverty related policies, actual evidence suggests that the depth and severity of poverty is still at its worst in Nigeria [27]. This situation is very disturbing and worrisome given the huge human and material resources that have been devoted to poverty reduction by successive governments and yet no noticeable success has been achieved in this direction. Furthermore, despite the commitments already shown by many countries including Nigeria

and the global approach as enshrined in the Millennium Development Goals towards the achievement of the goal of reducing income inequality, efforts geared at achieving this have been greatly hindered by insufficient knowledge of how to design appropriate policies that would call for broad participation, the modality of their implementation procedures and measurement of the overall impact on the economy.

A high level of income inequality exists between Nigerian rural and urban area [32]. There also exists variations in the level of income obtained by people in the rural areas is on the increase which could very much be linked to the growing dimension of poverty even among the rural households, as high level of income inequality produces an unfavourable environment for economic growth and development [31]. This differential between rural and urban incomes, most times, accounts for the rural-urban migration and hinders food security.

Food security is defined as when all people at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and for food preference for an active and healthy life [6]. Food as a basic necessity of life is seen in the fact that it is a means of sustenance and an adequate food intake in terms of quantity and quality, is a key for a healthy and productive life [29]. The importance of food is also shown in the fact that it accounts for a substantial part of a typical household budget. The concern for food security and nutritional well-being in an economy is predicted by role of human element in economic development [26]. The economic development of a nation in turn is dependent on its factor endowment. This includes the non-human and human resources. The productive capacity of the human resources is however, a function of how well they are fed.

Food scarcity is currently both a fundamental objective and an expected outcome of development policies in Nigeria as the country faces a challenge in meeting the basic food needs of its over growing population. Available data from the NBS (2003) [23] and the NDHS (2003) [24], showed that, the

Nigerian population especially women and children lived in severe social desperation, with many households being food insecure, with poor access to resources to meet basic needs, resulting in nutritional deficiencies.

Over the years, a lot of programmes have been instituted to ameliorate the problem of food security in Nigeria. Among the programmes are, the establishment of the Rural Integrated Agricultural Development Programme (ADP), Green Revolution Programme (GR) Agro-service Centre Programme (ASC), National Seed Service (NSS), Operation Feed the Nation (OFN), Directorate of Food, Road and Rural Infrastructure (DFRRI), National Agricultural Land Development Agency (NALDA), National Accelerated Food Production (NAFP), National Special Food Production (NSFP), Family Support Programme (FSP), Family Economic Advancement Programme (FEAP), Better Life Programme (BLP) and more recently presidential initiatives on cassava, yam, cocoa yam, rice, vegetable oil etc. all these are aimed ensuring food security and reducing income inequalities in Nigeria.

Despite, all these attempts, Nigeria have had a varied history of both good and bad of the food production, sustainability and food security [30]. Government at various times through various programmes has intervened, but the food deficit argument by food imports have remained and seem to be on the trajectory that is up and down of increase. Food security is also on top of the Millennium Development Goal of the United Nations and Federal Government development agenda. However, the goal of food security seems increasingly elusive because the formulation and implementation of agricultural policies alone are not yielding the desired results [33]. The consequences are that more Nigerians live below poverty line and are food insecure. This is exacerbated by the wide disparities i.e. the differences that are increasing between the urban and rural areas.

Given the high rise in prices, food importing nations like Nigeria will face increased costs in meeting domestic food demands. The implication is that the already existing hunger, malnutrition and food insecurity will re-double.

This emerging scenario in Nigeria has engendered a bloat in the percentage of food insecure households, especially those residents in the rural areas where the effect of government policies are rarely felt and as such inequalities will continue to widen. Statistically, the percentage of food insecure households was reported to be 18 percent in 1986 and over 40 percent in 2005 [33]. This figure seems to be increasing by the day; because of inequalities in income and poverty status of majority. Many studies have indicated the relationship between income and food consumption [4, 14, 7, 8, 9].

Over 70 percent of the population lives in the rural areas. Often in conditions of chronic poverty, characterized by subsistence production, limited access to markets, distribution network and opportunities for income generation [21]. While overall socio-economic development has taken place, disparities i.e. there are difference between rich and poor, are increasing among urban and rural areas [21]. The causes and implications of changes in inequality in many societies remain unclear [34]. The components that make up the acceptable standard of living can be represented as a composite whole by the real income expressed in currency values, in this case naira. Since, poverty can be linked to the income level of individuals of households and their standard of living is a measure of income obtained or received by them. It then becomes necessary to analyse income inequalities and food security of farmers in Abia State, Nigeria, where the occupation of majority, especially those in the rural area is farming. Specifically, the objectives of the study are to: access the income inequality of the farmers; determine the food security status of the households; determine the factors that influence food security among the farmers in the study area; and make recommendations based on the findings.

MATERIALS AND METHODS

The study area is Abia State. Abia State is one of the 36 States in Nigeria. The State lies

between Longitude $04^{\circ} 45'$ and $06^{\circ} 07'$ North and Latitude $07^{\circ} 00'$ and $08^{\circ} 10'$ East. It is situated in the South-East geo-political zone of Nigeria and is bounded by Imo State on the West, Ebonyi and Enugu States on the North, Cross Rivers and Akwa Ibom States on the East and Rivers State on the South. The State has a population density of 580 persons per square kilometer and a population of 2,833,999 persons (NPC, 2007) [25]. It has three senatorial zones namely Abia North, Abia South and Abia Central with seventeen Local Government Areas (L.G.As). Agriculturally, the State is divided into three agricultural zones also. They are Umuahia, Ohafia and Aba Zones.

The climate of the State is a tropical one and usually humid all year round; with two seasons, the rainy and the dry seasons. The rainy seasons starts from March to October while the dry season starts from November and ends February/March.

The major occupation of the people is farming and the major crops grown are Maize, yam, cassava, rice, vegetable, etc. Livestock kept include, goat, sheep. Pigs, etc. Plantain, palm oil, cocoa and rubber are some of the cash crops produced by the people.

Umuahia, Aba and Ohafia are the urban areas, while the rest are rural. Aba which is the commercial nerve centre of the State is home to many industrial outfits including agricultural processing firms.

Multi-stage sampling technique was adopted for this study. First, two Local Government Areas (L.G.As) were selected from each of the three agricultural zones. From these Local Government Areas, three communities were chosen. Finally, a random selection of twenty farmers was selected each from the three communities, bringing a total of one hundred and eighty (180) farmers/respondents. Primary source of data was used for the study. In order to realize the objectives, Gini-coefficient; food security index, and multiple regressions was employed. The model for the Gini-coefficient is specified thus:

$$Lgin(y) = 2 \sum_{i=1}^n i \left[-\frac{n+1}{2} \right] y_i$$

Where: n = number of observation
 μ = mean of the distribution
 y_i = income of the jth household
 IGINI = Income Gini

This model has been used in the past by [31].
 The food index formula is given as:

$$Fi = \frac{\text{per capital food expenditure for the } i\text{th households}}{\frac{2}{3} \text{ means per capital food expenditure of all household}}$$

Where Fi = Food security index
 When $Fi \geq 1$ = Food secure ith household
 $Fi \leq 1$ = Food insecure ith household
 This model has been used in the past by [29].
 The implicit function of the multiple regressions is given as:

$Q = f(X_1 \dots X_n e)$
 Q = expenditure on food and non food items
 $X_1 \dots X_n$ = explanatory variables
 e = error term

The four functional forms of the model, linear, Semi-log, double log and exponential were tried and the one (double log functional form) that gave the best fit based on econometric considerations was chosen.

RESULTS AND DISCUSSIONS

Assessment of the Income Inequality among the Respondents

The Gini-coefficient has been used in the past to measure the level of inequalities in many other contexts besides income, including wealth, education, energy consumption, etc [19]. However, this study was based on income inequalities. Inequality decomposition is a standard technique for examining the contributions of inequality of particular characteristics and can be used to assess income recipient characteristics and income package influences [32, 10]. According to [15], inequality can be conceptualized as the dispersion of a distribution, whether one is considering income, consumption or some other welfare indicators.

In this study the Gini coefficient obtained using the formula as specified above was

0.67. This result means that there is a high income inequality in the study area. According to [17]; Gini coefficient higher than 0.35 indicates higher inequality. Poverty and income inequality are closely related and it has been argued that income inequality is a manifestation as well as strong cause of poverty [35]. Furthermore, [20] found that a high level of poverty in the late 1990s in Russia was due more to the rise in income inequality. Thus as income inequality increases, the incidence of poverty also increases. The result of the present study is in line with the findings of other researchers [eg., 3, 37].

Food Security Status of the Household in Abia State, South East, Nigeria

The Table 1 shows the food security status of the respondents in the study area. The results revealed that majority of the respondents are food insecure. The food insecure household constituted about 68.57 percent while food secure household constituted about 31.43 percent.

Table 1. Distribution of food security status of the respondents

Food security index	Frequency	Percentage
< 1.00	48	68.57
> 1.00	22	31.43
Total	70	100

Source: Computation from Field Survey Data 2013

Determinants of Food Security Status among farming Households in Abia State, Nigeria

As shown in Table 2, the double log functional form was chosen as the lead equation based on some econometric considerations, like the number of significant variables, the R^2 -value and the F-ratio value. The results of the Ordinary Least Square (OLS) estimates showed that age of the household head, educational attainment of the household head and monthly income of the head were significant at various probability levels and therefore determinants of food security status in the study area.

Age of the household head was significant at one percent probability level with a positive sign. This implies that the older the household head, the probability of that particular

household been food secure. This result is in contrast with [29]. The possible explanation could be that with increasing age, household heads must have finished training some of their children and then depend mostly on these children to supply their food needs or household needs. The coefficient of educational attainment of the household was positive and significant at 10 percent probability level. This implies that the higher the level of education of the head, the more food secure that households will be. Education as it were has the tendency of exposing people and placing them in vintage positions over others who are not so much educated. This includes the knowledge of food combination among other things. This result disagrees with [28] but agrees with

[10].

Monthly income of the household head was positive and highly significant at one percent probability level. This means that as monthly income of the household head increases, there is 99 percent probability that the household will be food secure. Income had a positive sign and statistically significant at 99 percent confidence level. Increasing income means that households should be able to have access to food through affordability. This finding is consistent with [29, 36]. The R^2 as 0.646, meaning that 64.6 percent of the variability was explained in the model; while the F-ratio was 5.377 which are significant at one percent signifying the overall fitness of the equation.

Table 2. Estimates for the Determinants of Food Security Status among Households in Abia state

Variables	Linear	Semi-log	Double-log	Exponential
Constant	-0.348 (-0.312)	-8.169 (-2.167)*	-9.312 (-4.832)***	-2.412 (-2.844)***
Age (X_1)	0.003 (0.145)	0.306 (0.393)	0.660 (3.350)***	0.013 (1.313)
Educational attainment (X_2)	0.103 (1.098)	0.389 (0.249)	1.206 (2.117)*	0.129 (2.646)***
Monthly income (X_3)	2.130 (4.000)***	0.739 (3.492)***	0.369 (3.405)***	8.95E.007 (1.125)
Household size (X_4)	0.028 (0.300)	0.119 (0.307)	0.108 (0.546)	0.022 (0.449)
Gender of Household head (X_5)	-0.758 (-3.028)***	-0.474 (-1.401)	-0.564 (-1.523)	-0.100 (-0.551)
Dependency ratio (X_6)	0.036 (0.320)	0.180 (0.633)	-0.007 (-0.051)	-0.013 (-0.221)
R^2	0.065	0.204	0.646	0.212
F-ratio	2.515	2.601	5377***	2.736

Note. Figure in parenthesis are t-values; *, ***- denote 10 percent and 1 percent levels of significance respectively.
Source: Computation from Field Survey Data, 2013.

CONCLUSIONS

The study has shown that there is high income inequality in the study area. The regression results have also shown that, age of the household head, educational attainment of household head and monthly income were the determinants of households' food security status in the study and that majority of the respondents, constituting about 68.57 percent were food insecure in the study area.

-The study recommends that efforts should be made to narrow down or close the gap of income disparities. Efforts should also be made to increase farmers' income. To this end, government policies targeted at farmers should be strengthened. This will in no small way boost farmers' income and thus closing up the gap.

-Employment opportunities should be created in the rural areas. To this end small scale business opportunities should be made

available. This will provide the people the much needed income.

-Enlightenment should be mounted to educate the populace on the cheap but available foods items within their localities. It is very possible that these items exist but due to lack of knowledge, the majority are not aware of it and often times really on expensive food stuffs which they cannot afford.

-Government on its part should try to reduce and stabilize the prices of food items. This will in no small way make them available to the people.

REFERENCES

- [1]Aboyade, O., 1983, Integrated economics: a study of developing economies; Addison- Wesley Publishers Ltd.
- [2]Adams, R.H. (Jnr), 1999, Non-farm income, inequality and land in rural Egypt. PRMPO/MNSED, unpublished report for comment, World Bank, Washington DC
- [3]Adejare, A.A., 1999, Impact of soyabean consumption of food sufficiency in Ibadan metropolis. M.Sc Thesis, Department of Agricultural Economics, University of Ibadan, Nigeria.
- [4]Adenegan, K.O., Oladele, O.I., Ekpo, M.N., 2007, Impact of Agricultural Export on Food Security in Nigeria. Food, Agriculture and Environment 2(1): 107 – 112.
- [5]Addison, T., Cornia, G.A., 2001, Income Distribution Policies for Faster Poverty Reduction. WIDER Discussion Paper No. 2001/93, World Institute for Development Economic Research.
- [6]African Union/New Partnership for African Development (NEPAD), 2006, Progress Towards the Attainment of 1996 World Food Summit Commitments. National Position Paper Presented at the African Food Security Summit held at Abuja, Nigeria. December, 4-7.
- [7]Agwu, N.M., 2008, Comparative Analysis of the Demand for Beef and Chevon among Households in Enugu Metropolis of Enugu State, Nigeria. International Journal of Agriculture and Rural Development, 11(1):61-66.
- [8]Agwu, N.M., 2009, Economics of Processing Maize into Pap (Akamu) and Maize meal (Agidi) in Enugu State, Nigeria. Journal of Sustainable Development, 6(1): 47-53.
- [9]Agwu, N.M., Nwachukwu, I. N., Okoye, B. C., 2011, Worsening Food Crisis in Nigeria: A Discourse on Bailout Options. Sacha Journal of Environmental Studies, 1(1):64-68.
- [10]Agwu, N.M., Orji, C. O., 2013, Empirical Analysis of Income Inequalities and Welfare among Farmers in South Eastern Nigeria. Journal of Agricultural Sciences, 8(1):36-42.
- [11]Aigbohkan, B.E., 1999, The Impact of Adjustment Policies and Income Distribution in Nigeria: An Empirical Study. Research Report No. 5. Development Policy Centre, Ibadan, Nigeria.
- [12]Aigbokhan, M.S., 1997, Poverty Alleviation in Nigeria: Some Macroeconomic Issues. NES Annual Conference Proceedings. Pp. 181-209.
- [13]Atkinson, A.B., F. Bourguignon, 2000, Introduction: Income Distribution and Economics. In A.B. Atkinson and F. Bourguignon (eds). Handbook of Income Distribution, Vol. 1, North Holland: Amsterdam.
- [14]Babatunde, R.O., Omotesho, O.A., Sholotan, O.S., 2007, Socio-economic Characteristics and Food Security Status of Farming Households in Kwara State, North Central, Nigeria, Pakistan Journal of Nutrition 6(1): 49 – 58.
- [15]Babatunde, R.O., 2008, Income Inequality in Rural Nigeria: Evidence from Farming Households Survey Data. Australian Journal of Basic and Applied Sciences, 2 (1):134 –140.
- [16]Clarke, G.L., Colin, X., Zou, H., 2003, Finance and Inequality: Test of Alternative Theories. World Bank Policy Research Working Paper 2984. Washington DC. World Bank
- [17]Dillon, J.L., Hardaker, J.B., 1993, Farm Management Research for Small Farmer Development. Rome: FAO
- [18]Ipinaiye, A.O., 2001, A Decomposition Analysis of the Sources of Income Inequality in Ibadan Metropolis. Unpublished B.Sc Project, Department of Agricultural Economics, University of Ibadan.
- [19]Jacobson, A., Milman, A.D., Kammen, D.M., 2007, Letting the (energy) Gini out of the Bottle: Lorenz Curves of Cumulative Electricity Consumption and Gini coefficients as Metrice of Energy Distribution and Equity. Energy Policy 33:1825 – 1832
- [20]Kolenikov, S ., Shorrocks, A., 2003,. A Decomposition Analysis of Regional Poverty in Russia. Discussion Paper No. 2003/74. World Institute for Development Economic Research (UNU/WIDER), Helsinki.
- [21]Lapriorea, C., Muehlhoff B. E., 2005, Food Security and Nutrition Trend in West Africa Challenges and Way Forward. Theme. Improving the year-round Availability of Nutritionally Adequate, Safe and Affordable Food Supplies at National and Community levels. International Workshop Food-Based Approaches for a Healthy Nutrition, Quagadougou. Nov. 23-28.
- [22]Matlon, P., 1979, Income Distribution among Farmers in Northern Nigeria: Empirical Result and Policy Implications. African Rural Economy Paper No. 18. East Lansing, Mich, USA: Michigan State University.
- [23]National Bureau of Statistics, 2003, Poverty Profile for Nigeria; Abuja: National Bureau of statistics.
- [24]NDHS, 2003, National Demographic and Health Survey (NDHS) for Nigeria calvaton, Md, United States: National Population Commission and ORC/Macro

- [25]National Population Commission, 2007, Results of the 2006 Population Census. National Population Commission, Abuja, Nigeria, 2007
- [26]Okunmadena, F., 2001, Poverty Reduction in Nigeria: A Four Point Agenda. Annual Guest Lecture of the House, University of Ibadan, Ibadan.
- [27]Okunmadewa, F. Y., Yusuf, S.A., Omonona, B.T., 2005, Social Capital and Poverty Reduction in Nigeria. Revised Report Submitted to Africa Economic Research Consortium (AERC) Nairobi, Kenya.
- [28]Omonona, B. T., Agoi, G.A., 2007, An Analysis of Food Security Situation among Nigerian Urban Households; Evidence from Lagos State Nigeria. *Journal of Central European Agriculture*, 8(3): 397-406.
- [29]Omonona, B. T., Oni, O. A., Akpan, E., 2007, The Determinants of Demand for Nigeria's Agricultural Export Commodities. *Pakistan Journal of Social Sciences*. 4(2), 247 – 251.
- [30]Omotor, D.G., 2009, Food Security and Nutrition Trends in Nigeria. Munich Personal REPEC Archive. MPRA Paper No 22669 mpra.ub.uni-muenchen.de/22669.
- [31]Oluwatayo, I.B., 2008, Explaining Inequality and Welfare Status of Households in Rural Nigeria: Evidence from Ekiti State. *Humanity and Social Sciences Journal*, 3(1):70-80.
- [32] Oyekale, A., Adeoti, A.I., Ogunnupe, T.O., 2006, Measurement and Sources of Income Inequality among Rural and Urban Households in Nigeria, University of Ibadan. PMMA Working Paper No. 2006-20. Retrieved from http://papers.ssrn.com/so13/cf_dev/absbyauth.cfm
- [33] Sanusi R.A., Adebukola, B.C., Oyindamola, Y.B., 2006, Measuring Household Food Insecurity in Selected Local Government areas of Lagos and Ibadan, Nigeria. *Pakistan Journal of Nutrition* 5 (1) 62-67
- [34]Ssewanyana, N.S., Okidi, A.J., Angemi, D., Barungi, V., 2004, Understanding the Determinants of Income Inequality Uganda. CASE Working Papers, 2004-29.
- [35]UNU/WIDER, 2000,. United Nations University/World Institute for Development Economic Research, World Inequality Database, Vol. 10, Helsinki.
- [36]Waggins, S., Keats, S., 2009,. Current State of Food Security in African and Africa-Eu Partnership on the Millennium Development Goals. A paper for the 2nd Joints Experts Growing Meeting, Africa-EU MDGS Partnership, sub group on priority Action 2: Accelerate the food security targets of the MDGs. Pretoria south Africa. March, 24.
- [37]World Bank, 2003, Development indicators for 2002. Washington DC: World Bank. pp. 74-75

THE ECONOMIC IMPORTANCE OF THE BIODIVERSITY OF THE INVERTEBRATES FAUNA IN THE CORN CULTURE SOIL IN COPȘA MICĂ (SIBIU COUNTY) ROMANIA

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Abstract

The goal of our researches is in bringing the scientific arguments of the necessity of including the biologic parameters, mainly of the invertebrates in the soil, in the evaluation studies of the impact upon the environment and the national strategies of monitoring of the soils quality. If the chemical analysis measure the quantity of the pollutants, the invertebrates in the soil, especially the insects, reflect intensively the anthropologic influences, emphasizing the intensifications or inhibitions of their activity under the stress conditions. The study upon the invertebrates' fauna was carried on in Copșa Mică area (Sibiu County) in the corn agricultural ecosystem. The properties of the soil in this area are strongly changed by the industrial activity as a result of an accumulation of great quantities of heavy metals (lead, cadmium). The researches in this area are a part of a greater study upon the invertebrates' fauna in the corn culture soil of the Sibiu County, researches that took place during 2011-2013. The technology applied in this area is a semi intensive one. For collecting the invertebrates there were used two methods: drilling the soil and pitfall traps. There were identified invertebrates belonging to 4 classes (Annelida, Arachnida, Chilopoda, Insecta) and 11 orders (Haplotaenida, Aranea, Acari, Lithobiomorpha, Geophilomorpha, Collembola, Orthoptera, Heteroptera, Hymenoptera, Coleoptera, Diptera).

Key words: corn culture, invertebrates, soil

INTRODUCTION

It is a well known fact that the economy can destroy its own systems of support by consuming the fix means of the natural capital. In change of the detachment from the nature of the useful substances by exploitation, the nature gets in return waste materials and residues resulted from production. The soil constitutes the most important and sometimes the most neglected natural source. It imposes that the industrialized society to take into account its properties and the fertilization of the soil as well as its destruction no matter the reason involved. Our researches upon the biodiversity of the invertebrates proves that obeying the ecologic principles the indicators of the soil quality grow, and as a result the crops as well as the number of cattle grow and in this respect the health of people will be ameliorated. Nowadays the trend is of a green

economic growth [9].

The fundamental requirement imposed is a change in mentality and appreciation of values. To be aware that planet is our home and that we humans, are a part of nature, that our relation with the environment is important, and that there are no problems in themselves, but indicators of problems related to the design and management of ecosystems, to which we should be able to find solutions [7].

Development based on strategy is a clearly defined approach over the future of a country, a region, an economic sector or area. Increasing complexity of international environment requires the use of development strategies. The strategy is nowadays one of the most used concepts in development theory in economy and besides it [8].

The functionality of the soil is assured by the connections among the micro flora and micro fauna, by the herbivorous, by preys, by the

spontaneous and cultivated flora to which are added the environmental conditions and minerals. The virgin soil, upon which hasn't been yet cut in, is the generous gift of the Mother Nature, its variety permitting more cultures. It is a vivid soil with an extreme active life with a rich supply of water, air and nutritional elements, in which the plants grow, develop without being needed the intervention of the human inputs of synthesis. The soil upon which was cut in by different cultures is under the threatening of the alteration of the existent equilibrium, of the degradation and alienation from its ancestral mission of offering enough and ecological food to the human society. In a non ecological soil, that supposes a soil that "is in comma", so to speak and its biologic life began to disappear. Instead of 30 tones of living beings for each hectare it comes to 3 tones/hectare in the case when the structure of the soil is destroyed. In this case the mineral skeleton becomes dominant and unfavorable for the bios [4].

The complex study of the soil supposes the most appropriate solutions for maintaining the equilibrium and their establishment, again where they have been altered by irrational exploitation. Everything is included in a management based on the conception of a durable maintenance of the quality of the soil, benefiting by the scientific acquisitions and the progresses made in the understanding of the complexity of this vital behavior of our planet.

The main aim of our study is the evaluation of the invertebrates in the soil, especially the entomologic fauna, in order of finding out the taxonomic data on species in the agricultural ecosystem in Copșa Mică. The derived aim is that, which allows the man to become a wise partner of the nature in his triple hypostasis of builder, regulator and consumer in the intensive and traditional agricultural ecosystems.

MATERIALS AND METHODS

The locality where the researches took place was Copșa Mică (Sibiu County). In this locality used to work an industrial platform –

Sometra-Carbosin, one of the most important industrial centers in Europe, producing heavy metals, black smoke and other industrial substances.

The surface cultivated with corn in this locality was of 300 hectares in 2012. The shape of the plot was a rectangular one, with a surface of 2 hectares.

The intervals of collecting the biologic material from the soil and on the soil in order of obtaining the spring, summer and autumn samples were as follows: 02.03.-06.03.2012, 0.06-08.06.2012, respectively 03.09-06.09 2012. Due to the favorable climate conditions there was done a supplementary collecting in October during 22.10-26.10.2012.

In the researched corn agricultural ecosystem, the contain of lead (Pb) is situated in the class with very strong charge (558.45 mg/kg) as well as for cadmium (19.10 mg/kg). The soil is very strong polluted with heavy metals [1, 5].

The applied technology was a semi intensive type, on a soil having a medium texture (clay and sand), lacking nutritional substances and characterized by the absence of irrigations. The kind of corn used in the area was Pioneer PR 39D81, having a density of 62.000 plants/hectare.

The collecting methods used were: Pitfall Traps fixed at the level of the soil in which as an appealing and preserver substance was used the formic adelhide 4%; there were used 10 traps, at every 10 m. The collecting time was of 48 hours from installing. The second used method was that of the soil drillings. There were dug 10 holes, having the surface of 25/25cm and the depth of 30 cm. The collected fauna resulted from each drilling was a sample [2].

RESULTS AND DISCUSSIONS

The main sources of pollution in Copșa Mică are due to the industrial activity of two economic agents: SC. SOMETRA S.A., having a profile of nonferrous metallurgy, which before 1990 was considered the biggest unit of this profile in our country (till 1993) and SC. CARBOSIN SA, having a chemical

profile. The activity of these two plants had extremely bad consequences upon the environment, both non biotic and biotic, beginning with the perturbation of the microbiologic activity, respectively of the processes of getting too much ammonite, too much or less nitrate that led to the slowing and sometimes disappearance of humidification processes, in this respect the soil lacking the vivid component. This state of things was underlined by Barbu Horia in a preliminary study done in the Copșa Mică area in 2006 [3].

A thorough research of the soil in Copșa Mică locality, from a soil cultivating, physical-chemical and pollution point of view was done in 2000 by the Professor Mircea Micu, which also presents the correlation with the productivity. His Ph. D Thesis in 2001 entitled "The influence of the pollution upon the soils in Copșa Mică area and its ecologic implications" is a work of reference in this field [6]. One of the general observations of this study refers to the lack of homogenizing of the development level of the same vegetal species on the same subtype of soil. This fact was also noticed by us during the researches done in the analyzed agricultural ecosystem. The vegetation represented by the corn culture is not presented uniform, meaning that some parts are covered with developed plants and other ones with feeble plants or on some parts the plants are lacking totally. This thing assures a level of moderate productivity regarding the agricultural ecosystem. In this case the pollution with heavy metals is to be blamed for diminishing the productivity of the ecosystem.

Another aspect that can't be overlooked is represented by the effect of the black smoke, which presence is felt in the soils in the area. The deposits of black smoke provoke the closing of stomas and prevent the penetration of the sun's rays, affecting strongly the process of photosynthesis and accordingly lead to the lowering of the corn production. The accumulation of the black smoke at the level of the soil led to a stressed pigmentation of this. We noticed the modification of the color of the soil during the drawing of the soil

samples and agricultural entomologic fauna in the area. The blacking of the soil was noticed at depth that surpasses the action limit of the machines and equipment for the mechanical works for the mechanical works within the culture technologies.

The pollution of the environment in the Copșa Mică area has a strong negative impact upon the invertebrates in the soil. In the report done by Vădineanu and coworkers in 1991 there was a warning about the disappearance of some species like *Nematoda*, *Enchitreidae* and *Lumbricidae* and the number of species of *Oribatidae* and *Collembola* was reduced with 11-95% unlike the non polluted areas [10].

Our researches regarding the influence of the pollution with heavy metals upon the biodiversity of the agricultural entomologic fauna come to complete the few studies done in this field. So, in the tables 1-8 there are presented the taxonomic structure as well as the quantitative structure of the collected fauna through the two methods in the corn agricultural ecosystem in Copșa Mică during April, May, June, September and October 2012.

Table 1. The taxonomic and quantitative structure of the collected fauna through the soil drilling method Copșa Mică locality (Sibiu County) – April

Order		Numerical Abundance	Relative Abundance
Aranea		2	3,18
Geophilomorpha		1	1,59
Hymenoptera		39	60,32
Coleoptera		22	34,94
TOTAL		63	100,00
Order	Family	Genus	Species
4	7	8	7

Table 2. The taxonomic and quantitative structure of the collected fauna through the Pitfall Traps, Copșa Mică locality (Sibiu County) – April

Order		Numerical Abundance	Relative Abundance
<i>Acari</i>		3	3,26
<i>Aranea</i>		21	22,82
<i>Colembola</i>		1	1,09
<i>Orthoptera</i>		1	1,09
<i>Hymenoptera</i>		35	38,04
<i>Coleoptera</i>		30	32,61
<i>Diptera</i>		1	1,09
TOTAL		300	100,00
Order	Famiy	Genus	Species
7	9	10	9

After the analysis of the data from the upper tables there is established that besides the applied technology, of a semi-intensive type, the impact upon the local biodiversity in the corn culture is stressed by the local pollution with heavy metals and black smoke produced by the former plants in Copșa Mică, closed in 1990 because of the aggression upon the environment.

Table 3. The taxonomic and quantitative structure of the collected fauna through the soil drilling method Copșa Mică locality (Sibiu County) - June

Order	Numerical Abundance	Relative Abundance	
<i>Haplotaenidia</i>	40	33,36	
<i>Aranea</i>	3	2,50	
<i>Collembola</i>	3	2,50	
<i>Hymenoptera</i>	64	53,36	
<i>Coleoptera</i>	8	6,72	
<i>Diptera</i>	2	1,68	
TOTAL	120	100,00	
Order	Famiy	Genus	Species
6	11	14	13

Table 4. The taxonomic and quantitative structure of the collected fauna through the Pitfall Traps Copșa Mică locality (Sibiu County) – June

Vinea locality (Sirola County) – June			
Order	Numerical Abundance		Relative Abundance
<i>Lithobiomorpha</i>	6		4,41
<i>Aranea</i>	10		7,35
<i>Collembola</i>	79		58,1
<i>Orthoptera</i>	8		5,88
<i>Heteroptera</i>	1		0,74
<i>Hymenoptera</i>	19		13,97
<i>Coleoptera</i>	13		9,55
TOTAL	136		100,00
Order	Famiy	Genus	Species
7	12	17	16

Table 5. The taxonomic and quantitative structure of the collected fauna through the soil drilling method Copșa Mică locality (Sibiu County)- September

Copa Mica Locality (Sirola County) September			
Order	Numerical Abundance	Relative Abundance	
<i>Polydesmida</i>	1	3,45	
<i>Scutigeromorpha</i>	2	6,90	
<i>Acari</i>	3	10,35	
<i>Aranea</i>	8	27,58	
<i>Hymenoptera</i>	3	10,35	
<i>Coleoptera</i>	12	41,37	
TOTAL	26	100,00	
Order	Famiy	Genus	Species
6	9	9	8

The soil and the entire area covered by biocenosis of natural and semi-natural type are still affected till nowadays by high dozes, much

more above normal of the chemical noxious air. The structure of the biodiversity at invertebrates in the case of the soil drilling presented low values in the first part of the investigations (Table 1) both numerically and from the relative abundance point of view (4 orders, having *Hymenoptera* and *Coleoptera* in leading positions).

Table 6. The taxonomic and quantitative structure of the collected fauna through the Pitfall Traps Copșa Mică locality (Sibiu County) – September

Wine County (Stark County) - September			
Order		Numerical Abundance	Relative Abundance
<i>Acari</i>		3	3,94
<i>Aranea</i>		21	27,68
<i>Orthoptera</i>		11	14,46
<i>Collembola</i>		22	28,94
<i>Hymenoptera</i>		8	10,52
<i>Coleoptera</i>		11	14,46
TOTAL		76	100,00
Order	Famiy	Genus	Species
6	11	12	11

Table 7. The taxonomic and quantitative structure of the collected fauna through the soil drilling method Copșa Mică locality (Sibiu County) - October

Order		Numerical Abundance	Relative Abundance
Julida		1	0,88
Aranea		7	6,14
Homoptera		51	44,74
Hymenoptera		42	36,84
Coleoptera		11	9,65
Diptera		2	1,75
TOTAL		114	100,00
Order	Famiy	Genus	Species
6	13	16	11

Table 8. The taxonomic and quantitative structure of the collected fauna through the Pitfall Traps Copșa Mică locality (Sibiu County) – October

Order		Numerical Abundance	Relative Abundance
<i>Acari</i>		1	0,88
<i>Aranea</i>		3	2,64
<i>Collembola</i>		14	12,28
<i>Orthoptera</i>		5	4,38
<i>Homoptera</i>		13	11,41
<i>Hymenoptera</i>		72	63,15
<i>Coleoptera</i>		5	4,38
<i>Neuroptera</i>		1	0,88
TOTAL		114	100,00
Order	Famiy	Genus	Species
7	15	16	16

Regarding the epigeous fauna collected by the help of Pitfall Traps, it was richer due to the pioneer vegetation in the area (Table 2).

Regarding the comparison between the level of the fauna and its structure during the entire period of vegetation and the time of the investigations (March-October) in the experimental field in Copșa Mică (Tables 1-8) it was noticed, also, a reduced biodiversity, with only 11 orders, with the domination of the population of *Hymenoptera* and *Coleoptera* Orders (Figure1). The study is not an exhaustive one, a lot of species couldn't be registered taking into consideration the limits of the used techniques, this needing further investigations with better methods.

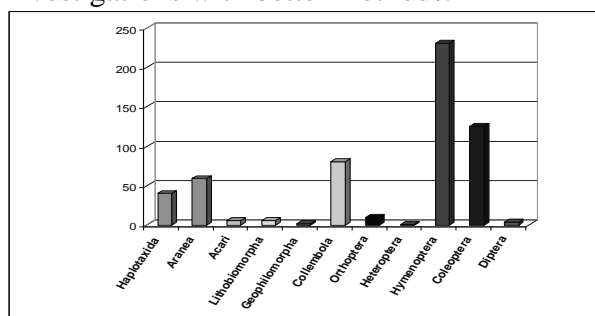


Fig.1 The fauna structure of the invertebrates in the experimental plot in Copșa Mică-Sibiu County-agriculture of semi-intensive type

CONCLUSIONS

The important factor of command, which influences the structure and the dynamics of the invertebrate's fauna in the soil of the experimental investigated culture in Copșa Mică, is the content in heavy metals. Our researches regarding the influence of the pollution with heavy metals upon the biodiversity of the agricultural entomologic fauna confirms the older data (Vădineanu and coworkers, 1991) and come to complete the studies done in this area.

The low biodiversity of the communities of invertebrates was influenced also by the high levels of pressure of the natural command factor, namely the excessive, persistent drought during the last three years, taking into consideration the non irrigated system where was cultivated the corn on the researched experimental plot.

The collected samples through the two specific methods, Pitfall Traps and soil drilling, comprised organisms belonging to the following taxonomic groups: 4 classes:

Annelida, *Arachnida*, *Chilopa* and *Insecta*; 11 orders: *Haplaxida*, *Aranea*, *Acari*, *Lithobiomorpha*, *Geophilomorpha*, *Collembola*, *Orthoptera*, *Heteroptera*, *Hymenoptera*, *Coleoptera*, *Diptera*; 65 families; 79 genus; 68 species.

Among the groups of invertebrates that were present in the soil of the experimental corn plot, the arthropods best represented were those from the Class *Insecta* with 6 orders (*Collembola*, *Orthoptera*, *Heteroptera*, *Hymenoptera*, *Coleoptera*, *Diptera*), followed by Class *Arachnida* with 2 orders (*Acari* and *Aranea*).

On the other side the groups of invertebrates that were present in the soil of the researched corn culture, the least represented populations were those from Class *Chilopoda* represented by the orders *Lithobiomorpha* and *Geophilomorpha*.

In the same time the biodiversity of the agricultural biocenosis which stood under the toxic impact of the industrial emissions of the former chemical plant in Copșa Mică was affected also by the great quantity of the pesticides whose degree of accumulation in the soil grows annually as a result of the practice of monoculture in the area.

REFERENCES

- [1]Antonie Iuliana, Pavel Petronela, Tănase Maria, Sand Camelia, 2012, The Indicators of the Soils and Their Importance upon the Entomologic Fauna in the Corn Culture in Copșa Mică – Axente Sever (Sibiu County), Buletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Agriculture, Romania, vol. 69, nr. 20, pp. 177-181
- [2]Antonie Iuliana, Petronela Pavel, Camelia Sand, 2012, Preliminary consideration on the assessment of the agricultural entomologic fauna dynamics in soil, Proceedings of the International Conference "Agricultural and Food Sciences, Processes and Technologies" Agri-Food 20, pp. 25-32, May 10-12, Sibiu
- [3]Barbu, H., 2006, Studiu preliminar. Cercetarea și evaluarea datelor și studiilor existente privind zona industrială Copșa Mică. Propunere de acțiune în vederea determinării exacte a gradului de poluare precum și estimarea costurilor acestora. Beneficiar Consiliul Județean Sibiu, Romania, pp. 3-12
- [4]Berca, M., 2011, Tehnologii ale agriculturii secolului XXI, in „Agrotehnica. Transformarea modernă a agriculturii”, Romania, Ed. Ceres,

Bucuresti, cap.1, pp 49-78

[5]Lăcătușu, R., Lăcătușu Anca-Rovena, 2010, Evolution of heavy pollution from Copșa Mică, Scientific Papers, USAMV Bucharest, Romania, Series A, vol. LIII, pp. 85-92

[6]Micu, M.O., 2001, Influența poluării cu metale grele asupra solurilor aluviale din zona Copșa Mică, Județul Sibiu, Teză de doctorat, Universitatea „Transilvania”, Brașov, Romania

[7]Simtion Daniela, Luca Roxana, 2010, Sustainable development in agriculture: long and term aspects, Simpozion Stiintific International, Managementul Dezvoltarii Rurale Durabile, Universitatea de Stiinte Agricole si Medicina Veterinara a Banatului Timisoara, România, pp. 199-207

[8]Simtion Daniela, Luca Roxana, 2010, Development of services in Romania, Conference „Vallis Aurea” Focus on: Regional Development, Croația, pp 1317-1325

[9]Trică Carmen Lenuța, Papuc Marinela, 2013, Creșterea economică verde – premisă pentru dezvoltare durabilă, Economie teoretică și aplicată, Romania, vol. XX, issue 1 (578), pp. 94-104

[10]Vădineanu A., H. Frumosu, V. Ciolac, Speranța Ianculescu, P. Marcuță, C. Ilinoiu, P. Weber, R. Lăcătușu, M. Toti, V. Naghi, T. Calameț, A. Georgescu, V. Cotârla, I. Medrea, Rodica Serban, Mariana Constantinescu, I. Jelev, 1991, Rezultate ale cercetarilor complexe referitoare la starea mediului reflectate în raportul comisiei guvernamentale privind poluarea din zona Copșa Mica, Mediul Înconjurător, Romania, vol. II, nr. 1-2, pp. 35-40

DETERMINANTS OF WOMEN'S PARTICIPATION IN SELF HELP GROUP LED MICRO-FINANCING OF FARMS IN ISUIKWUATO LOCAL GOVERNMENT AREA OF ABIA STATE, NIGERIA

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Abstract

This research analyzed determinants of women's participation in self help group-led micro-financing of farms in Isuikwuato Local Government Area of Abia State, Nigeria. The specific objectives were to; determine the level of women's participation in self help group led micro financing of farms; determine the factors that influence women's participation in self help group micro financing of farms; identify constraints of women participation in self help group micro financing of farms in the study area. Multistage random sampling technique was employed in collecting data from one hundred and twenty (120) members of women self help group using structured questionnaire. The data were analyzed using descriptive statistics, likert scale type and probit regression analysis. The research revealed that the women (respondents) actively participated in self help group meetings ($\bar{x} = 3.07$), financial and material contributions ($\bar{x} = 3.33$), self help group project ($\bar{x} = 3.36$) and recruitment of fresh members ($\bar{x} = 3.16$), because their calculated means were greater than the critical midpoint mean score (3.0). The study also showed that the women did not participate in committee membership ($\bar{x} = 2.54$) and holding of official executive position ($\bar{x} = 2.53$) in self help group since the midpoint score (3.0) was greater than their calculated mean values. The result of probit regression analysis showed that women's participation in self help group led micro financing of farms was influenced by household size, years of membership experience, access to credit, primary occupation, mode of entry and annual contribution. The model predicted 94.69 per cent of the sample correctly and posted a log likelihood value of -33.54958, a pseudo R^2 value of 0.3013 and a goodness of fit chi-square value of 32.10 which is statistically significant at 1.0% level. Meanwhile irregular monthly contribution and loan default were the major constraints of women's participation in self help group led micro financing of farms. It was recommended that leadership positions within self help groups should be made to rotate among the broad spectrum of longer serving members. This will ensure greater commitment to group success and sustenance by a greater number of members.

Key words: farm, micro financing, participation, self help group, women

INTRODUCTION

One of the major problems of an average Nigerian farmer is how to obtain farm credit from formal financial institutions. The unavailability of this credit from the formal financial institutions has prompted most farmers (especially women farmers) in the rural communities to organize themselves into financial self-help groups in order to meet their financial and social needs [10]. In some communities in Nigeria, individuals of the same age group or same family lineage or

affiliations exchange labour with each other in farming, building houses, constructing roads, harvesting and processing farm produce and solving some other socio-economic problems [18].

A Self Help Group (SHG) is a village-based financial intermediary usually composed of 10-20 local women. Members make small regular saving contributions over a few months until there is enough capital in the group to begin lending to the members or to others in the village. They use the pooled resources to meet the credit needs of the

group members [9]. The groups are democratic in nature and collectively make decisions. Since the members are neighbors and have common interest, the group is homogenous and cohesiveness is one of the characteristics features of the group. Regular savings, periodic meetings, compulsory attendance, early repayment and systematic training are the salient features of the SHG. Self help Group is a path toward empowerment and a participatory endeavor of people trying to secure economic, -social, political and psychological power that would empower them and improve their lives [4].

Self Help Groups (SHGs) play effective roles in promoting empowerment through giving of loans to members. They have helped in fighting poverty and have assisted in promoting microfinance in Nigeria. Self Help Groups (SHGs) are growing in number and are receiving increasing attention from the financial institutions, non-governmental organizations (NGOs) and the governments as one sure way to transform lives for the poor [18].

Women's participation in Self Help Groups provides them the opportunities to be actively involved in decision-making process and offer them an effective means of bringing about change in their way of life in terms of economic well-being and adoption of new technologies [20].

The significance of women's entry into the workforce in the form of women's organizations and associations over the past three decades has produced profound transformations in the organization of families, society, the economy and urban life. The past three decades have witnessed a steady increase in awareness of the need to empower women through measures that increase social, economic and political equity and broaden access to fundamental human rights, improvements in nutrition, income, basic health, and education [1].

Meanwhile, there has been little or no consideration for the development of self help group or mechanism to ensure delivery of support (financial services) to the poor. The absence of such organization and the

weakness of existing ones largely disenfranchise the poor from participating in the decision making process of interventions and issues that affect their welfare [19, 23], while the factors influencing participation level of rural women in self help group have not be determined. A lot of Local organizations (LOs) exist in sub-Saharan Africa but it has been pointed out [3,7] that most West African countries, including Nigeria, are very weak in terms of popular grassroots organizations. Grootaert [13] lamented that the situation is compounded by the fact that no attempts are being made to develop local groups at the community level, all over the world. It is against this background that the paper examines the determinants of women's participation in self help group-led micro-financing of farms. The specific objectives are to; describe the socio - economic characteristics of women in self help groups for farming in the study area; determine the level of women's participation in self help group led micro financing of farms; determine the factors influencing women's participation in self help group led micro financing of farms; identify constraints of women's participation in self help group led micro financing of farms in the study area. It was Hypothesized that women's participation in self help group led micro financing of farms is not influenced by age, education, household size, access to microfinance, income, marital status, years of membership experience, annual contribution, occupation and mode of entry and exit and.

MATERIALS AND METHODS

The study was conducted in Isuikwuato Local Government Area (LGA) of Abia State, Nigeria. The LGA was purposively chosen because it is one of the major food producing Areas in Abia State and majority of its farm labour force are women that participate actively in women self help groups. The Local Government Area lies between latitudes $5^{\circ}32'N$ and $5^{\circ}53'N$ of the equator and longitudes $7^{\circ}29'E$ and $7^{\circ}48'E$ of the Greenwich Meridian. It has a land area of

144.0 square kilometers with a population of 115,749 people. Of these 56,660 (48.95%) are males while 59,134.621 (51.05%) are females [16].

Multi-stage random sampling technique was used in the selection of Autonomous communities, villages, women self help groups and respondents. In the first stage, five autonomous communities were randomly selected from the Local Government Area. The second stage involved the random selection of two villages from each of the chosen autonomous communities. This gave a total of 10 villages. From each of the chosen villages, a list of women led self help groups was obtained from the village secretaries who were the key custodian of village information. These formed the sampling frame for the women self help groups from which samples of two women led self help groups were randomly selected in each of the selected villages, thus giving a total of 20 women self help groups. The last stage of sampling involved the random selection of 6 women farmers in each of the selected women self help groups. This gave a total sample size of 120 women farmers. The instrument of data collection was via a set of pre-tested and structured questionnaire. The various analyses carried out include the use of mean, frequency counts, likert scale type and probit regression analysis.

The use of a five point likert scale was adopted to determine the level of women farmers' participation in self help group led micro financing of farms. The level of participation in women self help groups was measured in terms of six elements as adopted by Anyiro *et al* [5] and Akpabio [3], viz; attendance at meetings, financial and material contributions, recruitment of fresh membership, participation in group projects, committee membership and official position held in the group. The total participation score was obtained by the summation of respondent's responses to different questions raised on each of the aforementioned elements and to which different weights were assigned. The following scaling procedure according to Nwaobiala [17] was adopted: always =5;

often =4; occasionally = 3; seldom = 2 and never =1. The values of the five responses were added and further divided by 5 to obtain 3.0, which was regarded as the mean participation level. Women farmers with mean score of 3.0 and above were regarded as having participated in women self help group led micro financing of farms, while women farmers with mean score of less than 3.0 did not participate actively.

Probit regression model was used to analyze the factors influencing women's participation in self help group.

Table 1. Description of Probit Analyzed Independent Variables

Variable	Type	Description
X1	Continuous	Age- Age of women farmers measured in years;
X2	Binary	Access to credit- 1= if the women received credit from SHG; 0 otherwise;
X3	Continuous	Education- Number of years of formal education;
X4	Continuous	Household size - refers to number of persons living and feeding from same pot;
X5	Binary	Occupation- 1= if household major occupation was farming; 0 otherwise;
X6	Continuous	Farm income- Annual farm income realized by the women in naira;
X7	Continuous	Membership experience- years of membership experience in women SHG
X8	Continuous	Annual contribution- Amount of annual contribution made to SHG in Naira;
X9	Binary	Mode of entry and exit - Free entry to and exit from SHG = 1, otherwise =0;
X10	Binary	Marital status- if women are married =1; 0 otherwise;

The model is appropriate when the response takes one of only two possible values representing participation or no participation. The model was adopted as used by Gujarati [14] and Ajani and Tijani [2].

$$P_i [y_i=1] = [Fz_i]$$

Where,

$$Z_i = \beta_0 + \beta_1 X_{1i} + \dots + \beta_k X_{ki} \dots (1)$$

$$y_i = \beta_1 + \beta_2 X_{2i} + \dots + \beta_k X_{ki} \dots (2)$$

y_i^* is unobserved but $y_i = 0$ if $y_i^* < 0$, 1 if $y_i^* \geq 0$

$$P(y_i = 1) = P(y_i^* \geq 0)$$

$$= P(u_i \geq -\beta_1 - \beta_2 X_{2i} + \dots + \beta_k X_{ki}) \dots (3)$$

$i = 1, 2, \dots, 120$

Y_i^* = an underlying latent variable that indexes the level of women's participation

Y_i = dummy variable indexing women's participation in self help group (Participation =1; 0 = no participation). Where the independent variables are as defined in Table 1.

RESULTS AND DISCUSSIONS

Socio-Economic Characteristics of Women Members of Self Help Groups

The socio-economic characteristics of the women farmers in self help group led micro-financing of farms are shown in Table 2.

Table 2. Socioeconomics of women farmers in women self help group led micro financing of farms in Isuikwuato L.G.A of Abia State Nigeria

Variables	Mean	Standard deviation
Age (years)	44.24	25.453
Household size (number)	4.25	2.167
Membership experience in self help group	5.5	2.95
Annual Income (₦)	100,741.7	73173.39
Farm size (hectare)	1.2	0.667
Marital Status	Percentage	
Single	21.67	
Married	78.33	
Education level	Percentage	
No formal education	8.33	
Primary education	28.33	
Secondary education	31.67	
Tertiary education	31.67	
Primary Occupation		
Farming	75.0	
Trading	7.5	
Civil service	16.67	
Artisanery	0.83	
Access to credit	63.3	
Yes	36.67	
No		

Source: Field Survey data, 2013: Note 1 USD = ₦160

The table shows that the mean age of the women respondents was 40.79 years. This is an indication that the women farmers in self help group in the study area were mostly middle aged that were within the active

productive work force. Majority (91.67%) of the women were literate possessing divers' formal educational levels that ranged from primary school education to tertiary school education. Majority (78.33%) of the women members of self help groups were married with a mean household size of 4.3 persons. The result reveals that 75.0% of the women engaged primarily in farming while 25.0% others were primarily engaged in trading, civil service and artisanery. The result also shows that the mean number of years spent in women self help groups was 5.5 years. This indicates a moderate membership experience among the women in self help group micro financing of farms in the study area. Meanwhile, majority (63.3%) of the women received micro credit from self help group led micro financing of farm, while 36.67% of them did not receive micro credit from the group. This indicates high access to credit by the women self help group members in the study area. This result supports the general assumption that individuals affiliate to association primarily because of their perceived economic benefit. The mean annual income and farm size of the women farmers were ₦100,741.7 and 1.2 hectares respectively.

Level of Women Participation in Self Help Group Micro Financing of Farm

Six participation elements adopted by Akpabio [2], viz; attendance at meetings, financial and material contributions, and recruitment of fresh membership, participation in group projects, committee membership and official position held in the group were identified and studied. The summary statistics for each of these dimensions is presented in Table 3.

The distribution of the women according to the level of participation in self help group meetings is shown in Table 3. The result shows that a fairly good proportion (32.5%) of the women in the study area seldomly attended self help group meetings while 21.7% of them always participated in self help group meetings. The Total Participation Raw scores (TPRS) for meeting attendance was 368 with a mean value of 3.07. Since the

midpoint score (3.0) is less than the calculated (3.07), it implies that the women actively participated in self help group meetings. This has implication on information dissemination. Further, the dissemination of information to members can only be easier when members of

associations attend meetings.

The distribution of women farmers according to the level of participation in financial and material contributions in self help group led micro financing of farms is shown in Table 3.

Table 3. Distribution of women farmers according to their level of participation in women self help group led micro financing of farms in Isuikwuato Local Government Area of Abia State, Nigeria

Participation element	Always	Often	Occasionally	Seldom	Never	TPRS	Mean
Meetings attendance	130 (21.7)	100 (20.8)	45 (12.5)	78 (32.5)	15 (12.5)	368	3.07
Financial and material contributions	140 (23.3)	124 (25.8)	78 (21.7)	44 (18.3)	13 (10.8)	399	3.33
Recruitment of fresh members	115 (19.2)	136 (28.3)	66 (18.3)	42 (17.5)	20 (16.7)	379	3.16
Participation in group projects	125 (20.8)	184 (38.3)	42 (11.7)	34 (14.2)	18 (15.0)	403	3.36
Committee membership	70 (11.7)	48 (10.0)	48 (13.3)	122 (50.8)	17 (14.2)	305	2.54
Official executive position	45 (7.5)	60 (12.5)	75 (20.8)	106 (44.2)	18 (15.0)	304	2.53

Source: Field Survey Data, 2013

Decision Rule 3.0 and above = Participation

n=120

Decision Rule <3.0 = no participation

Figures in parenthesis are percentages

TPRS= Total participation Raw scores

Always 5, Often 4, Occasionally 3, Seldom 2; Never 1

The result shows that a fairly good proportion (23.3%) of the women in the study area always participated in financial and material contributions in self help groups with Total Participation Raw scores (TPRS) of 399 and mean value of 3.33. Since the midpoint score (3.0) is less than the calculated (3.33), it implies that the women actively participated in financial and material contributions in their self help groups micro financing of farms. This result is not surprising because most women would seem to partake in these associations for economic gains. These contributions include payment of membership dues, marriage levies, burial levies, project/development levies, among others.

The distribution of the women according to the level of participation in group project is presented in table 3. The table revealed that a good proportion (38.3%) of the women in self help group in the area often participated in the

group project. The Total Participation Raw scores (TPRS) for group project was 403 with a mean of 3.36. The mean score was greater than critical value of 3.0 (which was the midpoint) and implies that the women participated actively in self help group projects. This has implications on the sustainability of the group. Meanwhile, this result is not surprising because the study observed that most of the group projects embarked by the women were capital raising projects such as investment in the purchases of hirable equipment, light implement and durables such as canopies, plastic chairs, grinding machines, construction of cold room, to mention but a few.

The distribution of the women according to the level of participation in recruitment of new members in their self help group led micro financing of farms is shown in Table 3. The result shows that a fairly good proportion

(28.3%) of the women in the study area often participated in the recruitment of fresh members to their group. The Total Participation Raw scores (TPRS) for recruitment of fresh members was 379 with a mean value of 3.16. Since the midpoint score (3.0) is less than the calculated (3.16), it implies that the women actively participated in recruitment of fresh members to self help group. This also has implication for the group sustainability.

Also, the distribution of the women according to the level of participation in committee membership and holding of official executive position in self help group is shown in Table 3. The result shows that a good proportion (50.8% and 44.2%) of the women in the study area seldomly participated in committee membership and holding of official executive position in self help group respectively. Mean values of 2.54 and 2.53 were obtained for participation in committee membership and holding of official executive position in self help group respectively. Since the midpoint score (3.0) is greater than the calculated mean values (2.54 and 2.53), it implies that the women did not participate in committee membership and holding of official executive position in self help group micro financing of farms in the study area. This could be attributed to the fact that married women with children may not be relieved of some filial responsibilities at home and may therefore not be able to devote more time to the obligations and commitment in leadership position of their group. This is in line with [3].

Factors Influencing Women's Participation in Self Help Group Led Micro Financing of Farms

The probit regression estimate of the factors that influenced women participation in Self Help Group-led micro-financing of farms in Isuikwuato Abia State, Nigeria is shown in Table 4. Overall, the model predicted 94.69 per cent of the sample correctly and posted a log likelihood value of -33.54958, a pseudo R^2 value of 0.3013 and a goodness of fit chi-square value of 32.10 which is statistically significant at 1.0% level.

In the model, six out of ten explanatory

variables were statistically significant at given levels and these include household size, years of membership experience, Access to credit, primary occupation, mode of entry and annual contribution. In this table, a positive sign on the variable's coefficient indicates that higher values of the variable increase women participation in Self Help Group-led micro-financing of farm and vice versa when a negative sign is obtained.

The coefficient (-0.013374) of household size had significant negative effect on women participation in Self Help Group-led micro-financing of farm. This coefficient was significant at 10.0 % alpha level and inferred therefore that the likelihood of participation in Self Help Group-led micro-financing of farm increases as household size decreases. This is expected because farm households with large family sizes may not likely participate in the group probably because of familial obligations within the household, as family life takes time and decreases the need for outside social relations [8]. Also, households with large family sizes may not be able to be meeting up with financial requirement of the group due to family responsibilities and as well are more likely to spend more of the micro credit obtained in financing consumption and other basic household requirements than on farm production [15] which will in turn affect repayment performance.

In line with *a priori* expectation, the coefficient of mode of entry and exit posed a negative influence on women participation in Self Help Group-led micro-financing of farm. Its coefficient (-0.1749368) was statistically significant at 1.0% probability level and implies that women with free mode of entry to and exit from the Group had lower likelihood of participation in self Help Group-led micro-financing of farm. This result conforms to Anyiro *et al* [5] that flexibility built into entry and exit in local organization may not encourage discipline, commitment, loan repayment and active participation in groups' activities and operations, hence, decrease in participation level.

The coefficient (1.90e-06) of annual

contribution had significant positive effect on women's participation in self help group-led micro-financing of farm. This coefficient was significant at 10.0 % alpha level and inferred therefore that an increase in the amount of annual contribution of women to self help group will stir up increase in participation in the group. This result is in tandem with *a priori* expectation. This particular view had been earlier upheld by the World Bank's declaration [22] that most successful groups are those in which a larger proportion of their capital is derived from group members' savings than from external sources, because of membership desire to safeguard their investments, hence participating more in the group. Esman and Uphoff [11] had also posited that local resource generation inhibits free ridership and also reduces cases of fund embezzlement. In same vein, Anyiro *et al* [6] stated that Households' cash contribution to association is presumably a sign of greater interest in the association and serves as a collateral effect for households wanting to borrow money, and hence increases the participation level of the households.

Table 4. Binary Probit Regression Coefficients of determinant of women's participation in self help group led micro financing of farm in Isiukwuato LGA of Abia State, Nigeria

Variable	Estimated coefficients	Standard errors	Z-ratios	P> z
Constant	-0.4146728	0.8591289	-0.48	0.629
Education	0.0034668	0.0723293	0.39	0.695
Household size	-0.013374 *	.0092971	-1.54	0.122
Years of membership Experience in SHG	-0.0033672**	.0016363	-2.20	0.028
Farm income	-0.0008038	0.0465678	-0.02	0.986
Age	0.0229735	0.0427792	0.52	0.602
Access to credit	0.0145931**	0.0068058	2.11	0.035
Annual contribution	1.90e-06 *	1.01e-06	1.95	0.051
Primary occupation	0.3123539***	0.1076863	2.90	0.004
Mode of entry and exit	-0.1749368***	0.0569818	-3.04	0.002
Pseudo R2	0.3013			
Log likelihood:	-33.54958			
Chi2(12)	32.10***			
Cases predicted correctly (%):	94.68			

Source: Field Survey data, 2013.

*** Significant at 1.0% level

** Significant at 5.0% level

* Significant at 10.0% level

The coefficient (0.0145931) of access to micro credit had positive relationship with women's participation in Self Help Group-led micro-financing of farm at 5.0% probability level. This implies that women with access to farm credit from self help group have higher probability of participation in the group. This result supports the general assumption that individuals affiliate to organizations primarily because of their perceived economic benefit [5].

The coefficient (-0.0033672) of years of membership experience was negative and significant at 5.0 % alpha level. This implies that higher membership experience would reduced the chances of women participation in Self Help Group-led micro-financing of farm. This result is not in conformity with *a priori* expectation and may be due to the fact that women do not actively participate in local network without expectations of some social, psychological or material rewards irrespective of their long years of membership in such group. That is why Shingi and Bluhm [21] reported that an individual seeks, participate and retains membership of any group that makes it possible for him/her to actualize his/her expectations.

The coefficient (0.3123539) of primary occupation was positive and significant at 1.0 % alpha level. This implies that a higher participation in self help group occurs among women who take farming as their primary occupation. This is a confirmation that farming is the major occupation of women in rural areas. The posture of this result may be attributed to high innovativeness among the women due to influence of group dynamic effects This result therefore conforms to *a priori* expectation and disagrees with Christoforou [8]; Fidrmuc and Gërzhani [12] that a person facing formal employment (white collar jobs) has a strong incentive to participate in social groups partly on account of the trust he/she tends to develop towards society.

Constraints of Participation in Women Self Help Groups

The problems militating against women's participation in self help group led micro

financing of farms in the study area are shown in Table 5. The table shows that 33.33% of the women ascribed irregular monthly contribution as a major problem of participation in women self help group. This problem usually affects the volume of loanable funds. Also, 25.83% of the women averred that inadequate loan repayment posed a serious constraint to effective participation in self help group. Furthermore, 22.50% of the women complained on the flexibility built into entry to and exit from the group which does not encourage discipline, commitment, hard work and active participation in the group activities and operations. Also, a few (20.0%) of the women complained of inadequate funds, while 18.0% of them complained of lack of members. Meanwhile, 3.33% and 1.67% others complained of low access to SHGs micro finance/small volume of lending and Loan diversion to non agricultural enterprise respectively.

Table 5. Constraints of women participation in Self Help Groups led micro financing of farms in Isiukwuato LGA of Abia State, Nigeria

Constraints	Frequency*	Percentages
Inadequate fund	24	20.0
Lack of members	18	15.0
Irregular monthly contribution	40	33.33
Loan repayment problem	31	25.83
Low access to SHGs micro finance/small volume of lending	4	3.33
Loan diversion to non agric enterprise	2	1.67
Free entry to and exist from SHG	27	22.5

Source: Field Survey Data, 2013

* Multiple responses recorded

CONCLUSIONS

Based on the empirical evidence emanating from both descriptive and inferential statistics employed for this study, the research had shown that the women actively participated in self help group meetings, financial and material contributions, self help group project and recruitment of fresh members, because the midpoint mean score (3.0) was less than their calculated mean. It also revealed that the women did not participate in committee

membership and holding of official /executive positions in self help group since the midpoint score (3.0) was greater than the calculated mean values (2.54 and 2.53 respectively). The research revealed also that the critical determinants of women's participation in self help group led micro financing of farms were household size, years of membership experience, access to credit, primary occupation, mode of entry and annual contribution. Meanwhile irregular monthly contribution and loan default were the major constraints of women's participation in self help group

Since sustainable group development is predicated on good leadership. Leadership positions within self help groups should be made to rotate among the broad spectrum of longer serving members. This will ensure greater commitment to group success and sustenance by a greater number of members. Also, increased and regular monthly contribution is a necessity among women in self help group and a veritable instrument which enables them make meaningful savings as well as investments in agriculture, it is recommended the women should be regular in their monthly contribution. This will generate adequate fund for general running of the group and loaned as micro credit to members who signify interest in loan, hence attracting new members and increasing participation level of the women.

REFERENCES

- [1]Aguilar, V. G., 2006, Women's participation in microfinance. Globenet (<http://www.globenet.org/archives/web/2006/www.globenet.org/horizon-local/ada/9905women.html>, accessed May 27, 2014).
- [2]Ajani, O.I.Y.,Tijani O.A., 2009, "The Role of Social Capital in Access to Microcredit in Ekiti State, Nigeria."Pakistan Journal of Social Sciences. 6(3): 125-132.
- [3] Akpabio I.A, 2008, Significant Predictors of Social Capital in Farmers Organizations in Akwa Ibom State, Nigeria. The Journal of International Social Research. 1(3): 61-68.
- [4]Anjugam M., Ramasamy C., 2007, Determinants of Women's Participation in Self-Help Group (SHG)-Led Microfinance Programme in Tamil Nadu. Agricultural Economics Research Review, 20: 283-298.

- [5]Anyiro C.O, Ezech, C.I, Emerole C.O, 2014a, Social Capital Dimensions and Microcredit Influence on Poverty. Lambert Academic Publishing GmbH & Co.Kg, Heinrich-Bocking-Str. 6-8, 66121 Saarbrucken, Germany
- [6]Anyiro, C.O., C. I. Ezech, J.C. Ijioma, Udensi A. I., 2014b, Local institutions' micro credit delivery and effects on rural farm households' poverty in Abia State, Nigeria. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development. 14(1):21-28.
- [7]Arokoyo, T., 1998, Agricultural Technology Development and Dissemination- A Case Study of Ghana and Nigeria Experiences. CTA, The Netherlands, pp.23-25
- [8]Christoforou, A., 2005, 'On the Determinants of Social Capital in Greece Compared to Countries of the European Union'. *FEEM Working Paper*, No. 68.
- [9]EDA and APMAS, 2006, "Self-Help Groups in India: A Study of the Lights and Shades" <http://www.edarural.com/documents/SHG-Study/Executive-Summary.pdf>. Accessed 27/5/14
- [10]Enabulele, H. N., Alufohai, G.O., 1999, Linkage Financial Self-Help Groups with the Banks; "Some Implications for Poverty Alleviation in Edo State, Nigeria" in Poverty Alleviation and Food Security in Nigeria. Nigeria Association of Agricultural Economists (NASE), Kayod. (Nigeria Limited), Ibadan
- [11]Esman, M. J., Uphoff N. T., 1984, Local Organisations: Intermediaries in Rural Development. Cornell Univ. Press. pp.391
- [12]Fidrmuc, J., Gerxhani, K., 2004, 'Formation of Social Capital in Eastern Europe: Explaining Gap vis-à-vis Developed Countries'. *CEPR Discussion Paper* No. 5068
- [13]Grootaert, C., 1999, Social Capital, Household Welfare and Poverty in Indonesia. Local Level Institutions Study, *Working Paper No. 6, Social Development*
- [14]Gujarati, D.N., 2003, Basic Econometrics. Tata McGraw-Hill Edition, New York
- [15]Njoku, J.E., Odii Maca, 1991, Determinants of Loan Repayment Under The Special Emergency Loan Scheme (SEALS) In Nigeria. A Case Study of Imo State. In *African Review of money, Finance and banking*. FIN Africa Italy, 2 (6); 35.
- [16]NPC., 2006, Census Report. National Population Commission (NPC). Umuahia, Abia State, Nigeria.
- [17]Nwaobiala, C.U., 2013, Appraisal of Farmers Participation in IFAD/FGN/NDDC Community-Based Natural Resource Management Programme in Abia and Cross River States, Nigeria. PhD thesis, department of Agricultural Economics and Extension, Abia State University, Uturu, Nigeria
- [18]Odebode, S.O., 2006, Financing Cassava Processing among Women in Rural Nigeria to Alleviate Poverty: The Place of Self-Help Groups. *Bulgarian Journal of Agricultural Science*, 12, 115-122
- [19]Okunmadewa, F., Olaniyan, Y.O., Yusuf, S.A, Bankole, A.S., Oyeranti, O.A, Omonona, B.T, Awoyemi T.T., Kolawole, K., 2005, Human Capital, Institutions and Poverty in Rural Nigeria. Research Report Submitted to African Economic Research Consortium (AERC) Kenya for the second Phase of Collaborative Poverty Research Project
- [20]Singh, A.P., 2009, Women's participation at grass root level: An analysis. *Mainstream*, Vol XLVII No 12. Retrieved on 27th May, 2010 from www.mainstreamweekly.com
- [21]Shingi, P. M., Bluhm L. H., 1987, "Participation in irrigation projects -changing patterns in N/W India" (In) H. K. Schwarzweller (ed) *Research In Rural Sociology and Development*. 3, 65 – 84, Greenwich. Jai Press
- [22]World Bank, 1997, Social Capital: The Missing Link?. in *Expanding the Measure of Wealth: Indicators of Environmentally Sustainable Development*, Washington D.C.: T.
- [23]Yusuf, S.A., 2008, Social Capital and Households Welfare in Kwara State, Nigeria. *Journal of Human Ecology*. 23(3): 219-229

MANAGEMENT ISSUES OF THE CORN CROP ON THE EUTRICAMBOISLS FROM BREBU AREA (PRAHOVA COUNTY)

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Abstract

Regardless of its geographical position in Romania, corn is a plant of great importance for both human alimentation and animal nutrition, mostly in rural areas. Experiments conducted on the eutricambosols from Brebu village have found that locals are using local varieties, with a 2-3 times lower productivity than that of specific hybrids in the area, but also that they are using monoculture, sometimes unlimited in time. Our experiences aim was that of changing some technological system links even on small surfaces of 1-5 ha. For this purpose, the varieties were replaced with hybrids, which led to yield increases of 1.5 times. It was also introduced the fertilization with compost obtained in the household, while potato, peas, alfalfa (jumping field) and corn were used as previous crops. The experience conducted for 10 years only confirms the negative effect of the local variety and of the monoculture (annually yields of about 5-10 q/ha). The ameliorative previous plants, such as peas and alfalfa, increased by only 4.6 q/ha the corn yield of the variety, which had no significant reactions not even to the compost fertilization. Introducing a hybrid from FAO 300 group, crop rotation and compost manure led to an increased corn production of up to 55 q/ha, opening a new economic vision for those who have chosen to try this system.

Key words: compost, corn, crop rotation, hybrid, local variety

INTRODUCTION

National Institute for Soil and Agrochemical Research (NISAR) claims that eutricambosols occupy, in Romania, about 1.4 million hectares and that those are frequently located at heights of 500-1000 meters, in the peripheral area of the Carpathian Mountains [3].

The soil from the Brebu village, on which the experiences were placed, lies at an altitude of 800 m, it has a medium fertility (about 2.8% hummus), but it is rich in calcium (Ca), being formed on calcareous sediments [5].

The large surfaces cultivated with corn in the villages' area maintain the average production of Romania, for over 50 years, less than 3000 kg/ha [4]. This is because of the low crop productivity in these areas, generated by low natural fertility of some soils, but especially by the low use of inputs and by their quality. For rural areas, corn is a crop of high

economic and spiritual tradition, sufficient grounds for us to become so much concerned about this crop, but also about the area in question.

MATERIALS AND METHODS

Work has been done directly in the field, following the mechanistic research conception, by installing an experience on a surface of approximately 4000 m².

The experimental model was a trifactorial one, of 4 x 2 x 2 type, in which the three factors are:

1. Previous plant (crop):

- corn (monoculture);
- potato;
- peas;
- alfalfa (jumping field)

2. Biological material:

- local variety;
- hybrid.

3. Fertilization:

- without compost and chemical fertilizers;
- with compost made inside the household.

The used variety came from a local white population, historical and anthropic selected directly from the field, while the hybrid was part of the 300 group, not being every year the same. However, it was each time matured until the beginning of October.

As regards the compost it was produced in a special pit of cement, built near the stables and cages of animals and birds.

Compostable material was a mixture of manure from the local animals (cows, pigs, poultry, turkeys, sheep), to which were added organic wastes of vegetable and animal origin, carefully collected from the farm, crushed and put in the pit fermentation, being well mixed with the manure.

Into the pit were also introduced mowed and chopped herbs, weeds and even small quantities of alfalfa, in order to improve the nitrogen concentration of the compost.

The fermentation pit has had a special role in the household greening process, absolutely all the organic waste being gathered there. Compost fermentation lasted over one year, in the experimental plots being applied a dose equivalent to 25 t/ha.

The chemical composition of the resulting compost was presented in a previous scientific paper [1].

Basic and maintenance works were the ordinary ones made for the corn crop, using small mechanical machines specific to the region [2] – 40 HP tractor + disc + harrow.

No pesticides were applied, weed control being made with a motocrop machine and a hoe, system used by householders in the area. For all crops, the harvest was done by hand. Corn production was brought to a moisture of 14% (in seeds).

Results interpretation was performed by variance analysis calculation, by the "t" test on the student distribution, calculating the correlations and functions. All this work was made with special programs, designed by our research team.

RESULTS AND DISCUSSIONS

It was found that the monoculture and the biological material (variety – the local population) blocks most the production level (Fig. 1). Under the monoculture, the local variety yield (average 10 years) is only 6.45 q/ha.

Any other previous plant, starting with potato, increases production, this increase being statistically assured for peas and alfalfa, but without exceeding 30 q/ha.

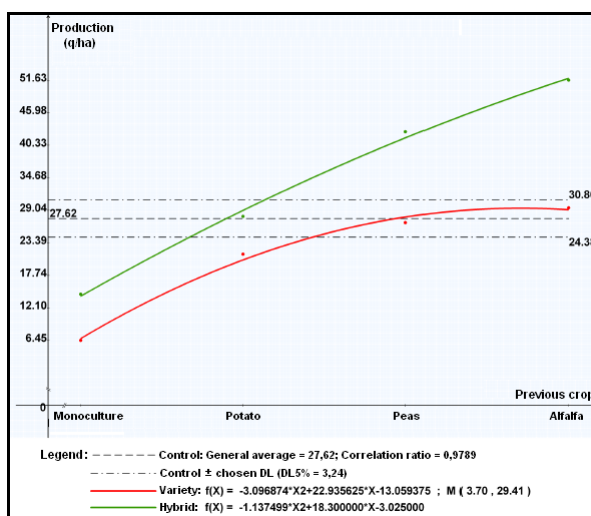


Fig. 1. Crop rotation and biological material influence on the corn yield – 10-year average (2001-2011) (original)

For hybrid, the yield in monoculture is not significantly detached, demonstrating that the long-term monoculture doesn't allow the superior valorization of a good biological material. Nevertheless, it is noticed that crop rotation, the previous crop, is much better used by the hybrid. Potato becomes, at its turn, a significant pre-plant, while peas and especially alfalfa raise the production to 40, respectively 51 q/ha.

On average, the compost is better exploited in peas and alfalfa, with residual effect on corn: +10.76 – very significant after peas and +15.06 – also very significant after alfalfa (Table 1).

Without compost, alfalfa provides to the corn crop the highest yield increase (+10.78 – very significant). It improves by 34 q/ha the negative effect of the monoculture in corn.

Table 1. Effect of fertilization and previous plant on corn production, using the average of the 10 years (original)

Fertilization	Previous plant	Prod. (q/ha)	Ratio (%)	Difference (q/ha)	Semnification
General average = 27.62 q/ha (Control)					
No compost	Monoculture	8.95	32.40	-18.67	o o o
	Potato	22.16	80.23	-5.46	o
	Peas	31.19	112.90	3.56	
	Alfalfa	38.40	139.01	10.78	* * *
25 t/ha compost	Monoculture	11.99	43.40	-15.63	o o o
	Potato	27.22	98.56	-0.39	
	Peas	38.39	138.97	10.76	* * *
	Alfalfa	42.69	154.53	15.06	* * *
				DL5% = 4.81	
				DL1% = 6.41	
				DL0.1% = 8.37	

Most important is to see how corn yield fluctuates depending on those three factors – biological material, treatment with fertilizers and previous crops (Table 2). Yield variation in this context is of $55.68 - 5.65 = 50.03$ q/ha, namely the level of a good production in the normal years, including in Southern Romania.

Table 2. Biological material, fertilization and previous plant effect on the corn production, using the average of the 10 years researched (original)

Variety	Fertilization	Previous plant	Prod. (q/ha)	Ratio (%)	Dif. (q/ha)	Semnification	
General average = 27.62 q/ha (Control)							
Local variety	No compost	Monoc.	5.65	20.45	-21.97	o o o	
		Potato	19.45	70.41	-8.17	o o o	
		Peas	27.27	98.74	-0.34		
		Alfalfa	29.23	105.80	1.60		
	25 t/ha compost	Monoc.	7.25	26.25	-20.37	o o o	
		Potato	23.38	84.62	-4.24	o o	
		Peas	26.50	95.93	-1.12		
		Alfalfa	29.70	107.52	2.08		
Hybrid	No compost	Monoc.	12.25	44.35	-15.37	o o o	
		Potato	24.88	90.05	-2.74		
		Peas	35.10	127.07	7.48	* * *	
		Alfalfa	47.58	172.23	19.95	* * *	
	25 t/ha compost	Monoc.	16.72	60.55	-10.89	o o o	
		Potato	31.07	112.50	3.45	*	
		Peas	50.28	182.00	22.65	* * *	
		Alfalfa	55.68	201.55	28.05	* * *	
						DL5% = 2.76	
						DL1% = 3.69	
				DL0.1% = 4.83			

Compared to the local conventional version (variety x monoculture), with 6.45 q/ha, the modern alternative proposed (hybrid x alfalfa) reaches 55.68 q/ha. Ratio, in this case, is:

$$\frac{55.68}{6.45} = 8.60$$

With the same work volume, but using a wise thinking and efficient technical and biological instruments, the yield can be 8 times increased, leading it in the field of economical satisfaction.

Compost is less valued (paradoxically) in monoculture, both by the variety (7.25 q/ha) and by the hybrid (16.72 q/ha). The difference between them is, however, significant.

Neglecting the crop rotation system and judging the difference between varieties (Table 3), we find that for both of them (local variety and hybrid) the 25 t/ha of compost doesn't increase in a significant way the production. So, we conclude that a combination formed between the previous plant and the compost application determines the production growth in proportion of over 87%.

Table 3. The effect of biological material and of fertilization with compost on the corn production, using the average of the 10 years (original)

Variety	Fertilization	Prod. (q/ha)	Ratio (%)	Difference (q/ha)	Semnification
General average = 27.62 q/ha (Control)					
Local variety	No compost	20.40	73.85	-7.22	o o
	25 t/ha compost	21.71	78.58	-5.91	o
Hibrid	No compost	29.95	108.42	2.33	
	25 t/ha compost	38.44	139.15	10.81	* * *
				DL5% = 3.21	
				DL1% = 4.29	
				DL0.1% = 5.61	

From Fig. 2 it follows that the use of compost is ineffective in monoculture and after potato, but it is effective after peas and relatively efficient after alfalfa.

Further it was carried out a calculation in order to separate the influence of each factor on the production increases, using a method elaborated by Berca Mihai and Draghici Manea (1972).

The factors influence distribution on the yield is presented below.

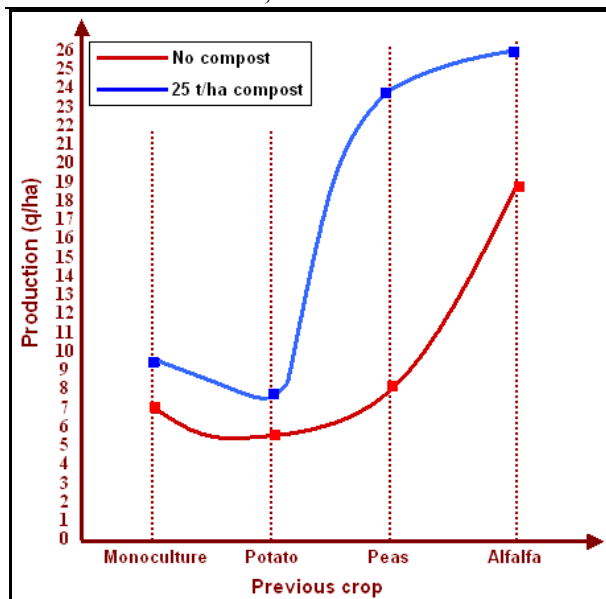
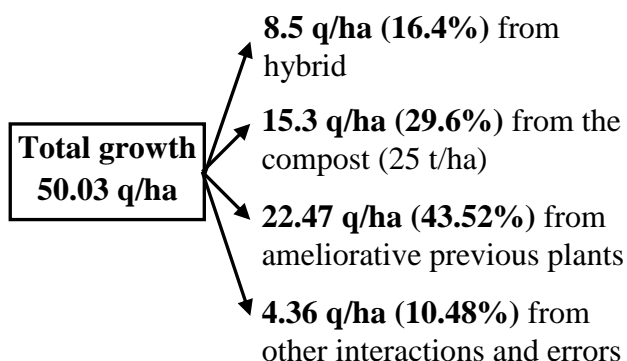


Fig. 2. Parallels between fertilized and unfertilized, depending on the difference between the biological materials used (hybrid – local variety), under the conditions of cultivation after different previous plants (original)

It resulted that the factors influence distribution on the yield is as follows:



CONCLUSIONS

On the eutricambosol from the rural area a subsistence agriculture is practiced, these leading to a yield of 6-8 q corn/ha using local populations, monoculture and with no fertilization.

By applying modern hybrids, a crop rotation system and using 25 t compost/ha as fertilizer, the production can reach over 55 q/ha, with a difference of about 50 q/ha compared to what it was produced before.

The used parameters (factors) participate with over 87% to the yield increase. What remains are interactions or errors.

Obtaining a production 8 times higher than the current one doesn't leave any question mark over the economical efficiency of this and not even over the householder satisfaction.

REFERENCES

- [1]Berca, M. et al., 2014, To a performant management in the subsistence households from the „branciog” (eutricambosols) area of Brebu Commune – Prahova County, Journal of Settlements and Spatial Planning (in publishing)
- [2]Berca, M., 2011, Agrotehnica, transformarea modernă a agriculturii, Editura CERES, București
- [3]Dumitru, M., Dumitru Sorina, Calciu Irina, Mocanu Victoria, Manea Alexandrina, Vranceanu Nicoleta, Tanase Veronica, Eftene Marius, Ciobanu, C., Risnoveanu, I., Preda Mihaela, 2011, Monitoringul stării de calitate a solurilor din România, Institutul Național de Cercetare-Dezvoltare pentru Pedologie, Agrochimie și Protecția Mediului, ICPA București, Ed. Sitech, Craiova
- [4]INSSE – Baza de date online Tempo
- [5]Date despre Comuna Brebu, www.brebuprahova.eu - <http://www.brebuprahova.eu/elemente-ale-cadrului-natural>

STUDIES AND RESEARCHES CONCERNING THE POSSIBILITY OF USING HYDROGEN IN TURBO ENGINES

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Abstract

The paper aims to study the main aspects related to using Hydrogen as fuel in thermal engines, the advantages and disadvantages of using it as fuel and the technical possibilities of adjusting it, Hydrogen used as supplement at the main fuel and Hydrogen used as working fluid. As a perspective, it can be considered using Hydrogen as thermal agent in a closed energetic flux with thermo- chemical compression of Hydrogen in a hybrid heat changer, based on the heat of burning products of thermal engines. The experiments made showed that using such a way of using the heat of burning products of turbo engines can assure the increase of power and efficiency of the whole installation with 20 %, which make us consider Hydrogen as a viable and advantageous alternative of fuel to be used in turbo engines and other engines.

Key words: efficiency, Hydrogen, turbo engine

INTRODUCTION

The quest of new sources of energy is one of major importance in our days, due to the situation of classic fuels, which would be exhausted in a near future. Among the new sources of energy, a special attention is accorded to the renewable sources of energy, such as the so called “green sources” of energy, of the wind, the sun, and Hydrogen. Hydrogen is considered to be the energy of the future, because it has very low pollution and the energetic efficiency is very high. In this respect, we studied the possibility of using Hydrogen in thermal engines, because the present engines fuelled with classic fuels are the most pollutant for the environment.

In order to use Hydrogen for turbo engine we must consider some important aspects, which are presented in the following lines.

The development of turbo engines emphasized the necessity of using fuels which fulfill the following basic aspects [2] :

- The powerfull release of heat in a reduced volume, in order to maintain in resonable limits of engine weight and dimensions
- The qualities of anti-pumping, such as the fuel flow to assure a stable burning at very low temperatures

-A very quick and sure start at low temperatures. In the case of a stop, the restart must be easy and sure

-The thermal power of fuel must be as high as possible considering the consumption

-The waste of combustion must not have a harming effect on the engine elements and on the environment

-The fuel must have characteristics which can assure a good stability in functioning

-The fuel must be available in sufficient quantities. This aspect has a special importance and explain the evolution of the last 10 years for fuels

-The fuel price, which counts directly and considerable in companies exploitation rentability to be decreased

The advantages of using Hydrogen are considerable, but the main disadvantage consists in the modifications which are required to the thermal engines, which are fuelled with classic fuels [3].

MATERIALS AND METHODS

In this section are presented the main ways and particularities of using Hydrogen in turbo engines.

The perspective of using Hydrogen in engines

can be studied in the following hypothesis:

- Hydrogen used as supplement to the main oil fuel
- Hydrogen used as basic fuel
- Hydrogen as working fluid.

The use of Hydrogen as additive

In the first case researched, Hydrogen is used as additive in the conventional fuel used in the engine usually. In this case, Hydrogen added to hydrocarbons is used in order to improve the exploitation characteristics of engines through [1] :

- Reducing of emissions of pollutant and carcinogen substances
- The extension of stable functioning zone of the burning chambers in the case of cooling the mixture fuel- air



Fig.1. The engine fuelled without Hydrogen compared to the engine with Hydrogen intake

In Fig. 1, in the left side is presented the classic engine and in the right side, the engine fuelled with Hydrogen. As we can observe, the power in case of using Hydrogen as fuel is 90 %, compared to 60 % in the case of classic engine. Also, the fuel consumption at 100 km is much lower in the case of using Hydrogen.

- The increase of economy and durability of the engine
- The consumption reducing of traditional hydrocarbons

In order to calculate the equilibrium composition of the dissociated burning products are usually used the following hypothesis:

- the burning products represent an ideal burning fluid which is obeyed to the state equation of the ideal gas and is in energetic, chemical and phase equilibrium

- the components enthalpies of the dissociated mixture, their specific heat and the equilibrium constants do not depend on pressure
- the burning is adiabatic and stationary, being characterized through the homogeneity of parameters in cross section of burning chamber and the complete release of heat.

RESULTS AND DISCUSSIONS

The use of pure Hydrogen

The use of Hydrogen as fuel in turbo engines allows to be realized compact burning chambers with more uniform thermal field at exit. At a given engine power, the function with Hydrogen is characterized through much more reduced values of gases temperature in the turbine, as a result of a much higher specific heat of gases, compared to the functioning with classic hydrocarbons.

The use of liquid Hydrogen in the cooling systems of the most thermal exposed parts can afford the substantial increase of the maximum temperature of gases in front of the turbine and the reducing of fuel. The Hydrogen burning is characterized through a reduced capacity of radiation and the absence of soot, which means that in the exploitation conditions characteristic to engine is not deteriorate in time and the life span, compared to the functioning with hydrocarbons increases.

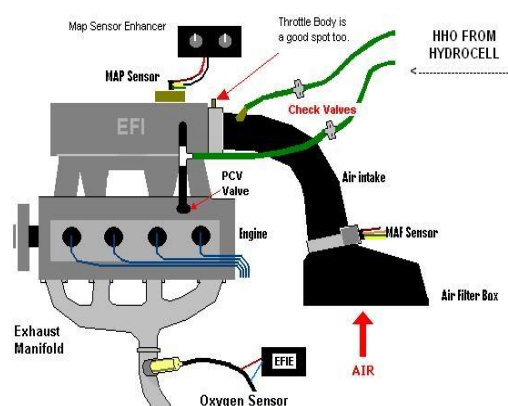


Fig.2. The scheme of engine fuelled exclusively with Hydrogen [4]

The use of atomic Hydrogen

The biggest traction of the engine can be

obtained through the chemical energy of free radicals of the substances which are in instable chemical state. The molecules dissociation in free radicals leads to energy absorption. The atomic Hydrogen is an accelerator of chemical reactions, and in particular of the fuel oxidation reactions with Oxygen.

In present, the obtaining and maintaining of atomic Hydrogen with high concentration and in big quantities represents a very difficult technical problem.

The use of Hydrogen as thermal agent

As a perspective, Hydrogen can be used as a thermal agent in closed energetic stream with the thermo- chemical compression of Hydrogen in a hybrid heat changer, based on the heat of burning products of thermal engines. The experiments showed that the use of such a way of using of the heat of burning products of turbo engines can assure the increase of power and the economy of the whole installation with 20 %.

If we look at using Hydrogen as fuel from the efficiency point of view, regarding the profitability and cost [6], [7], we will find that Hydrogen is a good choice.

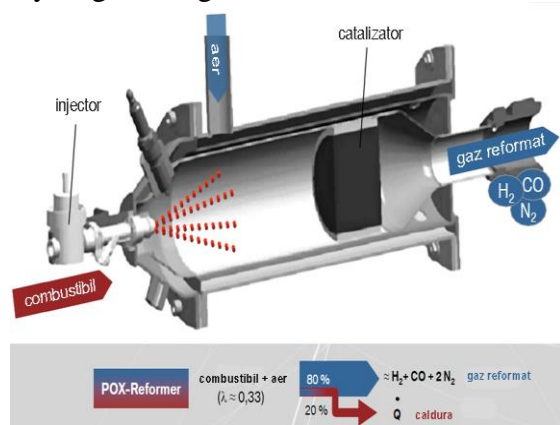


Fig.3. Heat recover from the rear bumper gases [5]

CONCLUSIONS

Achievements and perspectives

The main problems related to the use of Hydrogen as fuel are the engine adaptation and the assuring of service.

The first problem displays the following aspects:

A first advantage is that at equal volumes,

Hydrogen weights 10 times less than gasoline, which is an important factor to be considered.

- Hydrogen is an ideal fuel, which does not request but minor modifications to the existent engines. Such engines will have a life spam with 25 % longer than that of the present engines, needing with 25 % less time of maintaining

- Hydrogen has a burning temperature bigger than gasoline and thus has the possibility of obtaining bigger power

- Hydrogen presents the advantage that can be also used as a cooling agent of engine and of heated parts

- The main advantage of using Hydrogen as fuel in turbo engines is that it removes almost completely the environment pollution, compared to the pollution produced by the oil fuels.

Considering these aspects exposed above, Hydrogen can be a competitive fuel both from the efficiency point of view and the environment friendly fuel point of view. That is why the researches on using Hydrogen as future fuel are worth to be continued.

REFERENCES

- [1] Brian, C., 2001, An Introduction to Fuel Cells and Hydrogen Technology, Heliocentris, 3652 West 5th Avenue, Vancouver, BC V6R-1S2, Canada
- [2] Dumitru, M., 2010, Researches on the alternative fuels which can be used to motors, Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca vol.67, pag.115-122, Cluj-Napoca,
- [3] Dumitru, M., 2010, Researches on the possibilities of using alternative fuels at automobiles and tractors motors, Research Journal of Agricultural Sciences, vol.41, ISSN 2066-1843, Timișoara
- [4] Negurescu N., Pana C., Popa M., Cernat M., 2009, Experimental and Theoretical Researches of Hydrogen Use in SI Engine, International UAB- BENA WORKSHOP '2009, Alba Iulia
- [5] Prisecaru T, Dica C, Petcu, C, Prisecaru M, Chiriac, R., 2008, Injection Technology of Hydrogen Gas to Reduce Sulfur Oxide and Fly Ash Emission, ASME International Mechanical Engineering Congress and Exposition, Boston, Massachusetts, IMECE2008-66936, U.S.A.
- [6] Simtion D., Luca R., 2008, Profitability as main objective for ensuring sustainable development within agricultural exploitations, Bulletin of the University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Editura Academic Pres; p.338-343, Cluj-Napoca,

Napoca

[7] Simtion D., Luca R., 2008, Limits regarding profitability analysis based on financial and cost accounting information systems, Bulletin of the University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca Editura Academic Pres, p. 469, Cluj-Napoca

RISK ASSESSMENT IN PROJECT PLANNING USING FMEA AND CRITICAL PATH METHOD

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Abstract

This paper is based upon the research undertaken for the development of the doctoral thesis “Management of software projects based on object-oriented technology”. The study examines the existing risk management practices commonly used for classic software development. The goal is to integrate the elements of the traditional risk management methodologies to create a new agile risk management methodology. The thesis focuses on techniques that can be easily implemented in extreme programming (XP) and SCRUM. This study is motivated by the following research questions: What are the elements of existing quality assurance tools that could meet the principles of agile development? And is it possible to use risk estimation for improving quality in agile projects? The thesis presents a synthesis of the most common risk management techniques, as well as an introduction to agile methods XP and SCRUM. The proposal integrates the concepts of Failure Mode and Effect Analysis into the iterative life cycle of an agile software project. The thesis presents a metamodel which integrates the concepts of agile development methodologies: SCRUM and XP with the FMEA concepts for risk quantification. The model was partly implemented into a real development project. Partial results show the improvement in early identification of failures and allowed to reconsider the Sprint plan.

Key words: critical path method, failure, FMEA, project planning, risk management

INTRODUCTION

Agile methodologies were created to provide the user with several releases of the software as fast as possible assuming continuous variability in the requirements and design. Functional software is the only certain measure of progress; therefore continuous deliveries of them are required. Among the characteristics that agile methodologies should accomplish, according to the agile manifesto, customer satisfaction is one of their main focuses as the first principle establishes:

“Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.”[5]

We could say that a customer or user is considered satisfied when all the agreed requirements have been delivered on time and on budget.

In order to comply with the main principles of this approach, agile development teams should be totally receptive to continuous

changes in the requirements. Experts in software development quality assurance as Lindvall, Boehm and others, have discovered that the quality of personnel required for this type of projects is higher than usual [14]. Experience and communication skills become as influential as technical knowledge. Therefore, the software development team and the business analysts cannot be independent teams; they should have continuous cooperation and clear communication. Surveys like [9] and [10] show that it is called high-caliber team is one of the critical success factors in agile projects.

Agile development methodologies have become very trendy and successful software development techniques. However, there are still many critics regarding potential overspending due to the continuous changes in requirements and design. Authors from Carnegie Mellon institute like [13], [14], [16] consider that although there are principles of some agile methodologies that contribute to quality assurance, the truth is that there are no

formal processes defined for risk identification and control within the agile approach. This statement motivated the development of this thesis, which intended to formalize a risk management (RM) model suitable for agile software development.

The article presents an additional section covering the relationship between the critical path method and FMEA. Additionally I have explored the uses of FMEA in Agriculture for failure management in the production process.

Dissertation Goals

This thesis is based on a literature review of most popular agile development and risk management methodologies. The main sources base for this research were [4],[7],[8],[17],[18],[19],[20] with the support of many other sources.

This work is divided in 3 phases: literature collection and review, identification of gaps or opportunity for research and modeling of a methodological proposal.

The principal goals of the thesis are:

- To identify the agile practices those ensure quality software projects.
- To define a methodological approach for RM processes applicable to projects developed using XP or SCRUM. This approach will be based on existing methods for identification, evaluation and risk controlling.

The specific goals for this report are:

- To review the current state of art of FMEA and Critical Path Method uses in Project Planning
- To identify previous application of FMEA in Agriculture.
- To identify the relationship and possible integration of FMEA and Critical Path method for Project Planning.

MATERIALS AND METHODS

Agile risk management practices

There have been many discussions regarding which aspects of risk management are already included in the agile methods. Most of the analysis done [7], [15], [17], [18] conclude that there should be a mix of plan-driven and agile methods, in order to increase the probabilities of success.

The main purpose of risk management is to eliminate risks or transform them into acceptable (tolerable uncertainty), in order to make decisions with less subjectivity. Therefore, the impact and the probability of occurrence of risk should be measured.

While risk management models define clear stages of risk assessment, agile methodologies do not describe any risk management phases within their activities and processes. All decisions regarding the action to be taken are based on team member's opinion. Agile teams do not use any metrics to evaluate and/or determine the risk impact and probability of occurrence.

FMEA

FMEA (Failure Mode and Effect Analysis) [22] is used to identify potential failures within a system, evaluating their effects, which mean to rank their severity and occurrence. The purpose is to recommend possible actions to prevent these failures from reaching the customer/user.

A failure is considered any error or defect in any part of the system, which affects the customer. The effects are the consequences of a failure during the operation of the product. Severity is defined according to the harm produced to the customer or the seriousness of the effect on the functionality. There is a correlation between effect and severity; if the effect is critical then severity is high and vice versa.

The process FMEA is evolutionary and includes application of several technologies and methods. The aim is a quality product with the minimum of failures, prioritizing the customer requirements; partly the reason of agile methodologies as well.

Severity (SEV): The first step in a risk analysis is to quantify the severity of the effects; they are evaluated on a scale of 1 to 10 with 10 being most severe.

Occurrence: Represents a remote likelihood that customers experience the failure effect. Higher values represent more probability of occurrence, while lower values represent incidents that are unlikely to occur.

Detection: Is the rank corresponding to the probability that the current control will detect

causes of failure modes before the product leaves the manufacturing area. It's very important not assume low probabilities just because the occurrence is low; these two rankings may or not may be correlated.

Risk Priority Number: Known as RPN, defines the priority of the failure. In FMEA the goal is always to reduce RPN through a reduction in severity, occurrence and detection. The risk priority number (RPN) is the mathematical product of the severity, occurrence and detection:

$$RPN = S * O * D$$

Recommended action: There is no point to do FMEA analysis without a recommended action.

Typical recommendations may be:

- No action at this time (Tolerate)
- Add built-in detection devices (Increase detection or predictability)
- Provide alternatives to the design (Avoid before occurrence)
- Add a redundant subsystem (Tolerate with Action)
- Response action to effect (Mitigation)

FMEA in software development

Even that FMEA was originally created for assessing risk related to hardware, there are several studies [6], [12], [3] that confirm its use in agriculture.

In Lauritsen [12] they propose to use FMEA in the agile development. They specify two types of FMEA: Functional and Detailed. Functional FMEA refers to requirements definition phase. Detailed FMEA is used between the design and coding activities. The disadvantage of this proposal is the addition of extra activities to the workflow, instead of integrating the FMEA concepts within the current workflow. This may seem as lack of agility in this proposal. The advantage is the potential use of the FMEA results to easily create test cases.

Banerjee [3] became the base reference of the FMEA in software development. This paper concludes that FMEA brings several advantages to the development process, mainly accurate effort estimation and quality assurance.

FMEA in Agriculture

Several studies have been developed proving that FMEA finds its application also in the Agriculture sector. Existing methods for risk assessments have been also combined with FMEA in order to guarantee more accuracy.

T.H. Varzakas [25], [1], [2] from the Technological Educational Institute of Kalamata in Greece has several use cases of FMEA in Agriculture. In all of them the main emphasis is on the quantification of risk assessment by determining the RPN per identified processing hazard.

In [25] there is a comparison of ISO22000 analysis with HACCP over pistachio processing and packaging. The processes of salting and roasting, hand grading of split nuts to remove defects and debris, packaging and storage or shipping, drying of split and non-split nuts to 5-7% moisture as well as dumping of nuts and conveying over an air leg to remove debris were identified as the ones with the highest RPN (280, 240, 147, 144 and 130 respectively).

As FMEA suggests, corrective action were taken, depending on the level of tolerance of the identified risks. Following these actions RPN was calculated again obtaining significantly lower values.

Other methods were also applied, like the Ishikawa (Cause and Effect or Tree diagram). The results corroborated the validity of conclusions derived from risk assessment and FMEA. Therefore, the author considered that the incorporation of FMEA analysis within the ISO22000 system of a pistachio processing plant is considered essential.

In [2] as in the previous one a combination of the Failure Mode and Effect Analysis (FMEA) and ISO 22000 was applied for risk assessment, this time in salmon manufacturing processes.

Critical Control points were identified and implemented in the cause and effect diagram (also known as Ishikawa, tree diagram and fishbone diagram).

The processes with highest RPN identified were: Fish receiving, casing/marketing, blood removal, evisceration, filet-making cooling/freezing, and distribution (252, 240,

210, 210, 210, 210, and 200 respectively). As in the previous example the authors recalculated the RPN after the corrective actions were taken. The result once more shows that the incorporation of FMEA analysis within the ISO 22000 is anticipated to prove advantageous to industrialists, state food inspectors, and consumers.

The University of Bonn, Germany also has carried out studies of FMEA in Agriculture. In [11] the motivation to apply FMEA were the strong regulations of the government and other organizations related to hazard control in agro-food. Quality assurance becomes the aim of these regulations. The authors considered that FMEA could be an appropriate tool to enable animal health services to support farmers to fulfill these requirements. The paper presents a computer aided FMEA tool, which includes elements of the HACCP concept. The tool allows documenting efforts made to meet the claims of quality assurance and simultaneously provides gathered knowledge in form of a knowledge data base supporting the advisory service to solve concrete problems on farm. During the study, it was discovered that FMEA allows proving the execution of these procedures for health certification and health insurance purposes according to the demands of EU-regulations and distributive trade.

CRITICAL PATH METHOD

This Project management method was created to address complex and routine processes with certain level of uncertainty.

The method provides a graphical view of the activities and the sequence of these ones. Subsequently, helps to predict the time required to complete a task or project.

The graphical view and the allocation of time per activity allow identifying the longest path in the process. This one will be defined as the critical path.

Timing is defined based on four measurements: ES (earliest start time), EF (earliest finish time), LF (latest finish time) and LS (latest start time)

The critical path occurs when $ES=LS$ and $EF=LF$. In which case a delay in the critical path have consequences in the schedule of the

whole project.

There are some limitations in this model. The risk aimed is only concerning delays in the project. Additionally it works well for routine process. In projects where the processes are variable and the level of uncertainty is higher CPM does not provide sufficient support. [21]

The use of CPM and FMEA is complementary. CPM aims risks associate with the time required for completion of a task and its consequence in the subsequent processes. FMEA is very flexible and it is not attached to a specific type of risk. Its application in different fields proves the versatility and the success to address different levels of uncertainty in almost any kind of project.

METHOD AND GOALS DEVELOPMENT

We find a possibility of prioritization in case of lack of recourses. User stories can be discarded cause of detection ranking or level of occurrence. Giving more time for complex valuable stories or adding more stories to iteration. Standard agile rely on the iteration concept for solving problems. This implementation provides a complementary approach to track risks and failures.

Our intention with this study is to propose an iterative use of the FMEA as part of the process of an agile project, by nature iterative. Not only for identifying failures in the final product but also possible obstacles that may affect the development of the project itself.

This iterative analysis of risk will allow the team to consider update of the risk register after every iteration or Sprint.

We would like to evaluate the relationship between the concepts of FMEA and Software risk management previously described separately:

Failure: According to FMEA a failure is described as any malfunction in a system. In Software engineering, especially in the agile approaches, a failure can be described as fail to meet any of the functional or nonfunctional requirements.

Samples of failures in a software project can be divided in two categories, the one related to the final product and the failures related to the project management.

Sub categories of failures/risks related to final

Do I see any impediment that prevents me or the Development Team from meeting the

Table 1 shows the example of the agile FMEA form used for the study case. The form integrates the concepts of user stories and engineering task to a regular FMEA form.

43

Due to easy access to information and low restrictions of confidentiality we were able to work with the second sample mentioned above. The development team allows us to implement the methodology and track results. In order to evaluate results the methodology was implemented only for some parts of the projects. The team chose a group of user stories that will be monitored using FMEA.

We proceeded to compare the results of those User stories that were tracked against the ones that were not part of our process.

The user stories selected for FMEA use showed an interesting behavior. Most of them showed consequences that may compromise the quality of the product and the timing of the project. Therefore, some of the stories derivate in several ones. The developers were able to adjust the plan of the Sprint and schedule first the most critic engineering tasks fitting to the desired length of the Sprint.

CONCLUSIONS

Reviewing the current state of agile risk management practices we have confirm that the agile approach lacks of formal implementation of risk management activities. Common risk management practices in XP and SCRUM rely on the concept of incremental development.

As per the goals defined for this thesis, they were fulfilled as follows:

- The agile practices that ensure quality software projects were identified as follows:

- Principles in SCRUM of Inspection and adaptation. Regular evaluation against expected results is part of the life cycle in a SCRUM project. The SCRUM team is developing under the principle that requirements may and will change at any moment.

- Sprint retrospective is also present in SCRUM projects. It corresponds to an internal evaluation of the team performance in terms of processes and communication.

- Mitigation of risks: This task is performed basically turning issues into new features to develop.

- Real customer involvement in order to fulfill

user requirements and share continuous feedback on the ongoing development.

- Shared code responsibility among the team members. Collective ownership is translated in collective knowledge reducing the risk of truck factor.

The risk management activities identified in agile methodologies do not follow formal implementation neither cover the basic three aspects of risk management (identification, quantification/evaluation and control/monitoring).

- A methodological approach for RM processes was defined to be applied in projects developed using XP practices and/or SCRUM methodology. This approach uses the concepts of FMEA to identify, quantify and control risks.

- The methodological approach proposed by this thesis includes few and low effort activities to identify, track and measure risk. These activities are easily added to the normal life cycle of iteration in an agile project.

- The existing method for quality assurance FMEA we supported by several of the ideas compound in the agile approach. It can be considered by nature an agile method.

- The work presented in this document provides a formal framework for agile teams to address risk management without jeopardizing the agile nature of the project development.

Suggestions for further research

There may be a possibility of a quantitative model but this was not considered during this thesis since we believe this goes against the agile approach.

Future work is towards validation of the methodological approach defined in a real case of study integrating the RM processes into an XP/SCRUM project.

Future project could be initiated as an extension of the presented work to be applicable in other agile techniques as Adaptive Software Development, Agile Unified Process, etc.

REFERENCES

[1]Arvanitoyannis, I. S., Varzakas, T. H., 2008, Application of ISO 22000 and Failure Mode and Effect

- Analysis (FMEA) for industrial processing of salmon: a case study. *Critical reviews in food science and nutrition*, 48(5), 411-429.
- [2]Arvanitoyannis, I. S., Varzakas, T. H., 2009, Application of failure mode and effect analysis (FMEA) and cause and effect analysis for industrial processing of common octopus (*Octopus vulgaris*) – Part II. *International Journal of Food Science & Technology*, 44: 79–92. doi: 10.1111/j.1365-2621.2007.01640.x
- [3]Banerjee, N., 1995, Utilization of FMEA concept in software lifecycle management. *Software Quality Management*. 1, pp. 219-230. Southampton: Computational Mechanics Publications.
- [4]Beck, K., 2004, *Extreme Programming Explained: Embrace Change* (2nd Edition Ed.). Addison Wesley.
- [5]Beck, K., Grenning, J., Martin, R., Beedle, M., 2001, agilemanifesto. Retrieved 2008, from Manifesto for Agile Software Development: <http://agilemanifesto.org/>
- [6]Bicchieri I., Bucci, G., Nocentini, C., Vicario, E., 2012. An Ontological Approach to Systematization of SW-FMEA. In F. Ortmeier, & P. Daniel (Eds.), *Computer Safety, Reliability, and Security* (Vol. 7612, pp. 173-184). Berlin: Springer Berlin Heidelberg.
- [7]Boehm, B., 2002, Get ready for Agile Methods, with Care. *Computer*, 35 (1), 64-69.
- [8]Boehm, B., 1991, Software risk management: principles and practices. *Software*, IEEE, 8 (1), 32-41.
- [9]Buchalcevová, A., 2009, Research of the Use of Agile Methodologies in the Czech Republic. In *Information Systems Development* (pp. 51-64). New York: Springer US.
- [10]Chow T., C. D., 2008, A Survey study of critical success factors in agile software projects. *Journal of Systems and Software*, 81 (6), 961-971.
- [11]Gödderz, A., 2007, Failure mode and effect analysis (FMEA) as a decision support tool within a quality information system in pork production chains. *Quality management in food chains: [EAAE Seminar on Quality Management and Quality Assurance in Food Chains held at the Georg-August-University of Göttingen in 2005]*.
- [12]Lauritsen, T., Stålhane, T., 2005, Safety methods in software process improvement. 12th European conference on Software Process Improvement (pp. 95-105). Berlin: Springer-Verlag Berlin.
- [13]Levine, L., 2005, May, Carnegie Mellon Software Engineering Institute. Retrieved 2012, from *Reflections on Software Agility and Agile Methods: Challenges, Dilemmas, and the Way Ahead.*: <http://www.sei.cmu.edu/library/assets/reflections.pdf>
- [14]Lindvall, M., Basili, V., Boehm, B., Costa, P., Dangle, K., Shull, F., 2002, Empirical Findings in Agile Methods. Second XP Universe and First Agile Universe Conference Chicago (pp. 197-207). Berlin: Springer Berlin Heidelberg.
- [15]Moran, A., 2014, *Agiles Risk Management*. Zurich: Springer International Publishing.
- [16]Nelson, C., Taran, G., Hinojosa, L., 2008, Explicit Risk Management in Agile Processes. *Agile Processes in Software Engineering and Extreme Programming*. 9, pp. 190-201. Limerick: Springer Berlin Heidelberg.
- [17]Nyfjord, J., 2007, Commonalities in risk management and agile process models. *Proceedings of the 2nd International Conference on Software Engineering Advances (ICSEA'07)* (p. 18). France: IEEE Computer Society Press.
- [18]Nyfjord, J., 2008, Integrating Risk Management with Software Development: State of Practice. *Proceedings of The International MultiConference of Engineers and Computer Scientists* . 1, pp. 878-884. Hong Kong: Newswood Limited.
- [19]Nyfjord, J., 2008, Towards integrating agile development and risk management. Stockholm University, Faculty of Social Sciences, Department of Computer and Systems Sciences. Kista: Institutionen för data- och systemvetenskap (tills m KTH).
- [20]Project Management Institute PMI., 2013, *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)* (5th Edition ed.). Project Management Institute.
- [21]Sixsigmaonline.org, 2014, Types Of Six Sigma Tools. [online] Available at: <http://www.sixsigmaonline.org/six-sigma-training-certification-information/articles/types-of-six-sigma-tools.html>.
- [22]Stamatis, D., 2003, *Failure Mode and Effect Analysis: FMEA from Theory to Execution* (2nd Edition ed.). Milwaukee: Amer Society for Quality.
- [23]Sutherland, J., Schwaber, K., 2011, October, The SCRUM guide. The Definitive Guide to Scrum: The rule sof the game. Retrieved March 2012, from Scrum.org: https://www.scrum.org/Portals/0/Documents/Scrum%20Guides/Scrum_Guide.pdf
- [24]Torchiano, M., Ricca, F., Marchetto, A., 2011, Is my project's truck factor low?: theoretical and empirical considerations about the truck factor threshold. 2nd International Workshop on Emerging Trends in Software Metrics (pp. 12-18). New York: ACM.
- [25]Varzakas T.H., Zakyntinos I.G., Arvanitoyannis I.S., 2010, Application of failure mode and effect analysis (FMEA) and cause and effect analysis in conjunction with ISO2200 to a pistachio processing plant. In: Zakyntinos G. (ed.). XIV GREMPA Meeting on Pistachios and Almonds. Zaragoza: CIHEAM / FAO / AUA / TEI Kalamatas / NAGREF, 2010. p. 281-287 (Options Méditerranéennes: Série A. Séminaires Méditerranéens; n. 94) Available at: <http://om.ciheam.org/om/pdf/a94/00801316.pdf>

ETHICS AND COMMUNICATION IN MANAGEMENT

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Abstract

Management ethics, the determination at what means "fair", "correct" and "just" in decisions and action that affect the others, passes the simple problems like corruption, steal and swindle. It is focused on human interrelations such as between employers and employees, sellers and clients, shareholders, creditors, distributors, community members. The solving of the ethics dilemmas in management do not represent just a delimitation between good and bad, correct and incorrect, but also it is a complex judgement aiming a balance between economical and social performance of the firm, taking into consideration all what could happened. Solving ethics dilemmas by managers is not easy, and the decision will depend all the time of their personality, experience, education, feelings, attitude and personal values. The communication is part of the organization infrastructure. Any effort for the development of an organization should be considered a priority for the human factor. An efficient communication is the only way in which employees can correlate their efforts, whose quality is leading to the organization success.

Key words: ethic codes, organizational climate, communication, ethics, management

INTRODUCTION

Management ethics

Judge once as a trifle, ethics is seen today as a fundamental aspect of management.

Having the leading positions, ethics must be "a way on", a way of progress. An ethical conception is essential in setting up support and a positive involvement of all who take part to the firm success: employers, clients, shareholders, creditors, distributors or community members.

The main problem in management ethics is the permanent conflict between the firm economical performances, measured by incomes, costs, profits and the shareholders, firm social performances, clients, creditors, distributors, community members. So, management ethics dilemmas in management don't represent just a delimitation between good and bad, correct and incorrect, but also they are a complex judgement, taking into consideration all what could happened.

Every enterprise has a certain **responsibility** regarding the economical and social plan; this point of view is belongs to all the business "actors" of the world. In a classical way of

speaking about "ethics", the firms should bring benefits to the owners; economic and social approach - a maximum profit is the second priority of the firm, the first being the firm insurance.

In this respect, the **ethical obligations of the manager** would be:

- To the shareholders: fair administration, loyalty, information, transparency, confidentiality;
- To the employers: fair payment, professional development, respect to their personal life, respect to their petitions;
- To the clients: quality services/products, product warranty, information;
- To the community: protecting the environment, helping in solving the social problems, respecting the culture diversity.

Business ethics is essential for long term success.

Confidence means the diminishing of the risk and is referring to:

- Confidence in contractors relations;
- Confidence in consumers relations: a salesman wins client confidence when is honest, competent and kind with him. Clients are expecting from salesmen the promise of

quality and the correct information about the product;

▪ Confidence in employers relations: confidence must be taken to superiors and to subordinates, too. A confidence framework means a good communication, employer fidelity, trust, diminishing the conflicts between employers.

Under the conditions of an increased competition in business environment, it is not easy to decide all the time in favour of social performances.

On the other hand, it is not possible to decide every time in the favour of economical performances.

Regarding these problems, in fact ethical dilemmas, the legislation could be helpful, referring at a series of standards given by the society to guide the person way into society.

For managers, it isn't easy to solve this ethical dilemmas, and the decision will depend all the time on their personality, experience, education, feelings, attitude and personal values.

This is available both at company level, but also when managers travels in the business world [2, 3]

MATERIALS AND METHODS

The practical fundamentals of ethical business are the following ones [1]:

1. Respecting the informational confidentiality;
2. Sensibility to the conflict of interests;
3. Respecting the right rules;
4. Professional consciousness;
5. Loyalty and good faith;
6. The sense of responsibility;
7. Respecting the rights and freedom of others;
8. Respecting the human being.

In many business situations, it was proved that ethics represents a need and respecting the ethics fundamentals we will obtain good results in any area. The practice has demonstrated that ethics in business represents a good investment on long term, because it creates a favourable image and personality. Ethics is the best advertisement that an organization can do it.

The fundamental relation on which business ethics is focused is due to the economical performances of the enterprise measured by incomes, costs, profits and due to the shareholders, firm social performances, clients, creditors, distributors or community members. Speaking about ethics at company level, we must think at all the dimensions involved by this such as:

- Personal ethics;
- Fellows ethics like organization members (achieving the purpose, respecting the internal rules);
- Organization ethics;
- Enterprise ethics in its relation with external environment (contractors, clients, mass-media, society, natural environment). [2]

Strategy and ethics are conjugated at organization level. We can conclude that ethics is profitable; it must be seen like an investment of the organization for a long run. It is not against profit, but only against an unfair profit obtained illegally and/or not morally.

The advantages offered by the application of business are:

- Market advantage;
- Employers' superior performances;
- Earnings in management reputation.
- Legal and financial advantages.

The ethics quality of the firm and of its personnel depends on the leaders and managers' quality.

This study started from the model established by Luthans et al., in 1988, regarding the managerial effectiveness based on canonical correlations which pointed out that there are two types of managers [4]:

(a) the quality oriented manager, where the correlation between productivity-quality is -0.79, the correlation between quality and interacting with outsiders is -0.48, the correlation between quality and productivity is -0.79 and the correlation between quality and planning is -0.31;

(b) the quantity oriented human resource manager, where the correlation between productivity-efficiency is 0.50, the correlation between productivity-quantity is 0.76, the correlation between effectiveness and staffing is 0.53 and between effectiveness and

motivating 0.37.

In fact, the main conclusion is that the most successful manager is the one who performs fewer activities.

In this study case, it was selected a sample of 10 managers of agricultural and food processing companies from various counties of Romania in order to evaluate the effects of their orientation in human resource management destined to increase the performance of the company, therefore, it was considered that all of them belong more to "**the quantity oriented human resource manager**".

For this reason, considering that the results of their human resource management is the best reflected by economic indicators, there were taken into account two important economic indicators: turnover/employee and profit/employee.

Also, it was considered another sample of 10 employees from each company whose purpose was to evaluate employees' satisfaction for their work, incentives, salary, atmosphere, management in the company, based on a scale between 1-4, where: 1-Very satisfied, 2 - Satisfied, 3-Less satisfied, 4-Unsatisfied.

For each criterion, each company received a point using a scale from 1 to 10, one meaning the top position for the best result and 10 the lowest one.

Then all the points were summed, and finally, each company received its position in the company ranking.

RESULTS AND DISCUSSIONS

Ethics and employers. The activities regarding leading human resources as: personnel recruitment and selection, formal evaluation, record analysis, remuneration etc) are the ones which frequently are the causes of the ethics dilemmas. To encourage ethics, in human resources management, the leaders should support some activities like:

- Recruiting of personnel in the departments with a sensitive ethics, and these persons should know all what this domain involves ethically speaking;
- Recruiting people whose ambitions are

temperate of other objectives; excessive ambition can determine employers to break the law and ignore ethics;

- Encourage their trust and loyalty; this will determine the employers to feel good when ethics is available;
- Growing the relation between personnel and managers will improve communication;
- Dividing work tasks so that the employer to be motivated and feel that is appreciated;
- Establish the internal mechanisms against illegal behavior and without ethics;
- Creating some standards to give awards according to the performances;
- Establish some moderate sanctions if the case.

Ethics and consumers is a relation close related to marketing policy, quality and product safety. At the individual consumer level, the critics are regarding misinformation and cheating, whose purpose is to denigrate some companies and firms. At social level, the main concerns are regarding social and cultural impact of marketing communication.

Roll of ethical codes in organization management

Frequently, the levels of the managerial ethics application are clear mentioned in the ethics codes.

At the beginning, the codes were developed by professional groups as deontological rules and only later it was noticed an explosion of this inside the organization.

The ethic code is available only if all the members of the organization respect it; when the manager does not give importance to it, for sure even the employers won't respect it.

Ethics codes are the ones which give status, standards and trust to the organization. This norms are in general suggested, discussed and defined by the leading board and then published and distribute to the employers. The norms express the way in which the organization members must act in a given situation.

So, through ethical codes, the board tries to encourage the way of thinking and attitude who lead to the wanted goal.

The importance of ethic codes of the organization is given by:

- A higher involvement and loyalty coming from employers and superiors;
- A deeper staff selection and promotion based on the values of firm;
- A higher trust and cooperation from the moment when the working team is interested in.

Objectives of a behaviour code

A behavioural agreement is concluded between ethics when one is trying to promote professional values. In addition to this desideratum, there are some other purposes such as:

- Concluding a moral contract between beneficiary and organizations, and with the members of that organization, too;
- Protecting the organization from the unfair acts;
- Promoting a positive image of the organization;
- Offering a way to establish the members devotion;
- Creating a feeling of one less for group members;
- Showing managers' commitment;
- Making agreements based on trust and responsibility;
- Guiding behaviour in case of some ethical dilemmas.

If we would like to set up a hierarchical system of the importance of ethical standards, we could say that the basic rules that should be respected by the organization and also by clients and employers.

Regarding the client, negotiation must start from the idea that the both parts have the power of discernment, that they could see the risks, and are responsible and have good intentions. Regarding the employers, we must remember that people often are like a work force. Relationships between employers and firms on ethic bases are required for the existence of the most active values of the work process –the human resources.

Communication in Management Activity

The specific forms of the communication process are in accordance with the specific management activities.

Based on experimental studies performed on the management activity of the successful

managers, Luthans, Hodgetts and Rosenkrantz (1988) and Sharp (1998), also have drawn the conclusion that the management activities are [4, 5]:

- communication, that is an information exchange of various types, representing one third of the working time;
- traditional management, meaning prognosis, decision, and control representing one third of the working time;
- management of human resources, meaning the development of employees, their motivation and conflict management.

The concrete targets for which the manager communicates are based on the following communication functions:

Information Function: the organizations need interaction with the outside environment in which they perform, but also inside the organization, within the departments and also between employees. The manager has to deal with 2 types of information: external (marketing, advertising and public relations) and internal information.

Control and Training Function refers to the way in which the employees and the departments are operating in the direction of their target. Decisions and instructions ensure the conformity to the organization policy, the uniformity of procedures and the safe achievement of work targets. They are important in the process of formation and development of new employees.

Inducing, Convincing, Consulting and Advising Function refers to: the correct use of communication channels, keeping the team in operation by flowing information, selection, and checking of data. Communication is the way through which employees can be motivated and which influences their attitude and behavior. This is the context in which management communication activities represent the bond that keeps the organization united towards the general benefit.

Specific of Communication in Management: the characteristics of management communication are generated by the communication purpose, aim and role, by the organization's structure and culture. At the same time management communication is

subject to the ethic norms of the organization culture and policy, as well as to the individual ethics of managers. The process and products of the management communication rely on specific principles, standards and rules and take specific shape.

The performance management has appeared after 1980. Since that moment, the manager has become entrepreneur, resource administrator and leader. As an administrator and leader, he works for the best results for which there is a market, products, services, and technologies. This means that the administrator draws the effective decisions and become the core of decision and leadership. Thus, the management communication is not only a way of sending messages, training, motivation, but it also becomes a dynamic force to be shaped by its environment. The communication system creates instruments necessary to adjust the organization structure and processes to continuously changing conditions. The manager's role is to develop the communication system to help the implementation of the organization's strategy. Communication is vital in all management functions. Thus, planning based on foresight defines the targets of performance, decision on work targets, and necessary resources to achieve goals.

The organizational work implies the construction of the relational framework of the information system, reception and use of feedback, motivation on targets, all these being achievable through communication. Coordination and control will make the activities and resources ensure achievement of the proposed targets. In fact these targets depend on the efficiency of communication, on

how responsibilities are shared, on a good cooperation climate, on the employees' motivation. The control function is done through communication means and takes into consideration the evaluation of employees' performance, and working behavior. Without an efficient communication, there is no other way to adjust the organization, to operate changes and to implement strategies.

Even if the importance of the code ethic increase, a few companies are counting ethics considerations in them programs of managerial development, few are firms who establish ethical and social responsibilities at Directory Council or at every other level of the organizations.

The existence of an ethical code of organization isn't a guaranty that the employers will act properly, but could reflect a certain level of culture organization.

Some codes are only a policy for some organizations, trying to give an incentive to employers ethical management. Some other codes are making rules for establishing a proper management of business meetings and establish the procedures for a normal act.

Nobody can say exactly which code is more efficient and even if a certain code guaranties a proper employers' conduct. It seems that a general rule is that these ethic codes to be more simplified; the more complicated they are, the more chance to result a negative effect. [6,7]

The managers activities followed in this study on a sample of 10 managers of agricultural and food processing companies are presented in Table 1. In the same table, there are shown as term of reference, the results found by Luthans et al., 1988.

Table 1. Managerial activities

Activity	Percentage in this study	Percentage found by Luthans et al.1988
Planning/coordinating	25	23
Processing paper work	6	19
Interacting with outsiders	18	13
Monitoring/Controlling performance	15	11
Socializing	12	9
Training	10	8
Staffing	7	5
Managing conflict	4	5
Motivating	3	4

Source: [4], Own calculations

Table 2. Turnover, gross profit and number of employees per company in 2013

Crt.No.	Name of the Company	Turnover	Gross Profit	Number of Employees
1	SC Agroindustrială Pantelimon SA, Ilfov	4,403,307	163,405	58
2	SC Avicola Buzau SA, Buzau	187,314,306	329,155	449
3	SC Ilya Agro Valcele SA, Calarasi	7,844,338	1,609,231	27
4	SC Casa Popenilor Verzi SA, Dabuleni, Dolj	179,663	8,377	1
5	SC Hibridul SA Harman, Brasov	3,043,419	9,454	1
6	SC Agricola International SA Bacau	363,291,288	961,676	1,755
7	SC Meda Prod 98 SA Bucuresti	101,341,028	493,794	487
8	SC Agrovet SA Bucuresti	19,456,507	353,855	33
9	SC Avicola Slobozia SA, Ialomita	62,743,128	3,521,656	386
10	SC Agro Pol Popesti-Leordeni SA, Ilfov	1,026,390	40,242	12

Source: Balance Sheets and Profit and Loss Accounts, 2013

Turnover, gross profit and the number of employees per company are presented in Table 2.

Turnover/employee, profit/employee, overall performance, employee satisfaction, total points and the ranking of the companies based on these criteria reflecting the effect of the managers' activity oriented to company performance but also to human resource satisfaction are presented in Table 3.

-Turnover/employee varied between Lei for 3,043,419 for the Company 5, occupying the top position and Lei 75,919 for the Company 1, situated on the last position. The average turnover was Lei 526,059. The companies with a turnover per employee higher than this average have been only 5 and 8.(Table 3).

-Profit/employee ranged between Lei 59,601 in case of the company 3 situated on the top position and Lei 547 in case of the company 6, coming on the 10th position. The average profit/employee accounted for Lei 2,334. The

companies which registered a higher profit per employee than this average there were:1,3,4,5,8,9,10. Therefore, only 3 companies: 2,6,7 registered a lower profit per employee compared to the average profit.(Table 3).

-Overall performance. Summing the points received for these criteria, it was established the number of points for overall performance for each company, where only three companies:5,8 and 3 recorded the lowest number of points, reflecting the best activity. On the last position was situated the company 1 with the highest number of points. (Table 3)

-Employee satisfaction. The individuals included in the sample, used to evaluate the employees' satisfaction giving marks in the scale between 1 and 4, had only two alternatives, 1 meaning " Very satisfied" and 2" Satisfied". For this reason there are not significant differences between companies. (Table 3)

Table 3.Companies ranking concerning the economic effects of human resource management oriented on company performance, based on various criteria and points method

Crt. No.	Turnover/Employee		Profit/Employee		Overall performance Total points	Employee satisfaction	Total points	Firm position
	Lei	Position	Lei	Position				
1	75,919	10	2,817	7	17	2	19	7
2	418,295	3	713	9	12	2	14	3
3	290,531	4	59,601	1	5	1	6	2
4	179,663	7	8,377	5	12	2	14	3
5	3,043,419	1	9,454	3	4	1	5	1
6	207,003	6	547	10	16	2	18	6
7	208,092	5	1,013	8	13	2	15	4
8	589,591	2	10,722	2	4	1	5	1
9	162,546	8	9,123	4	12	2	14	3
10	85,532	9	3,354	6	15	2	17	5
Average	526,059	2,334	-	-	-	-	-	-

Note: Employee's satisfaction 1-Very satisfied 2- Satisfied

Total Points has been determined by adding all the points received for Overall performance to Employee satisfaction. (Table 3)

Company ranking. Based on the total points, there were identified two companies for the top position: Company 5 and Company 8. On the second position is situated Company 3 and on the third position there are coming three Companies: 2, 4 and 9. On the last position is situated Company 1. (Table 3)

CONCLUSIONS

An ethics code must have the following properties:

- To strictly and clearly establish the ideal elements and also the obligations;
- To be used to every bodies satisfaction. They wouldn't be used to serve the individual interest against the public interest;
- To protect the public interest;
- To honest and peculiar to the work domain.

Managers can improve communication diagnosing dysfunctions in sending messages.

The first steps to a good communication are:

- 1.Increasing trust level by: solving problems by means of reciprocal collaboration; using a descriptive speech; spontaneous and honest attitude; describing the targets clearly; avoiding employees manipulation; discussing and analyzing each operation; practising an egalitarian attitude, avoiding superiority.
- 2.Leading productive meetings
- 3.Changing organizational structure
- 4.Avoiding communication barriers with the aim of improving it.

Regarding the study case, the main conclusion in Ethics and communication at company level, it is obvious that most of the managers belong to the type "oriented quantity human resource manager", because their goals are to increase production, turnover, profit, firm performance but also the employees' satisfaction that they accomplished their responsibilities.

REFERENCES

[1]Donaldson, T., Dunfee, W.T., 1999, Ties that Bind: A Social Contracts Approach to Business Ethics. Harvard Business School Press

[2]Donaldson, T., Dunfee, W.T., 1999, When Ethics Travel: The Promise and Peril of Global Business Ethics, California Management Review, Vol.41(4):45-63

[3]Fritzsehe, D. J., 1997, Business Ethics: A Global Managerial Perspective, Curs MBA, McGraw-Hill Companies.

[4]Luthans, F., Hodgetts, R., Rosenkrantz, S., 1988, Real Managers, Baliner Cambridge, M.A.

[5]Sharp, D. 1998, Business Ethics Cases, The Univ. of Western Ontario

[6]Tănăsescu Rodica, 2001, General and juridical management, Ed. Universitas, Bucharest.

[7]Țigu Gabriela, 2003, Business ethic in turism, Ed. Uranus, Bucharest

THE MANAGEMENT OF RISKS IN BUSINESS AND IN THE MANAGEMENT OF HUMAN RESOURCES

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Abstract

The characteristics of market economy and coordinates of modern life have determinate both individual level and organizations increase of number of risk who can affect us, of their dimensions and of the consequences which induce them, but at the same time a highest need of firm security. In economic and financial department was develop an entire area –management risk and many financial instruments to reduce or diminish risk. The behaviour of economical agents respectively of the entrepreneurs and managers is different according to the risk in many respects: risk adversaries unaffected to risk and risk believers who leave mark on decisions take it. Management risk is an cyclical process with distinct stages: risk identification, risk analyses and risk reactions. The management of this phenomenon goes from this context and the firm objectives, analyse the risk factors into a security conception having the purpose to minimize the risks and the cost. The policies of occupational safety and health at the level of the organization must include information regarding: the general security and health policy at work; the specific risks and the way of dealing with them; the responsibility of the managers in this field; the measures of implementation of these policies and must be based on: Employee safety is very important; Safety is prior to efficiency; Employee safety leads to advantages and efficiency; Respecting the regulations

Key words: business, work environment, reaction to risk, work security, means of work

INTRODUCTION

A first signal of market economical maturity is the quality of economical agent to think strategically in what concern risk. So, economical agents from Romania are astonished by the risk dimensions in business.

To initiate an affair, the enterprising takes upon certain risks. Some are inherently for development of business, other appear as unknown causes. Enterprising must know how to manage in this situations for the risks trough an efficient system.

Risk management in business enterprises was commented by Carey and Turnbull (2001), Hunt (2001), Butteworth, (2001). [3,5, 9]

As financial subject, risk management was studied later [15]

Risk is define in general terms, as a possibility to expose to danger, to support losses.

Generally, the risk is an economical, social, political category distinguished as:

- An uncertain event but possible with its consistence in incertitude;

- An element which produces material or moral damages;

- The risk appear in human, political and economical activities;

- Its effect once happened, it can be removed. Excepting the incertitude, risk is characterized by the possibility to describe a probability law given results, and being aware of this law for the specialists and economical agents.

The objective probability and its risks reflects the events position on its statistic data.

The subjective probability and its risk have the personal mark of the fellow (optimistic or pessimistic), reflecting the mentality of the person who decide, based on intuition or at the moment observations of the decisions he had taken.

Objective risk is a variable independent of the fellow.

Subjective risk is a estimation of objective one influenced by the perception. Perception is influence by the preparation, experience, age, health, temperament.

The taken risk depends on the financial efforts which are assumed by the manager to obtain the future results, in function of the available finances.

Risk is caused by the following aspects:

- Changes in the economical conditions along the time (fail interest, foreign currency, inflation, import);
- Technological changes;
- Invalidation of previous experiences;
- An imperfect knowledge of exogenous variables;
- Pessimist or optimist attitude of the team;
- Errors of economical or technical analysis;
- State intervention (taxes and inputs);
- Price changes.

Pure risk is the consequence of some accidental activities who are a menace for firm, losses being hardly delimited.

Speculative risk appears due to the manager wish to achieve the objectives which will increase the economical power of firm. It can be carried out in time and controlled by administration, marketing and management technics.

Classic economy combat is against the two risk technics which in reality are interdependent. The increased vulnerabilities of the company is the result of the interdependence between the two risk categories.

Based on the assurance possibilities, there are: insured risks or assured risks. The causes which determine them are named events such as: hail, polish, avalanche, floods, robbery etc.

According to their type, risks can be: Market Risk, Property Risk, Personnel Risk, Customers Risk, Contractors Risk, Operational risk, Credit risk, Bankruptcy risk etc. [1, 12,16]

Based on the events which determined them, the risks are: climatic risks, technical risks, technological risk, commercial or marketing risk, financial risk, economical or failure risk, investment risk, social risk, political risk, informational risk, exchange risk, state risk, conjunctural risk, accidental risks, professional risk etc. [7,8]

Among the most used methods suitable to various types of risks, there are the following

ones: Loss distributions, Value-at-Risk, Credit rating models, Economic Capital, Shareholders value added, Risk pricing, Risk transfer, Scenario analysis, Sensitivity analysis, Control self assessment, the Expected Value Method, Simulation, Decision Trees. [11,15]

Managers attitude given to risk

“Into a market economy, the fellows are risking time and money hoping that they will have benefits. While some don’t win nothing, other succeed. The market system work trough trials and errors and assign resources for what seems to be a moment innovation.” [4]

The management of the economical agents is different after the types of risk: risk rivals, indifference at risk, risk lovers. Business men tolerance at risk is marked by themselves.

In this context, bankruptcy represent the legal-economical attempt to take part of this situations in which the potential risk is a certitude for some firms.

Business Risk depends of the strategy of each economical agent, of its capacity to anticipate the evolution in the future.

Business men tendency to risk is different. This is happening because the atmosphere developed inside the firm.

Without risk it couldn’t be benefits.

There are three essential motivations to calculate the decision:

- Assuming the risk to have success;
- Assuming a professional obligation as a personal one;
- Assuming the risk involves emotions because the danger that it involves. Many people affirm that the pleasure of success is stimulated by risk.

Other studies mentioned that managers avoid risk because it is considered that it can n't be controlled. They don’t accept the idea that the risks to control them. They consider that they are able to control the risk. When they take the risks, they do it changing the conditions to be sure that they don’t fail. Before of any other decision, they think of a good strategy to control the situation.

The French physician Louise de Broglie said: “We must follow the risk because it is the key of success”.

The risk comes from us because we live in a risky society. The appearance and development of risk creates crises which are thought as some gapes in a system.

Risk evaluation means to establish the next values of risk: neglectful risk, minor risk, medium risk, major risk, disaster.

Table 1. Six levels of Risk Management-The socio-technical system involved in risk management

Research Discipline	Risk management levels	Environment stressors
Political Science, Law, Economics, Sociology	GOVERNMENT Judgment-safety reviews, accident analysis	Changing political climate and public awareness
Economics, Decision theory, Organizational sociology	REGULATIONS, ASSOCIATIONS Law Judgment-incident reports	
	COMPANY Regulation Judgment-operations review	Changing market condition and financial pressure
Industrial engineering, management and organization	MANAGEMENT Company policy Judgment-Logs and work reports	Changing competency and levels of education
Psychology, Human factors, Human-Machine intercatons	STAFF Plans Judgment-observations, data	
Mechanical, chemical and electric engineering	WORK Actions Hazardous process	Fast pace of technological change

Source: Rasmussen Jens, 1997[13]

There are six level of risk management as mentioned in Table 1, as established by Rasmussen Jens, 1997. [13]

Based on this schema, Cassano-Piche et.al.(2009), evaluated risk management in the food safety domain on BSE in the UK. [6] In this context, this research work aimed to assess risk bankruptcy at company level, one of the most important risks that a company manager should keep under control.

MATERIALS AND METHODS

The risk bankruptcy was determined using the Score Function Z (Conan, J. and Holder, M.,1968) for an agricultural commercial company dealing with dairy farming in the Southern Romania. [16]

The Z function equation was:

$$Z = \sum_{i=1}^n K_i R_i + C,$$

where K_i = each ratio weight, R_i = ratio value for a certain company, C – a constant variable.

The value of Z function is:

$$Z = 16R_1 + 22R_2 - 87R_3 - 10R_4 + 24R_5$$

where: R_1 = Partial Liquidity, R_2 – Financial Stability, R_3 – Financial Expense, R_4 – Personnel Salaries, R_5 – Profit weight in value added.

The resulted Z value was compared to the standards values: $Z < 4$, 75 % high bankruptcy risk, $4 < Z < 9$ – 35-50 % bankruptcy risk and $Z > 9$, 10-35 % bankruptcy risk.

The analysis period was 2010-2012 and the primary data were collected from the company Balance sheets and Profit and Loss Accounts.

RESULTS AND DISCUSSIONS

Risk management

To realize objectives and project of an enterprise, we must assume some risks, caused by:

- Medium or internal changes;
- Composing some unrealistic strategies;
- Errors in production and in execution.

Risk inside a firm is referring to the probability of not respecting the terms:

- Performance (not achieving the quality standards);
- Program (not respecting the terms of execution);
- Cost (exceeding the budget).

Risk management is a cyclical process, with different stages: identify the risk, analysis and reaction of risk. It contains a series of activities, which start from the context and firm objectives, analysis the risk factors and minimize the risk and cost.

Two important characteristics of market economy should be taken into consideration:

- Tendency to increase the risk because of the development of technological process, dimensions and interdependency of activities, social changes;
- The increased need to assure firm security.

Practically, the management risk involves a systematic process of knowing potential factors which determine firm security, measuring the danger level, effect decrease by protecting and preventing, and at the end, the transfer of those causes which can't be administrated by the firm.

The financial theory shows two important effects:

- Economical effect, regarding the patrimonial elements of a firm;
- Financial effect related to firm abolishment and solvency.

Risk management has two important dimensions:

1. factor variability and the consequences of the negative results;
2. different administration cost, depending on risk consequences and its manner of decrease.

The cost of administration risk is the total of external expenses. The risk insurance is such a cost. Based on the two dimensions: the total injury and the cost of administration risk, it could happen the decision factors to the risk by the following aspects:

- preventive measure which can reduce the consequences and the increase of the risk cost, minimize repetitions and realizations of the events;
- transfer of some partial or total risk to assurance, determine the cost increase, and

diminish the consequences of the risk decrease. So, the objective of risk management is the placement into an area in which the risk is assumed, and the cost is acceptable and the firm allow them.

In the decisional process, the risk involves to make difference between general management and risk management. In the Western countries, there is a Department dealing with the evaluation, analysis and administration of the risk. Its function is an intermediary one between the traditional firms and firm management.

This process is managed by persons who communicate all the information to the members board. This person is named a "risk-manager" by anglo-saxons and in France "auditeur des risques" meaning a bookkeeping risk.

Risk evaluation is divided into three segments:

- a) estimation of the business area – national economy, activity sectors and firm;
- b) study of firm organization – functions, strategy, budget, administration control;
- c) the general analysis of the financial situation and results – investments, analysis of internal and external financial sources, analysis of cost, profit and expenses.

All these are mentioned in a periodical report to which all the members of the Board can have access, especially the general manager and the financial directory.

Risk analysis includes:

The Phase to identify the risk

Identification of the risk can be made using some methods:

Making some lists which involve the risk potential: medium conditions, expected results, employment, estimation of cost etc;

Using the experienced personal to identify risks. Often the employers know better the risks than the ones from the office. Communication will help to diminish these two risk types.

Identify of the external risks, with the need of one person who will participate at meetings and who will know all what is published.

The Phase of evaluation

We take into consideration the risk from the first phase and realize a quantification of that. For risk analysis it is used a mathematical

instrument which must be adjusted based on the needs and data base.

The Phase of analysis refers to the identification of needs, causes and establish the managerial measures of decrease and elimination of risk. A risk can be provoked by many causes which must be treated, and the

causes can be prevented or treated on short, medium or long run.

Regarding the study case in this paper on risk bankruptcy, the resulting Z value, using the R1-R5 values in the score function, is shown in the Tables given below.

Table 2. Primary data used in bankruptcy risk analysis (Lei)

Specification	2010	2011	2012	2012/2010%
Working assets	1,876,890	3,050,832	2,780,296	148.13
Inventories	966,795	1,616,354	1,749,635	180.97
Financial expenses	126,565	91,737	57,863	45.72
Personnel expenses	1,310,954	1,086,224	1,341,302	102.31
Turnover	3,564,940	3,383,381	3,569,396	100.12
Long term equity	641,340	0	0	0
Current debts	489,240	265,932	982,119	200.14
Total liabilities	2,148,803	2,885,302	1,871,508	87.09
Gross profit	-449,773	-58,083	+19,584	435
Value added	1,569,242	1,750,989	1,948,784	124.19

Source: Balance sheets and Profit and loss account of the Company, Own calculations.

Table 3. Risk ratios in bankruptcy analysis

Risk ratio		2010	2011	2012	2012/ 2010 %
Partial Liquidity	R1	186.02	539.41	104.94	56.41
Financial Stability	R2	75.18	31.75	81.26	108.08
Financial Expenses	R3	3.55	2.17	1.62	45.63
Personnel Expenses	R4	83.54	62.03	68.82	82.37
Gross profit share in Value added	R5	-28.66	-3.32	+1.004	-

Source: Own calculations.

Table 3. Z function value

Item	2010	2011	2012
16 R1	2,976	8,630.56	1,679.04
22 R2	1,653.96	698.50	1,787.72
-87 R3	-308.85	-188.79	-140.94
-10 R4	-835.40	-620.30	-688.20
24 R5	-687.87	-79.68	24.00
Z	2,798.19	8,440.29	2,661.62

Source: Own calculations

The Z values were positive in the analyzed period. However, the figures from Table 3 reflect that the company is facing a high bankruptcy risk. The lack of payment capacity and the low profitability rate are obviously the

convincing proof.

A risk coefficient of 80% is very high, therefore, there is no room for a financial recover. Such an analysis should be made periodically so that to be enough time as the manager to take the corresponding measures to improve the financial statement.

Risk elimination is compulsory and involves as the managers:

Not to initiate a business transaction;

To establish a high price to eliminate the risks;

To condition the offer.

The companies which apply the project of risk management had the following advantages:

-A better assignment of resources;

-Lower cost of risk transfer;

-Company, firm exposure to risk.

Some companies administrate the risks in the individual department of management. So, the treasurer is the one who determines the effects and fluctuations.

Even the company manager could be a risk, because he manages the firm capital.

Another manager risk is the one who picks an assurance program on many years to prevent the company of some risks.

In all these situations, the risk will appear after a decisional process. The treasurer analyses the financial and operational risk, and the president analyses the political,

economical and financial risk.

Every risk manager draws decisions on risk administration for which he is responsible and this could lead to an unefficient risk of administration.

Among the reasons determining some companies to administrate risks in a centralized manner there are:

- Expansion in many countries, subdue the company to variation, regulation and different business environment.

- Expansions can bring big losses, mainly financial losses to the company, affecting the activity for other countries;

- Changes inside the company;

- Proactive management and a proactive attitude to risks.

A manager who can't take his risks does not have what to do in this field.

Recently, the risk does not represent the impossibility to assure the expected result, but its costs. This remark confirms two values: the performance level and the survival level. These values are studied for the point of view of success, lack of success and development.

In the opinion of many experts, defining occupational health and safety management and circumscribing their objectives is one of the major problems which depends on the status of this specialized field clarification.

According to those authors, occupational health and safety management can be defined as the set of management and organization activities with the purpose of taking optimal decisions in the projection and process regulation, by means of which the desired level of health and safety for employees is obtained. Also, in a reference work, the occupational health and safety management is analyzed as a set of the following activities:

- elaboration of health and safety policies;
- identifying and assessing risks;
- implementation of occupational safety and health programs that belong to the organization's domain;
- accident prevention and stress management;
- safety and health organization and communication of appropriate practices

The Objectives of occupational health and safety management aim at reaching maximum

security in activity conditions and refer to:

- maintaining and promoting the health of employees and their ability to work;

- eliminating occupational accidents and diseases;

- creating optimal working conditions;

- avoiding the risks of injury and occupational disease;

- minimizing risks which cannot be avoided;

- developing organizations and their culture so that this promotes a positive social climate.

With regard to maximum security, it is considered a set of principles and methods combined into a general strategy of the organization whose purpose includes:

- mobilizing, involving and adhering of all employees

- improving safety and health by prevention;

- evaluating work safety and health. [18]

Factors involved in work process and their interconnection

Work accident and professional illnesses are random events under probability appreciation.

No matter what activity is involved, each and every work process implies four factors interconnecting with one another: performer, target, capital goods, work environment.

The human factor is also indirectly found in the system, namely as a conception and decision factor for the other factors. Thus, both the target and the capital goods as well as part of the work environment are conceived and activated by human factor. All these facts are part of the work system. From the point of view of work protection, the work process has two characteristics: human factor is present as „performer” and the ability of the involved factors to achieve a work system.

The first characteristic defines the work process as a space for work accidents; the second helps to understand the mechanism of work accidents occurrence.

Risk Factors in Work System

In order to underline these factors we need a systematic analysis at the level of each system component.

Performers Risk Factors

A possible deviation of the performer from the target line is an error at the level of the basic links of activity which can lead to

reception, processing and rendering errors of information, performance and decision errors.

Risk Factors for Work Targets

At this level two types of possible accident or professional illness causes can appear:

- improper contents of the work target regarding the requirements imposed by the risk situation
- under/over estimation of the requirements imposed on the performer

Risk Factors for Capital Goods

These risk factors can appear under the form of:

- mechanical risk factors
- thermic risk factors
- electric, chemical and biological risk factors

Risk Factors for Work Environment

The physical environment can have deviations such as:

- an overflow of specific parameter levels (lighting, noise, noxes, radiation)
- improper work conditions

The social environment can be characterized by psychic risk factors which could lead to an excessive implication of the performer.

CONCLUSIONS

All what we notice lead to the next conclusions:

- Business without risk wasn't and wouldn't be. The difference is that some affairs are more risky. Some managers try to ignore the risks, and others are doing all what they can to diminish it. However the risk is present. So, faster you get use to the managerial risk faster you will succeed.
- The dimensions and the form of risk in the market economy is the highest one compared to the centralized economy;
- Need of some strict instruments to calculate the risks;
- Risk gets a function of managerial competence, doesn't have anything in common with the destiny, but only with the manager to establish its evolution;
- Economical agents and their managers have less information concerning the types of risk and their dimensions;
- Risk analysis should allow a hierarchy;
- The increase of risk roll in the decision area

is the main item in the activities development of managerial risk which will allow to form a mentality on the market economy;

-Risk generates crisis which are considered as broken sides from the normal function of the system;

-Risk area is concentrated into three expressions:

- ANALYSIS: to identify the risks and evaluate the direct and indirect consequences;
- REDUCTION: to prevent risks, to diminish or to eliminate them. To assure the apparition of new risks and to diminish the unexpected effects by corresponding means of protection;
- FINANCE: to control the costs and the potential losses.

REFERENCES

- [1]Alexander, C., 2001, (ed).Mastering risk, Vol.2, Applications, London, Financial Times, Prentice Hall
- [2]Beasley Mark, Hancock Bonnie, Case studies on Enterprise Risk Management Implementation
- [3]Butteworth, M, 2001, The emerging role of the risk manager in Pickford, J. (ed)
- [4]Caraiani, G.et al., , 2006, Business management, Ed. PRO Universitaria, Bucharest
- [5]Carrey, A., Turnbull, N., 2001, The broadroom imperative on internal control in Pickford, J., (ed)
- [6]Cassano-Piche, A.L., Vicente, K.J., Jamieson, G.A., 2009, A test of Rsmussen's risk management framework in the food safety domain: BSE in the UK, Theoretical Issues in Ergonomics Science, Vol.10 (4):283-304
- [7]Cornescu Viorel, Marinescu Pal, Curteau Doru, Toma Sorin, Managementul riscului, <http://ebooks.unibuc.ro/StiinteADM/cornescu,Cap.5.htm>
- [8]Cornescu, V., Mihailescu, I., Stanciu S., 1994, Management theory to practice, Ed. ACTAMI, Bucharest
- [9]Hunt, B., 2003, the Timid Corporation, Chichester: John Wiley
- [10]Lipsey, R. C., Chrystral, K. A., 1989, Positive Economy, Ed. Economica, Bucharest
- [11]Louisot, J.P., Ketcham, C., 2014, ERM-Enterprise Risk Management: Issues and Cases, Wiley, 280 pages
- [12]Marrison,C., 2002, The Fundamentals of Risk Measurement, New York Mc.Graw Hill
- [15]Markovitz, H., 1959, Portofolio selection: Efficient diversification investments. New York, John Wiley
- [16]Mikes Anette, 2005, Enterprise risk management in action, Discussion Paper no.35, London School of Economics and Political Science
- [15]Pickford, J., (ed), 2011, Mastering Risk, Vol.1:Concepts, London, Financial Times, Prentice

Hall

[16]Popescu Agatha, 2007, A case study concerning the use of bankruptcy risk analysis, Scientific Papers Agricultural Management, Timisoara, Vol.IX(4)

[17]Rasmussen Jens, 1997, Risk management in a dynamic society, a modelling problem, Safety Science, Vol.27, No.2/3, pp.183-213, Elsevier, Great Britain

[18]Tanasescu, R., 2001, General and juridical management, Ed. Universitas Company, Bucharest.

RESEARCHES ON THE DIGESTERS AND REACTORS WHICH CAN BE USED IN A FARM SCALE BIOGAS PLANT

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Abstract

In the general context of searching integrated system of renewable energy production, this paper present some researches on the reactors and the digesters, as a main part of a biogas plant at a farm scale. After we present the most used types of digesters, we also concentrated over the processes which take place into a digester, one of them being the removal of H₂S from biogas (desulphurisation), which can be made by various methods, either biological or chemical, taking place inside or outside the digester. In the case of biological desulphurization outside the digester, we concentrate on the types of reactors which can be used in this case. Beside the well known types of reactors, we present the possibility of using an original self pressure membrane bioreactor. In this type of bioreactor, the metabolic activity of gas producing microorganisms, especially yeast, could obtain high pressure from gas produced in closed medium on the one hand, and separation of other products of metabolism through membrane on the other hand, using gas pressure as driving force. It is known that several strains of yeast resist on very high hydrostatic pressure heaving good activity. This fact give the possibility to use their energy for other purposes, such as producing mechanical work. Combination of both, gas pressure and alchool burning, increase the process efficiency.

Key words: biogas plant, digester, modular membrane bioreactor, self pressurized membrane bioreactor

INTRODUCTION

A farm scale biogas plants is named the plant attached to only one farm, digesting the feedstock produced on that farm. Many farm scale plants co-digest also small amounts of methane rich substrates (such as oily wastes from fish industries or vegetable oil residues), aiming to increase the biogas yield. It is also possible that a farm scale biogas plant receives and processes animal slurries from one or two neighbouring farms (e.g. via pipelines, connecting those farms to the respective anaerobe digestion unit).

There are many types and concepts of farm scale biogas plants around the world. In Europe, countries like Germany, Austria and Denmark are among the pioneers of farm scale biogas production. The interest of European farmers in anaerobe digestion applications is growing nowadays, not only because agricultural biogas production transforms waste products into valuable resources and produces high quality fertiliser, but also because it creates new business opportunities

for the involved farmers and gives them a new status, as renewable energy providers.

The farm scale biogas plants have various sizes, designs and technologies. Some are very small and technologically simple, while others are rather large and complex, similar to the centralised co-digestion plants. Nevertheless, they all have a common principle layout: manure is collected in a pre-storage tank, close to the digester and pumped into the digester, which is a gas-tight tank, made of steel or concrete, insulated to maintain a constant process temperature. Digesters can be horizontal or vertical, usually with stirring systems, responsible for mixing and homogenising the substrate, and minimising risks of swimming-layers and sediment formation.

MATERIALS AND METHODS

The core of a biogas plant is the digester - an air proof reactor tank, where the decomposition of feedstock takes place, in absence of oxygen, and where biogas is produced. Common

characteristics of all digesters, apart from being air proof, are that they have a system of feedstock feed-in as well as systems of biogas and digestate output [5]. In European climates anaerobic digesters have to be insulated and heated.

There are a various types of biogas digesters, operating in Europe and around the world. Digesters can be made of concrete, steel, brick or plastic, shaped like silos, troughs, basins or ponds, and they may be placed underground or on the surface. [1]. The size of digesters determine the scale of biogas plants and varies from few cubic meters in the case of small household installations to several thousands of cubic meters, like in the case of large commercial plants, often with several digesters (Figure 1).

The design of a biogas plant and the type of digestion are determined by the dry matter content of the digested substrate. As mentioned before, anaerobe digestion operates with two basic digestion systems: wet digestion, when the average dry matter content of the substrate is lower than 15 % and dry digestion, when the dry matter content of the substrate is above this value, usually between 20-40 %.

Wet digestion involves feedstock like manure and sewage sludge, while dry digestion is applied to biogas production from solid animal manure, with high straw content, household waste and solid municipal biowaste, green cuttings and grass from landscape maintenance or energy crops (fresh or ensiled). From the point of view of feedstock input and output, there are two basic digester types: batch and continuous.

Vertical digesters

In practice, most digesters are vertical digesters. Vertical digesters are generally built on-site round tanks of steel or reinforced concrete, often with a conic bottom, for easy stirring and removal of sand sediments. They are air proof, insulated, heated and outfitted with stirrers or pumps. The digesters are covered by a roof of concrete, steel or gas proof membrane and the produced biogas is piped and stored in an external storage facility, close to the digester or under the gas proof membrane. The membrane is inflated by the

produced biogas or it can be fastened to a central mast

Horizontal digesters

Horizontal digesters have a horizontal axis and a cylindrical shape. This type of digesters are usually manufactured and transported to the biogas plant site in one piece, so they are limited in size and volume. [1]. The standard type for small scale solutions is a horizontal steel tank of 50-150 m³, which is used as the main digester for smaller biogas plants or as pre-digesters for larger plants. There is also an alternative of concrete, the channel type digester, which allows a larger digester volume of up to 1 000 m³.

Horizontal digesters can also run in parallel, in order to achieve larger throughput quantities. Because of their shape, the plug-flow stream is automatically used. The feedstock flows slowly from the entry side to the discharge side, forming a plug-flow, streaming through the digester. The risk of discharging undecomposed substrate is minimised through a minimum guaranteed retention time of the substrate inside the digester. Horizontal continuous flow digesters are usually used for feedstock like chicken manure, grass, maize silage or manure with a high straw content.

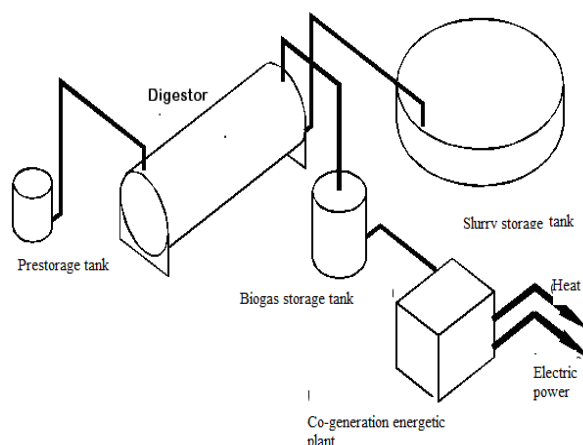


Fig. 1. Schematic representation of a farm scale biogas plant, with horizontal digester of steel [6]

Digestate is used as fertiliser on the farm and the surplus is sold to plant farms in the nearby area. The produced biogas is used in a gas engine, for electricity and heat production.

About 10 to 30% of the produced heat and electricity is used to operate the biogas plant and for domestic needs of the farmer, while the surplus is sold to power companies and respectively to neighbouring heat consumers.

Apart from the digester, equipped with stirring system, the plant can include pre-storage for fresh biomass, storage for digested biomass and for biogas, and even a Combined heat and power unit. The digester can also be vertical, with or without conic bottom, a so called 'two-in-one' slurry storage and digester tank, where the digester is build inside the storage tank for digestate. The two tanks are covered with a gas tight membrane, inflated by the emerging gas production and stirred by electric propeller. The plant can furthermore consist of a pre-storage tank for the co-substrate and a Combined Heat and Power unit.

A recent development of the farm scale biogas plant is the concept of energy-crop based plants. Their advantage is that the energy content of energy crops is much higher than of most of the organic waste materials. The major limitations of these kinds of biogas plants are related to operation costs, land use and availability.

Centralised (joint) co-digestion plants

Centralised co-digestion is a concept based on digesting animal manure and slurries, collected from several farms, in a biogas plant centrally located in the manure collection area. The central location of the biogas plant aims to reduce costs, time and manpower for the transport of biomass to and from the biogas plant. Centralised anaerobic digestion plants co-digest animal manure with a variety of other suitable co-substrates (e.g. digestible residues from agriculture, food- and fish industries, separately collected organic household wastes, sewage sludge).

Animal manure and slurries are collected from the pre-storage tanks or from the slurry channels at the farm and transported in special vacuum container trucks to the biogas plant, according to an established schedule [8]. At the biogas plant, manure is mixed with the other co-substrates, homogenised and pumped inside the digester tank. The transport of fresh manure from the farmers to the biogas plant and of

digestate from the biogas plant to the farmer's storage facilities, placed close to the fields where digestate is applied as fertiliser, is the responsibility of the biogas plant. The storage facilities for digestate are sometimes shared by several farmers.

The digester feeding system is continuous, and biomass mixture is pumped in and out of the digesters in equal amounts through precise pump-sequences. Digestate, pumped out of the digester, is transferred by pipelines to temporary storage tanks. In many cases, these tanks are covered with a gas proof membrane, for the collection of the additional biogas production (up to 15% of the total), taking place at lower temperature. Before leaving the biogas plant, digestate is analysed and nutritionally defined. The manure suppliers can take back only that amount of digestate, which they are allowed by law to spread on their fields. The excess is sold as fertiliser to the crop farmers in the nearby area. In all cases, digestate is integrated in the fertilisation plan of the farm, replacing mineral fertilisers, closing the cycle of carbon and nutrient recycling (Figure 2). More and more biogas plants are also equipped with installations for separation of digestate in liquid and solid fractions.

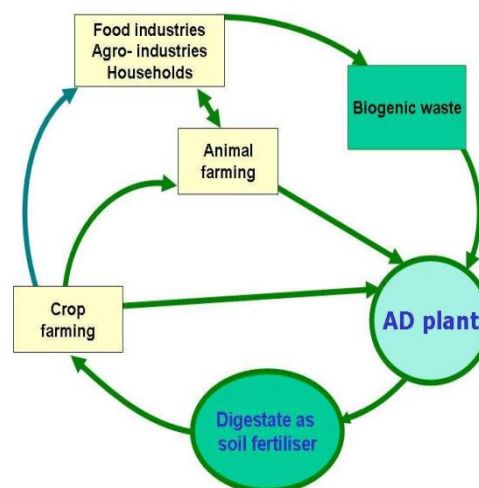


Fig. 2. Schematic representation of the closed cycle of centralised anaerobic digestion [2]

This way, centralised co-digestion represents an integrated system of renewable energy production, organic waste treatment and

nutrient recycling.

Experience shows that the system (Fig. 2) is capable to generate agricultural, environmental and economic benefits for the farmers involved and for the overall society such as:

Renewable energy production

- Cheap and environmentally safe recycling of manure and organic wastes
- Reduction of greenhouse gas emission
- Improved veterinary safety through sanitation of digestate
- Improved fertilisation efficiency
- Less nuisance from odours and flies
- Economical benefits for the farmers

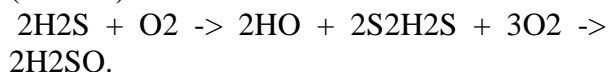
Desulphurization

Removal of H_2S from biogas (desulphurisation) can be done by various methods, either biological or chemical, taking place inside or outside the digester. Desulphurisation depends on the content of HS and the throughput rate throughout the desulphurization equipment.

The throughput rate can fluctuate significantly, depending on the process. Higher biogas production and thus high throughput rates can be observed after insertion of new feedstock into the digester and during stirring. Throughput rates up to 50% higher than normal can occur for short time intervals. For this reason and in order to ensure complete desulphurization, it is necessary to use over-dimensioned desulphurization equipment, compared to average throughput rate.

Biological desulphurization

Biological oxidation is one of the most used methods of desulphurisation, based on injection of a small amount of air (2-8 %) into the raw biogas (fig.3). This way, the hydrogen sulphide is biologically oxidised either to solid free sulphur or to liquid sulphurous acid (H_2SO_3):



In practice, the produced sulphur precipitate is collected and added to the storage tanks where it is mixed with digestate, in order to improve fertiliser properties of digestate. Biological desulphurization is frequently carried out

inside the digester, as a cost-effective method. The oxygen is provided by injection of air in the top of the digester, done with the help of a very small compressor. The air injection pipes inside the digester should be positioned on the opposite side of the biogas output, in order to avoid blockage of the output pipe.



Fig. 3. Elementary sulphur resulted from biological desulphurization inside the digester [9]

The air is injected directly in the headspace of the digester and the reactions occur in the reactor headspace, on the floating layer (if existing) and on reactor walls.

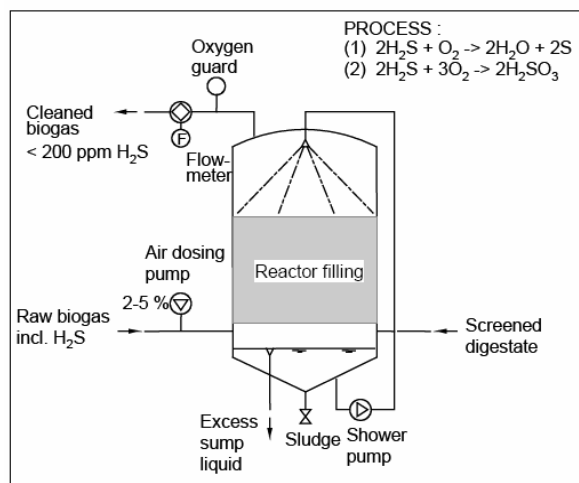


Fig. 4. Schematic diagram of system for biological H_2S oxidation [3]

Due to the acidic nature of the products there is the risk of corrosion. The process is dependent of the existence of a stable floating layer inside the digester. For these reasons, the process is often taking place in a separate reactor as shown in figure 4.

Biological desulphurization can take place

outside the digester in desulphurization tanks or desulphurization columns. This method facilitates the control of desulphurization process and the precise adjustment of oxygen addition.

RESULTS AND DISCUSSIONS

The reactor is similar to a scrubber, consisting of a porous filling (randomly packed plastic elements or similar) where micro-organisms can grow, a sump, a pump and nozzle arrangement, allowing regular showering of the filling. The H₂S is oxidized through a biological process to acidic products or free sulphur, by upstream injection of a small amount of atmospheric air.

Showering has the function of washing out acidic products and supplying nutrients to the micro-organisms. The sump must therefore contain a liquid with high alkalinity, rich in essential nutrients for the micro-organisms. Digestate, preferably screened, is in this case the ideal and available choice.

A reactor loading of approx. 10 m³/h of biogas per m³ of reactor filling and a process temperature around 35°C can normally be chosen. The process has proven very efficient, provided sufficient air is injected (slightly more than stoichiometrically needed). The sump pH must be maintained at 6,0 ppm or higher. A washing procedure, where the filling elements are showered through with an air/water mixture, has to be carried out at regular intervals in order to prevent free sulphur deposits from closing the reactor filling.

In some cases, when biogas is stored or passing a digestate storage tank HS reactor is omitted and only air is injected. Biogas cleaning is, in such case, relying on the formation of a floating layer in the storage tank, on which the micro-organisms can grow and perform the oxidation. A floating layer can usually be maintained with the choice of a low mixing intensity, without too many problems in operating the tank as buffer storage. This solution is more cost effective, but more unreliable as well, as floating layers are rather unstable, i.e. sinking overnight

without notice and resurfacing some days later. Periods with low efficiency of H₂S removal are therefore likely to occur.

Desulphurisation can also be done by adding a chemical substance to the feedstock mixture, inside the digester. This way, the sulphur is chemically bounded during the AD process, preventing the release of hydrogen sulphide into biogas. Thereby, sulphur is not lost, but remains in the digestate.

Chemical biogas desulphurisation can take place outside of digester, using e.g. a base (usually sodium hydroxide). The method needs special equipment.

Another chemical method to reduce the content of hydrogen sulphide is to add commercial ferrous solution to the feedstock. Ferrous compounds bind sulphur in an insoluble compound in the liquid phase, preventing the production of gaseous hydrogen sulphide. The method is rather expensive, as the consumption of ferrous material on a stoichiometric basis has proven to be 2-3 times the desired reduction in gaseous hydrogen sulphide. A cheaper alternative is thus to supply co-substrates (organic wastes) containing ferrous materials and to use the ferrous addition only as a back up.

The possibility of using a self pressurized membrane bioreactor

In our studies, we researched the possibility of using a self pressured membrane bioreactor, which use of metabolic activity of micro-organisms for getting a high pressure generator [4]. This is possible through the accumulation of gas resulting from metabolism in a closed environment. As a result, the pressure created can be used both as a driving force in membrane separation of the product of metabolism and as a potential energy gained for other processes that use pressure (fig.5). The yeasts have been extensively studied over time, being involved in important branches of food industry based on fermentation and wine-making technology, beer and bakery technology. The same principles that are based on fermentation, production of ethanol as bio-fuel is another area whose importance increases with the price of crude oil through alternative energy

and environmentally friendly that it offers.

In closed environment, can be easily obtained as the limit pressure, metabolic activity is not affected by the condition to eliminate the constant-products of metabolism and nutrient medium composition remains constant. Certainly one factor is the strength of the membranes involved in limiting the accumulation of pressure separation to the nominal level required by the manufacturer.

We aim to obtain practically useful for both separation pressure product of metabolism found in the biomass - ethanol - and in order to build upon mechanical excess gas accumulated at the top of the bioreactor. Constant supply of nutrient media and culture, the culture of constant discharge and the separation constant dead maintain constant ethanol production of carbon dioxide and thus obtain the entire system working pressure. Also, always maintaining the optimal level of nutrient concentrations, metabolic activity during which a culture of micro-organisms is used will be constant at the value obtained previously in the literature or by testing and allows adjustment of the exhaust flow yeast culture.

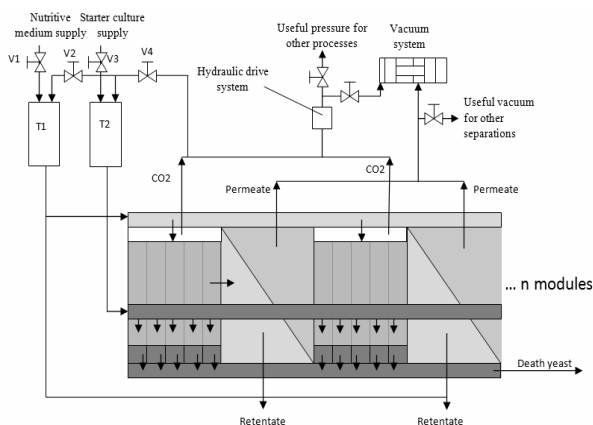


Fig.5. Block diagram for obtaining hydraulic pressure using biotechnological methods [7]

CONCLUSIONS

In this paper, we concentrated over the reactors and digesters which can be used in a farm scale biogas plant. We presented the most used digesters over the world, but we also proposed a self pressured membrane bioreactor, which can use the metabolic

activity of micro-organisms for getting a high pressure generator.

We also presented the most used methods of desulphurisation, biological or chemical, which take place inside the digesters.

In the world context of searching new alternatives for new sources of energy, the use of biogas is one of the viable solutions for the future, both for rural communities and for urban sites.

REFERENCES

- [1] Al Seadi, T., Rutz, D., Prassl, H., Tobias M., Janssen, R., 2008, Biogas handbook, University of Southern Denmark Esbjerg, Denmark
- [2] Al, Seadi, T., 2001, Good practice in quality management of AD residues from biogas production. Report made for the International Energy Agency, Task 24- Energy from Biological Conversion of Organic Waste. Published by IEA Bioenergy and AEA Technology Environment, Oxfordshire, United Kingdom
- [3] Angelidaki, I. et al. 2004, Environmental Biotechnology. AD – Biogas Production, Environment & Resources DTU, Technical University of Denmark
- [4] Dumitru, M., Moise, G., Bibu, M., 2013, Obtaining bioethanol used as biofuel for auto-vehicles using a self pressured bioreactor, Simpozionul științific internațional „Managementul dezvoltării rurale durabile, Timisoara “Lucrări Științifice Management Agricol” Seria I, vol. XV
- [5] Dumitru, M., 2012, The advantages of using biogas as an alternative fuel in rural areas, Bulletin UASVM Agriculture, 69(1)/2012, Cluj- Napoca
- [6] Hjort-Gregersen, K., 1998, Danish Farm Scale Biogas Concepts- at the point of commercial break trough. Danish Institute of Agricultural and Fisheries Economics, Proceedings of the International Conference Würzburg, Germany: Biomass for Energy and Industry, 8-11 June 1998, p. 641-643.
- [7] Moise, G., 2011, Obtaining mechanical force using gas pressure generated by microorganisms in a self pressurized membrane bioreactor, The 7th International Conference on Integrated Systems for Agri-food Production, Nyiregyhaza, Hungary, pag. 227-229.
- [8] Moller, H. et al., 2004, Methane productivity of manure, straw and solid fractions of manure, Biomass & Bioenergy 26, p. 485-495
- [9] Rutz D., Janssen R., Epp C., 2008, The Biogas Market in Southern and Eastern Europe: Promoting Biogas by Non-technical Activities. - Proceedings of the 16th European Biomass Conference and Exhibition, Valencia, Spain.

THE MAIN STATISTIC INDICATORS ANALYSIS THAT CHARACTERIZE THE MAIZE CROP IN ROMANIA, IRAK AND WORLDWIDE

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Abstract

The maize crop is one of the most important cultivated crops, with a great importance in agriculture and economics. In this paper were treated aspects regarding the cultivated area and the average production obtained in three focus areas, namely: worldwide, Iraq country and in our country, Romania. The analysis was conducted over a vast period of time, and is divided into 3 segments: 1990-1999, 2000-2012 and the summary of the entire period 1990-2012. Using statistical indicators, were been highlighted the data variations and the differences between periods and areas of interest.

Key words: average, crop surface, maize crop, maize production, statistics

INTRODUCTION

The maize in terms of agriculture occupies the third place in world as cultivated crop. The maize is originally from America, north of the equator, being brought to Europe by Christopher Columbus in 1493 on his first expedition and was cultivated in Spain after that was cultivated in Italy [6]. Serban Cantacuzino introduced maize in Romania and managed to rid the country of an economic crisis and famine. Today the maize crop occupies an important place for our agriculture and the maize for sale trade is successful because it uses in human nutrition and feeding animals and birds.

The maize has a high production capacity by up to 50% compared to other grains, it gives high and steady yields, and is not so much influenced by the climate as other cereals, it capitalizes well on irrigation water as well as fertilizers [1].

MATERIALS AND METHODS

For the average production analysis, were used the following indicators: the average production per hectare, the average of the mean productions for a period of time, the

average standard deviation, the coefficient of variation, the confidence interval limits for a certain probability.

The formulas used to calculate these indicators are [3], [4]:

For the arithmetic mean = $\bar{x} = \frac{\sum x_i}{n}$;
where:

X = the arithmetical mean; x_i = The average production values for a number of years (i);
n = number of years taken into account

For the standard deviation =

$\sigma = \sqrt{\frac{\sum (\bar{x} - x_i)^2}{n-1}}$; where:

σ = standard deviation; x_i = the average values for a number of years
n = number of years taken into account

For mean square deviation =

$\sigma_x = \sqrt{\frac{\sum (\bar{x} - x_i)^2}{n(n-1)}}$; where:

σ_x = mean square deviation;

The confidence limits corresponding to a given risk $X = \pm \sigma_x \cdot t_p$, in which:

X = the arithmetic average; average square deviation; t_p = tabular value for the probability of transgression (risk).

Amplitude of oscillation of the limits of

confidence [2] =

$$= ((X + \delta x * tp) - (X - \delta x * tp) / (X)) * 100,$$

superior limit: $X + \delta x * tp$ and

inferior limit: $X - \delta x * tp$

Coefficient of variation =

$$C = \frac{\delta}{\bar{X}} \times 100, \text{ where:}$$

C-coefficient of variation (expressed as a percentage).

Coefficient of variation can be: between 0-10% variation; between 10-20%-sized variation; more than 20%-large variation.

RESULTS AND DISCUSSIONS

1. The period 1990-1999

As it can be seen from Table 1, the area cultivated with maize in 1990-1999 recorded values with significant oscillations in Iraq, observing the high coefficient of data variation around the average, of 40%. In our country the average cultivated surface, was around 2, 999 million hectares, with a small variation, the coefficient with a value below 10%, ie 9.2%, indicating a high homogeneity of data. In the situation regarding the maize crop surface globally during this period, there were very small oscillations, the average values were close to 136348 million ha, according to FAOSTAT statistics.

Table 1. The main statistical indicators characterizing the maize cultivated area in Romania, Iraq and in the world, period 1990-1999

Specification	UM	1990-1999		
		Ro	Iraq	Worldwide
Average surface	mil ha/an	2.999	0.082	136.348
Standard deviation (σ)	mil ha/an	0.277	0.033	3.387
Variation coefficient	%	9.2	40.3	2.48
Average production	kg/ha	3130	2268	4007.5
Standard deviation (σ)	kg/ha	667	269	303.4
Variation coefficient	%	21.3	13.2	7.6

Source :FAOSTAt,2014,[http://faostat3.fao.org/faostat-gateway/go/to/download/Q/QC/F\[5\]](http://faostat3.fao.org/faostat-gateway/go/to/download/Q/QC/F[5])

Following the data in tables 1 and 2, we see also, an analysis of average production in the three interest points, from which it appears that the global average production between

1990 to 1999 recorded the highest values, kg / ha, with a standard deviation of 95.9 kg, within a 90% probability interval, with a calculated lower limit of 3837 kg / ha and higher of 4178 kg / ha.

In Romania, in this decade, the average had a large variation of 21.3%, around 3130 kg / ha, standard deviation recorded 667 kg / ha.

For Iraq, the average production is around a value lower than the world or our country, ie, 2268 kg / ha, with a medium variation of 13.2%.

Table 2. The main statistical indicators characterizing the average production of maize crop in Romania, Iraq and the world, years 1990-1999

Specification	UM	1990-1999					
		Ro		Iraq		Worldwide	
Average production	kg/ha	3130		2268		4008	
Mean square deviation (σ_x)	kg/ha	211		85		95.9	
The maximum and minimum limit	kg/ha	3506	2754	2419	2117	4178	3837
Interval ($X \pm \sigma_x * tp$), GL=12, Tp=1, 782	kg/ha	752		303		342	
Interval towards the average	%	24.0		13.4		8.5	

Source :FAOSTAt,2014,[http://faostat3.fao.org/faostat-gateway/go/to/download/Q/QC/F\[5\]](http://faostat3.fao.org/faostat-gateway/go/to/download/Q/QC/F[5])

The maize production evolution in the period 1990-1999, in Romania, Iraq and globally, according to FAOSTAT, can be seen in Figures 1, 2 and 3.

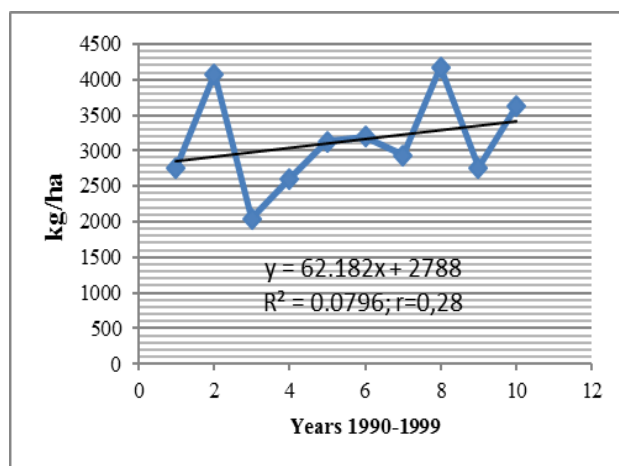


Fig.1. The maize production evolution in Romania, in the period 1990-1999

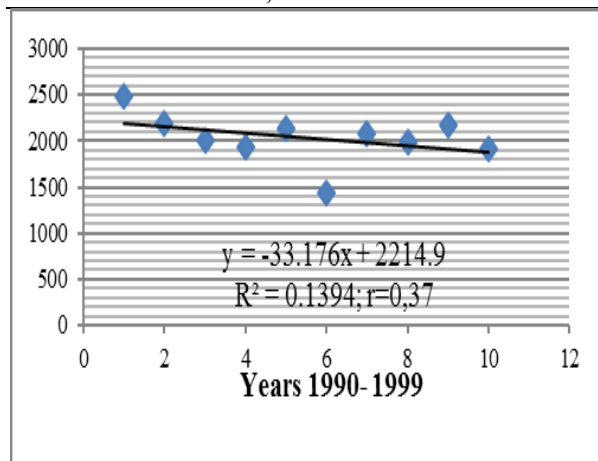


Fig.2. The maize production evolution in Irak, in the period 1990-1999

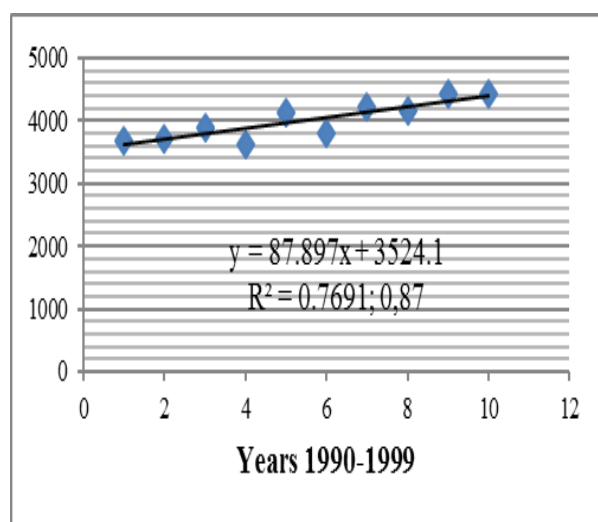


Fig. 3. The maize production evolution in the world , in the period 1990-1999

2. The period 2000-2012

In the period 2000-2012, we can observe increases in cultivated area both globally and at the level of Iraq, but with a decrease in our country, as follows:

- Globally, the surface cultivated with maize has a value around 153,300 million ha, with a small variation of 8.89% and a standard deviation of 13 million ha / year.
- In Iraq, the surface increases during this period from 0.033 million ha / year to 0.127 million / ha year, however with a large variation of the data in the analyzed period;
- Romania suffers a fall from 2.99 million ha / year to 2.67 million ha / year, with an average variation data of 12.9%.

Table 3. The main statistical indicators characterizing the maize cultivated area in Romania, Iraq and in the world, during the period 2000-2012.

Specification	UM	2000-2012		
		Ro	Irak	Worldwide
Average surface	mil ha/an	2.670	0.127	153.3
Standard deviation (σ)	mil ha/an	0.0034	0.0033	13.0
Coef. variation	%	12.9	26.4	8.89
Average production	kg/ha	3251	2103	4824
Standard deviation (σ)	kg/ha	978	1852	20.1
Coef. variation	%	30.1	46.4	4.7

Source: FAOSTAt,2014,[http://faostat3.fao.org/faostat-gateway/go/to/download/Q/QC/F\[5\]](http://faostat3.fao.org/faostat-gateway/go/to/download/Q/QC/F[5])

The average production during the period 2000-2012 (Table 3 and 4), is increasing both globally and in Romania, such as:

- Globally, the production of maize varies very little around 4824 kg/ha , the variation being of 4.7% with a standard deviation of 20.1 kg / ha. The 90% probability interval is bordered by close limits: lower limit of 4709 kg / ha, the upper limit of 4939 k / ha (Fig. 6);
- In Iraq, the average production decreased during this period, as compared to the previous one, reaching a value of 7% lower, respectively 2103 kg / ha . From table 3 we can see a large variation around the data values, the deviation being of 1852 kg / ha, and the coefficient of variation of 46.4% (Figure 5).

Table 4. The main statistical indicators characterizing the average production of maize crop in Romania, Iraq and the world, during the period 2000-2012

Specification	UM	2000-2012					
		Ro		Iraq		Worldwide	
Average production	kg/ha	3251		2103		4824	
Mean square deviation (σ_x)	kg/ha	211		85		62.5	
Min and max limit	kg/ha	3517	2743	2188	1877	4939	4709
Interval ($X \pm \sigma_x \cdot t_p$), $GL=9, T_p=1.833$	kg/ha	774		312		229	
Interval towards the average	%	23.8		7.8		4.7	

Source:FAOSTAt,2014,[http://faostat3.fao.org/faostat-gateway/go/to/download/Q/QC/F\[5\]](http://faostat3.fao.org/faostat-gateway/go/to/download/Q/QC/F[5])

- Romania has an increase in average production, which for this period stands at around 3251 kg / ha, with a large standard deviation of 978 kg / ha and a high coefficient of variation, 30.1% (Figure 4).

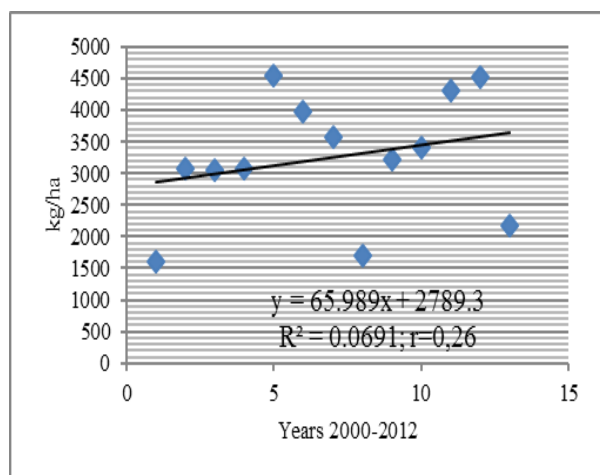


Fig. 4. The maize production evolution in Romania, in the period 2000-2012

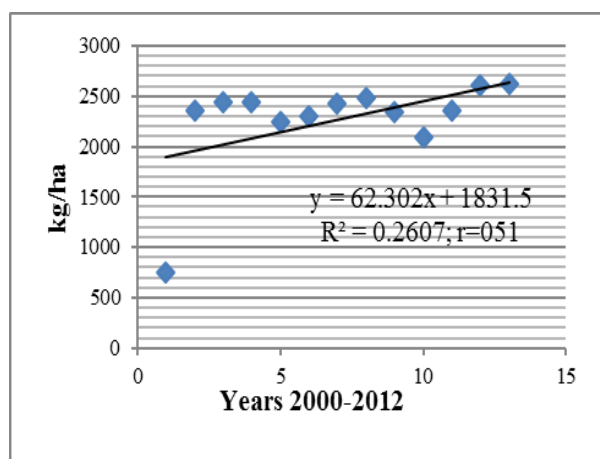


Fig. 5. The maize production evolution in Irak, in the period 2000-2012

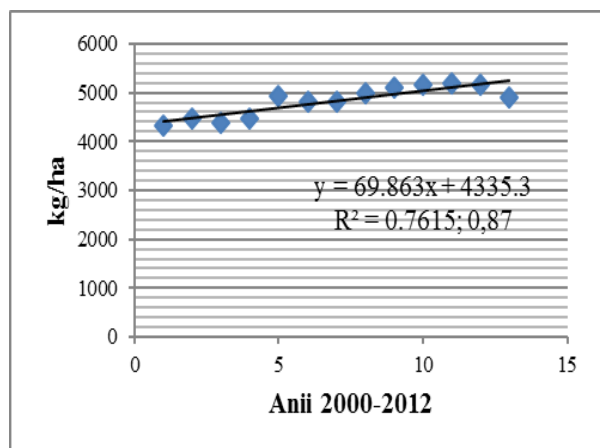


Fig 6. The maize production evolution in the world, in the period 2000-2012

3. The period 1990-2012

Making a summary of the two periods (Table 5 and Table 6), we see that:

- The maize cultivated area, globally, for the period 1990-2012 stands at around 146 million ha / year, the oscillations are small, as shown by the coefficient of variation 8.89% (small variation);
- In Iraq, the average cultivated area of maize per year for the entire period is of 0.107 million ha, with a great swing c% of 37.2%, and a deviation of 0.039 million ha / year.
- For Romania, the cultivated area focuses on values close to 2.81 million ha per year, the deviation being of 0.353 million ha, and the coefficient of variation with a middle value, 12.6%.

Table 5. The main statistical indicators characterizing the average surface of maize crop in Romania, Iraq and the world, during the period 1990-2012

Specification	UM	1990-2012		
		Ro	Iraq	Worldwide
Average surface	mil ha/an	2.81	0.107	146.0
Standard deviation (σ)	mil ha/an	0.353	0.0399	12.98
Coef. variation	%	12.6	37.2	8.89
Average production	kg/ha	3199	2275	4469
Standard deviation (σ)	kg/ha	841	409	501
Coef. variation	%	26.3	18.9	11.2

Source: FAOSTAT,2014,[http://faostat3.fao.org/faostat-gateway/go/to/download/Q/QC/F\[5\]](http://faostat3.fao.org/faostat-gateway/go/to/download/Q/QC/F[5])

- Regarding the average production, in the two periods together, shows a higher value at the global level, where it was achieved an average production about 4469 kg / ha, in Romania the average is 3199 kg / ha and a value much lower for Iraq, where the average production is 2275 kg / ha.

- The highest stability is observed at the global data, where average yields are dictated by the big countries specialized in maize production.

Table 6. The main statistical indicators characterizing the average production of maize crop in Romania, Iraq and the world, during the period 1990-2012

Specification	UM	1990-2012					
		Ro		Iraq		Worldwide	
Average production	kg/ha	3251		2275		4469.2	
Mean square deviation (σ_x)	kg/ha	315		153		192.3	
Min and max limit	kg/ha	3739	2637	2428	1903	5010	4139
Interval ($X \pm \sigma_x \cdot t_p$), $GL=9, T_p=1,833$	kg/ha	1102		525		871.0	
Interval towards the average	%	33.9		13.2		19.5	

Source: FAOSTAT, 2014, [http://faostat3.fao.org/faostat-gateway/go/to/download/Q/QC/F\[5\]](http://faostat3.fao.org/faostat-gateway/go/to/download/Q/QC/F[5])

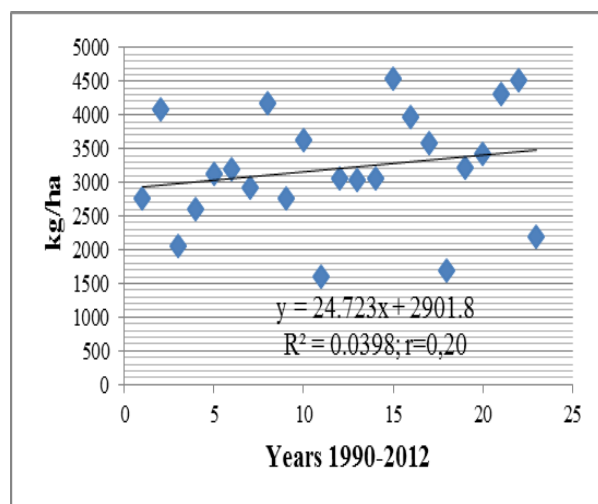


Fig 7 . The maize production evolution in Romania, in the period 1990-2012

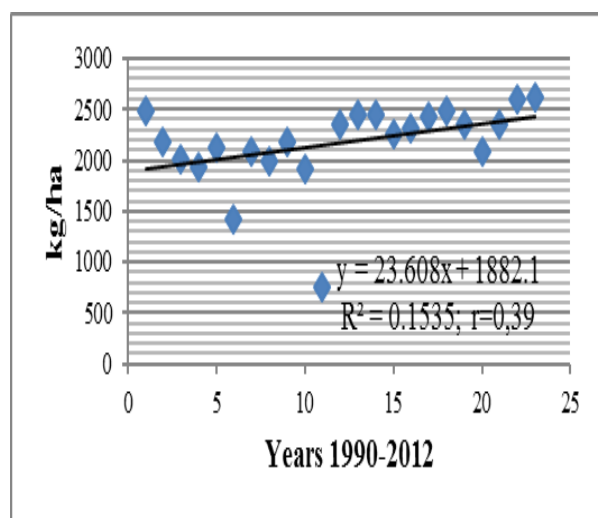


Fig 8. The maize production evolution in Irak , in the period 1990-2012

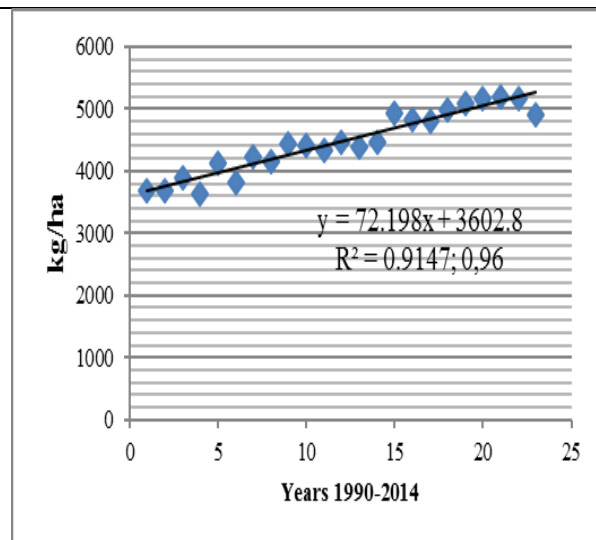


Fig 9. The maize production evolution in the world , in the period 1990-2012

For all 3 areas of interest, we see an upward trend over the entire period, with large oscillations for our country, as illustrated in Figures 7, 8 and 9.

CONCLUSIONS

Following this analysis, the following conclusions can be drawn:

- The maize crop occupies an important place both in our country agriculture and in Iraq and especially in the agriculture and the world economy;
- The period 1990-1999 was marked by greater stability of surface cultivated data , worldwide and in our country, homogeneity is highlighted by low values of standard deviation and coefficient of variation;
- The second period, recorded higher fluctuations in the cultivated areas, for Iraq and globally they are in a rising trend, except our country, where the average surface recorded a lower value compared to the previous period;
- In terms of maize production for both periods is observed a greater homogeneity for the global data, the average recorded values fluctuating slightly around 4470 kg / ha;
- The situation is different when it comes to our country, which in comparison to Iraq is at a higher level of production average, but with large swings over the years, which highlights the lack of a competitive agriculture based on

technology and knowledge and the dependence on environmental conditions.

REFERENCES

- [1]Bran Mariana, 2001, Agrofitotehnie - Cereale, Editura ASE
- [2]Build Free Website of your own on, Tripod, <http://statisticasociala.tripod.com/tabele.htm>
- [3]Ceapoiu N., 1968, Metode statistice aplicate in experientele agricole si statistice, Ed.Agro-Silvica, Bucuresti
- [4]Creșterea demografică, http://www.dictsociologie.netfirms.com/_IndDem/IndReproducere.htm
- [5]FAOSTAT, 2014, <http://faostat3.fao.org/faostat-gateway/go/to/download/Q/QC/F>
- [6]"Origin, History and Uses of Corn", 2014, Iowa State University, Department of Agronomy, February 11.

RISKS, VULNERABILITY AND DETERMINANTS OF WOMEN FARMERS' PARTICIPATION IN SELF-HELP-GROUP (SHG)-LED MICROFINANCING IN ISUIKWUATO, ABIA STATE, NIGERIA

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Abstract

This study on risks, vulnerability and determinants of women farmers' participation in Self-Help-Group led micro financing was carried out in Isuikwuato local Government Area (LGA) of Abia State in Nigeria. Two-stage random sampling and purposive sampling techniques were adopted in selecting communities and respondents. Socio-economic and some farm operation variables were analyzed descriptively and others regressed on discrete decision of women participating or not participating in Self-Help- group (SHG) financing. Fire outbreak, ill health, theft, soil erosion and attack of farm products by pests and diseases were perceived (in this descending order) as risks/natural disasters confronting the farmers. Previously owed debts, Ease of membership to groups, Age of the woman, Household size, and use of cultural/formal insurance over perceived risks were factors that influenced participation of women farmers in self-help-group micro financing. To ease the burden of inaccessibility to formal farm credit among women farmers, we recommended that relatively younger women should be encouraged to join older women in such mutual self-help groups to reap benefits accruable from the groups especially being able to manage their farms and households with less stress.

Key words: micro financing, risks, Self-Help-Group, vulnerability, women

INTRODUCTION

On grounds of world development issues, women occupy underprivileged positions and in low income countries of Asia and Africa fall into vulnerable category in terms of risks, shocks and constraints to formal labour markets and entrepreneurship [10]. In attempts to come out of this, they come together to help themselves by forming Self-Help-Groups (SHG). The woman SHG usually is a community-based financial intermediary that consists of 10-20 local women who gets started by members making small regular savings contributions over a few months until there is enough capital in their coffers to start lending first to their members and then to others. Leadership of management of women Self-Help-Groups must come from ranks and commitment of the women themselves and their quality participation achieved through formation of the group and educational programmes [8]. Their ambition is to mutually assist one another and improve

their livelihood. Such mutual SHG often constitute evolving social securitization units and method of transforming cash flows and risk management practices amongst poor entrepreneurs and farmers.

Risk refers to potential of losses incurable (the probability of occurrence of which can be estimated) that prompts action of taking credit facility. Among women SHGs the risks vary and may include loan repayment defaults, information asymmetry, declined yield, product price instability, and high interest charges on loans. The groups in most cases constitute average return of credit contract and are also the risks which such contracts imply [14]. Actually, women SHG are avenue of transferring risk to co-group members in form of borrower(s) defaulting on the debt agreement or credit-linked security [6]. Some women farmer borrowers, are risk averse and have ever been denied access to formal credit but have insisted on borrowing from informal loan sources [14,11]. Their insistence has often amounted to devout participation in

units mobilizing micro finances. [20] found a positive evidence that vulnerability was a determinant of microfinance participation.

Vulnerability is a concept that relates to defenselessness vis-à-vis to risks and shocks [5]. Thus two aspects have been recognized for vulnerability, namely internal and external aspects. The external aspect relates to the risks and shocks to which an individual, household, group, or community could be prone at any time. These risks could be illness or death, economic shocks, natural disasters, or personal shocks. The internal aspects of vulnerability refer to the defenselessness and the difficulty, due to shortage of means, of coping with a shock without experiencing a loss. [7] defined vulnerability as the existence and extent of poverty and destitution. It is the inability to smooth consumption across adverse shocks to income [20]. The amount of consumption credit a household can access in a bad state, or its liquid assets and access to insurance measures her vulnerability.

Participation was defined by [4] as a process by which people are enabled to become actively and genuinely involved in defining the issues of concern to them, in making decisions about factors that affect their lives, in formulating and implementing policies, in planning, developing and delivering services and in taking actions to achieve change. Studies have shown that dependence on outside borrowing by households greatly declined after households joined SHGs [18,2,19]. Mutual self-help assistance has thus remained a subtle way of keeping on with farming activities especially among the socially backward and landless women. An individual or household participates in a microfinance programme if it borrows from that source of credit [9].

Participation combined with gender can strengthen both concepts, grounding gender in realities of people's lives and make participation a more effective channel for the expression of marginalized people's demands. Mainstreaming both approaches can increase redistribution of positive outcome of projects [1]. [21] are of the view that participation is a vehicle to achieve development of a group and

their community. In the case of women SHG projects in a community, a member participates if she contributes to and borrows from the group [3]. In core Igbo states of Nigeria, SHGs are popular local institutions that greatly have improved welfare of farm households [12]. With the foregoing background, this study has a main objective of analyzing factors that influence participation of women farmers in self-help-group micro financing projects amidst inherent risks and conditions of vulnerability in Isuikwuato Local government Area of Abia State, Nigeria.

The specific objectives are to:

- (i)compare household demographics, vulnerability indicators to SHG member farm households and non-SHG member farm households in the study area;
- (ii)analyze perception of natural hazards or risks by SHG women farm households in the study area;
- (iii)distribute women SHG members by amount of farm credit accessed from their groups;
- (iv)determine factors that influenced women farmers participation in Self-Help micro financing group in the study area.

MATERIALS AND METHODS

This study was conducted in Isuikwuato Local Government Area (LGA) of Abia State, Nigeria. Isuikwuato lies between Latitudes $5^{\circ}41'N$ and $5^{\circ}46'N$ of the Equator and Longitudes $7^{\circ}41'E$ and $7^{\circ}45'E$ of the Greenwich Meridian with a population of 114,442 human inhabitants in 50 autonomous communities made up of 56,831 males and 57,611 females [17]. The area has its administrative headquarters at Mbalano. Isuikwuato shares boundary with other LGAs in Abia State namely Bende, Umunneochi and Umuahia North in the East, North and South respectively. It also shares boundary with Okigwe LGA of Imo State. The area has undulating topography and typically is agrarian producing food crops like maize, cassava, and melon alongside cash crops like cashew and oil palm. Livestock such as poultry, sheep and goats are kept by male and female farmers in a small scale.

Two-stage random sampling followed with purposive sampling technique was adopted in this study. Firstly, five communities were randomly chosen from fifty autonomous communities in the area. Secondly, two villages were randomly chosen from the selected communities. This gave a total of 10 villages. All Women-Self-Help Groups were purposively selected from the chosen villages. Twelve woman-led households and members of the SHG were also purposively selected to give a sub-sample of 120 member households. From the same villages where member households were chosen, another 120 non-member woman-led households were selected twelve from each village also. This gave a sample 240 women respondents for this study. A semi-structured, pre-tested questionnaire was administered by personal interview method and used in gathering their operational primary data used in this study. Data gathered among others included demographic information of age of woman household head, household size, farm size, amount of credit accessed from their groups, value of liquid asset (part of SHG borrowed fund used for feeding and harvested but not sold crops/livestock). Other information included measures taken to guard against farm losses including cropping and farming systems, some cultural practices and debts previously owed, and ease of membership. Data gathered were analyzed descriptively using frequency distribution, means, and standard deviations. In analyzing member farmer's level of perception of risks and management practices, a likert type question on a 5-point score was used. Perception category nominal scores were: Strongly perceived (5); Perceived (4); Not sure (3); Did not (2) and Strongly did not (1). Probit multiple regression model was used to inferentially analyze determinants of participation in SHGs and was based on utility theory or rational choice perspective on their behaviour [16,15,3]. It was assumed that participation or non-participation on SHG was based on unobservable utility index (I_i) that was explained by independent variable (X_i) in such a way that the larger the index I_i the

greater the probability of participation in SHG. The index was explained thus:

$$I_i = \beta_0 + \beta_1 X_i + U \quad \dots\dots\dots (1)$$

Where β_0 is the constant; β_1 is the coefficient of independent variable(s); X_i is the independent variable(s); and U is the random error term. There was a critical threshold of index I_i such that if I_i exceed I_i^* , households will have participated in SHG, otherwise they have not. Though the threshold I_i^* exists as if I_i was not observable, it was possible to estimate the parameters of the index when we assumed that I_i was normally distributed with the same mean and variance. Given the assumption of normality, the probability that I_i^* was less than or equal to I_i could be computed from the standardized normal cumulative distributive function (cdf), thus:

$$P_i = P_r(Y=1) = P_r(I_i^* < I_i) = F(I_i) \quad T \\ = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{I_i} e^{-t^2/2} dt \quad \dots\dots\dots (2)$$

$$P_i = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\beta_0 + \beta_1 X_i} e^{-t^2/2} dt \quad \dots\dots\dots (3)$$

Where 't' is a standardized normal variable with zero mean and constant variance, i.e $N(0,1)$.

To obtain information on the index, I_i and coefficients β_0 , and β_1 , the inverse was taken, thus:

$$I_i = F^{-1}(P_i) = F^{-1}(P_i) = \beta_0 + \beta_1 X_i \quad \dots\dots\dots (4)$$

Where F^{-1} is the inverse of the normal cdf. In Probit analysis, the unobservable utility index I_i was simply known as Normal Equivalent Deviate (NED) or simply Normit. Since I_i would be negative, i.e $P_i < 0.5$ in practice, the number 5 was added to the NED and the result was called Probit, thus:

$$\text{Probit} = \text{NED} + 5 = I_i + 5 \quad \dots\dots\dots (5)$$

Rewriting to estimate β_0 and β_1 we have:

$$I_i = \beta_0 + \beta_1 X_i + U$$

All variables are as defined; the equation estimated for this study was explicitly thus:

$$\text{PWSHG} = \beta_0 + \beta_1 \text{AG} + \beta_2 \text{HS} + \beta_3 \text{FS} + \beta_4 \text{LA} + \beta_5 \text{DW} + \beta_6 \text{CC} + \beta_7 \text{RI} + \beta_8 \text{EM} + \beta_9 \text{LA} + U \quad \dots\dots (6)$$

Table 1. Description of variables estimated to influence women participation

Variable	Variable type	Hypothesized sign	Description of Variable
PWSHG	Binary (Dependent)		1 if jth woman participated in SHG; 0 otherwise
Independent Variables			
AG	Continuous	-	Age of woman head of household in Years
HS	Discrete	+	Household Size-Number of persons feeding from same pot
FS	Continuous	+	Farm size cultivated in Hectare
LB	Continuous	+	Amount of loan borrowed from SHG in ₦'000
DW	Continuous	+	Amount of debt owed previously ₦'000
CC	Continuous	+	Part of borrowed fund consumed as food ₦'000
RI	Dummy/Discrete	+	1 if woman uses cultural or formal insurance against personal/enterprise risks; 0 otherwise
EM	Dummy/Discrete	+	1 if it is easy to join and be a member of SHG; 0 otherwise
LA	Continuous	-	Amount of own liquid Assets ₦'000
U			Disturbance or error term

RESULTS AND DISCUSSIONS

Comparative Socio - economic Characteristics of Women farmers

Table 2.0 compared the socioeconomic characteristics of the women farmers in the study area.

The Table showed that women farmers involved in this study were young with more of those not involved in Self-Help-Group relatively younger. The mean age of the women involved in SHG financing was 44.3 years and that of those not involved as 39.9 years.

Among the women involved in SHG financing, a fairly large proportion (39.2%) was in the age cohort of 41 to 50 years, an age range when women are leaving child bearing and are getting into training of children in secondary/tertiary schools.

Table 2. Characteristics of Respondent SHG and Non-SHG Households in Isuikwuato

Variable	Female SHG Member Household (n=120)	Percentage	Female Non-SHG Member Household (n=120)	Percentage
Age (Years):	Number	%	Number	%
20-30	16	13.3	13	10.8
31-40	40	33.3	44	36.7
41-50	47	39.2	43	35.8
Above 50	17	14.2	20	16.7
Mean age	44.3		39.9	
Std. Deviation	7.9		9.5	
Household Size:				
1-4	73	60.8	76	63.3
5-8	42	35.0	41	34.2
≥ 9	5	4.2	4	3.3
Mean household size (persons)	4		5	
Farm Size (Ha):				
< 1.0	90	75.0	66	55.0
1.0-2.0	17	14.2	43	35.8
> 2.0	13	10.8	11	9.2
Mean size (Hectare)	0.98		0.63	
Level of Formal Education (years):				
No formal Education	9	7.5	4	3.3
Primary Education	23	19.2	16	13.3
Secondary Education	78	65.0	67	55.8
Tertiary Education	10	8.3	33	27.5
Amount of SHG Credit accessed (₦'000):				
Loan category	Amount received			
≤ 50	2070	69	57.5	n.a
50-100	1950	22	18.3	n.a
101-150	1080	9	7.5	n.a
151- 200	1750	10	8.3	n.a
Above 200	2500	10	8.3	n.a
	9,350	120		
Vulnerability Indicators:*				
Lives in own home	49	40.8	78	65.0
Lives in rented home	50	41.7	20	16.7
Has Bank Savings	17	14.2	34	28.3
Has Home savings	29	24.2	120	100.0
-Married & lives with husband	45	37.5	100	83.3
-Single	40	33.3	9	7.5
-Widowed	56	46.7	11	9.2
-Divorced	10	8.3	nil	nil

*Multiple responses observed; n.a = Not applicable

Mean size of the households was 4 persons to woman-led SHG households and 5 persons to woman-led non-SHG households was moderate as such numbers could be comfortably managed using own generated or borrowed funds. The farm sizes were small and indicative of smallholder status. Both categories of woman-led households were highly literate as more than 90.0% of them had in each category at least primary education.

Loans were given to members according to size of their regular contributions. Bulk of the loan received from the SHG (₦2.5m) went to 8.3% of the members with bulk of the recipients (57.5%) receiving a relatively lower sum (₦2.07m). This was also indicative of the level of vulnerability of the large proportion of membership of women SHGs. More of the women in the SHGs were vulnerable widows, single parents living in rented apartments, with many having no bank accounts or savings in their homes.

Other measures of vulnerability of the groups showed that non-SHG members were relatively less vulnerable than SHG members. The highest indicator of vulnerability of SHG membership was bereavement of spouse as 46.7% of members were widows. The table also indicated that having bank savings in addition to home savings reduced the propensity of belonging to SHG as relatively

more of women with such status did not belong to SHGs. Living in rented homes (41.7%) as against own homes (40.8%) was an indicator that showed more members of SHG compared with non-SHG members (16.7%) as against (65.0%) respectively.

Risks/Natural Hazards and Woman Farmer Perception

Table 3.0 showed risks of concern and their level of perception by woman members of SHG in Isuikwuato area of Nigeria. The most perceived risk by the farmers was risk of outbreak of fire arising from incessant bush burning by farmers and hunters in the area. The hunters in the area have the habit of setting the bushes on fire during the dry season to scare out their game from the hideouts and in the process ignite unquenchable fires that burn adjoining farms. The common cultural management practice adopted by farmers was slashing of perimeter bushes to act as fire break. Next in the rank of risks perceived by the respondents was ill health. Many of the poor women perceived being ill at one time or the other and reported having managed their predicament by going to health centers and/or clinics and paying for their drugs over the counters.

The women reported risk of theft of their farm products.

Table 3.SHG Women Farmer Members Risks Perception and Management

Perceived Risks/Natural Hazards	Level of Perception of Risk							Mitigation Measure(s)
	Strongly perceived	Perceived	Not sure	Did not	Strongly did not	Total	Rank	
Fire outbreak	26 (130)	24 (96)	6 (18)	2 (4)	2 (2)	250	1st	Creating perimeter fire break by slashing surrounding bushes to the plot.
Theft	27 (135)	20 (80)	3 (9)	4 (8)	6 (6)	238	3rd	Keeping surveillance and harvesting crops as soon as they mature.
Product Diseases and Pests	22 (110)	27 (108)	4 (12)	4 (8)	3 (3)	231	5th	Planting resistant varieties; Trapping rodents and using scare crows to scare away birds
Ill health	30 (150)	20 (80)	1 (3)	7 (14)	2 (2)	249	2nd	Attending clinics and buying drugs over the counters.
Soil Erosion	19 (95)	28 (112)	7 (21)	3 (6)	3 (3)	237	4th	Integrating cover crops such as melon as part of enterprise.

Note. Figures in parentheses are likert nominal scores; other figures are number of farmers/frequencies.

Thieves most times invaded their farms and stole either fresh matured crops or livestock or harvested and stored products. However they managed this risk culturally by keeping close watch to their farm enterprises and in severe cases harvested their crops promptly soon as they mature in the fields. Soil erosion was equally a serious risk in the ultisol soils of undulating terrain that characterized the area. They managed this by planting cover crops such as crawling vegetables and melon as intercrops. The least perceived risk was that of attack of pests and diseases, which they contained with by selecting and planting improved certified crop varieties that are resistant to them.

Factors Influencing Participation of Women Farmers in SHG Financing

Other factors that were significant at alpha level of probability of 5.0% but had negative and moderate influences on participation were age of the women, and their use of cultural/formal insurance measures on perceived risks.

Table 4. Binary Probit Regression Coefficients of Determinants of Women Farmer Participation in Self-Help Group Micro-financing in Isuikwuato LGA of Abia State

Variable	Estimated Coefficient	Standard Errors	Z-ratio	P> z
Constant	-0.4147	0.8591	-0.48	0.629
Age of Woman household head	-0.0034**	0.00164	-2.07	0.003
Household Size	0.0134*	0.0093	1.54	0.122
Farm size	1.90e-06	1.01e-06	1.95	0.051
Amount of loan borrowed	0.0008	0.0466	0.02	0.986
Debt owed previously	1.1488***	0.2870	4.00	0.000
Part of loan consumed	0.0229	0.0428	0.52	0.602
Use of cultural/Formal insurance	-0.0719**	0.0364	-2.09	0.037
Ease of Membership	0.1749***	0.0569	3.07	0.002
Own Liquid Assets	-0.0008	0.0465	-0.02	0.986
Pseudo R ²	0.4301			
Log Likelihood	33.5496			
Chi ²	32.10			
Cases predicted correctly (%)	94.68			

*** Significant at 1.0%; ** Significant at 5.0%; * Significant at 10.0%

Size of the households was the fifth factor that significantly influenced participation of the

Table 4.0 showed estimates of factors hypothesized to influence women farmer participation in Self-Help-Group micro-financing in the study area. The probit model explained 94.68% of the predicted cases correctly and showed estimates of five out of eight factors to have significantly influenced women participation in SHG micro-financing in Isuikwuato, Nigeria. These factors are previously owed debts and ease of membership to the groups that very highly influenced participation at 1.0% alpha level of probability. Both factors exerted very high positive influences meaning that when previously owed debts are high and entry into SHG was easy many women farmers participated in the group activities (i.e. saved money and borrowed from the SHGs). women in SHG financing. This factor influenced women farmer participation lowly but positively in such group financing activities in the area.

CONCLUSIONS

Using indicators of vulnerability, more of the women in the SHGs were widows, single parents living in rented apartments, with many having no bank accounts or savings in their homes. The most perceived risk by the farmers was risk of outbreak of fire arising from incessant bush burning by farmers and hunters in the area. To guide against this risk, a common cultural management practice adopted by farmers was slashing of perimeter bushes to act as fire break. The least perceived risk was that of pests and diseases attacks, managed by selecting and planting improved certified crop varieties that are resistant to them. Incidences of huge debts owed by women, and easy conditions attached to SHG motivate more aged women to participate in such groups. To ease the burden of inaccessibility to formal farm credit to women farmers we recommended that relatively younger women farmers should join the older ones in such mutual self-help groups to reap the benefits accruable from such groups especially being able to manage their farms and households with less stress.

REFERENCES

- [1]Akerkar, S., 2001, Gender and Participation. Cutting Edge Pack Topical Gender Knowledge. Institute of Development Studies. ISBN 1858643856
- [2]Anjugam, M., Alagumani, T., 2001, Impact of Microfinance through Self-Help-Groups- A Case Study, Indian Journal of Agricultural Economics 56(3): 458.
- [3]Anjugam, M., Ramasamy, C., 2007, Determinants of Women's Participation in Self-Help-Group (SHG)-Led Microfinance Programme in Tamil Nadu Coimbatore India. Agricultural Economic Review 20: 283-298.
- [4]Breuer, D., 1999, Community Participation in Local Health and Sustainable Development: a working Document on Approaches and Techniques. European Sustainable Development and Health Series. World Health Organization, pp:9-10.
- [5]Chambers, R., 1989, Editorial Introduction: Vulnerability, Coping and Policy. IDS Bulletin 2. pp:1-7.
- [6]David, R., 2001, 'Risk Transfer Between Banks, Insurance Companies and Capital Markets: an Overview', Financial Stability Review, Issue number 11.
- [7]Dercon, S., 2005, Vulnerability: A Micro Perspective. Mimeograph, Oxford University.
- [8]Deshmukh, N., 2005, Women's Empowerment Through Panchayati Raj Institutions. Indian Journal of Public Administration 1(2): 194-203.
- [9]Diagne, A. , Zeller, M., 2001, Access to Credit and its impact on Welfare in Malawi, Report No. 116 International Food Policy Research Institute, Washington, DC, USA.
- [10] Elborgh-Woytek, K. Newiak, M., Kochhar, K., Fabrizio, S., Kpodar, K., Wingender, P., Clements., B., Schwartz., G., 2013, Women, Work, and The Economy: Macroeconomic Gains from Gender Equity. International Monetary Fund (IMF) Strategy, Policy and Review Department and Fiscal affairs Department. pp: 32.
- [11]Emerole, C.O., Nwachukwu, A.N., Anyiro, C.O., Osondu, C.K., Ibezim, G.M.C., Jonah, N., 2014, Default Risk and Determinants of Farmers' Access to Micro-credit from Cooperative Societies in Abia State, Nigeria. Asian Journal of Agricultural Extension, Economics and Sociology 3(1): 50-62.
- [12]Emerole, C.O. , Anyiro, C.O., Osondu, C.K., 2013, Local Institutions in Poverty Reduction and Welfare in Farm Households in Core Igbo States of Nigeria. Experimental Agriculture and Horticulture Article ID1929-0861-2013-2-3-01 Academic Research Center of Canada p.1-12
- [13]Gine, X., 2010, Access to Capital in Rural Thailand: An Estimated Model of Formal Vs. Informal Credit. Working Paper, World Bank MC3-307, 1818 St, Washington, DC 20433.
- [14]Guirking, C., 2005, "Risk and the Persistence of Informal Credit in Rural Peru" Agricultural and Resource Economics, University of California Davis. pp:22.
- [15] Gujarati, N.D., 2003, Basic Econometrics, New York: McGraw Hill Companies Inc.
- [16]Mc Fadden, M.L., 1981, Econometric Models of Probabilistic Choice. Structural Analysis of Discrete Data, Cambridge MIT, Press.
- [17]National Bureau of Statistics (NBS), 2007, 2006 Population Census . Official Gazette (FGP/71/52007/2,500(OL24): Legal Notice on publication of the details of the breakdown of National and States Provisional Totals. nigerianstat.gov.ng
- [18]Nedumaran, S., Palanisami, K., Swanminathan, L.P., 2001, Performance and Impact of Self-Help-Groups in Tamil Nadu. Indian Journal of Agricultural Economics, 56(3):471-472.
- [19]Padia, V., 2002, Study on Microfinance and Social Mobilization for Empowerment of Women: A Case Study of Dahn Foundation, UNDP Report New Delhi.
- [20]Pearlman, S., 2007, Too Vulnerable for Microfinance?: Risk and Vulnerability as Determinants of Microfinance Selection. Seminar Paper Presented to Department of Economics University of Maryland, Lima Peru. Study of Dahn Foundation, UNDP Report New Delhi.
- [21]Zadeh, B.S., Ahmad, N., 2010, Participation and Community Development. Current Research Journal of Social Sciences 2 (1): 13-14.

USING IMAGING ANALYSES TO PREDICT CHEMICAL PROPERTIES OF ORANGE FRUITS

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Abstract

At different ripening stages the color of orange varies from nature green, yellow, to intense orange color. Sometimes, instead of chemical analysis, color measurement may be used if a correlation is present between the presence of the colored component and the chemical in the food since color measurement is simpler and quicker than chemical analysis. The aim of this research:(a)Study possibility of using computer vision and for as a suitable technique to predict of orange chemical properties fruit maturity according to their image analysis for color changes during maturity stage.(b)The relationships between hue and saturation of images in this research revealed that to find a sensitive relation between some different chemical properties. The results showed significant correlation between RGB, hue and saturation indices and some chemical properties such as total soluble solid (Tss), ph, acidity and percentage of liquid.

Key words: chemical composition, image indices, orange, maturity

INTRODUCTION

At different ripening stages the color of orange varies from nature green, yellow, to intense orange color. Sometimes, instead of chemical analysis, color measurement may be used if a correlation is present between the presence of the colored component and the chemical in the food since color measurement is simpler and quicker than chemical analysis. Citrus fruits and juices generally serve as primary sources of human daily requirement of vitamin C, their demand for and acceptance depending mainly on their nutritional value, flavour, aroma and then on colour, texture and cloudiness. It is well-known that the orange is one of the most abundant sources of vitamin C, however, it also contains considerable amounts of sugar, carotenoids, flavonoids, essential oil and some minerals. The computer vision systems have been used increasingly in industry for inspection and evaluation purposes as they can provide rapid, economic, hygienic, consistent and objective assessment [1]. The common image processing system conformation including the five components: image acquisition, pre-processing image

segmentation, object measurement, classification [2]. Several physical and nutritional properties of four orange varieties (Alanya, Finike, W. Navel, and Shamouti) such as Water soluble dry matter were 10.9 , 12.4, 12.1 and 11.8 (°Bx) respectively, pH were 3.19, 3.64, 3.62 and 3.84 respectively and Titratable acidity were 1.375, 0.841, 0.687 and 0.875 (g/100 ml) respectively [8]. The orange maturity in three degrees (raw, ripe and overripe) by using system consists of a color CCD camera for image acquisition and a computer for image processing. The ISH color model is used and decision rules are derived from the hue color [7]. The average characteristics under study were assessed by determining the total soluble solid content (TSS=11.75±0.14°Brix), using the Abbey refractometer, and titratable acidity (TA=1.52±0.16% w/vcitric acid equivalent), using 0.1 M NaOH standard solution, on the juices expressed from five fruits randomly selected from the experimental lot, these data being replicated four times. This allowed their maturity index (MI=TSS/TA) to be estimated as 7.8±0.8 °Brix/(% w/v) [5]. An image analysis technique was found to serve as a

suitable and accurate method for external orange fruit inspection. Relationships were determined between R/G ratio band, average of RGB bands and VARI index with chlorophyll a and b and carotenoids [3]. stated that there are relationship between hue and chemical properties with three applications of nutrition minerals and with growth substance hue increased from 0.64 to 0.76 when while percentage of liquid, pH and total soluble solid (Tss), 38.46 to 48.22 %, from 2.97 to 3.15, from 8.07 to 9.07 (Brix,%) [6].

MATERIALS AND METHODS

An experiment was carried out in winter 2011 at a farm in Wadi Elnetron , Bohira governorate , Egypt to detect the relationship between some chemical properties of orange fruits by using image indices and its maturity . The results revealed that, some chemical properties of orange fruits.

Valencia orange:

Fruits samples were collected for identifying different biochemical measurements for determination of maturity.

Imaging box:

An imaging box was constructed with dimensions of 30*30*30 cm (length*width*depth) to put the fruits inside. A non reflective black cloth was put on the inside sides of the box to keep the reflectance from them at a minimum to avoid interference. A digital camera was installed at the top of the box to acquire images has the following specification:

- Image device: 7.75mm (1/2.3 type) color CCD, primary color filter.
- Total pixel number of camera: Approx. 16.4 Megapixels.
- Effective pixel number of camera: Approx. 16.1 Megapixels.

Envi programme:

After acquiring images for different treatments the images with JPEG were changed to TIFF files to be imported to Envi programme then can find three bands (RGB) which were used to derive indices fig.1. The correlation relationship was investigated between different chemical properties and

derived indices.

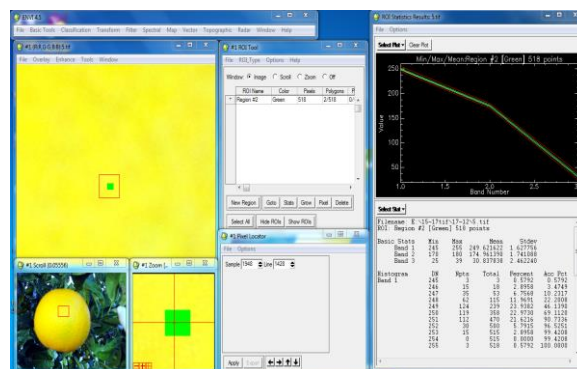


Fig. 1 window of ENVI programme software

Color indices: Using the most popular color model RGB color space. The color was presented with R, G and B, the amount of information is tripled. RGB system is sensitive to lighting or other conditions. To evaluate the color of captured images of fruit, the acquired RGB color information was transformed to HSI:

These equations used to transform RGB color to HIS color as follows:

$$H = \cos^{-1} \left\{ \frac{(2R - G - B)/2}{[(R - G)^2 + (R - B)(G - B)]^{1/2}} \right\}$$

$$S = 1 - \frac{3}{(R + G + B)} [\min(R, G, B)]$$

Orange chemical properties:

Different chemical properties of orange fruits were determined after the applications of nutrition minerals and the application of growth substance. The following properties of orange fruits were measured and/or determined:

- Following extracting orange juice the total soluble salts (TSS) was estimated using a single digital refractometer.
- TSS was estimated by using a digital refractometer.
- pH value was measured by using pH meter as an indicator of juice acidity.

RESULTS AND DISCUSSIONS

Relationship between orange chemical properties and maturity time

Results in (fig. 2) shows that during maturity

time from 17 December to 24 December with some chemical properties such as the total soluble solid (Tss) increased from 8.20 to 10.06 (Brix,%) , ph increased from 2.84 to 3.07, percentage of liquid increased from 41.54 to 49.83 % and (Tss/acidity) increased from 6.7 to 9.00 while acidity decreased from 1.25 to 1.07 %.

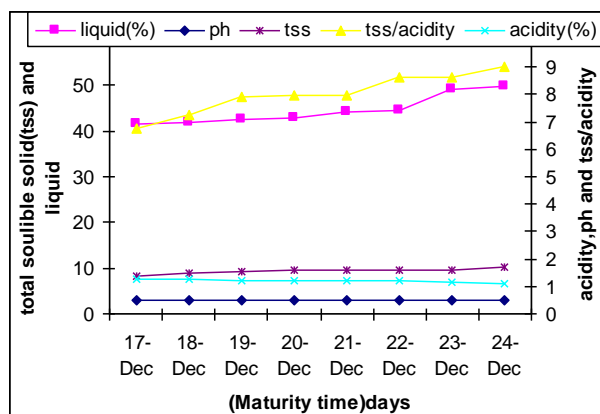


Fig 2. The relationships between the maturity time (days) total soluble solid (tss), ph, acidity, percentage of liquid and tss/acidity.

The results showing the relationships between hue and saturation and total soluble solid (Tss), ph, acidity, percentage of liquid and (Tss/acidity) at different maturity days.

Relationship between color indices and chemical properties

There are the relationships between hue and acidity, percentage of liquid, ph and also total soluble solid (Tss) shown in Fig.3 when acidity decreased from 1.25 to 1.07 % the hue indices increased from 00.65 to 00.78 while percentage of liquid, ph and also total soluble solid (Tss) increased from 41.54 to 49.83 %, from 2.84 to 3.07 and from 8.20 to 10.06 (Brix,%) respectively.

The following equation forms were satisfied for predicting acidity, percentage of liquid, ph and also total soluble solid (tss) by hue during maturity time.

$$y = -14.725x^2 + 19.817x - 5.4166$$

$$R^2 = 0.8751$$

$$y = 443.86x^2 - 570.84x + 225.18$$

$$R^2 = 0.8297$$

$$y = -1.889x^2 + 4.0852x + 1.0372$$

$$R^2 = 0.7316$$

$$y = -45.358x^2 + 76.142x - 21.81$$

$$R^2 = 0.893$$

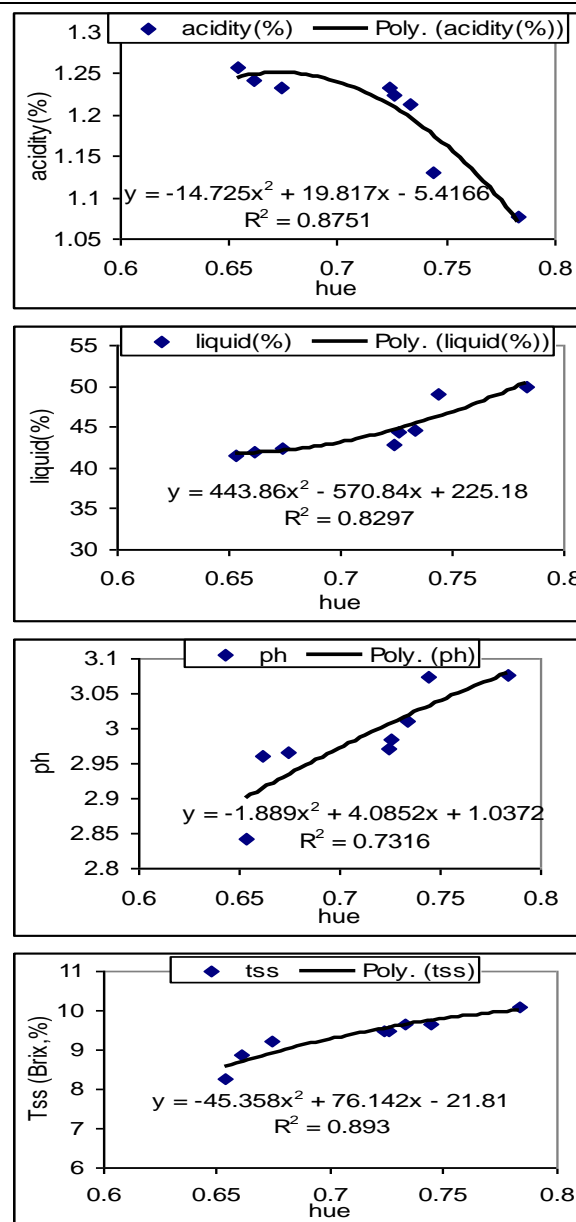


Fig. 3. The relationships between the hue and acidity, percentage of liquid, ph, total soluble solid (Tss)

In Fig. 4 the data showed there are the relationships between saturation and acidity, percentage of liquid, ph and also total soluble solid (tss) when acidity decreased from 1.25 to 1.07 % while saturation increased from 00.98 to 00.99 while percentage of liquid, ph, total soluble solid (tss), and also tss/acidity increased from 41.54 to 49.83 %, from 2.84 to 3.07 and from 8.20 to 10.06 (Brix,%) respectively.

The following equation forms were satisfied for predicting acidity, percentage of liquid, ph and total soluble solid (Tss) by saturation during maturity time.

$$y = -34819x^2 + 68973x - 34156$$

$$R^2 = 0.7225$$

$$y = 2E+06x^2 - 4E+06x + 2E+06$$

$$R^2 = 0.8051$$

$$y = 20426x^2 - 40428x + 20007$$

$$R^2 = 0.8977$$

$$y = 189257x^2 - 374663x + 185434$$

$$R^2 = 0.9931$$

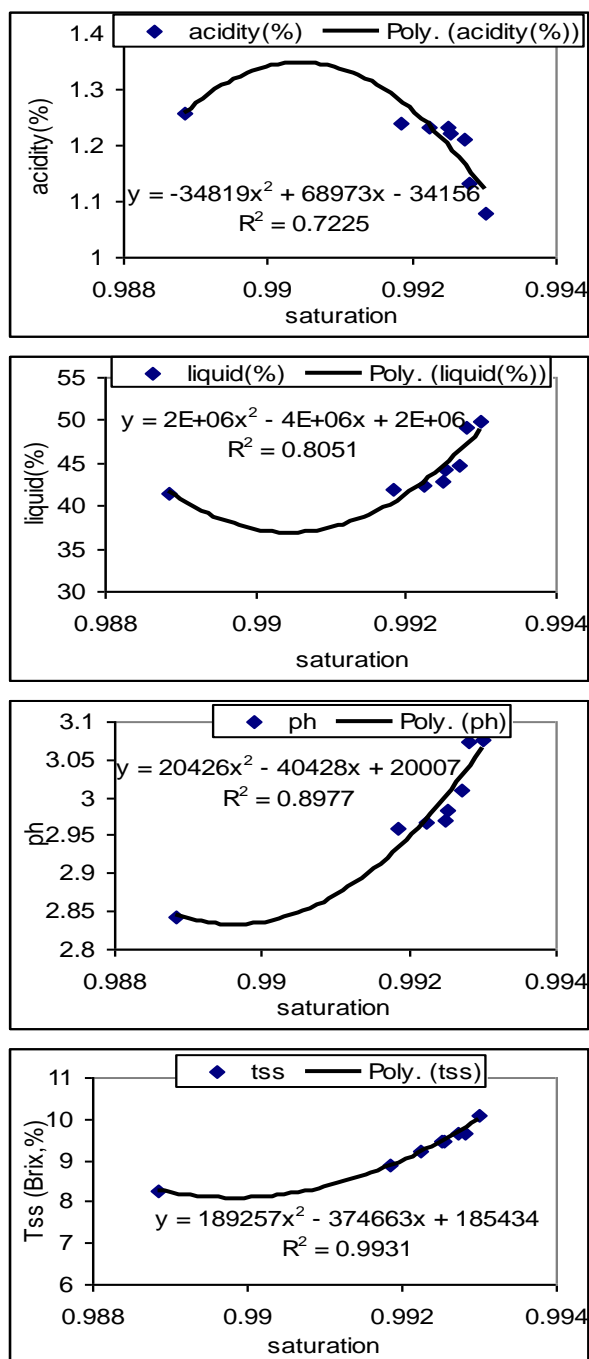


Fig. 4. The relationships between the saturation and acidity, percentage of liquid, ph and also total soluble solid (Tss)

CONCLUSIONS

In this research we test a computer vision and image analysis program as a suitable technique for external orange fruit inspection. The results show the relationships between hue and saturation and total soluble solid (Tss), ph, acidity and percentage of liquid. The multiple regression analysis and correlation coefficient was used to test the association between some chemical properties different hue and saturation to ranked the more suitable maturity indices. The results obtained in this research demonstrated that hue and saturation indices gives understanding about between total soluble solid(tss), ph, acidity and percentage of liquid. The coefficient of determination at all properties equation of saturation indices more than with hue indices.

REFERENCES

- [1]Brosnan, T., Sun, D., 2002, Inspection and grading of agricultural and food products by computer vision systems a review. Computers and Electronics in Agriculture , 36: 193-213
- [2]Du, C.J., Sun, D.W., 2004, Recent developments in the applications of image processing techniques for food quality evaluation. Trends in Food Science and Technology 15:230–249
- [3]Fouda, T., Derbala, A., Elmetwalli A. H., Salah, S., 2013, Detection of orange color using imaging analysis. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.13(2)/2013
- [4]Khojastehnazhand, M., Omid, M., Tabatabaefar, A., 2010, Development of a lemon sorting system based on color and size. African Journal of Plant Science, 4(4): 122-127
- [5]Ladaniya, M. S., 2008, Citrus fruit: biology, technology and evaluation San Diego: Academic. (p. 198)
- [6]Salah, Sh. E., 2013, Using image analysis to predict orange fruits maturity. Ms.c. Thesis, Agric. Eng. Dept. Fac. of Agric., Tanta Univ.
- [7]Sirisathitkul, Y., Thumpen, N., Puangtong, W., 2006, Automated Chokun Orange Maturity Sorting by Color Grading. Walailak J. Sci and Tech, 3(2): 195-205
- [8]Topuz, A., Topakci, M., Canakci, M., Akinci, I., Ozdemir, F., 200, Physical and nutritional properties of four orange varieties. Journal of Food Engineering, 66: 519–523

DETERMINANTS OF CHANGES IN WORK PROFITABILITY IN POLISH AGRICULTURE IN 2004-2013

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Abstract

The main purpose of this work is to analyse the changes in work profitability in Polish agriculture. The analysis is based on the Economic Accounts for Agriculture, i.e. the applicable in the EU harmonised financial statement, which enables the analysis of the economic situation in agriculture according to uniform rules. The basis for the research have been the proposed systems of work profitability indicators and factor analysis (the logarithm method). The research has proven that in the post-accession period work profitability in agriculture increased in real terms on annual average by about 4,47%, and in 2013 in comparison to 2004, work profitability was higher in real terms by almost 60%. In the light of the factor analysis the main determinant of changes in work profitability in the domestic agriculture was the increase in work productivity and production subsidies.

Key words: economic accounts for agriculture, Poland, systems of indicators of work profitability in agriculture, work profitability in agriculture

INTRODUCTION

The accession of Poland to the European Union (EU) and application of the Common Agricultural Policy (CAP) instruments to Polish agriculture fundamentally changed the conditions of the domestic agriculture.

The EU membership provides for unlimited access to a huge market, and, which is very important for agricultural producers, creates new opportunities to generate income due to the size of the EU market and subsidising agriculture under the CAP [2, 3, 4, 5, 11].

The authors of this article have focused on the issue of profitability of agriculture after the accession to the EU, mainly considering its basic indicator, which is the agricultural entrepreneurial income per unit of employment.

The structure of the paper is as follows. The first part discusses the source materials and methodological assumptions. It presents a sequential calculation of generating income based on Economic Accounts for Agriculture [6] and the concept of systemic analysis of work profitability in agriculture.

The second part presents the results of

empirical studies, which include:

an analysis of generating income, a systemic analysis of work profitability and a factor analysis of changes in the level of profitability of work in Polish agriculture in 2004-2013.

MATERIALS AND METHODS

In the analysis of profitability of work in agriculture there have been used the Economic Accounts for Agriculture (EAA), i.e. applicable in the EU harmonised financial statements enabling an analysis of the economic situation in agriculture according to uniform rules [6], published by EUROSTAT.

One of the main objectives of the EAA is monitoring agricultural income perceived in terms of: the value added (gross, net, at factor cost), the operating surplus and the net agricultural entrepreneurial income.

The sequence of the EAA, allowing accounts of the afore mentioned categories of income, is as follows [6]:

a) Formula	b) Components account
c)	d) Output at producer price
e) +	f) Subsidy on products
g) -	h) Taxes on products
i) =	j) Output at basic prices
k) -	l) Intermediate consumption
m) =	n) Gross value added
o) -	p) Fixed capital consumption
q) =	r) Net value added
s) -	t) Taxes on production
u) +	v) Subsidies on production
w) =	x) Factor income
y) -	z) Compensation of employees
aa) =	bb) Operating surplus
cc) +	dd) Interest received
ee) -	ff) Interest paid
gg) -	hh) Rent paid
ii) =	jj) Entrepreneurial income

In the EAA the net value added is a measure of the value created by all agricultural entities adjusted for depreciation. Moreover, it is a basic income category informing about the ability to bring new value in relation to incurred material costs, also regarded as an indicator of the quantity and quality of human capital [7, 9]. However, it should be noticed that the net value added in the agriculture sector, due to the **output pricing** in the base prices and the valuation of intermediate consumption in purchasers' prices, is adjusted for taxes on products, but includes the amount of subsidies for products. Reducing the net value added by the amount of other taxes on production and adding to it other subsidies for production, there is achieved another category of income – the value added at factor cost (income of the factors of production). This category of income is a measure of the value generated by the factors of production such as

land, capital and labour; the labour factor is here presented in the form of all of the labour resources engaged in agricultural activities, i.e. it includes both agricultural entrepreneurs' own work as well as the hiring of labour. The occurrence of hired labour is reflected in the next category of income, which is the net operating surplus (mixed income). It measures the value generated by land, capital and unpaid labour, which is less than the value added at factor cost by the hired labour costs. The final component of the EAA account is the agricultural entrepreneurial income. Its value is calculated by adjusting the operating surplus for financial costs and revenues in the form of the balance of received and paid interest and lease costs. Agricultural entrepreneurial income is a synthetic measure of the level of remuneration for unpaid labour resources, remuneration of capital employed and pensions in respect of land ownership.

In the analysis of the dynamics of changes in various categories of the EAA account, the authors have used the average annual rate of change indicator. In practice, most commonly used in this case is the geometric mean, which is not always justified because, due to the ambiguous nature of the development trend of the studied phenomenon, its use may lead to erroneous interpretations. The geometric mean has a major drawback stemming from the inclusion in its construction of the computational value of the extreme years and omission of the values between those years. Considering the above, in assessing the dynamics of changes in various categories of the EAA account the authors have used the following measure, which accounts for all the observations (values) of the time series [10]:

$$r_g = \frac{-3m + [9m^2 + 24m(n-1) \times \left(\frac{1}{y_1} \sum_{t=1}^n y_t - n\right)]^{1/2}}{2m(n-1)} \times 100$$

where: $m=n(n+1)$, n - the number of observations (years), y - the value of the feature.

The presented above EAA account has been used to analyse the level, direction, dynamics and reasons for changes in work profitability in agriculture via constructing systems of

indicators. A Systemic approach in the analysis of the studied phenomenon appears to be fully justified and is due to several reasons. Firstly, it results from a high level synthesis of the category of income and, secondly, the need to respect the primacy/inferiority of the EAA categories,

thirdly, from the key or secondary nature of these categories, fourthly, from creating opportunities for a casual analysis by constructing pyramids of indicators and the use of quantitative methods. In a systemic approach the indicator of work profitability in the agricultural sector may be presented as the following equation¹:

$$\frac{DR}{ZN} = \frac{WB}{ZO} \times \frac{WN}{WB} \times \frac{WN-PD}{WN} \times \frac{DCZ}{WN-PD} \times \frac{NO}{DCZ} \times \frac{NO+SO}{NO} \times \frac{DR}{NO+SO} \times \frac{ZO}{ZN}$$

where:

DR/ZN – work profitability indicator [agricultural entrepreneurial income (DR)/number of unpaid employees (ZN)],

WB/ZO – labour productivity indicator measured by gross value added [gross value added (WB)/total number of employees (ZO)], WN/WB – indicator of costs of depreciation of fixed assets [net value added (WN)/gross value added (WB)],

(WN – PD)/WN – tax costs ratio [(net value added (WN) – taxes (PD))/net value added (WN)], DCZ/(WN – PD) – indicator of subsidies for agricultural production [**factor income** (DCZ)/(net value added (WN) – taxes (PD))], NO/DCZ – indicator of payroll expenses [operating surplus (NO)/**factor income** (DCZ)],

(NO + SO)/NO – indicator of financial income and expenses [(operating surplus (NO) + balance of received and paid interest (SO))/operating surplus (NO)], DR/(NO + SO) – indicator of cost of leases [agricultural entrepreneurial income (DR)/(operating surplus (NO) + balance of received and paid interest (SO))], ZO/ZN – indicator of structure of employment resource [total number of

employees (ZO)/number of employees unpaid (ZN)].

In order to identify the causes of changes in the level of work profitability in agriculture the deterministic method has been used – the logarithm method. With a simplifying assumption that the synthetic indicator of work profitability in agriculture (W_1) from the period t_1 is a function of the product of only three factors, namely (x_1, y_1, z_1) , tj.

$$W_1 = x_1 \times y_1 \times z_1,$$

and the synthetic indicator of profitability in agriculture (W_0) from the period t_0 is a function of the product of three factors (x_0, y_0, z_0) , tj.

$$W_0 = x_0 \times y_0 \times z_0,$$

i.e., and at the same time it is a reference point for the changes, the procedure in the logarithmic method is as follows:

1. Calculation of the absolute deviation (ΔW) of the synthetic indicator of work profitability in agriculture:

$$\Delta W = W_1 - W_0 = x_1 \times y_1 \times z_1 - x_0 \times y_0 \times z_0$$

2. Calculation of partial deviations ($\Delta W_x, \Delta W_y, \Delta W_z$) informing about the impact of the factor on changes of the synthetic indicator of work profitability in agriculture (W):

$$\Delta W_x = \Delta W \times \frac{\log \frac{x_1}{x_0}}{\log \frac{W_1}{W_0}}$$

$$\Delta W_y = \Delta W \times \frac{\log \frac{y_1}{y_0}}{\log \frac{W_1}{W_0}}$$

$$\Delta W_z = \Delta W \times \frac{\log \frac{z_1}{z_0}}{\log \frac{W_1}{W_0}}$$

1.

3. Comparison of the absolute deviation of the synthetic indicator of work profitability in agriculture (ΔW) with the sum of partial deviations of the factors – partial indicators of the system ($\Delta W_x, \Delta W_y, \Delta W_z$), in order to

¹The presented decomposition of the work profitability ratio does not exhaust all the possibilities. The author has also developed other alternative systems of the work profitability indicator which reveals, among others, the importance of productivity of expenditures, technical infrastructure of work and the importance of agricultural land resources and their intensity of use (land productivity and intensity of production), however, due to editorial limitations, these systems in this publication have been omitted.

verify the correctness of the conducted calculations according to the formula:

$$\Delta W = \Delta W_x + \Delta W_y + \Delta W_z$$

4. Substantive interpretation of partial deviations, i.e. determining the impact of changes of the factors (partial indicators of the system) on changes of the synthetic indicator of work profitability in agriculture: on the basis of partial deviations and/or on the basis of the percentage of individual deviations in the sum of partial deviations.

RESULTS AND DISCUSSIONS

Table 1 presents in a synthetic form the economic calculation for Polish agriculture in 2004-2013, i.e. the period from the moment of Polish accession to the EU and using the CAP

instruments, together with the information on the level and structure of employment and work profitability measured by the relationship of agricultural entrepreneurial income per one unit of unpaid labour resources. The data in Table 1 indicate that the agricultural income, measured by the **output pricing** at producer prices, in real terms increased on average by 1.17%, and consequently, in 2013 (74.93 billion PLN) it was – as compared to 2004 (62.51 billion PLN) – higher by about 18%. In a similar pace, due to a comparable dynamics of change in subsidies for products (19%) there increased in 2004-2013 the real agricultural income measured by the **output pricing** at base prices (on average per annum by 1.17%).

Table 1. The Economic Accounts for Agriculture– agriculture in Poland in 2004-2013 (real value in mld PLN)

Specification	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2013	r_g in %
											2004 = 100	
Output at producer price	62,51	56,80	57,53	68,03	66,75	62,28	64,61	75,75	77,53	74,93	117,9	1,17
Subsidy on products	3,58	3,75	4,52	4,20	3,73	4,71	4,40	3,61	2,74	2,99	83,4	1,19
Taxes on products	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-	-
Output at basic prices	66,09	60,56	62,05	72,23	70,49	66,98	69,01	79,36	80,26	77,92	119,9	1,17
Intermediate consumption	38,93	36,05	37,10	42,33	44,88	41,45	41,92	48,44	49,08	47,32	121,6	1,70
Gross value added	27,17	24,51	24,95	29,90	25,61	25,54	27,08	30,92	31,18	30,61	112,7	0,38
Fixed capital consumption	5,79	5,44	5,09	5,07	5,29	5,10	5,17	5,14	5,20	5,31	91,6	-1,76
Net value added	21,38	19,06	19,86	24,82	20,32	20,44	21,91	25,78	25,98	25,30	118,4	0,91
Taxes on production	1,41	1,42	1,24	1,39	1,40	1,29	1,05	1,11	1,96	1,98	140,6	0,19
Subsidies on production	4,35	4,77	6,21	7,20	7,82	9,85	10,65	12,74	10,79	11,45	263,4	12,79
Factor income	24,31	22,42	24,82	30,63	26,74	29,00	31,50	37,41	34,81	34,77	143,0	3,60
Compensation of employees	2,79	2,87	2,82	3,37	3,81	3,55	3,02	3,06	3,29	3,28	117,6	2,41
Operating surplus	21,52	19,55	22,01	27,26	22,93	25,46	28,48	34,35	31,52	31,49	146,3	3,75
Rent paid	0,35	0,35	0,39	0,43	0,43	0,39	0,39	0,41	0,25	0,41	116,3	1,49
Interest paid	0,88	0,99	1,17	1,20	1,18	1,16	1,15	1,11	1,09	1,07	121,6	4,05
Interest received	0,16	0,16	0,15	0,15	0,15	0,12	0,10	0,11	0,14	0,09	56,9	-3,42
Entrepreneurial income	20,45	18,36	20,60	25,78	21,46	24,03	27,04	32,94	30,31	30,10	147,2	3,72
Total agricultural labour input (mln AWU)	2,28	2,29	2,29	2,30	2,30	2,21	2,10	2,10	2,10	2,10	92,0	-0,59
Non-salaried agricultural labour input (mln AWU)	2,15	2,16	2,16	2,16	2,16	2,07	1,99	1,99	1,99	1,99	92,4	-0,59
Work profitability (tys.PLN/AWU)	9,51	8,49	9,53	11,96	9,96	11,60	13,60	16,56	15,24	15,14	159,2	4,47
The share of subsidies in income (%)	38,8	46,4	52,1	44,2	53,8	60,6	55,7	49,7	44,6	48,0	38,8	4,39

Source: own elaboration based on the Economic Accounts for Agriculture [11]

Favourable trends are also noticeable in the changes in the gross value added, the level of which in 2004-2013 increased from 27.17 billion PLN (2004) to 30.61 billion PLN (2013), i.e. by about 13%. Nevertheless, it is worth noticing that the average annual dynamics of change of the real gross value added (0.38%) was evidently lower than the dynamics of change in the real **output pricing** (1.17%). This means that in the period 2004-2013 the efficiency of intermediate consumption expenditures increased, which is confirmed by a slower rate of growth of these expenditures than the value added. Positive changes in the efficiency of agricultural income are also indicated by a positive net To a definitely greater extent than the net value added increased the income from factors of production calculated by adjusting the net value added for taxes on production and other subsidies for agriculture. A strong dynamics of change in this category of income was relatively less related to changes in taxation, since it was almost entirely due to the amount of the so-called other subsidies to the production obtained from the implementation of the CAP instruments. The accession of Poland to the EU resulted in a 2.6-fold real increase in the value of these subsidies in 2004-2013. These changes fundamentally determined the dynamics of change and the level of income of the factors of production. On average per annum in the post-accession period its real value increased by 3.6%, as a consequence of which, the income from the factors of production increased in real terms from 24.31 billion PLN (2004) to 34.77 billion PLN (2013), i.e. up to 43%.

In the post-accession period there was quite a clear growth in payroll expenses in the agricultural sector, which in real terms on average per annum grew by nearly 2.41%, and in 2013 – as compared to 2004 – were higher by 17.6%. Despite this trend payroll expenses constituted less and less in the income from the factors of production, which in turn resulted in a rapid increase of the operating surplus, stronger than the increase of the income from the factors of production. The data in Table 1 indicate that the real value of

value added growth. These changes, however, need to be perceived in a wider context. On one hand, they can be regarded as beneficial, since the real net value added increased on average per year in 2004-2013 by 0.91%. The dynamics of change of this category, however, was greater than the dynamics of change of the gross value added (0.38% and 0.91%), which denotes a significant reduction in the degree of diminishing the value added due to depreciation costs. On one hand, in the context of economic calculation, it is a beneficial situation, on the other hand, it points to a progressive decapitalisation of fixed assets in agriculture, which is the result of weak dynamics of investment processes. the operating surplus in agriculture was at the end of the analysed period higher by as much as 46.3% (2013/2004). In the years 2004-2013 there were no radical changes in the level of financial costs and revenues and lease costs. Although financial costs and lease costs were higher after the accession, they reduced the operating surplus of agriculture to a relatively low extent. As a result of these conditions the dynamics of growth of the agricultural entrepreneurial income exceeded the dynamics of growth of the operating surplus, and the total agricultural entrepreneurial income in 2013, amounting to over 30 billion PLN, were higher in real terms respectively by 47.2% (2013/2004). Such a strong scale of changes resulted in a strong increase in work profitability in agriculture, measured by the ratio of agricultural entrepreneurial income to the number of unpaid workers. The data in Table 1 indicate that in 2004-2013 the rate of work profitability increased in real terms from 9.51 thousand PLN (2004) to 15.24 thousand PLN (2013). These figures indicate a nearly 60% real increase in work profitability in agriculture. It should be emphasised that, apart from a significant real increase in incomes in agriculture, changes in agricultural employment had an impact on beneficial and dynamic growth in work profitability. In the analysed period there was a decrease of similar dynamics (0.59% on average per annum) in both total employment resources and employment resources

representing unpaid work. As stated above, changes in the efficiency of agriculture are determined by a number of external and internal factors. In relation to work profitability, these reasons may be seen in the results of the factor analysis, developed on the basis of a system of indicators accounting for the variability and the relations of individual EAA items described in the research methods of this article. Such an analytical approach allows to investigate the relationship between

the ratio of the work profitability and the factors by which it is determined. Moreover, it also allows the concretisation of the strength and direction of the impact of these factors on the analysed variable [7, 10].

Table 2 presents the results of the factor analysis (the logarithmic method) of work profitability in agriculture for the years 2005-2013.

Table 2. Factor analysis of changes in work profitability (DR/ZN) in Polish agriculture in 2005-2013 years

Lata Years	$\frac{WB}{ZO}$	$\frac{WN}{WB}$	$\frac{WN - PD}{WN}$	$\frac{DCZ}{WN - PD}$	$\frac{NO}{DCZ}$	$\frac{NO + SO}{NO}$	$\frac{DR}{NO + SO}$	$\frac{ZO}{ZN}$	$\frac{DR}{ZN}$
value of ratios									
2004	11,90	0,79	0,93	1,22	0,89	0,97	0,98	1,06	9,51
2005	10,69	0,78	0,93	1,27	0,87	0,96	0,98	1,06	8,49
2006	10,89	0,80	0,94	1,33	0,89	0,95	0,98	1,06	9,53
2007	13,00	0,83	0,94	1,31	0,89	0,96	0,98	1,07	11,96
2008	11,14	0,79	0,93	1,41	0,86	0,95	0,98	1,07	9,96
2009	11,54	0,80	0,94	1,51	0,88	0,96	0,98	1,07	11,60
2010	12,89	0,81	0,95	1,51	0,90	0,96	0,99	1,06	13,60
2011	14,71	0,83	0,96	1,52	0,92	0,97	0,99	1,06	16,56
2012	14,84	0,83	0,92	1,45	0,91	0,97	0,99	1,06	15,24
2013	14,57	0,83	0,92	1,49	0,91	0,97	0,99	1,06	15,14
average 2005-2013	12,62	0,81	0,94	1,40	0,89	0,96	0,98	1,06	12,16
partial deviations									
2005/2004	-0,96	-0,10	-0,08	0,38	-0,13	-0,09	-0,02	-0,01	-1,01
2006/2005	0,16	0,21	0,11	0,44	0,15	-0,03	0,00	0,00	1,03
2007/2006	1,90	0,45	0,07	-0,21	0,04	0,08	0,02	0,07	2,43
2008/2007	-1,69	-0,50	-0,15	0,85	-0,41	-0,07	-0,04	0,00	-2,00
2009/2008	0,38	0,09	0,07	0,75	0,25	0,05	0,04	0,02	1,64
2010/2009	1,39	0,13	0,20	-0,03	0,37	0,05	0,02	-0,14	2,00
2011/2010	1,99	0,45	0,08	0,06	0,23	0,12	0,03	0,00	2,97
2012/2011	0,14	-0,01	-0,55	-0,72	-0,22	-0,02	0,07	0,00	-1,32
2013/2012	-0,28	-0,12	-0,05	0,44	0,00	-0,01	-0,08	0,00	-0,11
average 2005-2013	0,34	0,07	-0,03	0,22	0,03	0,01	0,01	-0,01	0,63
structure of partial deviations ¹ (%)									
2005/2004	53,96	5,81	4,61	21,48	7,52	4,87	1,09	0,65	100
2006/2005	14,54	18,61	10,39	39,54	13,34	3,14	0,44	0,00	100
2007/2006	66,46	15,88	2,58	7,46	1,48	2,97	0,80	2,37	100
2008/2007	45,69	13,39	3,98	22,95	10,98	1,97	1,04	0,00	100
2009/2008	22,99	5,76	3,99	45,42	15,28	2,90	2,47	1,19	100
2010/2009	59,35	5,69	8,49	1,39	15,77	2,25	0,92	6,13	100
2011/2010	67,04	15,22	2,71	2,05	7,90	4,05	1,03	0,00	100
2012/2011	7,91	0,57	31,71	41,95	13,01	1,00	3,85	0,00	100
2013/2012	28,85	12,16	5,03	44,10	0,42	1,49	7,95	0,00	100
average 2005-2013	40,75	10,35	8,16	25,15	9,52	2,74	2,18	1,15	100

¹partial structure of the partial deviations was calculated on the basis of the absolute values of partial deviation

Source: own elaboration

Their analysis leads to the conclusion that in real terms as the main sources of the positive direction of changes in work profitability in agriculture in the analysed years, measured by the agricultural entrepreneurial income, there should be regarded primarily two factors, i.e. labour productivity growth measured by the gross value added per person employed in agriculture in total [WB/ZO] and the increase in other agricultural subsidies [DCZ/(WN-P)]. In the light of the logarithmic method, changes in labour efficiency and production subsidies in 2005-2013 determined the variability of work profitability on average at 40.75% and 25.15%. Moreover, a rather large variability of the strength and direction of impact may be noted. In the analysed period the share of the variability of labour productivity and production subsidies in the variability of work profitability in the domestic agriculture fluctuated within a very wide range of respectively: 7.91-67.04% and 1.39-45.42%.

Work profitability was determined to a relatively lesser degree by changes in the cost of depreciation [WN/WB], taxes on production [(WN-PD)/WN] and payroll expenses [NO/DCZ]. In the period 2005-2013 the share of these factors in the variability of the real level of work profitability was approximately 8-10%. The data presented in Table 2 also indicate that the impact of other factors on changes in work profitability in agriculture was rather marginal. Analysis of partial deviations and their structures in the case of financial income and expenses [(NO + SO)/NO], leases costs [DR/(NO + SO)] and the rate of employment structure [ZO/ZN] indicates that on average in the post-accession period the variability of work profitability was shaped by these factor of no more than 3%. The data presented in Table 2 also indicate that the impact of other factors on changes in work profitability in agriculture was rather marginal. Analysis of partial deviations and their structures in the case of financial income and expenses [(NO + SO)/NO], leases costs [DR/(NO + SO)] and the rate of employment structure [ZO/ZN] indicates that on average in the post-accession period the variability of

work profitability was shaped by these factor of no more than 3%.

CONCLUSIONS

In the post-accession period there was a rapid growth in the real level of work profitability in Polish agriculture. In the period 2004-2013 work profitability increased realistically from 9.5 thousand PLN/AWU to the level of 15.1 thousand PLN/AWU, i.e. by about 60%. In the light of the results of the logarithmic method, the main determinants of the variability of work profitability in domestic agriculture was mainly a positive direction of changes and the scale of variability of the real level of labour productivity and production subsidies. Nevertheless, from the point of view of development prospects, of fundamental importance for the further growth of economic and financial efficiency of agriculture will be mainly further progress in terms of labour productivity. The importance of subsidies will still be high, however, at the same time it will be stable in terms of its impact on the variability of profitability. This means therefore that without an acceleration of processes of structural changes aimed at increasing the size of the basic units of production in agriculture, downsizing and accelerating the pace of technical reconstruction of agriculture, opportunities for further growth of income seem unrealistic.

REFERENCES

- [1] Economic Accounts for Agriculture -values at real prices, 2014, <http://epp.eurostat.ec.europa.eu>.
- [2] Gołaś, Z., 2010a, Wydajność i dochodowość pracy w rolnictwie w świetle Rachunków Ekonomicznych dla Rolnictwa. Zagadnienia Ekonomiki Rolnej, 3, 19-42
- [3] Gołaś, Z., 2010b, Propozycja systemowej analizy wydajności i dochodowości pracy w rolnictwie. Zeszyty Teoretyczne Rachunkowości, 57(113), 15-28
- [4] Poczta, W., Czubał, W., Pawlak, K., 2009, Zmiany w wolumenie produkcji i dochodach rolniczych w warunkach akcesji Polski do UE. Zagadnienia Ekonomiki Rolnej, 4, 40-52
- [5] Poczta, W., 2003, Rolnictwo polskie w przededniu integracji z Unią Europejską. Wyd. AR Poznań
- [6] Regulation (EC) No 138/2004 of the European Parliament and of the Council of 5 December 2003 on

the Economic Accounts for Agriculture in the Community, Official Journal of the European Union, 05.02.2004

[7]Skoczylas, W., Niemiec, A., 2005, Przyczynowa analiza ekonomicznej wartości dodanej w identyfikacji i ocenie strategii jej wzrostu. Prace Naukowe, AE Wrocław, 1061, 71-81

[8]Skoczylas, W. (red), 2007, Determinanty i modele wartości przedsiębiorstw. PWE, Warszawa.

[9]Wędzki, D., 2006, Analiza wskaźnikowa sprawozdań finansowych. Oficyna Ekonomiczna, Kraków.

[10]Wysocki, F., Lira J., 2003, Statystyka opisowa. Wyd. Akademii Rolniczej w Poznaniu

[11]Zegar, J.S., 2008, Dochody w okresie transformacji i integracji europejskiej. IERiGŻ, Warszawa

DAIRY BUSINESS: THE CASE OF BULGARIAN DAIRY CATTLE FARMERS

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Abstract

The purpose of the study was to explore differences between dairy cattle farmers in Bulgaria, according to certain factors. Information about the social characteristics of the farmers (educational level, gender, and age), and about the farm characteristics (number of cows in the main herd, average milk yield, and the rate of return on investment) was collected. Sixty percent of the farmers were up to 50 years of age. Fifty percent of the farmers had had a secondary education and the rest had gained a university degree. The study found that only one of the 20 farmers was a woman. It was found that the group of farmers with a university degree had lower average age than the group of farmers with secondary school. There was no significant difference in the rate of return between the two groups of farms in terms of the effectiveness of the farm. The difference in the number of cows in the main herd was not significant too. The research identified a need for additional training for farmers in order to reduce their dependence on hired workers. It was found that farmers attend basic courses in the field of agriculture and livestock breeding in order to fill the gap between the existing levels of knowledge of farmers and the necessary skills for the effective management of dairy farms.

Key words: age, case study research, farmers, education, ROI

INTRODUCTION

Dairy cattle farming is a promising sector in Bulgaria, and one that creates opportunities for young people to work in rural areas and to engage in agricultural production. The sector also provides opportunities for boosting employment through enterprise development. In that context both a formal and informal education is essential. While there are many studies, concerning the dairy business and the development of rural areas in Bulgaria, the personal profile of dairy cattle farmers has had little research. Little is known about their education, gender, age, the rate of return on investment, the main sources of information and the intended courses from the farmers. Therefore, the study focused on differences between dairy cattle farmers according to certain factors.

Bulgarian dairy farming is still at an unsatisfactory level and during the last decade, there was a steady declining tendency in the number of dairy cattle farms with up to 9 animals. In the same time the number of farms, breeding 10 or more cows gradually

rises. The concentration of dairy herds in the country is still low in 2010: the average number of dairy cows in a farm is 5 animals, whilst for the EU this average is 28 [14]. About 49% of dairy cows in Bulgaria are bred in farms with up to 19 animals in the main herd as at November 1st, 2012 [18]. Some of the most important factors holding up the competitiveness of dairy cattle farms in Bulgaria are the poor mechanisation of the production process and obsolete equipment in the majority of small farms [25], as well as the insufficient agricultural experience. The average milk yield of herds in Bulgaria was 3562 l in 2011 [16] whilst for the EU-27 the average milk yield was 6692 kg per dairy cow in 2011 [14]. According to a scientific research, the increase in average milk yield improves the profitability of dairy farms [24]. An analysis of the social and economic characteristics of the rural population is essential to the development of dairy farming. Major problems for the Bulgaria are depopulation and high unemployment rate in rural areas.

The rural population, engaged in agriculture

belongs to social groups with low income, low education and qualifications, and with a higher average age, which limits the ability of farms to choose production solutions [19].

The development of rural areas strongly depends on the agricultural sector [20].

The poor age structure is one of the main problems in agriculture: no more than 5% of all farmers are under 35 years and 55% are over 55 years of age and the majority (95% for 2007) of farms in Bulgaria use family labor [19].

The role of education, according to Bulgarian national statistics [21], can be documented from the point of view of the employment rate. For 2012 the employment rate of the population aged 15 and more years is 69.1% for university graduates; 55% for those with secondary education; 19.3% for people with primary education and 8.4% for people with lower education. Employment is determined primarily by the level of education and professional qualifications [30]. Education is the most important factor for higher employment and the reduction of social disparities and the researches in that field strongly confirm that higher education leads to greater job security and career development [30].

According to the National Human Development Report 2003 [29], measures are needed to encourage investments in non-agricultural sectors in rural regions in Bulgaria, as well as alternative employment outside agriculture. Farmers who are better educated are more likely to consider non-farm self-employment [28]. The motivation of the farmers depends on the economic results from the farm operations, sector prospects and development opportunities. However the economic results are connected to milk and beef production, environmental conditions in the farms [7], including housing system, cleaning, feeding [10], milking, water requirements [2], light conditions [3], heat stress [1], reproduction [8], [9], longevity [11], breeding value of bulls [6], and the health and welfare of animals [23], as well as from the effective management [25] and education and age of farmers [5].

Dairy cattle farming is a labour-intensive sector, in which biological and non-biological processes are intertwined. Effective management and the production of high quality cow milk require a set of resources - both capital and labour. Generally the equipment in small-scale dairy farms in Bulgaria is physically obsolete [25]. Some of the main challenges for the small-scale farmers are connected with an improvement of the average milk yield through the selection and use of high productive cattle breeds, an increase in the concentration of dairy herds and adoption of modern technologies for milking, feeding, cleaning. The role of the manager is to reconcile adequately the farm resources with the market requirements for the production of high quality milk and milk products. It could be achieved by adequate education and qualifications in the field of dairy farming.

One of the main indicators, characterizing the farms' effectiveness is the rate of return on investment. The role of investment for the modernisation and expansion of farms is unquestionable. The planning of operational cash flows and investments in tangible and intangible assets, as well as the optimisation of the production costs, are of paramount importance for the competitiveness of the individual farm and for the competitiveness of the sector as a whole. The profitability of the farms can be improved by reducing the fixed costs per unit of output, which could be achieved by increasing the size of the farm and with investments in new, more productive equipment [19].

The purpose of the study was to explore the differences between dairy cattle farmers in Bulgaria, according to certain factors. The objectives were as followed:

1. To compare dairy cattle farmers according to social characteristics of age and educational level;
2. To compare dairy cattle farmers according to farm characteristics: the number of cows in the main herd, the average milk yield and the rate of return on investment (ROI);
3. To investigate the sources of information, which Bulgarian dairy cattle farmers use and

to specify the main specialised courses, which farmers could use to improve their qualifications.

However the educational level of Bulgarian dairy cattle farmers is still unexplored and that study enters into a new area of knowledge.

MATERIALS AND METHODS

The focus of this study was based on 20 dairy cattle farmers in Bulgaria. The primary information was collected in 2012-2013 through a survey. The data were collected through personal interviews. The respondents were assured that the information would be confidential.

Information about social characteristics of the farmers was collected: (a) education, (b) gender, and (c) age.

The respondents were also asked about the number of cows, the average milk yield and ROI in the farms.

This research belongs to the case study researches [32]. Case study researches build theories [4], confirm or disconfirm a given theory [22] and are used in a variety of disciplines [27].

Although the majority of the studied farmers didn't have agricultural education, the efficiency of the farms, compared to the educational level of the farmers was studied to determine whether the additional years, spent in education had affected the farm performance.

The 20 farms under the study bred a total of 1796 dairy cows.

According to the educational level, the respondents were divided into 2 groups – with secondary education (10 farmers) and with a university degree (10 farmers). And these were the two groups, which were compared below.

A Two-sample t-test was conducted to compare the two independent groups when the dependent variable was quantitative and followed the normal distribution. The nonparametric test - the Mann-Whitney U test [13], [31] was conducted to compare the differences between two independent groups when the dependent variable was ordinal or

quantitative but did not follow the normal distribution.

The quantitative variables were tested for normal distribution and for the homogeneity of the variances. The normal distribution was tested with one-sample Kolmogorov-Smirnov test [15] and Shapiro-Wilk test [26]. The Levene's test of homogeneity of the variances was also conducted.

The quantitative variables were the age of the farmers, and number of cows in the herd.

The age: the normal distribution of this variable was not rejected according to the conducted one-sample Kolmogorov-Smirnov test ($p > 0.05$) and Shapiro-Wilk test ($p > 0.05$). The normality of each group of the analysed variable was verified. Here the normality assumption was acceptable.

The number of cows: the two groups within the variable were not normally distributed, according to the significance of the one-sample Kolmogorov-Smirnov test ($p < 0.05$) and Shapiro-Wilk test ($p < 0.05$).

The farmers were asked to indicate in which group, in terms of ROI, their farms fall within: Group 1 - from 1 to 10% (lower rate of return) and Group 2 - more than 10% (higher rate of return). Group 1 was less favorable than Group 2 and that was the reason why ROI was classified as an ordinal variable.

A Two-sample t - test was used to compare the age of farmers by their educational level. The test compared the age of farmers with a secondary education with the age of farmers with a university degree. The t - tests were performed, after homogeneity of the variances was verified with Levene's test ($p > 0.05$).

The nonparametric Mann-Whitney U test was used to compare ROI by the educational level of farmers, because the rate of return on investment was an ordinal variable. Mann-Whitney U test was also conducted to compare the number of cows in the main herd, because the number of cows in the two groups, formed according to the educational level of farmers weren't normally distributed, according to the one-sample Kolmogorov-Smirnov test ($p < 0.05$) and Shapiro-Wilk test ($p < 0.05$).

RESULTS AND DISCUSSIONS

The results from the research were as followed:

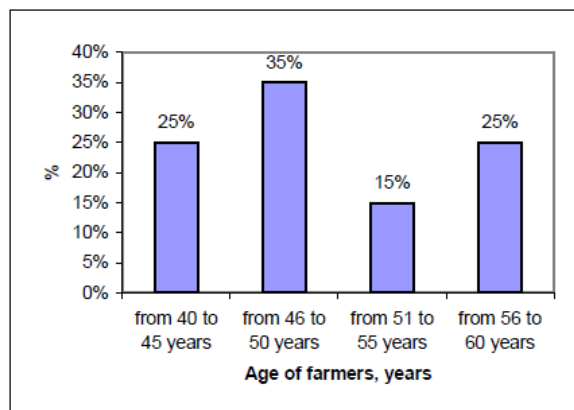


Fig. 1. Distribution of Farmers according to Their Age, N=20

Figure 1 shows the distribution of the farmers according to their age. The age of farmers varied from 40 to 60. It was found that 35% ($n=7$) of the respondents were within 46 - 50 age group, followed by the two groups - between 40 to 45 years ($n=5$) and between 56 - 60 years ($n=5$) with equal percentage (25%); 15% ($n=3$) were within 51- 55 age group.

The study found that one of the 20 farmers was a woman, which was consistent with the conclusion of a scientific research [30], according to which mainly men are engaged in the Bulgarian agriculture and women are mostly involved in the service sector.

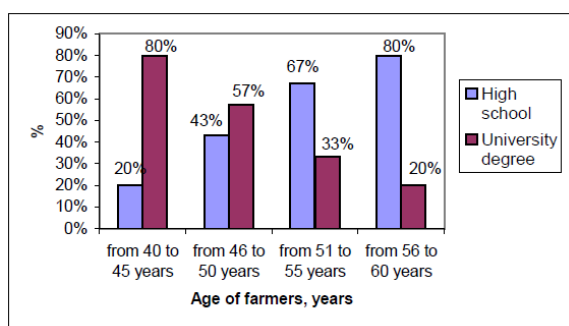


Fig. 2. Educational Level of Farmers according to Their Age, N=20

Figure 2 shows the educational level of the farmers according to their age. The majority of the respondents between 40 and 45 years of age and between 46 and 50 years were university graduates (80% and 57%

respectively). In the age groups: between 51 and 55 years and between 56 and 60 years predominated farmers with a high school diploma (67% and 80% respectively). Two of the respondents with a university degree had a diploma, connected with agriculture or animal breeding (one farmers was a veterinarian and one was an agronomist). This result was consistent with the conclusion of a scientific research [19], according to which despite the relatively high level of public education of the farm managers (secondary or higher education) in the majority of farms, the agricultural experience of the managers is low. This conclusion was confirmed by the results from the survey, held in 2010 [17], which stated that 96.58% of farm managers had only practical agricultural experience, 2.08% had secondary educational degree in agriculture and 1.34% had higher educational degree or postgraduate degree in agriculture.

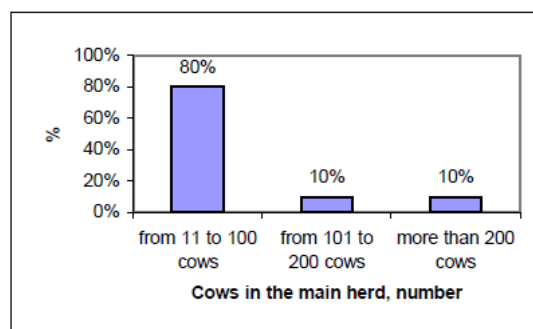


Fig. 3. Distribution of Farms according to the Number of Cows in the Main Herd, N=20

Figure 3 represents the distribution of farms according to the number of cows in the main herd. Between 11 and 340 cows in the main herd were bred in the studied farms. Eighty percent ($n=16$) of the farms fall within 11 - 100 cows category, followed by the group between 101 and 200 cows ($n=2$) and the group with more than 200 cows ($n=2$) with equal percentage (10%).

Table 1 represents descriptive statistics of the number of cows in the main herd, the age of the farmers, and average milk yield of the farms. The average age for all farmers was 51 years; for university graduates – 47 years, and for the farmers with high school – 53 years.

Table 1. Descriptive Statistics of the Variables: Number of Cows in the Main Herd, Age of the Farmers, and Average Milk Yield

Variable	Number of observations	Minimum	Maximum	Mean	Standard deviation
Number of cows	20	11	340	90	88
Age - all farmers	20	40	60	51	6
- Age - university graduates	10	40	60	47	6
- Age - high school	10	41	60	53	6
Average milk yield	20	3000	7800	5740	1466

The average number of dairy cows for a farm was 90. The standard deviation was 88 for the number of cows and 6 for the age of farmers. The average milk yield for the studied farms was 5740 kg with standard deviation 1466.

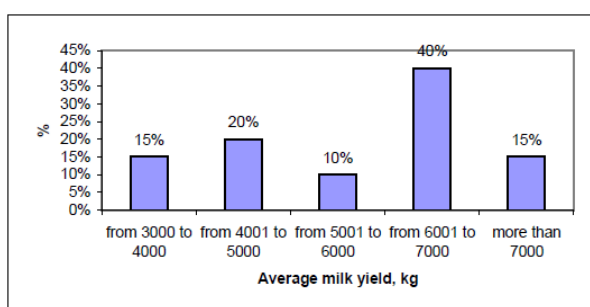


Fig. 4. Distribution of Farms According to the Average Milk Yield, N=20

Figure 4 represents the distribution of farms according to the average milk yield. Forty percents ($n=8$) were with 6001-7000 kg category; and 15% ($n=3$) had higher than 7000 kg average milk yield. The rest (45%) had average milk yield between 3000 and 6000 kg.

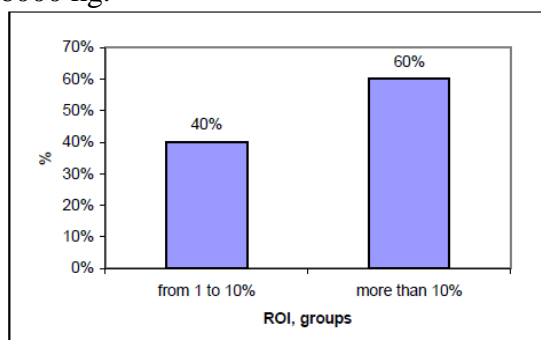


Fig. 5. Distribution of Farms According to ROI, N=20

Figure 5 represents the distribution of farms according to ROI. The study found that 40% ($n=8$) of the farmers had a realised ROI from 1 to 10% and the rest of farmers had higher rate of return.

The results from the conducted statistical tests showed that the difference in the age between

the two groups of farmers (first group – with secondary education, second group - with a university degree) was significant ($p = 0.048$). The average age of farmers with a secondary education was 53 years, and for those with a university degree was 47 years. There was not a significant difference in the number of cows in the main herd ($p = 0.796$), as well as in ROI between the two groups ($p = 0.481$).

Access to information was crucial for the proper functioning of the farms. Successful farm managers seek active information [12]. From the analysis of the data it was found that the farmers mainly informed themselves, in the field of dairy production, by specialised literature, television, internet, from consultations with other farmers and experts (veterinarian, accountant, business partner), and from seminars on topical issues. The majority of young farmers increase their qualification through consulting services and reading specialised literature [25].

The respondents often faced problems in recruiting and retaining their workforce. In order to reduce their dependence on hired workers and specialists in agriculture, most of the farmers completed specialised courses for agricultural producers, courses for artificial insemination techniques for farm animals, training courses necessary to work with farm machinery and agricultural equipment, and computer literacy courses. The courses increased their knowledge and managerial abilities and the farmers themselves implemented some of the key activities, such as insemination of animals, some of the mechanised agricultural processes and others. From this perspective, the additional training is extremely important for the cost-effective operation of the farms. This research was consistent with the conclusion of a scientific research [19], according to which cost reductions in farms can be achieved through the use of farmer's own labour.

CONCLUSIONS

The majority of studied farms bred between 11 and 100 cows in the main herd (80%) and only 10% had more than 200 cows. Farmers with a university degree on average were

younger than the farmers with secondary school. From the studied 20 farmers, one was a woman.

There was no significant difference in ROI between the two groups of farms in terms of the effectiveness of the farm. The difference in the number of cows in the main herd was not significant too. The research identified a need for additional training for farmers in order to reduce their dependence on hired workers.

REFERENCES

- [1]Armstrong, D.V., 2000, Methods to reduce heat stress for dairy cows. Paper presented at the 2000 Heart of America Dairy Management Conference, 2000, 21-22 June, 13-19. Retrieved from: http://jokko.bae.uky.edu/ext/Livestock/Dairy/PDFs/KSU_heatstress.pdf#page=12
- [2]Brouk, M. J., Smith, J. F., Harner, J. P., DeFrain, S. R., 2001, Drinking water requirements for lactating dairy cows. Paper presented at the Dairy Day 2001 Report of Progress 881, Kansas State University, 35-39. Retrieved from: <http://www.ksre.ksu.edu/historicpublications/pubs/srp881.pdf>
- [3]Dahl, G. E., Petitclerc, D., 2003, Management of photoperiod in the dairy herd for improved production and health. *Journal of Animal Science*, 81(3): 11-17. Retrieved from: http://www.journalofanimalscience.org/content/81/suppl_3/11
- [4]Eisenhardt, K. M., 1989, Building Theories from Case Study Research. *The Academy of Management Review*, 14(4): 532-550. doi: 10.5465/AMR.1989.4308385
- [5] Harizanova–Metodieva, Ts., Metodiev, N., 2013, Social characteristic of farmers according to different factors, *Agricultural Science*, 46(3-4): 26-31
- [6]Ivanova, T., 2004, Estimation of the Breeding Value of Bulls from the Black and White Cattle Breed by Some Traits. *Bulgarian Journal of Agricultural Science*, 10: 377-382
- [7]Ivanova, T., 2005, Influence of Some Genetic and Environmental Factors on the Reproductive Traits in Cows. *Bulgarian Journal of Agricultural Science*, 3: 353-358
- [8]Ivanova, T., 2009, A study on reproductive characteristics and the milk yield of Holstein Friesian cows. *Journal of Animal Science*, 1: 23-27
- [9]Ivanova, T., 2009, Effect of reproductive disorders on milk productivity and days in milk in Holstein cows. *Journal of Animal Science*, 4: 9-14
- [10]Ivanova, T., Petkova, M., 2010, Comparative study on the composition of milk from cows fed by conventional and organic feedstuffs. *Journal of Animal Science*, XLVII, Suppl. 1: 240-245
- [11]Ivanova, T., 2011, Variance in Holstein Friesian cows longevity. *Journal of Animal Science*, 4: 14-18
- [12]Luening, R., 1996, Technical Dairy Guide, Dairy Farm Business Management. Babcock Institute for International Dairy Research and Development, pp.11
- [13]Mann, H. B., Whitney, D. R., 1947, On a Test of Whether one of Two Random Variables is Stochastically Larger than the Other. *Annals of Mathematical Statistics*, 18(1): 50–60. Retrieved from: <http://projecteuclid.org/euclid.aoms/1177730491>
- [14]Marquer, P., 2013, Milk and dairy production statistics. *Statistics Explained*. Retrieved from: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Milk_and_dairy_production_statistics
- [15]Massey, F. J., Jr., 1951, The Kolmogorov-Smirnov Test for Goodness of Fit. *Journal of the American Statistical Association*, 46(253): 68-78. Retrieved from: <http://www.jstor.org/stable/2280095>
- [16] Ministry of Agriculture and Food, Republic of Bulgaria. 2012. Agricultural Report 2012. Retrieved from: <http://www.mzh.government.bg/mzh/bg/Documents/AgrarenDoklad.aspx>
- [17] Ministry of Agriculture and Food, Republic of Bulgaria. 2012. General characteristics of the structure of agricultural holdings. Retrieved from: http://www.mzh.government.bg/MZH/Libraries/Структура_зем_стопанства_рез_и_дин_редове/AC2010-1-sflb.ashx
- [18]Ministry of Agriculture and Food, Republic of Bulgaria, 2013, April, Livestock in Bulgaria at November 1st, 2012. Retrieved from: http://www.mzh.government.bg/MZH/Libraries/%D0%B6%D0%B8%D0%B2%D0%BE%D1%82%D0%BD%D0%BE%D0%B2%D1%8A%D0%B4%D1%81%D1%82%D0%B2%D0%BE2013/R_A241-Livestock_Nov2012.sflb.ashx
- [19] Mishev, P., Ivanova, N., Sterev, N., Harizanova, H., 2009, State and perspective of development of semi-subsistence farms in Bulgaria. *Research papers*, 2, 3-60. Sofia, Bulgaria: University of National and World Economy. Retrieved from: <http://research.unwe.bg/br17/1.pdf>
- [20]Mishev, P., Ivanova, N., Harisanova, C., 2010, Structural Changes and Labour Adjustments in Rural Bulgaria. Paper presented at the 118th seminar of the European Association of Agricultural Economists (IAAE), Rural development: governance, policy design and delivery, Ljubljana, Slovenia, 2010, 25-27 August, 713-728. Retrieved from: http://ageconsearch.umn.edu/bitstream/95317/2/Mishev_Structural_changes_and_labour_adjustments_in_rural_Bulgaria-198%5b1%5d.pdf
- [21] National Statistical Institute, Republic of Bulgaria. (n.d.). Statistical database. Retrieved from: <http://www.nsi.bg>
- [22]Pahre, R., 2005, Formal Theory and Case-Study Methods in EU Studies. *European Union Politics*, 6(1): 1-14

113–146. doi: 10.1177/1465116505049610 [23]Regula, G., Danuser, J., Spycher, B., Wechsler, B., 2004, Health and welfare of dairy cows in different husbandry systems in Switzerland. Preventive Veterinary Medicine, 66(1–4): 247–264. doi:

<http://dx.doi.org/10.1016/j.prevetmed.2004.09.004>

[24]Rodriguez, L. A., DeFrain, J. M., 2009, Factors Affecting Profitability of Western Dairies. Paper presented at the Southwest Nutrition and Management Conference, 79-89. Retrieved from:

http://animal.cals.arizona.edu/swnmc/Proceedings/2009/09Rodriguez_09.pdf

[25]Rusev, N., Bachvarova, S., Gaidarska, V., Harizanova, T., Stoykov, P., Ivanova, T., 2012, Study on basic criteria of a grade of dairy farms with different herd size. Bulgarian Journal of Agricultural Science, 18(6): 958-964.

Retrieved from: <http://www.agrojournal.org/18/06-19-12.pdf>

[26]Shapiro, S. S., Wilk, M. B., 1965, An analysis of variance test for normality (Complete Samples). Biometrika, 52(3/4): 591-611. Retrieved from: <http://www.jstor.org/stable/2333709>

[27]Soy, S. K., 1997, The case study as a research method. Unpublished paper. University of Texas at Austin. Retrieved from:

<https://www.ischool.utexas.edu/~ssoy/usesusers/1391d1b.htm>

[28]Traikova, D., Möllers, J., Buchenrieder, G., 2012, How Farmers Become Entrepreneurs - Prenatal Diagnostic of Rural Firms in Bulgaria. Paper presented at the International Association of Agricultural Economists (IAAE) Triennial Conference, Foz do Iguaçu, Brazil, 2012, 18-24 August, 1-45. Retrieved from:

http://ageconsearch.umn.edu/bitstream/126816/2/IAAE_Traikova_et_al.pdf

[29]United Nations Development Programme, Bulgaria. (2004, 05 February). National Human Development Report 2003. Retrieved from: http://www.undp.bg/uploads/documents/1176_585.pdf

[30]Vladimirova, K., 2008, Employment strategies and equal opportunities for men and women. Research papers, 1: 3-52. Sofia, Bulgaria: University of National and World Economy. Retrieved from:

<http://research.unwe.bg/br12/1.pdf>

[31]Wilcoxon, F., 1945, Individual Comparisons by Ranking Methods. Biometrics Bulletin, 1(6), 80-83. Retrieved from: <http://www.jstor.org/stable/3001968>

[32]Yin, R. K., 1984, Case Study Research: Design and Methods. Beverly Hills, London: Sage.

EFFECT OF REFLECTOR APPLICATION ON PV PANEL PERFORMANCE UNDER EGYPTIAN CONDITIONS

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Abstract

The proposed approach in the present study is to employ a mirror augmented PV solar panel to track the sun and reflect rays on to the PV panel. Its performance was compared with same PV module without reflector under the same environmental conditions. The mirror augmented solar PV panel tracked sun from East to West along the daytime in Winter 2011 with tilt angle 0.523 rad (30 deg) for panel and 0.122 rad (7deg) for mirror which are estimated by experiment. The average energy output values of 1.11 and 0.95 kWh/day were recorded for panel with and without mirror, respectively. The average daily η_{panel} values of 12.6 and 11.02 % were recorded for panel with and without mirror, respectively. The increase percentages in the output of panel and discharge differs with the solar radiation along daytime. The application of mirror is an efficient and an effective way to enhance the performance of solar photovoltaic pumping system with the same panel area.

Key words: Egyptian conditions, performance, pv panel, reflector application

INTRODUCTION

Egypt has a high potential of solar energy, which can be considered as a reliable energy source even during the winter season. It lies within the subtropical region. The annual daily average of solar radiation intensity during winter is about 7kW/ (m² .day) and the measured annual daily sunshine duration amounts to approximately 11h [4].

Photovoltaic (PV) water pumping has become a widely adopted solar energy technology in the last two decades [1].

Achieving low cost solar electricity is the driving force behind the research and development in photovoltaic technology. Research is in progress in different fields like material, manufacturing process to make effective photovoltaics [2]. The proposed approach is to use a tracking flat mirror to continuously track the sun and reflect the solar radiation on a tracking PV panel. The solar tracking reflective mirror will increase the incident solar radiation. Thus increased solar radiation will improve the total output of

the PV panel and the free discharge of the submersible pump.

The present investigation aims to determine the outputs of the PV module and the volume of pumped water with and without the application of mirror under Egyptian conditions.

MATERIALS AND METHODS

Experiments were performed in Meet Eldeeba, Kafresheikh Governorate, Rice Mechanization Center, Egypt which lies at latitude 31.07°N and longitude 30.57°E during Winter 2011.

Augmented device to reflect solar radiation on the PV modules:

The material of the reflector was a flat mirror to reflect the sunlight on the modules.

The PV array has a capacity of 140 peak Watt. The photovoltaic panel is following the sun's track from its rising in the East to its setting in the West. Panel and mirror were moved until the index has no shadow around. Therefore, the output power was the highest

one. Panel tilt angle is 0.523 rad (30 deg) and mirror tilt angle is 0.122 rad (7deg).



Fig. 1: Augmented device to reflect solar radiation on the PV modules.

The experiments were divided to five processes as follows: 1) Panel tilted at suitable tilt angle [0.549 rad (20deg) in Summer and 0.872 rad (50deg) in Winter] and the panel tracking sun from East to West along day time. 2) Panel tilted at 0.523 rad (30deg) [latitude angle] and the panel tracking sun from East to West along day time. 3) Panel tilted at suitable tilt angle [0.349 rad (20deg) in Summer and 0.872 rad (50deg) in Winter] and panel was oriented toward south along day time. 4) Panel tilted at 0.523 rad (30deg) [latitude angle] and panel was oriented toward South along day time. 5) Panel positioned horizontally along day time. The insolation to the PV array (P_{in}) was calculated by using the following equation [3]:

$$P_{in} = I_{ns} \times a, \text{ W} \dots\dots\dots 1$$

Where:

I_{ns} = insolation, W/m^2 , and a = solar module area, m^2

The DC output power (P_{output}) from the PV array is given by:

$$P_{output} = V_{oc} \times I_{sc}, \text{ W} \dots\dots\dots 2$$

Where:

V_{oc} = open circuit voltage, Volt and

I_{sc} = short circuit current, Amp.

The panel efficiency was calculated by using the following equation:

$$\eta_{panel} = \frac{P_{max}}{P_{in}} = \frac{V_{oc} \times I_{sc} \times FF}{I_{ns} \times a} \times 100 \dots\dots\dots 3$$

Where:

η_{panel} = panel efficiency, % and

FF = fill factor which equals about 0.67 for silicon.

The gain in collected radiation and output electric power due to the application of reflector (mirror) as compared with the gain without reflector can be obtained by using the following relation:

$$\text{Benefit Ratio of Power (BRP)} = \frac{P(\text{with reflector})}{P(\text{without reflector})} \dots\dots\dots 4$$

Where:

P = output electric power, W.

RESULTS AND DISCUSSIONS

Effect of stationary reflector on the efficiency and temperature of the photovoltaic panel:

Table 1. Performance parameters of the panel at different levels of solar radiation and constant panel temperature of 303.15K(30 °C.)

Radiation, W/m^2	I_{sc} , Amp.	V_{oc} , Volt	Power, W	η_{panel} , %
200	1.53	19.1	29.223	11.75
314.29	2.4	19.5	46.8	11.97
571.43	4.35	19.7	85.695	12.06
730.85	5.22	19.9	103.878	12.44
911.39	6.42	19.95	128.079	12.76

From Tables 1 and 2, panel performance affect positively by incident solar radiation but affect negatively by panel temperature.

Table 2. Performance parameters of the panel at different panel temperatures and constant solar radiation of 557.14 W/m^2

$T_{panel, k}$ (°C)	I_{sc} , Amp.	V_{oc} , Volt	Power, W	η_{panel} , %
300.15(27)	4.31	19.7	84.9	12.25
304.15(31)	3.8	19.6	74.48	12.15
320.15(47)	3.73	18.73	69.86	10.08

With the application of reflector on the

photovoltaic panel the incident, the actual effect is the increase in the amount of solar radiation on the panel surface. Consequently, temperature of the panel increased with the application of the reflector due to extra solar radiation. Therefore, it is necessary to

evaluate if the power and efficiency of the panel increased with application of reflector.

From Table 3, it is clear that the performance of the panel improved by the application of the reflector.

Table 3. Performance indicators of the panel at different solar radiation values due to the application of reflector in Winter 2011.

Processes		1	2	3	4	5
Average	Radiation, W/m ²	135.714	504.761	729.428	803.809	878.928
ISC, Amp.	With out reflector	1.290	3.610	5.128	5.657	5.968
ISC, Amp.	with reflector	1.290	3.763	5.504	6.360	7.365
VOC, Volt	With out reflector	19.000	19.666	19.814	19.880	19.915
VOC, Volt	with reflector	19.000	19.777	19.914	19.943	19.983
Power, W	With out reflector	24.510	71.068	101.610	112.456	118.847
Power, W	with reflector	24.510	74.497	109.610	126.840	147.174
η_{panel} , %	With out reflector	14.520	11.349	11.208	11.248	10.948
η_{panel} , %	with reflector	14.520	11.885	12.099	12.686	13.558
Improvement	η_{panel} , %	0.000	4.723	7.947	12.786	23.839

The effect of reflector on the performance of the panel can be divided into five groups according to different values of solar radiation as shown in Table 3. Also, it can be seen in Table 3 that the percentage of improvement efficiency differs according to different values of solar radiation. When the average radiation value (R) was $\leq 35.714 \text{ W/m}^2$, there was no improvement efficiency (η_{panel}). When average R values were 504.701, 729.428, 803.809 and 878.928 W/m², the average η_{panel} values were 4.723, 7.947, 12.786 and 23.839%, respectively. Thus, the positive effect of increase of solar radiation on the panel efficiency (η_{panel}) is more than the negative effect. This is due to the increase in panel temperature (T panel).

CONCLUSIONS

The averaged energy output values of 1.11 and 0.95 kWh/day were recorded for panel with and without mirror. The average daily η_{panel} values of 12.6 and 11.02 % were recorded for panel with and without mirror,

respectively. Benefit Ratio of Power (BRP) due to the application of mirror was 1.32. The optimum tilt angles for using mirror with panel were 0.523 rad (30deg) for panel and 0.122rad (7deg) for mirror. The application of mirror is an efficient and effective way to enhance and improve the performance of solar photovoltaic panel.

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REFERENCES

- [1]Awady, M.N., Sallam, M.F.A., Hegazi, A.M., 2002, Performance of solar powered dirp irrigation system. Misr J.Ag.Eng., 19(2): 297-312
- [2]Badescu, V., 2003, Time dependent model of a complex PV water pumping system. Renewable Energy, 28: 543–560
- [3]Hamza, A.A., Taha, A.Z., 1995, Performance of submersible PV solar pumping system under conditions

in the Sudan. Renewable Energy, 6(5):491-495

[4] Moharam, A.F.A., 1993, Utilization of solar energy for irrigation and its evaluation. Unpublished M.Sc. Thesis. Ag.Eng.Dept., Fac of Ag., Ain Shams Univ., Cairo, Egypt

ENDOGENOUS DETERMINANTS OF INVESTMENTS IN FARMS OF SELECTED COUNTRIES OF CENTRAL AND EASTERN EUROPE

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Abstract

The aim of this study is to identify endogenous factors that determine the level of investment in farms of economic size over 16 ESU in selected CEE countries belonging to the European Union. The empirical material were data from Farm Accountancy Data Network FADN for the years 2004-2009. Analysis of endogenous factors determining investment activity farms showed that the positive effect depends on the level of executed investment economic situation of agricultural holdings, especially the level of generated net farm income and profitability of agricultural production and the level of farm support under the agricultural policy of the European Union.

Key words: farm, endogenous determinants, investment

INTRODUCTION

Factors determining the investment activities of farms can be divided into two main groups. The first group is exogenous factors, located in the external environment farm buildings associated with the macroeconomic, political situation, demographic pressure, institutional arrangements and legal regulations. In turn, endogenous factors are associated with the production potential and economic power of agricultural farm, determined by the resources and relationships of factors of production (resources of land, labor and capital), the production technologies used, human capital, financial situation and the level of income received [4, 6, 7]. Households with higher production potential and economically stronger adopt new production technologies faster and easier. In addition, large agricultural holdings may acquire new technologies earlier because of easier access to external sources of financing, they may also provide better financial security and they are willing to accept higher risk and can not afford the costs of experimenting with new technologies [1, 2].

The level of the investments on the farm is the result of the impact of both exogenous and

endogenous factors. In studies on the factors determining the level of the investments it is difficult to capture the role of a single factor, as these factors are interrelated and affect the investment decisions of farmers in a synergistic manner. The complexity and multifaceted determinants influencing the investment decisions of farmers requires a judgment value as to the validity of the individual factors. Exogenous factors are crucial. Only under a favorable perception by farmers of changes in further or closer external environment of agriculture risks associated with investments are taken. In turn, endogenous factors related to potential of agricultural farm have an impact on the willingness and farmers' ability of investment put a condition on initiation of the investment process. Even with very favorable external circumstances, it is difficult to imagine that the investments will be made in a farm of considerable internal constraints.

The aim of this study is to identify an endogenous factors determining the level of investment in farms of economic size over 16 ESU in selected countries of Central and Eastern Europe belong to the European Union.

MATERIALS AND METHODS

The empirical material were data from Farm Accountancy Data Network FADN for the years 2004-2009. However, due to the availability of data, information regarding Bulgaria and Romania included only the years 2007 to 2009. Analysis included all agricultural households from 10 countries and Central Eastern Europe belonging to the European Union (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia) represented in the FADN database from the three largest economic size classes (16 - <40 ESU ; 40 - <100 ESU \geq 100 ESU).

To identify factors affecting the level of investment activity of farms EU countries multiple regression equation of the general form was used:

$$y_i = \beta_0 + \sum_{j=1}^k \beta_j x_{ij} + \sum_{j=1}^k \gamma_j x_{ij}^2 + \sum_{r=1}^q \zeta_r z_{ir} + \varepsilon_i \quad (1)$$

where: y_i - i -th observation on the explanatory variable ($i = 1, 2, \dots, n$), x_{ij} - i -th observation on the j -th explanatory variable belonging to a set of variables characterizing the internal situation of households, z_{ir} - i -th observation on the r -th binary explanatory variable, taking the value of 1 for the data from the r -th country and zero for the other, $\beta_0, \beta_j, \gamma_j, \zeta_j$ - structural parameters of the regression equation.

Binary variables were introduced into the model, to make it possible to identify differences in the dependent variables between the countries included in the study. In the set of explanatory variables the binary variable relating to Poland is not present. This gives the effect that the regression coefficients at binary variables tell how much the average level of the explanatory variable differed from the average level of the variable in Poland. Squares of variables characterizing the internal situation of households (x_i) were included in the model, so that it would be possible to capture the non-linear dependence between a explained and the explanatory variables, if such dependence appeared.

The level completed investments in farms of the Member States of the European Union has been characterized by three variables whose variation is described by the model (1):

Y_1 - net investment outlays per farm [EURO],

Y_2 - fixed assets reproduction calculated as the ratio of net capital expenditures in relation to the value of fixed assets [multiplicity],

Y_3 - net investment per total labor input [EUR/AWU].

A set of potential explanatory variables belonging to a set of variables characterizing the internal situation of households included:

x_1 - economic size of farms [ESU], x_2 - total utilised agricultural area [ha], x_3 - full-time person per 100 ha of AL [AWU/100 ha AL],

x_4 - total output/total input [multiplicity], x_5 - balance subsidies & taxes on investments [EURO], x_6 - net farm income [EURO], x_7 - farm net value added [EURO/AWU], x_8 - net farm income family labor [EURO / FWU], x_9 - total assets [EURO], x_{10} - total fixed assets [EURO], x_{11} - cash flow (1)² [EURO], x_{12} - cash flow (2)³ [EURO], x_{13} - cash flow (2)/total farm capital [multiplicity], x_{14} - balance current subsidies & taxes [EURO], x_{15} - total debt ratio⁴ [%], x_{16} - technical equipment of the agricultural land⁵ [EURO/ha], x_{17} - technical equipment of labor⁶ [EURO / AWU], x_{18} - labor productivity⁷ [EURO/AWU].

Assessments of the structural parameters of the model (1) describing the variation of each of the dependent variables were calculated using the least squares method using the procedure of *a priori* selection. This procedure allowed the removal from the set all explanatory variables of the model (1), and those that did not affect significantly the formation of the dependent variables.

² cash flow (1)=sales of products+other receipts+sales of livestock-all costs paid-purchases of livestock+farm subsidies-farm taxes+VAT balance+subsidies on investments-taxes on investments

³ cash flow (2)=cash flow (1)+sales of capital-investments+closing valuation of debts-opening valuation of debts

⁴ Debt ratio is calculated as the ratio of total liabilities to total assets

⁵ Technical equipment of land calculated as the ratio of current assets (excluding land, permanent crops and production quotas) to 1 ha

⁶ Technical equipment of labor calculated as the ratio of the value of machinery, equipment and means of transport to one full-time employee

⁷ Labour productivity is calculated as the ratio of total production to the number of full-time

RESULTS AND DISCUSSIONS

The characteristics of the explanatory variables are shown in Table 1. It is worth to pay attention to the production potential of the analyzed farms. The highest level of economic size were characterized by farms from Romania and the Czech Republic, while the lowest level of farm equipment were in Slovenia. Similarly, the lowest agricultural area was noted in farms in Slovenia. In the case of workforce equipment of farms analyzed, the highest level of the indicator of full-time person per 100 ha of AL was in agricultural holdings in Slovenia, Poland and Bulgaria. In other countries, this ratio is at a level of 2.0 - 2.8 ha AWU/100 AL. On the other hand, in the case of equipment of analyzed farms in total assets the greatest value was recorded in farms in Slovakia and the Czech Republic, the lowest value was in farm equipment from Bulgaria, Slovenia and Poland. Indicator of technical equipment of agricultural land was the highest in Slovenia. Similarly, the agricultural farms of Slovenia were characterized by the highest value of the indicator technical equipment of labor, but also for the farms of Lithuania, the Czech Republic, Estonia, this ratio was at a similar level. The lowest value of the technical equipment of labor was reported on the farms of Bulgaria and Slovakia.

The investment activity of agricultural holdings with economic size over 16 ESU in the analyzed countries is shown in Table 2. The highest level of investment per one farm occurred in Latvia, Lithuania and Estonia, and a negative value was recorded in Slovakia. Similarly, the rate of reproduction of fixed assets has reached the highest level in Latvia, Lithuania and Estonia, but also in Bulgaria. In turn, the lowest rate of interest reproduction of fixed assets was recorded in the Czech Republic and Slovakia.

Factors affecting the level of net investment realized in farms analyzed countries were identified using multiple regression analysis (Table 3). Net investment are gross investment less amortization. Net investment value indicates a real increase of agricultural

farm production assets. The condition for the development of agricultural farm is not just reproduction of the productive assets (simple reproduction), but most of all development investments (extended reproduction). If the net investment are negative, this indicates a depreciation of wealth.

The level of net capital expenditures attributable to the agricultural farm has been explained with the help of the ten variables. With the increase of farm income, cash flow (1), total assets, square of relationship between total output/total input increased level of realized net investment (Table 3). It is worth to pay attention to the importance of net farm income and total output/total input relation in the creation of farmers' investment activity. These two variables indicating the economic situation of the agricultural farm and the profitability of agricultural production, determine the possibility of the creation of investment funds, but also are important as part of the farmers' perception of the economic situation in the sector. Also the value of cash flow (1) has positive impact on the level of the investments. But square of cash flow (1) adversely affects the level of realized net investments, which shows a non-linear relation. cash flow (1) shows the ability of agricultural farm self-financing its operations and create savings in operating activities, at the same time it is also the result of the profitability of agricultural production and the direct support of agriculture in agricultural policy. Therefore, the income situation of agricultural holdings is particularly important from the point of view of investment activities, since it allows to take pro-development activities, the essence of which is the creation of an investment fund that converts to turn in investment demand.

Negative impact on the level of implemented net investments was recorded in the case of cash flow (2), farm net value added/AWU, economic size, total debt ratio, the square of the total fixed assets and square of technical equipment of the land (Table 3). The negative relationship between cash flow (2) and the level of implemented net investment was due to the fact that the cash flow (2) takes into

account not only flows from operating financing activities.
activities, but also from investing and

Table 1. The explanatory variables (average for years 2004 – 2009)

Parameter	Bulgaria	Czech Republic	Estonia	Hungary	Lithuania	Latvia	Poland	Romania	Slovakia	Slovenia
Economic size of farm [ESU]										
\bar{X}	128,2	207,9	102,2	165,5	101,1	138,1	117,0	217,4	157,3	41,8
<i>sd</i>	126,4	240,2	87,3	177,7	85,0	138,4	112,4	311,8	164,6	18,3
Total utilised agricultural area [ha]										
\bar{X}	459,7	443,2	505,6	372,1	415,9	453,4	192,1	567,2	698,9	35,4
<i>sd</i>	427,7	458,9	376,8	364,8	316,5	342,0	202,7	501,7	628,5	13,4
Full-time person per 100 ha AL [AWU/100 ha AL]										
\bar{X}	4,3	2,8	2,0	2,7	2,0	2,7	4,7	2,8	2,6	9,1
<i>sd</i>	1,8	0,6	0,5	0,5	0,7	0,9	1,5	1,0	0,6	2,8
Total output/total input [multiplicity]										
\bar{X}	0,98	0,94	0,98	0,98	1,19	0,93	1,23	1,03	0,72	1,15
<i>sd</i>	0,13	0,10	0,10	0,08	0,19	0,08	0,15	0,13	0,11	0,08
Balance subsidies & taxes on investments [thousand EURO]										
\bar{X}	1,82	3,96	17,35	7,37	18,36	19,47	-0,20	4,54	10,25	5,59
<i>sd</i>	1,69	6,06	14,94	10,80	13,70	18,69	1,56	4,61	16,97	5,81
Farm net income [thousand EURO]										
\bar{X}	52,31	40,78	66,27	53,07	105,34	74,15	53,63	129,80	-45,59	39,71
<i>sd</i>	57,05	33,25	55,01	52,48	74,87	61,45	39,08	175,33	116,20	23,43
Farm net value added [thousand EURO/AWU]										
\bar{X}	74,25	12,98	12,51	15,51	17,40	10,08	13,63	13,57	5,53	13,19
<i>sd</i>	29,31	29,26	38,56	4,13	6,71	3,11	3,61	7,02	2,93	7,28
Farm net income family labor [thousand EURO/FWU]										
\bar{X}	52,85	20,65	49,34	39,83	73,31	46,65	32,16	51,53	20,14	15,76
<i>sd</i>	52,57	12,47	38,49	23,20	53,37	38,75	25,30	42,41	38,26	8,75
Total assets [thousand EURO]										
\bar{X}	444,65	1348,58	824,08	865,12	757,84	869,16	638,28	843,40	1637,44	496,98
<i>sd</i>	342,48	1505,73	721,91	836,87	642,26	947,55	589,72	810,31	1954,63	160,54
Total fixed assets [thousand EURO]										
\bar{X}	260,31	998,61	628,32	500,38	459,36	536,64	478,78	506,55	1039,20	461,57
<i>sd</i>	179,31	1090,64	552,76	423,82	372,56	589,68	405,70	458,57	1321,56	144,59
Cash flow (1) [thousand EURO]										
\bar{X}	69,27	88,35	100,82	88,29	129,15	113,99	73,59	142,95	68,45	53,97
<i>sd</i>	67,98	69,95	69,71	73,43	91,07	94,35	54,40	175,39	74,41	27,89
Cash flow (2) [thousand EURO]										
\bar{X}	19,91	30,68	38,82	58,27	69,11	45,0	34,42	98,84	-3,88	18,22
<i>sd</i>	39,99	20,88	39,42	62,99	55,47	40,56	40,78	150,45	58,43	16,37
Cash flow(2)/farm total capital [multiplicity]										
\bar{X}	0,0252	0,0629	0,0652	0,0871	0,1162	0,087	0,0729	0,1020	0,0150	0,0344
<i>sd</i>	0,0849	0,041	0,0354	0,042	0,0525	0,049	0,0326	0,0690	0,0430	0,0249
Balance current subsidies & taxes [thousand EURO]										
\bar{X}	58,32	105,08	68,47	87,64	56,47	85,40	31,12	1020,08	137,66	19,21
<i>sd</i>	59,49	109,08	55,84	91,48	42,08	76,88	33,56	998,82	139,37	9,40
Total debt ratio [%]										
\bar{X}	26,31	17,59	32,34	30,84	23,74	37,82	20,28	12,76	9,66	4,83
<i>sd</i>	9,94	7,40	6,16	7,29	3,77	10,37	7,09	6,66	4,61	1,53
Technical equipment of the agricultural land [EURO/ha UR]										
\bar{X}	557,93	1737,30	1011,82	1032,77	800,24	736,32	2547,59	700,91	1058,36	8426,30
<i>sd</i>	187,17	393,24	221,40	82,02	226,58	324,83	855,51	77,10	614,16	1005,45
Technical equipment of labor [thousand EURO/AWU]										
\bar{X}	7,73	29,54	26,03	20,70	30,71	17,83	22,52	14,98	9,49	30,03
<i>sd</i>	2,90	5,97	12,36	6,16	12,77	5,89	4,86	5,98	3,25	12,26
Labor productivity [thousand EURO/AWU]										
\bar{X}	15,69	34,50	36,42	40,59	34,94	28,21	35,43	27,63	22,52	33,52
<i>sd</i>	5,30	4,94	8,92	9,82	10,55	9,37	10,22	11,80	4,66	14,53

Source: own study based on Farm Accountancy Data Network

Table 2. The level of investment outlays in farms with economics size from 16 ESU in selected countries (average for years 2004 – 2009)

Country	Net investments per farm [euro]		Fixed assets reproduction ratio [%]		Net investment per total labor input [EURO/AWU]	
	\bar{x}	<i>sd</i>	\bar{x}	<i>sd</i>	\bar{x}	<i>sd</i>
Bulgaria	38456,4	76,80	15,29	65,13	2906,31	73,59
Czech Republic	9053,78	184,86	0,65	192,95	481,55	209,41
Estonia	62520,22	112,10	11,00	52,33	6102,81	55,19
Hungary	15066,89	165,57	2,17	104,03	1293,04	98,66
Lithuania	64500,28	77,65	15,87	31,39	9175,02	45,26
Latvia	94716,39	130,81	16,58	59,40	5462,10	64,94
Poland	17174,61	115,15	3,72	60,74	2820,66	65,32
Romania	25503,78	128,60	2,57	225,53	983,73	187,16
Slovakia	-39609,7	255,60	0,81	705,67	-698,60	363,41
Slovenia	18381,75	81,37	3,33	65,83	5986,61	74,22

Source: own study based on Farm Accountancy Data Network

Table 3. Regression summary of depend variables: Y_1 – net investment outlays per farm [EURO]

Variable	Variable name	b_j	$S(b_j)$	t	p
x_0	Constant	8939,38	14477,6	0,6174	0,5379
x_6	Farm net income	1,17	0,1	13,096	0,000
x_{11}	Cash flow (1)	1,18	0,3	3,5609	0,0005
x_{11}^2	Square of cash flow (1)	-0,001	0,0	-5,430	0,000
x_{12}	Cash flow (2)	-0,65	0,1	-5,282	0,000
x_{12}^2	Square of cash flow (2)	0,001	0,0	3,2811	0,0013
x_9	Total assets	0,07	0,0	6,0310	0,000
x_7	Farm Net Value Added/AWU	-5,01	0,8	-6,2877	0,000
x_1	Economic size	-714,79	138,7	-5,153	0,0001
x_1^2	Square of economic size	0,64	0,2	3,437	0,0007
x_{15}	Total debt ratio	-374369,66	109987,2	-3,403	0,0008
x_{15}^2	Square of total debt ratio	1101707,23	199327,5	5,527	0,0000
x_{10}^2	Square of total fixed assets	-0,001	0,0	-5,704	0,000
x_4^2	Square of total output/total input	26947,43	9574,2	2,814	0,0055
x_{16}^2	Square of technical equipment of the agricultural land	-0,00001	0,0	-2,275	0,024

 $R^2 = 0,7984$ corrected $R^2 = 0,7784$

Source: own study based on Farm Accountancy Data Network

Therefore, the cash flow (2) reflects the investments made and the financial burden resulting from this fact, and is not a factor stimulating farmers to invest. At the same time a square of cash flow (2) is positively correlated with the level of investment which proves the non-linear relation. Also, with

increasing values of total debt ratio investment activity of farmers decreased, the relationship was not linear (positive impact of squared variable of total debt ratio). This is due to the fact that the increase in the debt level of an agricultural farm reduces its credit rating. With the increase in the value of the

square of technical equipment of land, the square of the total fixed assets and labor productivity index calculated farm net value

added/AWU the level of investments made is reduced.

Table 4. Regression summary of dependent variables: Y_2 – fixed assets reproduction [%]

Variable	Variable name	b_j	$S(b_j)$	t	p
x_0	Constant	-0,561	0,095	-5,9092	0,000
x_{15}	Total debt ratio	0,3461	0,045	7,62560	0,000
x_4	Total output/total input	0,9799	0,184	5,32042	0,000
x_4^2	Square of total output/total input	-0,363	0,086	-4,2239	0,001
x_{10}	Total fixed assets	-0,0001	0,00	-6,0545	0,000
x_5	Balance subsidies & taxes on investments	0,0001	0,00	6,89202	0,000
x_5^2	Square of balance subsidies & taxes on investments	-0,0001	0,00	-6,0488	0,000
x_7	Farm Net Value Added/AWU	-0,0002	0,00	-2,4272	0,016
x_9	Square of total assets	0,0001	0,00	4,95765	0,001
x_{14}	Balance current subsidies & taxes	0,00001	0,00	2,57657	0,010
x_{14}^2	Square of balance current subsidies & taxes	-0,0001	0,00	-3,4782	0,001
x_{13}	Cash flow (2)/farm total capital	-0,7674	0,14	-5,4599	0,000
x_{13}^2	Square of cash flow (2)/farm total capital	3,842	0,79	4,83102	0,001
Binary variables that identifies countries where the level of Y_2 is different from the average in Poland	Hungary	-0,078	0,013	-5,7449	0,000

$R^2 = 0,8386$ corrected $R^2 = 0,7032$

Source: own study based on Farm Accountancy Data Network

This would indicate that the farms that are better equipped with fixed assets and higher labor productivity have a better, more modern production workshop which reduces investment needs.

Comparing the level of net implemented investment by farm in Poland to farms in the rest of the countries surveyed showed no statistically significant differences. Matching of determined model to empirical data is 78,94 % (Table 3). Another analyzed dependent variable is the rate of reproduction of fixed assets (Table 4). The rate of reproduction of fixed assets indicates a degree of property reproduction. If the value of this ratio is in the range 0 - 0.99 %, this means a simple reproduction, the rate of value above 0.99 % points to expanded reproduction, and less than 0 % to negative reproduction [11]. The rate of reproduction of fixed assets for the analyzed farms has been explained with the

help of eight explanatory variables. With the increase in total debt ratio, total output/total input, Balance subsidies and taxes on investments, balance current subsidies and taxes, square of cash flow (2)/total farm capital increased, the rate of reproduction of fixed assets increased. At this point, special attention should be paid to the positive role of balance subsidies & taxes on Investments and balance current subsidies & taxes to stimulate investment activity for farmers. These two quantities are dependent on the level of support in agricultural policy both in operations and investment and play an important role due to reducing investment risk and in ongoing activities, and also allow for reduction of the costs associated with financing investments from external sources. In addition, the allow for reduction of the impact of credit constraints [10]. Square of balance subsidies & taxes on Investments and

square of balance current subsidies & taxes take negative values which indicates the existence of non-linearity. On the other hand, with the increase in total fixed assets, farm net value added/AWU and cash flow (2) / total farm capital, the rate of reproduction of fixed assets decreased (Table 4).

Comparing the level of the rate of reproduction of fixed assets by farm in Poland to farms in other countries analyzed, it was found that it was statistically significantly lower only in Hungary. This ratio did not differ significantly in the farms of other analyzed countries. Matching of determined model to empirical data is 83.86 % (Table 4).

The last analyzed the dependent variable is net investment per total labor input. This indicator is important because of the observed changes in prices of agricultural production means, the prices of agricultural production, prices of production factors and their mutual relationships. Observed trends in changes to the price level during long periods are particularly important for the processes of modernization. Analyzing the changes in the prices of agricultural products and prices of products purchased by farmers (in real terms) in the U.S., J.P. Chavas [3] and W. E. Huffman and R. E. Evenson [5] noted a permanent separation of the price scissors and a worsening of the income of farmers. Similarly, in studies by H. Runowski and W. Ziętara [9] it was found that labor costs have the largest dynamics of increase, then come the costs of prices of goods purchased by farmers. In contrast, the lowest growth trend is seen for the prices of agricultural products sold by farmers. Appearing trend causes a decrease in unit profitability of agricultural production. In the context of rapid increase in labor costs in agriculture, there is need to improve the efficiency factor of production which is work. Achieving this is difficult, but it is slowly becoming the only possibility [8]. Due to the rapid growth of labor costs compared to other factors of production it becomes necessary to implement the cost-effective production technology resulting in an increase in capital-labor relations.

The level of net investment per total labor input for the analyzed farms has been explained with the help of eleven explanatory variables (Table 5).

With the increase in total output/total input, balance subsidies & taxes on investments, square of farm net value added/AWU, net farm income, labor productivity, square of economic size and square of total net assets the level of investment per total labor input increased. In the case of the dependent variable it can be also noted that among the endogenous factors the net farm income, profitability of agricultural production and the level of subsidies & taxes balance on investments are important. However, the square of total output/total input and square of Balance subsidies & taxes on investments are negative which indicates the presence of non-linearities. This analysis points to the importance of the economic situation of agricultural holdings as an important element for the adoption of the investment effort, but also stresses the importance of financial support for public investment activity. Improving the economic situation of agricultural farm allows for financing the investment, and the possibility of obtaining financial assistance from public funds further enhances the ability to fund capital expenditures or increase the range of investment size. In turn, negative correlation was observed between the net investment per labor total input and total utilised agricultural area, full-time person per 100 hectares of agricultural area, cash flow (2)/total farm capital and square of cash flow (1).

Comparing the level of net investment per total labor input on farms in Poland to farms in other countries analyzed, it was found that it was statistically significantly lower only in Hungary and the Czech Republic, and agricultural holdings in Bulgaria achieved a higher rate of it. In the farms of other analyzed countries, this ratio did not differ significantly. Matching of determined model to empirical data is 87.13 % (Table 5).

Table 5. Regression summary of dependent variables: Y_3 – net investment per total labor input [EURO/AWU]

Variable	Variable name	b_j	$S(b_j)$	t	p
x_0	Constant	-20077,3	4613,7	-4,35	0,001
x_4	Total output/total input	33832,0	9123,9	3,71	0,003
x_4^2	Square of total output/total input	-14070,4	4261,0	-3,3	0,001
x_5	Balance subsidies & taxes on investments	0,4385	0,04	9,554	0,000
x_5^2	Square of balance subsidies & taxes on investments	-0,00001	0,00	-6,355	0,000
x_2	Total utilised agricultural area	-6,9531	1,06	-6,51	0,000
x_7	Square of farm net value added/AWU	0,00001	0,00	5,57	0,000
x_6	Farm net income	0,0214	0,01	4,31	0,001
x_3	Full-time person per 100 ha AL	-352,704	124,2	-2,83	0,005
x_{18}	Labor productivity	0,3621	0,11	3,22	0,001
x_{18}^2	Square of labor productivity	-0,00001	0,00	-4,0	0,001
x_{13}	Cash flow (2)/farm total capital	-19468,9	5688,6	-3,42	0,008
x_1^2	Square of economic size	0,0079	0,004	2,01	0,045
x_{11}^2	Square of cash flow (1)	-0,00001	0,000	-4,93	0,002
x_9	Square of total assets	0,00001	0,000	4,10	0,007
Binary variables that identifies countries where the level of Y_3 is different from the average in Poland	Hungary	-3402,13	656,5	-5,18	0,001
	Czech Republic	-4008,8	690,0	-5,80	0,000
	Bulgaria	2372,02	987,6	2,40	0,017

 $R^2 = 0,8713$ corrected $R^2 = 0,7592$

Source: own study based on Farm Accountancy Data Network

CONCLUSIONS

The investment decision is the process in which the information from different sources is processed. A farmer's decision to invest in physical capital might be the result of economic considerations regarding to the external environment factors, farm buildings and internal factors inherent in the farm, the characteristics of the farmer or the objectives pursued. Together, all these factors contribute to making specific investment decisions, which in turn translates into capital expenditure.

The ex-post analysis of endogenous factors affecting the investment activity of agricultural farms of economic size over 16 ESU in the countries of Central and Eastern European Union showed that in the case of net investment outlays per farm, fixed assets investment and net reproduction per total labor input the economic situation of agricultural holdings, particularly the level of

farms generated net income and profitability of agricultural production has positive impact the level of realized investment. Good economic situation of agricultural farm allows for the financing of investment activities on the basis of its own resources, but also allows the obtaining of funds from external sources. It also allows more optimistically assess the future and take risks associated with investments. The analysis also pointed out the importance of agricultural policy in shaping the investment activity of farmers. The level achieved by holding agricultural subsidies was positively correlated with the value of the investments evaluated by indicators: fixed assets reproduction and net investment per total labor input. The role of subsidies, due to the fact that they share a certain level of confidence (do not depend on the market situation, their level is quite sure in a certain period of time resulting from the financial perspective of the EU agricultural policy), should be assessed as a factor mitigating the risks associated with ongoing investments.

REFERENCES

- [1]Barrett, C.B., Carter, M.R., Timmer, C.P., 2010, A Century-Long Perspective on Agricultural Development. *American Journal of Agricultural Economics* 92 (2): 447 – 468
- [2]Carter, M., 1988, Equilibrium Credit Rationing of Small Farm Agriculture. *Journal of Development Economics* 28: 83 – 103
- [3]Chavas, J. P., 2011, Agricultural Policy in a uncertain world. *European Review of Agricultural Economics*, Vol. 38(3): 383 – 407
- [4]Gallerani V., Gomez y Paloma S., Raggi M., Viaggi D., 2008, Investment behaviour in conventional and emerging farming systems under different policy scenarios. European Commission JRC Scientific and Technical Report Institute for Prospective Technological Studies
- [5]Huffman, W.E., Evenson R.E., 2001, Structural and productivity change in US agriculture, 1950 – 1982. *Agriculture Economics* 24: 127 – 147
- [6]Kusz D., Gędek S., Ruda M., 2013, Endogeniczne uwarunkowania działalności inwestycyjnej gospodarstw rolniczych w Polsce. *Roczniki Ekonomii Rolnictwa i Rozwoju Obszarów Wiejskich*, Tom 100 – Zeszyt 1, PAN Wydział Nauk Humanistycznych i Społecznych – Komitet Ekonomii Rolnictwa i Rozwoju Obszarów Wiejskich, Wydział Nauk Ekonomicznych SGGW w Warszawie: 52 – 61 (in Polish)
- [7]Kusz, D., 2009, Procesy inwestycyjne w praktyce gospodarstw rolniczych korzystających z funduszy strukturalnych Unii Europejskiej, Oficyna Wydawnicza Politechniki Rzeszowskiej, Rzeszów (in Polish)
- [8]Rembisz, W., Bezat-Jarzębowska, A., 2013, *Microeconomics of agricultural producers' income*. LAP Lambert Academic Publishing
- [9]Runowski, H., Ziętara, W. 2011, Future role of agriculture in multifunctional development of rural areas. *APSTRACT: Applied Studies in Agribusiness and Commerce*, Vol. 5, Numbers 1 – 2: 29 – 38
- [10]Sckokai, P. 2005, Modelling the impact of agricultural policies on farm investments under uncertainty: the case of the CAP arable crop regime. Working Paper AGR/CA/APM(2005)13/FINAL, OECD, Paris
- [11]Sobczyński, T., 2007, Wpływ wielkości ekonomicznej gospodarstw rolniczych UE na ich możliwości rozwojowe. *Zeszyty Naukowe SGGW w Warszawie, Problemy Rolnictwa Światowego*, Tom 9 (XXIV), Wydawnictwo SGGW w Warszawie, Warszawa: 159 – 168 (in Polish)

ECONOMIC ANALYSIS OF SELECTED OPTIONS OF STRAW USE DEPENDING ON HARVESTING TECHNOLOGY

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Abstract

Post-harvest straw deserves particular attention among agricultural raw materials. It can be intended for sale, applied as litter material in animal husbandry or used in field fertilization. To a lesser extent it can be used for fodder production, covering mounds of roots and tubers and the production of insulation materials in horticulture and building construction. Using surplus straw directly for energy generation, including production of pellets and briquettes, should also be considered rational. Several applications were analyzed. The main purpose of the research is to determine the profitability level of winter wheat cultivation and of energy use of the straw obtained. Among others, they included situations in which obtained straw was used in the production of pellets, in fertilization after prior grinding and mixing with manure or used for direct sale. For our calculations, the costs/ha of wheat cultivation and then straw collection were estimated. The comparative analysis of various options of wheat straw utilization shows the highest profitability in the option of selling the straw and mineral fertilization.

Key words:, biomass, economic calculations, wheat, straw

INTRODUCTION

Energetic crops constitute an increasingly high proportion of arable crops cultivated on farms [2]. Those plants have high energetic value, high yielding of biomass and widespread use in power generation. Among agricultural raw materials straw deserves particular attention [1]. For many years straw remained in the field and was burned by farmers. Recently however decreasing tendency to use straw in that way has been observed [6]. Application of chemical fertilizers and plant protection products leads to increases in the yields of grain and straw [3]. Therefore a problem arises how to utilize surpluses which can be used directly for energy production [5].

Biomass used as a renewable energy source has a huge impact on the operation of business entities. It enables sustainable development of a country, ensuring energy security, economical and rational use of fuels and energy, growth of competition and it

counteracts negative impacts of natural monopolies [8].

MATERIALS AND METHODS

The main objective of the research is to determine the profitability level of winter wheat cultivation and of energy use of the straw obtained from the wheat in the Lower Silesia region. The research provides economic calculation of wheat production profitability using a simple cost-sharing method in the form of simplified calculations. The calculations use prices of year 2012. In order to estimate the profitability of straw, four possible options for straw use are presented including production costs. The subject of research in all the options is the content of different macroelements and the possibility of balancing the shortages of those elements. Cost calculation of straw biomass production has been conducted in the following options:

1. The final collection of organic matter and nutrients in the form of straw is compensated by manure and mineral fertilizations.
2. The final collection of minerals is balanced with mineral fertilization.
3. Straw remains in the field and after being supplemented with a nitrogen fertilizer it is ploughed.
4. Straw remains in the field without fertilization.

The paper also presents graphs of the dependency of farmer's income on the costs of straw transport in the 'loco' farm and 'loco' company variants. The result of the analysis is the presentation of the farmer's direct surplus taking into account the value of his production and incurred production costs.

RESULTS AND DISCUSSIONS

As shown in Fig.1, the highest percentage of costs connected with wheat cultivation is related to mineral fertilizers, which account for 42% of all the costs.

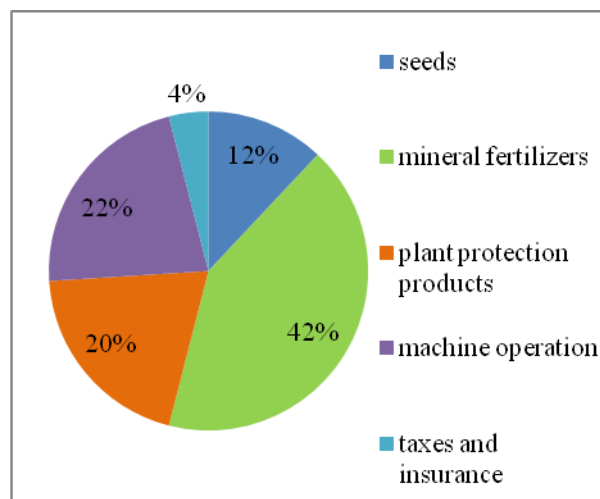


Fig. 1 Cost structure for wheat production per hectare
Source: Author's calculations based on the table of costs of using machines after [7]

The second group 4 of highest costs of cultivation per hectare is connected with agrotechnical operations. Wheat requires very good soils. It yields the best on heavy soils which are present to a sufficient degree in the Lower Silesia soil structure. Following the data in Table 1 and calculating the following

options:

profitability of wheat cultivation it is assumed that an average yield per hectare is 55q (q=quintal=100kg) and the price is 95 PLN·q⁻¹.

Table 1. Production income from winter wheat per hectare

Specification	Unit	[Amount ·ha ⁻¹]	Value in PLN
Price of 1 Quintal of Grain	[PLN·q·(100kg) ⁻¹]		95
Grain Yield	q(100kg)	55	
Value of Grain Yield	PLN		5225
Grain	q(100kg)	2.5	490.5
Mineral Fertilizers	PLN		1800
Plant Protection Products	[PLN·ha ⁻¹]		882.2
Total Direct Costs	PLN		3172.7
Direct surplus	PLN		2052.3
Shallow Ploughing	h(hour)	2	57
Harrowing	H	0.5	19
Fertilization	H	0.5	14
Sowing Tillage	H	2.5	200
Sowing	H	1	50
Late fertilizing (N)	H	1	25
Spraying	H	0.5	50
Grain transport	H	0.7	40
Combine harvesting	H	0.8	270
Taxes and insurance	PLN		180
Indirect Costs	PLN		905
Total Costs	[PLN·q ⁻¹]		4077.70
Production Income	PLN		1147.30
Single area payment	Ha	1	710.57
Supplement to the area payment	Ha	1	274.23
Production Income			2132.10

Source: Author's study

With such assumptions, the direct surplus was 2052.3 PLN and the direct costs were slightly

over 3000 PLN. The total income including indirect costs exceeded 2000 PLN. Table 2 shows profitability calculation for winter wheat straw. It was assumed that 36 bales of straw can be obtained from 1 hectare and the price of one bale is 25 PLN. The calculation also considered all the costs connected with collecting the straw from 1 ha field. The overall direct surplus from selling the straw amounted to 667.93 PLN·ha⁻¹.

Table 2. Calculation of straw profitability per hectare in 2012

Straw	Unit	Value
Total number of straw bales	Item	36(7150 kg)
Unit Price	[PLN·bale ⁻¹]	25
Income	PLN	900
Straw Pressing	PLN	124.46
Loading	PLN	30.69
Straw Transport	[PLN·h ⁻¹]	76.92
Total Costs	[PLN·h ⁻¹]	232.07
Transport Costs	[PLN·km ⁻¹]	3.85
Income from Straw	PLN	744.85
Direct Surplus	PLN	667.93

Source: Author's study

The structure of costs incurred on straw and grain production was also evaluated. The calculation was based on the income from selling individual crops. Knowing the income, it was possible to estimate the overheads which were then reflected in the production of one ton of wheat (Table 3). According to former research, straw yield to grain yield relation is about 0,46 [1]. In my calculation grain yield is 8000 kg, so proportion is 0,89 and then overheads 0,17.

Table 3. Calculating production overheads for straw and wheat grain

Straw Value [PLN]	900
Grain Value [PLN]	5225
Overheads	0.17
Value of grain production costs [PLN]	900
Value of straw production costs [PLN]	155.02

Source: Author's study based on [4].

Straw can be used for multiple purposes. Therefore, considering the income from its

sale, a profitability calculation of several options was conducted depending on the straw use.

Option 1 - Straw removed from the field - fertilization supported with manure

The costs of labour for two operators have been included in operational costs. Table 4 presents quantitative content of the most important macroelements constituting the straw. The total yield of straw obtained from one hectare of wheat is 7150 kg.

Table 4. The content of macroelements in the collected straw

Element	Percentage of elements in straw	Straw yield [kg]	Mineral content in the straw [kg·ha ⁻¹]
N	0.6	7150	45.8
P ₂ O ₅	0.1		7.9
K ₂ O	1.1		83.7
Mg	0.1		6.4
Ca	0.3		19.3

Source: Author's study based on [10]

Based on that amount, the quantities of NPK, Mg and Ca were estimated. In order to supplement fertilization, mineral fertilizers were used in the form of ammonium nitrate and potassium salt. Costs of fertilization are calculated in Table 5. It has been assumed that one manure spreader should carry a load of 3000 kg.

Table 5. Cost calculation for manure fertilization

Item	Cost [PLN·h ⁻¹]	Time (h)	Total cost [PLN]
Spreader	32.02	0.3	9.6
U 3512 Tractor	32.62		9.8
U 2812 Tractor	28.19		8.5
Loader	2.5		0.8
Total			28.6

Source: Analysis based on [7].

To carry out manure fertilization the following machines should be used: the tractor Ursus 3512 with a spreader and the tractor Ursus 2812 with a front loader.

A required dose of minerals is presented in Column 2. It corresponds to the NPK amount in the straw collected from the field. In order

to supplement the shortage of these elements manure was applied. Considering the full coverage of the phosphorous requirement, the amount of almost 2633 kg of manure should be applied per hectare. Such a dose however does not fully cover the demand for nitrogen and potassium (Table 6).

Table 6. Mineral balance after removing straw from the field and supplementing the field with a proper amount of manure

Mineral	Mineral content in the straw [kg·ha ⁻¹]	Content of pure NPK component in manure [kg·t ⁻¹]	Required manure dose in [kg]	Mineral balance [kg]
Nitrogen	45.8	5	9160	Shortage 39
Phosphorus	7.9	3	2633	Full dose
Potassium	83.7	7	11957	Shortage 65.27

Source: Author's study based on chemical composition of fertilizers

The calculation of the expenditures is presented in Table 7.

Table 7. Cost of mineral supplementation after manure fertilization

Cost of Additional Fertilization	Unit Price in [PLN·q ⁻¹]	Amount of Mineral [kg]	Cost of Mineral Fertilization [PLN]
Ammonium Nitrate	139.0	39.0	54.2
Potassium Salt	201.6	81.9	165.2
Total Cost of Mineral Fertilization			219.4
Total Cost of Manure Fertilization [PLN]			28.6
Total Costs			248
Value of Straw [PLN]	900		
Income [PLN]	652		

Source: Author's study based on input prices in 2012

As a result of using that option the farmer generates an income of 652 PLN. Such a solution is pro-ecological because the shortage of minerals which have been lost in straw collection is supplemented through

manure fertilization and mineral fertilizers.

Option 2 - Straw removed from the field - mineral fertilization

In this calculation the shortage of NKP elements is supplemented exclusively by mineral fertilization. Fertilization includes the use of ammonium nitrate, potassium salt and Polifoska 6. The result of income calculation in this option is higher than in manure fertilization and amounts to 658 PLN, which is shown in Table 8.

Table 8. Costs of mineral fertilization

Cost of Fertilization	Unit Price in [PLN·q ⁻¹]	Amount of Mineral [kg]	Cost of Mineral Fertilization [PLN]
Ammonium Nitrate	139.0	45	62
Potassium Salt	201.6	84	164
Polifoska 6	196	7.9	16
Total Cost of Mineral Fertilization [PLN]			242
Value of Straw [PLN]	900		
Income [PLN]	658		

Source: Author's study based on market prices in 2012

Option 3 - Straw remains in the field supplemented with urea

It was assumed in this calculation that straw remains in the field.

For a quicker decomposition of harvest residues, fertilization with urea was used (Table 9).

In this situation the whole amount of NPK remains in the soil.

The results of the calculation are presented in Table 9. In this option the farmer does not benefit financially from straw production.

However the positive aspect of this option is the creation of humus layer in the soil from the harvest residues.

Table 9. Economic calculation for the option: Straw remains in the field

Cost of Fertilization	Unit Price [PLN*dt ⁻¹]	Amount of Mineral [kg]	Cost of Mineral Fertilization [PLN]
Urea	169	100 kg	169
Production Loss [PLN]	-169		

Source: Study based on [9].

The costs incurred by the farmer result from the purchase of urea.

Option 4 - Straw remains in the field

No mineral fertilization is applied.

The farmer's income then equals zero. He

does not incur any additional costs.

Having estimated the income obtained from selling the straw, a relationship was defined between an income obtained from selling the straw and the costs connected with the transport and collection of the straw. Three variants are considered here:

Variant 1: the farmer presses the straw, a company loads and transports it

Variant 2: "loco" farm,

Variant 3: "loco" company.

Figures 2 shows the relationship between the distance and the income obtained from selling the straw.

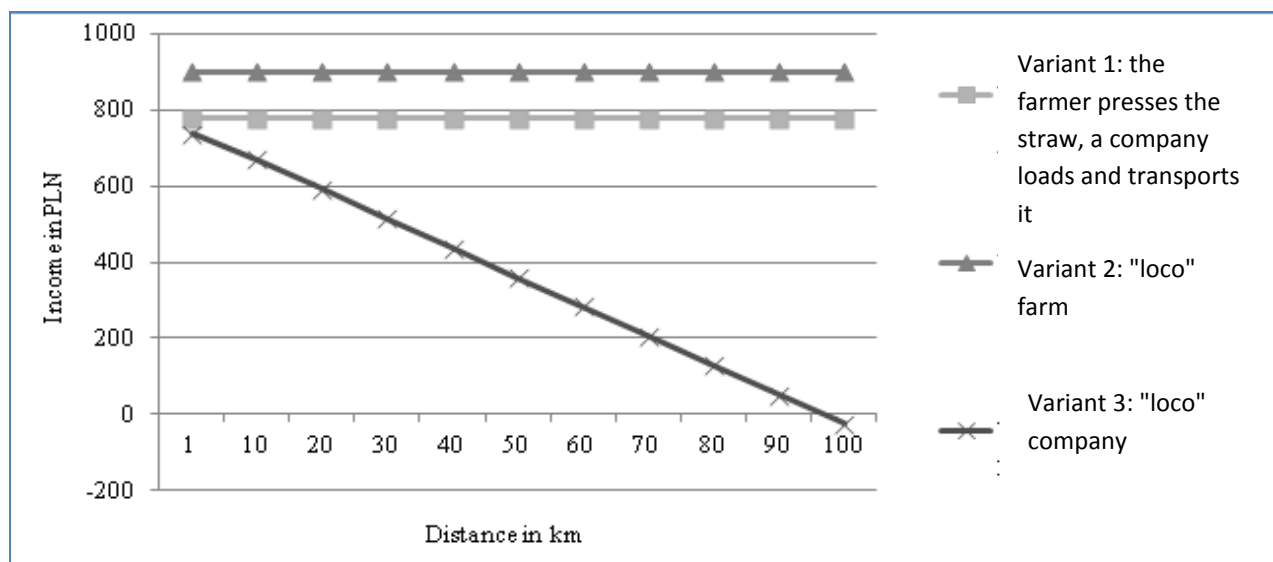


Fig. 2. Multi-variant analysis of farmer's income changeability depending on the distance of straw transportation
Source: Author's study

In the first variant the farmer presses the straw and a company loads it and transports on its own. Then the income is constant and amounts to 775 PLN. The highest profitability for the farmer is obtained in the 'loco' farm variant because then the farmer does not bear any costs connected with straw collection. Then the income is 900 PLN. The farmer receives the lowest possible income in the 'loco' company variant, where he incurs the total costs of straw collection.

Estimation of the 'loco' company variant shows that the threshold distance which ensures the farmer's income is 95 km. Beyond that distance the farmer makes a loss.

CONCLUSIONS

The comparative analysis of various options of wheat straw utilization shows the highest profitability in the option of selling the straw and mineral fertilization in order to balance the NPK minerals. The structure of expenditures on wheat cultivation per hectare shows significant prevalence of costs connected with mineral fertilization and applied plant protection products. In energetic use of straw, the most profitable variant is 'loco' company because the farmer does not bear any costs connected with collecting the

straw from the field. The primary objective of modern farm is to minimize costs and maximize benefits through the use of modern means of production. The straw obtained by farmers can be used in many ways and generates some economy profits. This article presents the calculation of chosen options on the basis of adopted assumptions.

REFERENCES

- [1]Denisiuk, W., 2008, Słoma-potencjał masy i energii, Inżynieria Rolnicza, Nr. 2(100), Kraków, p. 23-30.
- [2]Golinowska, M., 2010, Ekologizacja rolnictwa dolnośląskiego (w) Rozwój zrównoważony rolnictwa i obszarów wiejskich na Dolnym Śląsku. IRWiR PAN, Wrocław. p. 99-121.
- [3]Gradziuk P., 2003, Biopaliwa, Wydanie „Wieś Jutra” Sp. z o.o., Warszawa, p. 114.
- [4]Harasim, A., 1994, Relacja między plonem słomy i ziarna zbóż, Pamiętnik Puławski. Puławy.
- [5]Hejft, R., 2002, Ciśnieniowa aglomeracja materiałów roślinnych. Biblioteka problemów eksploatacji. Politechnika Białostocka, Białystok.
- [6]Krzywy, E., 2000, Nawożenie gleb i roślin. Akademia Rolnicza w Szczecinie, Szczecin.
- [7]Muzalewski A., 2011, Koszty eksploatacji maszyn, nr 25, Wydawnictwo ITP, Falenty - Warszawa.
- [8]Ostrowski, J., 2010, Modelowanie ocen i kartograficzna prezentacja przydatności gruntów do uprawy roślin energetycznych (w) Zeszyty Naukowe Uniwersytetu Warszawskiego, Warszawa, p. 2-3.
- [9]Pikuła, D., 2010, Dlaczego warto zostawić słomę na polu?, Instytut Uprawy Nawożenia i Gleboznawstwa – Państwowy Instytut Badawczy w Puławach.
- [10]Sadowski, A., Hołubowicz, T., Nurzyński, J., Pacholak, E., 1983, Określenie potrzeb nawożenia roślin sadowniczych. Instytut Sadownictwa i Kwiaciarstwa, Skierniewice.

PRODUCTION COSTS AND PROFITABILITY OF THREE POTATO VARIETIES: LORD, VINETA AND JELLY IN YEARS 2011-2012

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Abstract

The paper Farm incomes in Poland vary substantially, which is entirely confirmed by the results of agricultural accounting in Polish FADN. The income is influenced by a range of factors of which the most important are natural conditions, the farm production potential, production intensity as well as subsidies under the Common Agricultural Policy. The increase in potato production on the European market has caused a low price level. In some countries the decline in prices was even 15% in 2010. The decline in prices led to the decline in profitability of potato production because low prices obtained by producers entailed higher costs of potato production. This work shows research results from years 2011-2013. The aim of the research was to compare the profitability of edible potato production on an individual farm in the Łódź Province in the early and late harvesting of the analysed years. The data needed to estimate the profitability were obtained based on the data included in the report which an individual farm runs in order to determine the profitability of the application of new cultivation technique or new varieties. Based on the obtained data, direct and indirect costs as well as profit were calculated. The profitability estimated on the basis of the data collected from the farmer was compared to the profitability which would be achieved by the farmer on the basis of the percentage of direct and indirect costs provided by the Institute of Agricultural and Food Economics. The profitability calculated on the basis of indicators of the Institute of Agricultural and Food Economics was lower than the profitability estimated on the basis of the data obtained from the analysis of the farm financial report.

Key words: costs, cultivation, potato, profitability, varieties

INTRODUCTION

The potato (*Solanum tuberosum* L.) belongs to the most important arable crops for the world economy. The current global potato production amounts to over 320 million tons and for many years it has shown an upward trend. Poland is the sixth biggest producer of potato in the world and the third in Europe. In Poland the potato holds a special position, also yielding on low-quality soils which constitute a substantial part in the structure of arable land. The potato cultivation in a rational crop rotation causes soil loosening, weeding, and reduction in the growth of pathogens. It also prevents soil degradation, improves soil fertility and increases the yield of subsequent plants. The potato is a widely used crop. It is a vital foodstuff, a component of feed and an industrial raw material. During

the last decade a significant decrease in the land used for potato cultivation has been observed. In 1997 the potato was cultivated on 1,300,000 hectares whereas in 2007 on about 570,000 hectares (a reduction of more than 56%) [9],[10]. In that period, average yields per hectare did not increase significantly and ranged between 15 - 20 tons/hectare. Such a significant drop in potato cultivation in Poland was caused by several factors of which the most important are: marginalisation of potato's significance as the feed for pigs, the decrease in the profitability of some production areas (low prices of edible potatoes, low profitability of seed potato production, disappearance of spirit production depending on potato, starch amounts - drop in the production of starch potato) and increasing requirements in a wider potato industry [9]. All this results in the fact that

major producers look for ways of increasing the quality and quantity of produced potatoes. The level of potato crop depends to a high degree on the choice of variety, but the size and quality of potato tubers also depends on the applied agrotechnology. Market demands influence the crop area, yields and destination of potato [5],[6]. Over the years potato crop area as well as potato harvest and yields have changed.

MATERIALS AND METHODS

This work presents research results from years 2011 – 2012. The objective was to compare the profitability of potato growing depending on the time of harvesting on an individual farm in the Łódź Province in the analysed years. The total farm area is 120 ha dominated by potato cultivation and cereals. The data needed to calculate the profitability was obtained on the basis of information from the report run by a given farm in order to determine the profitability of application of new cultivating techniques or new varieties. Based on the collected data, direct and indirect costs as well as profit were calculated. The profitability calculated based on the data obtained from the farmer was compared to the profitability which the farmer would achieve based on the percentage of direct and indirect costs provided by the Institute of Agricultural and Food Economics [1],[2]. The economic viability estimated on the basis of indicators of the Institute of Agricultural and Food Economics was lower than the one obtained from the analysis of the farm financial report.

RESULTS AND DISCUSSIONS

Tables 1, 2 and 3 show costs and profitability of potato cultivation depending on how early the potato variety is. In both early and late varieties, the purchasing cost of the planting material represents the biggest part of direct costs. The cost results from an incredibly high price of planting material in years 2010-2012. Following the methodology of cost calculation of this economic category, the calculation of labour costs of the farmer and

his family was not included.

Table 1. Cost and income calculations of the Lord potato variety cultivation in PLN per hectare (the average over years 2011 – 2012)

No.	Specification	Amount	Price	Value
1	Value of Production			26002.6
1.1	Main Production	30	850	25500.0
1.2	Direct Subsidy			502.60
1.3	Planting Material	3.5	1500	5250.0
2	Mineral Fertilization			1656.8
3	Plant Protection Products			933.25
4	Direct Costs		43%	7840.05
5	Direct Surplus			18162.6
6	Direct Surplus without Subsidies			17660.0
7	Indirect Costs		57%	10392.6
8	Total Costs			18232.7
9	Production Cost of 1 ton			607.8
10	Operating Income without Subsidies			7267.3
11	Operating Income with Subsidies			7769.9

Source: Author's analysis

In the last 15 years the structure of potato use has changed significantly [3]. Although the leading position in previous years - potatoes used for feed - still constitutes about 30% of the total production, it is only 4 million tons in absolute figures compared to 30 million tons in the past decades [4]. Apart from the calculation of costs, the basis for the calculation of potato production profitability is the potato price for a given year, which depends mostly on potato yields and potato production area in respect of the whole country. In the case of the Lord variety (early variety) the income obtained from one hectare was the highest both with and without direct subsidies. It is mainly connected with the fact

that in the period from June to July potato prices on the domestic market are the highest compared to the prices in the subsequent months. It should also be mentioned that in analysed year 2011 the potato price was much higher than in following year 2012. In the case of late varieties, the profitability is lower, whereas the yield which compensates the lower price is higher.

Table 2. Cost and income calculations of the Vineta potato variety cultivation in PLN per hectare (the average over years 2011 – 2012)

No.	Specification	Amount	Price	Value
1	Value of Production			24102.6
1.1	Main Production	40	590	23600
1.2	Direct Subsidy			502.6
1.3	Planting Material	3.5	1500	5250.0
2	Mineral Fertilization			1656.8
3	Plant Protection Products			933.25
4	Direct Costs		43%	7840.05
5	Direct Surplus			16262.6
6	Direct Surplus without Subsidies			15760.0
7	Indirect Costs		57%	10392.6
8	Total Costs			18232.7
9	Production Cost of 1 ton			455.8
10	Operating Income without Subsidies			5367.3
11	Operating Income with Subsidies			5869.9

Source: Author's analysis

We commercially process less than 2 million tons of potato, which is about half less than in the 1970s. The distilling industry has decreased significantly becoming ten times lower. We process several times less potato in starching. Since the 1990s potato processing for food preparations has increased almost six times. Potato production in Poland, as in other European countries, becomes completely dependent on the customer the quality of

potato must be perfectly suited to the direction of use.

Table 3. Cost and income calculations of the Jelly potato variety cultivation in PLN per hectare (the average over years 2011 – 2012)

No.	Specification	Amount	Price	Value
1.	Value of Production			23902.6
1.1	Main Production	39	600	23400
1.2	Direct Subsidy			502.6
1.3	Planting Material	3.5	1500	5250.0
2.	Mineral Fertilization			1656.8
3	Plant Protection Products			933.25
4	Direct Costs		43%	7840.05
5	Direct Surplus			16062.6
6	Direct Surplus without Subsidies			15560.0
7	Indirect Costs		57%	10392.6
8	Total Costs			18232.7
9	Production Cost of 1 ton			467.5
10	Operating Income without Subsidies			5167.3
11	Operating Income with Subsidies			5669.9

Source: Author's analysis

Among agrotechnological factors determining the amount and quality of potato yield are the following: growing site, soil cultivation, organic and mineral fertilization, health of seed potatoes, time and technology of planting, proper care and protection [7],[8]. Spring soil cultivation for potatoes is aimed at limiting water losses from winter stocks, accelerating the heating of soil, thorough mixing of soil with mineral fertilizers and providing optimal conditions for planters [1], [2]. Potato is a widely cultivated crop, which causes numerous problems connected with its production, dissemination of the technological and biological progress as well as organization of potato purchasing for consumption and processing.

CONCLUSIONS

The level of production costs of edible potatoes depends mainly on the applied farming methods, the potato variety and the conditions for growth, which the farmer has less influence on. The direct surplus being the resultant value of production and direct production costs constitutes the most important feature necessary to assess the economic viability of edible potato production by variety. The highest direct costs incurred during the production of individual varieties of potato were connected with purchasing a certified planting material. The best production result is achieved in late varieties of potato whereas the best economic result, i.e. the most satisfying for the farmer, is achieved in early varieties cultivated with the application of proper agrotechnology and protection.

REFERENCES

- [1]Bernat, E., 2008, Wpływ terminów zaprawiania sadzeniaków na wielkość i jakość plonu bulw. *Ziemniak Polski* 2:19 – 23
- [2]Bernat, E., 2005, Wiosenna agrotechnika ziemniaka przy różnych kierunkach użytkowania. *Agrotechnika* 3 (519):43 – 47
- [3]Dzwonkowski, W., Szczepaniak, E., Roszak, E., Bochińska, E., 2005, Popyt na ziemniaki. *Rynek ziemniaka stan i perspektywy* 27. IERiGŻ, ARR, MRiRW, 8 – 13
- [4]<http://rolnicy.com/uprawa-roslin/oplalnosc-produkcji-ziemniakow-spada-sso.html>
- [5]Leszczyński, W., 2012, Znaczenie ziemniaka jako produktu żywnościowego oraz w przetwórstwie przemysłowym. *Ziemniak Polski* 1:38 – 43
- [6]Lisińska, G., 2004, Przetwory ziemniaczane spożywcze: wielkość produkcji, wartość żywieniowa. *Zesz. Probl. Post. Nauk Rol.* 500: 57 - 58
- [7]Lisińska, G., 2006, Wartość technologiczna i jakość konsumpcyjna polskich odmian ziemniaka. *Zeszyty Problemowe Postępów Nauk Rolniczych* 511: 81 – 94
- [8]Plich, J., Flis, B., 2012, Hodowla odpornościowa – efektywny sposób walki z patogenami ziemniaka. *Ziemniak Polski* 1: 8 – 13
- [9]Sass, R., 2011, Ocena sytuacji produkcyjnej i ekonomicznej gospodarstw najlepszych, średnich i najgorszych, „Zagadnienia Doradztwa Rolniczego”, 65: 37–40
- [10]Wyniki standardowe uzyskane przez gospodarstwa rolne uczestniczące w Polskim FADN w latach 2007–2009. Część I. Wyniki standardowe, IERiGŻ, Warszawa, 38–59

MARKETING RESEARCH ON WINE CONSUMERS PREFERENCES IN ROMANIA

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Abstract

The paper is based on a research that aimed to make some assumptions regarding wine consumer preferences in Romania. The research method was survey made through questionnaires administered to a relevant number of respondents. In order to establish the main goals of this research, we considered aspects as: identification of purchase and consume frequency of wine, the preferred consumer's places for serving or buying wine, the average quantity of wine that is usually bought, the level of price accepted by the consumer, the type of wine preferred by consumer in relation with wine color and taste, the preferred package, time spent for wine shopping, preferred producers, brands, grape variety, quality influence in choosing wine categories, identifying wine consumers profile. The analysis and interpretation of results revealed that decision factors in buying wine are the type of the wine, the price, followed by color, packaging and advertisement.

Key words: consumer preferences, market, Romania, wine

INTRODUCTION

The relation between food and wine is very close in the human history. The wine is part of the world history, having an important role in agriculture development, a strong influence of the people's culture. Measuring consumer preferences can be made based on sensory or non-sensory attributes of the wine. The second category is relevant for the market research and can include aspects regarding price, region of origin and grape variety, brand name, label and package attractiveness. Worldwide Romania ranks 11 in terms of area cultivated with vines, respective 5th place in the European Union. Also in terms of grapes production, Romania ranks 19 at world level, respective 5th place in the European Union. According to National Institute of Statistics from Romania, wine consumption ranks second in consumption and purchase of alcoholic beverages, after beer. A Romanian consume on average about 2 liter of wine per month, which indicates that Romania is in the top ten wine consumers worldwide. Some studies revealed that consumers couldn't find

sensory differences between commercial wines while perceptions on closures varies, depending on use of the natural, synthetic cork or screw cap [3]. The relations between price and quality in the consumers' perceptions was considered not so accurate, especially in the case of consumers who have limited time to think about what they choose in the marketplace, where they usually face vast amounts of information about the good which they intend to buy and consume [1]. It is also well-known the role of advertising in consumer decision, based on idea that consumers choose in conditions of incomplete information, taking the risk in deciding what seems to be the best satisfying trade off among a huge range of similar products [5]. The colors and shapes of the wine labels have also influence on consumers' perceptions, and it seems that that there are strong preferences for selected combinations of colors and shapes in the composition design of wine labels [4]. The color of wine is seen as a part of a hierarchical structure that exists in the consumer choice process but also has its influence as a cultural value [2].

MATERIALS AND METHODS

For this paper, questionnaires have been used in order to make some conclusion regarding wine consumer preferences and their perceptions in relation with aspects as wine quality-price ratio or wine buying and consume habits. This study was conducted on a sample with different demographic and socio-economic conditions. We accounted a total of 1200 respondents to the questionnaire. The specific objectives of marketing research were: identifying the frequency of purchase and consumption of wine among consumers; determine the places where consumers prefer to serve wine or to purchase; ascertain the amount of wine that the consumers buy at a purchase; establishing the price that a consumer would pay for a bottle of one liter; determining the type of wine bought by consumers according to color and taste; determining the type of packaging that consumers prefer when buying wine; identification of time spent by consumers in front of the stands for choosing wine; determining of brands and varieties of wine that consumers prefer to purchase and also manufacturers that they prefer; identifying the category of wine that consumers prefer, depending on quality; identifying criteria that consumers consider important in the purchasing decision of wine and the factors that influence consumer opinion on its quality; determining the wine consumer profile.

RESULTS AND DISCUSSIONS

Research hypotheses from which we started to make this research were: 75 % of consumers taste wine once a week, 15% consume once a month, 7% consume wine 2-3 times per week, and only 3% consume wine once a year; 75% of consumers prefer to buy wine once a month and only 25% prefer to buy annual or weekly; 65% of consumers prefer to drink wine on occasion and about 35% in weekend; most consumers buy a bottle of one liter at a purchase; much would pay for a bottle of wine 10-25 lei; specialized stores (wine cellars) are

the most preferred by wine consumers when purchasing this product because here more information can be obtained; 42% of consumers prefer white wine, 48% red wine, and only 10% rose wine. In terms of taste, sweet and semi-dry wine is preferred by most consumers and only a few prefer dry wine and sweet; 65% of consumers prefer wine glass, 20% wine in pet bottle and 15% bag in box; most consumers spend on stand 2-5 minutes; consumer opinion on wine quality influences the following factors: the varieties of grapes used for wine place and year of harvest; most consumers of wine are male, farmers, aged between 25-50 years old and live in rural areas; personal monthly net income consumers on average is 900 lei or less, most of them are unmarried and in general secondary education is the latest completed studies. In the table 1 it can be seen the structure of socio-economic characteristics of respondents.

Table 1. The structure of socio-economic characteristic of respondents

Indicator	Characteristic	Number	%
Age	18-24	380	31.66
	25-29	216	18
	30-49	254	21.16
	>50	350	29.16
Gender	M	675	56.25
	F	525	43.75
Environment	Urban areas	635	52.91
	Rural areas	565	47.08
Occupation	Student	301	25.08
	Employee	394	32.83
	Farmer	230	19.16
	Unemployed	164	13.66
	Retired	111	9.25
Net income	900 lei or less	365	30.41
	900-1499 lei	305	25.41
	1500-1999 lei	271	22.58
	Over 2000	259	21.58
Civil status	Married	555	44.58
	Unmarried	645	55.41
Studies	Primary school	207	17.25
	Secondary school	594	49.5
	Higher education	399	33.25

Source: Own calculation, based on data base research

To find out consumer preferences for wine we used a questionnaire consisting of 18 questions related to wine consumption. The first question asked respondents to indicate whether or not consume wine. Most respondents 85% responded that they consume wine, while 15% of respondents said they don't prefer to drink wine. Of those who

prefer not to consume wine, most responded with the reason that the doctor forbids them because they have health problems while others have said the reason that they don't usually consume alcohol and minority responded that they don't like the taste of wine. For those who don't consume wine we went straight to socio-economic questions. Most consumers responded that they prefer to drink wine once a month (35%), while 26% use to consume wine once a week. Approximately 22% of them consume wine once a year and 17% drink wine 2-3 times a week. As it can be seen in the Fig.1, most wine consumers purchase wine once a year (53%), while 25 % of them use to buy wine once a week. Around 13% of them use to buy wine once a month, while 9 % buys wine 2-3 times a week.

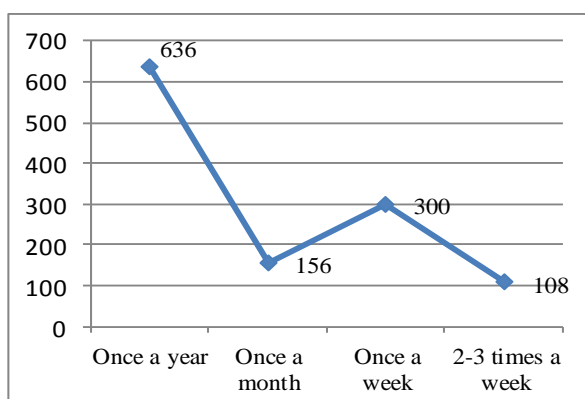


Fig.1. Frequency of wine purchasing

It can be noticed that most consumers buy wine at occasions followed by those who buy wine in weekend. If we analyze the consumption and purchase of wine, we can see that is consumed more wine than is bought. Most respondents consumed wine once a month, but they bought once a year, which means that they received wine as gift or they were small producers of table wine. When were asked about the preferences about wine consumption place, most consumer (41%) said they prefer to drink wine at home because it's the perfect place to enjoy a glass of wine. A proportion of 33% prefer to consume wine regardless of location, while a smaller proportion opts for bar, restaurant or other meeting places with friends. Most wine consumers (55%) purchase bottles of 0.75

liter because it is more practical, it ends quickly and the wine hasn't time to ferment or to change its taste and smell. In the second place are the people who buy more than 2 liters of wine (24%). These people are buying several bottles of 0.75, 1 or 2 liter wine or buy a metal box or bag-in-box. Those who buy more than 2 liters of wine purchase for a party, or to have enough wine for the whole week, or as the case a month or even a year. When consumers were asked how much would they pay for a bottle of 0.75 liters of wine, most of them indicated that they are willing to pay between 20-50 lei (543 people), while a significant number of them indicated that can pay between 10 and 20 lei (413 lei). (Fig.2.)

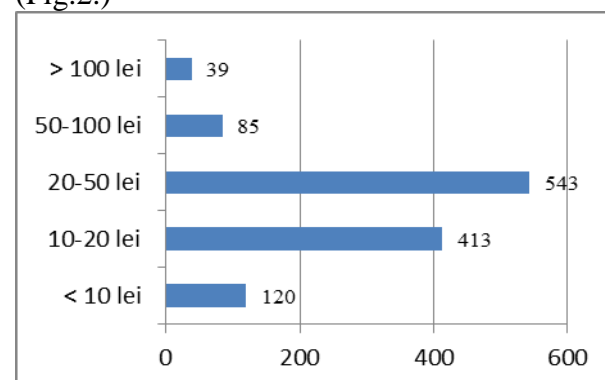


Fig.2. Money that consumer are willing to spend on a wine bottle of 0.75 liters

To know consumer habits, respondents were asked where they prefer to purchase wine. (Fig.3.)

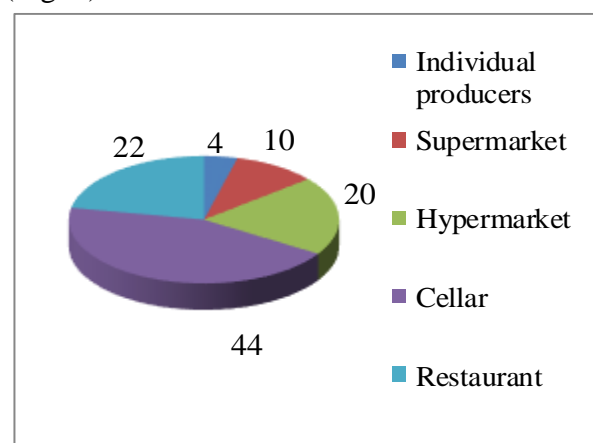


Fig.3. Places to purchase wine (%)

Most of those surveyed (44%) responded that they prefer to buy wine from the cellar. Thus we see that the consumer prefers quality wine,

and it purchased from specialty stores, where it is all about the wine they buy. Approximately 22% of consumers purchase wine at the restaurant in this case considered the ideal place to enjoy a glass of wine. From hypermarket prefer to buy wine 20% of respondents, while 10% of them buy wine at the supermarket, and about 4% from the individual producer. One of the questions aimed to identify the influence of wine color on consumers. Most respondents prefer red wine 46%, followed by those who choose white wine 38%. Rose wine is preferred by only 16% of consumers because it must be consumed quickly. Regarding favorite wine, the results indicate that most consumers prefer wine demi-sec (43%). This wine is the most sought and can be served at dinner. Semi-sweet wines are consumed by about 27%, and are valued as an appetizer. Least favorite are dry and sweet wines. Dry wine contains a small amount of sugar is consumed by 19% of consumers, while 11% prefer sweet wine. Regarding the preferred packaging for wine, most people prefer glass (70%), this package is considered the most affordable and the most common. About 14% prefer PET, 12% prefer the bag-in-box while 4% prefer metal boxes, although they are quite rare. Price is considered to be a very important factor in the decision for 51% of respondents, and important for 24% of them, while 10% are indifferent with the price and 6% consider the price to be unimportant in their choosing decision.

Table2. Quantification of criteria in wine purchasing decision (no of respondent)

Criteria	Rating				
	5	4	3	2	1
Price	615	285	125	75	100
Packaging	370	475	225	108	22
Wine type	508	380	145	132	35
Color	395	425	205	171	4
Advertise	430	290	415	60	5
Producer	485	380	215	85	35
Harvest year	378	353	245	139	85
Vinifying place	483	375	232	72	38
Grape variety	512	325	212	120	31

(5 = very important, 4 = Important, 3 = indifferent, 2 =unimportant, 1= without any importance)

For 8% of respondents price is without any importance when they are choosing which wine they want to buy.

If we calculate the score for each criteria, the results indicates the price as the most important criteria: SPrice = 4.03; SPackaging = 3.89; SWine type = 4.00; SColor = 3.86; S Advertise = 3.90; SProducer = 4.00; SHarvest year = 3.67; SVinifying place = 3.99; S Grape variety = 3.97.

CONCLUSIONS

The profile of our wine consumer indicates, that this use to drink wine once of month but buy wine once a year and makes choices especially depending on price, type of wine and producer. Romania has an important market for red wines and dry wines. The price is very important in the consumer choice, but he accepts to pay more depending on quality and other relevant aspects. Each sensory or non-sensory attributes of the wine have an important role in wine consumer decision.

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REFERENCES

- [1]Almenberg, J., Dreber Anna, 2009, When Does the Price Affect the Taste? Results from a Wine Experiment, The Journal of Wine Economics, Working Paper, 35
- [2]Geraghty Sarah, 2009, Wine Consumer Behaviour: An Irish Wine Market Analysis. A literature review, Wine Consumer Behaviour 10:1-27
- [3]Marin Anna, Jorgensen Emily, Kennedy James, Ferrier Jordan, 2007, Effects of Bottle Closure Type on Consumer Perceptions of Wine Quality, American Journal of Enology and Viticulture, 58(2):182-191
- [4]Mello, L., Pirez, R., 2009, Message on the Bottle: Colour and Shapes of Wine Labels, The Journal of Wine Economics, Working Paper, 42
- [5]Prasanna,K., Venkateswara,R., 2013, The Role of Advertising in Consumer Decision Making, Journal of Business and Management, 14(4):37-45

ASPECTS REGARDING WINE PRODUCTION AND WINE SECTOR COMPETITIVENESS IN ROMANIA

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Abstract

The paper aimed to make some assumptions regarding wine sector competitiveness in Romania. Vineyards have an important share in Romanian agriculture, Romania being ranked on 11th position in the world and on 5th position in the European Union in terms of vineyards surface, while the wine industry is an important contributor to the GDP. The research method was based on analyze of wine sector evolution in the last years. The paper presents current global context of wine market at international level and focus on Romanian wine production sector and wine trade, seen in the light of competitiveness. The competitiveness of Romanian wine sector need to be related with measures that are able to increase the attractiveness of Romanian wines, both on domestic and external markets.

Key words: competitiveness, sector, Romania, wine

INTRODUCTION

Competitiveness has always been a difficult and controversial concept, and there are also discussion related to proper measure of it. Competitiveness of wine sector is related with measures that ensure attractiveness of Romanian wines, both on domestic and external markets. Several studies argue that foreign trade performance measurement does not adequately reflect the competitiveness. However, despite these views, it is noted that most often competitiveness is associated with foreign trade performance [1]. The industries and firms are competitive when they are able to continue to increase foreign trade by establishing product offerings that are as good as or better than their competitors. [2]. An international institution have proposed definition of competitiveness as the ability of a national economy to produce goods and services that pass the tests of international markets, while their citizens can enjoy a high standard of living and sustainable in the long term[6]. Other authors use a broader definition of competitiveness. They are

focusing on structural factors, as productivity, innovation and skills, which influence the economic performance in the medium and long term. [3]. Also in the wine sector, it can apply the principle according to which in order to define competitiveness, it is important to identify who are the key factors that determine the survival of the sector business.[4]. In terms of competitiveness assessment, this can be done at firm level, industry or sector level and national level [5].

MATERIALS AND METHODS

For this paper, we made an assessment of competitiveness at sector level, starting with the presentation of current global context at international level and continuing with analysis of production inputs, outputs and the exports level in the Romanian wine sector.

RESULTS AND DISCUSSIONS

If we consider the vineyards surface, Romania is ranked on 11th position in the world and on 5th position in the European Union. We can

mention here that Europe has the largest area under vine with 3.570.708 ha (51%), followed by Asia 1.885.581 ha (27 %), America 973.224 ha (14%), Africa 356.766 ha (5%) and Oceania 183.094 ha (3%). European Union is a very important player in the wine market, which includes 46.41% from total vineyards surface and 90.58% from European vineyards surface. In Romania the area under vine has a structure in which the share of hybrid varieties is very high. Of the 178.378 ha planted with vines, 88,643 ha are planted with hybrid vines, representing 49.69% of the total. Family farms have most part of the surfaces with hybrid vineyards. Wine production is made in most part for home consumption. In the case of areas under noble vines, they are concentrated in the major wine units, in which supply chain is integrated. During 2004-2013, the surface with vines decreased by 13.14%, respectively, from 205.381 hectares in 2004 to 178.378 in 2013. The surfaces with grafted vines reduced by 31.67% while the hybrid vines increased by 19.69%. (Fig.1)

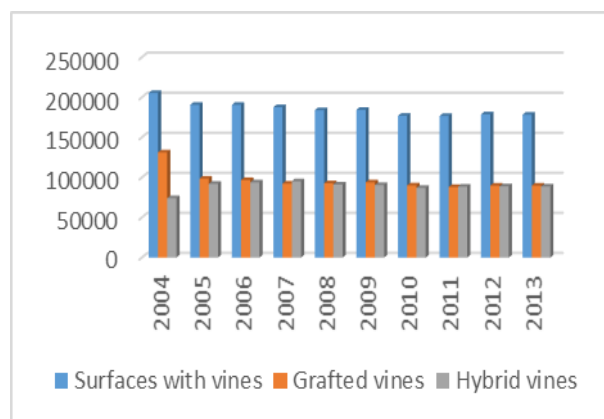


Fig.1. Evolution of vines surfaces in Romania (ha)

Wine produced from hybrid varieties is prohibited from trading, depriving thus Romanian market by a significant part of the local supply, and leading to increased imports of noble wine with lower quality. From a regional perspective, South East ranks first in terms of area vineyards bearing, holding 39% of the wine of the country, mostly located in Vrancea County. In the second place we can find the South West Region that owns about 18%, most of the area being concentrated in

Dolj County. The South-Region Muntenia and the North East Region have about 16% each and counties as Prahova County, Teleorman, Iasi and Vaslui hold significant vineyards. (Fig.2)

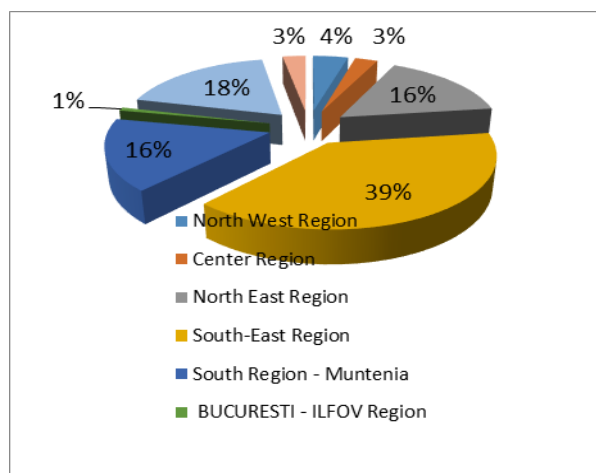


Fig.2. Distribution of Romanian vineyards area by region in 2013

Other regions have about 11% of the total area under vines, because on one hand there are not areas for agricultural purposes (applicable for Bucharest-Ilfov Region) or, on the other hand, there are regions with different farming specific or other prevailing cultures.

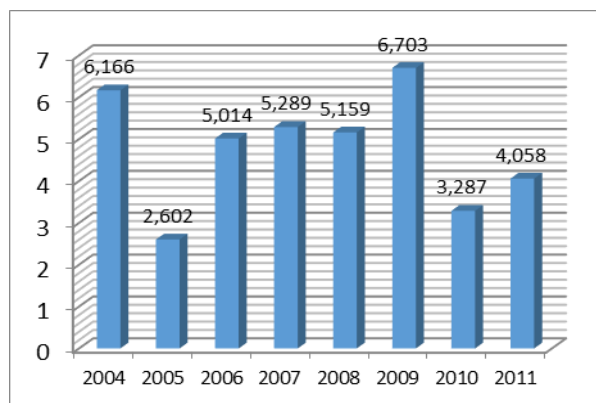


Fig.3. Evolution of Romanian wine production between 2004 and 2011 (million hectoliters)

In Romania, wine production has fluctuated between 2004 and 2013. (Fig.3) Regarding the distribution of wine production by category, noble wine shares 55%, while 45% is wine hybrid. The share of white wines in total wine production is 52%, while 45% is red wines and 3% rosé wines. In 2010, according to the Ministry of Agriculture and

Rural Development, in the manufacture of wines operated 362 enterprises, with a total production capacity of approx. 8,480,000 hl, but it was used only 48.5% of this respectively 4.11 million hl. More than half of these enterprises were micro enterprises. Based on preliminary statistics released by the International Trade Center 2013, Romania's total exports of wine from fresh grapes marked an increase in value of 15.13%, in quantitative terms, the volume of these exports decreasing by about 3.73%. (Table 1) On the other hand, total imports of wine from fresh grapes have experienced tremendous growth, both in value (144.59%) and in quantitative terms (179.68%).

Table 1. Evolution of Romanian trade with wine from fresh grapes

Exp./Imp.	2009	2011	2013	2013/2009 %
Export (th. \$)	19099	19973	21988	15,13
Export (to)	10890	10526	10484	-3,73
Import (th. \$)	20648	69480	50502	144,59
Import (to)	13139	90769	36747	179,68

Source: Own calculation based on International Trade Center data

For vermouth and other wine of fresh grapes flavored with plants or aromatic substances, Romania's exports declined both in terms of value (-38.12%) and in terms of quantity (-33.78%). (Table 2)

Table 2. Evolution of Romanian trade with vermouth and other wine of fresh grapes flavored with plants or aromatic substances

Exp./Imp.	2009	2011	2013	2013/2009 %
Export (thousand \$)	2479	363	1534	-38,12
Export (to)	1116	147	739	-33,78
Import (thousand \$)	2155	3910	2214	2,74
Import (to)	536	4503	1281	138,99

Source: Own calculation based on NIS Romania data

Import values had increased with 2.74%, while in terms of quantity we had a significant increase by 138.99%. In the period 2009-

2013, Romania exported wine of fresh grapes on the following main selling markets: UK, Germany, China, Italy and USA. Romania's main foreign suppliers of wine of fresh grapes were Spain, Italy, Moldova and Bulgaria. Wine sector has an important place in foreign trade in alcoholic beverages and soft drinks. The share of exports in total exports of wine spirits in terms of value, showed a downward trend during the period 2004-2013. (Fig.4)

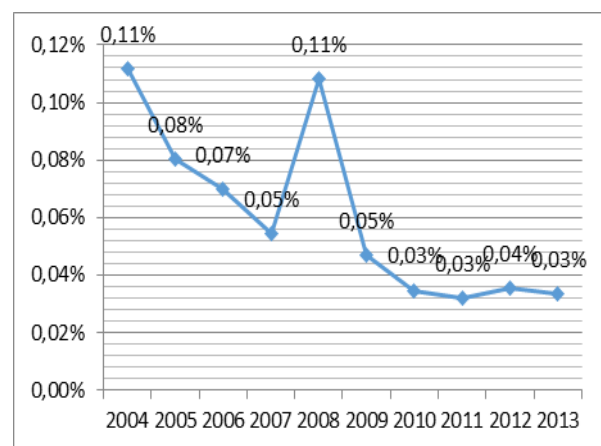


Fig.4. The evolution of the value of wine exports in total exports of alcoholic beverages during the period 2004-2013

From a quantitative perspective, beer and alcohol were significant increases in the volume of exports of alcoholic beverages. In recent years the share of wine in terms of quantity, in the total exports of alcoholic beverages recorded a downward trend. (Fig.5)

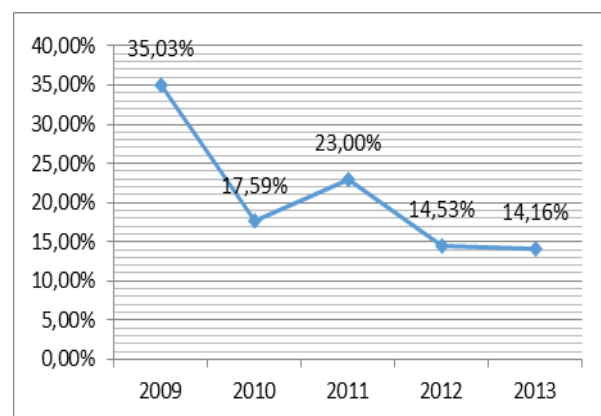


Fig.5. Evolution of the quantity of wine exported in total exports of alcoholic beverages between 2009 and 2013

Romania also has a modest wine trade with other countries outside of EU since Romania's

exports represent only 0.5% of EU exports, the major exporters of world class, being other European Union countries: France, Italy and Spain. From the analysis of the wine chain we can conclude that it has both strengths and weaknesses. Wine chain is organized from the institutional point of view, and grape growers and wine processors have their own organizations. The common rules for wine market have been successfully developed in Romania, which respected the timetable for implementing the European Union legislation for the wine sector.

CONCLUSIONS

Romania recorded in recent years an increase in exports of wine, but also a much higher level of total wine imports, which is a negative sign on competitiveness of this sector. Weaknesses of wine chain are in the production part and lies in the structure of vineyard, about 50% of the areas being planted with hybrids. To enhance the competitiveness of the wine chain, can be considered different strategic directions, such as strengthening the wine assets by restructuring areas planted with vines, namely deforestation hybrid vines and planting noble vines. Wines made from hybrid are prohibited from trading and are not covered of aid granted to producers in this sector. Other weaknesses that can be diminished in the next years consist in the use of outdated technology that achieves low yields per hectare and reduced competitiveness of the wine supply chain. Competitiveness of the wine chain sector can be also assured by measures as revival of research by developing new production technologies. Modernizing of viticulture production in family farms and merge of these farms can lead to large quantities of grapes, homogeneous in terms of type and quality.

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REFERENCES

- [1] Esterhuizen, D., Rooyen, V., 2007, Determinants of competitiveness of South African agricultural export firms, *Competitiveness Review* 16(3&4)
- [2] Esterhuizen, D., Rooyen, V., 2007, An inquiry into factors impacting on the competitiveness of the South African wine industry, *Agrekon* 45(4)
- [3] Fagerberg, J., Technology and competitiveness, 1996, *Oxford Review of Economic Policy*, 12(3), 39-51
- [4] Feurer R., Chaharbaghi K., 1994, Defining competitiveness: a holistic approach, *Management Decision*, MCB University Press Limited, 32(2):49-58
- [5] Porter, M.E., 2002, Building the Microeconomic Foundations of Prosperity: Findings from the Microeconomic Competitiveness Index, in: *World Economic Forum, Global Competitiveness Report*, Geneva, p. 23–45
- [6] US Competitiveness Policy Council, 1992, *Building a Competitive America, First Report to the President and the Congress*, Washington, D.C. (March)

THE ANALYSIS OF THE RURAL INFRASTRUCTURE DEVELOPMENT IN SOUTH-MUNTENIA REGION

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Abstract

The infrastructure is an element of support, with particular importance for the support of all economic and social and cultural activities in the rural area. The infrastructure covers both the structural area, giving unity to the system and the space area, thus creating a viable territorial configuration or not, which is reflected by different levels of accessibility. Actually it is the circulatory system of the economic and social body, individualized in a well determined area as the regional one. South-Muntenia Region is characterized by a well defined infrastructure due to its advantageous geographical position. Its location in a peripheral area of Romania has favoured the emergence of some major roads, which allowed the development of its relations not only with the neighbouring national regions, but also with the neighbouring country Bulgaria. Its location around Bucharest-Ilfov Development Region, resulted in shaping a dense infrastructure for transport and communication, an extension of that developed in Bucharest, the most important city and administrative centre.

Key words: development, infrastructure, region, rural area

INTRODUCTION

South-Muntenia Region covers an area of 34,453 square kilometers and represents 14.45% of Romania. The seven districts, administrative and territorial units that compose South-Muntenia Region, occupy a territory that covers the following geographic divisions, from the South to the North [1]:

- The Danube River and Valley; GuraVaii-Calarasi sector, Calarasi-Pătlăgeanca sector, the Danube Valley, including Balta Ialomiței;
- the Romanian Plain with subdivisions (from the East to the West) Bărăgan Plain, Ialomiței Plain and Teleorman Plain;
- Getic Piedmont - Piedmont Plateau, Getic Sub-Carpathians and the Sub-Carpathians Curvature;
- the Meridional Mountains and the Eastern Carpathians Mountains from the group of Curvature mountains.

South Muntenia Region is bordered to the North by the Center Region, to the North-East to South East Region, to the South with Bulgaria, the limit is given by the natural border - the Danube River, and to the West by South West Region. The presence in Southern

region of the Danube River gives it the possibility to have communication links with the 8 river countries and through the Danube – the Black Sea channel, access to the Black Sea and Constanta Port. Including the capital city - Bucharest within the region is by existing infrastructure, including the international airport Henri Coanda, an economic and social advantage. South-Muntenia Region consists of: 7 counties [2]: Arges (6,826 sq km), Calarasi (5,088 sq km), Dâmbovița (4,054 sq km), Ialomita (4453 sq km), Giurgiu (3,526 sq km), Prahova (4,716 sq km) and Virginia (5,790 sq km), with 16 municipalities, 32 towns and 519 communes.

MATERIALS AND METHODS

In this paper, I used and processed the data made available from the national Institution of Statistics and Romania Yearbook 2010 and Regional Statistics regarding South-Muntenia Region regarding its infrastructure.

RESULTS AND DISCUSSIONS

The physical infrastructure as a specific form for both the development of the rural area of

South-Muntenia Region and for the urban areas, includes transport infrastructure and means of communication, technical infrastructure which includes the distribution of drinking water, sewerage system and gas network, constructions housing.

The physical infrastructure includes also post and fixed / mobile network. The specific of the rural area is the form of infrastructure regarding the stock of tractors and machines that serve this area.

In the wider context of the strategy of regional infrastructure development, its specific objectives are: to improve road access within the region by improving the county roads and utilities, including their territorial density increase; investments to less developed areas; improved quality of life especially in areas with social and economic problems by connecting them to the regional and national infrastructure; eliminating the problems caused by traffic conditions in the community; eliminating factors restricting the development potential of the region; stop active population migration from the rural communities [3]:

Transport infrastructure

The transport infrastructure in the context of the work relates to road, rail and river transport, vital ways of the economic activity of the country and of the region, enabling the mobility of labour, raw materials and commercial products. The road density is 34.6 km/100 sq km and railway density is 45.2 km/1,000 sq km. The quality of roads and railways is low, much part of the road network (50%) should be modernized and a large part of the railway network (over 2.3) should be electrified. There is a long term governmental strategy, aimed at rehabilitation of national roads by the year 2020. In the next 20 years it is also aimed at construction of several highways.

In terms of technical condition, most of them are inadequate, which determines the access to the national road network of some rural population in some communities (especially in the South of the region) to be difficult. The quantitative and qualitative improvement of the county and commune public roads

network in the rural area benefited of EU subsidies in 2002-2008, under SAPARD Programme, Measure 2.1. "Development and improvement of the rural infrastructure".

The region has no civil airport for air transport for goods and passengers, but it has access to two airports in Bucharest namely Henri Coanda and Aurel Vlaicu.

The region's rail network is well developed lines in use had at the end of 2011, a length of 1.251 km, the region in this regard is on the sixth place in the country.

In 2011, from total county and commune roads, the share of modernized roads at the region level is of 15,5%, being exceeded by the share at national level. The network of county and commune public roads in 2011 has a length of 9916km, having 78.0% of total public roads network as it is shown in table 1 and table 2.

Table 1. The structure of the public roads in Romania and in South Muntenia Region, year 2011

Development region/county	Public roads – total	National roads	
	km	km	%
Romania	83703	16690	100,0
South - Muntenia	12707	2791	16,7
Argeş	3476	585	3,5
Călăraşi	1320	500	3,0
Dâmboviţa	1868	361	2,2
Giurgiu	1159	311	1,9
Ialomiţa	1155	352	2,1
Prahova	2205	293	1,8
Teleorman	1524	389	2,3

Processed according to Romania Statistical Yearbook, 2012

Table 2. The structure of the modernized roads in Romania and in South Muntenia Region, year 2011

Development region/county	Commune and county roads		Modernized roads	
	km	%	km	%
Romania	67013	100,0	11412	100,0
South - Muntenia	9916	14,8	1537	13,5
Argeş	2891	4,3	85	0,7
Călăraşi	820	1,2	38	0,3
Dâmboviţa	1507	2,2	156	1,4
Giurgiu	848	1,3	377	3,3
Ialomiţa	803	1,2	138	1,2
Prahova	1912	2,9	234	2,1
Teleorman	1135	1,7	509	4,5

Processed according to Romania Statistical Yearbook, 2012

Maritime Transport

The Danube River is the only waterway, the hydrographical network of the region not allowing maritime transport. The trade with the neighbouring countries bordering the Danube river ports is made through Giurgiu Oltenita, Calarasi, Zimnicea and Turnu Magurele ports, located on the main route of the European navigation, with a development potential of the rural area through export of agricultural products, through this way of transport. The technological facilities is poor and physically obsolete and the river ports reduce gradually their activity, are factors that contributed to reduce the use of existing transport potential, with unfavourable influence on the communes and villages adjacent to the port centres.

Communication Infrastructure

Communications are represented by the postal and telephone services, fixed and mobile telephony and electronic communications - Internet:

Characterized by a positive trend during the last few years both in terms of coverage and in terms of quality, the regional telecommunications system now provides better and faster access of the region inhabitants to the national and international telecommunications network. In 2011, the total number of connections in the South Muntenia Region is 10.8% of the country, the largest share being registered by Prahova County, with 3.7%, followed by 2.7% Argeş and Dâmboviţa 1.2% .

Drinking water supply network.

Most localities in the region are supplied with centralized water, the supply sources are surface water and groundwater.

Infrastructure of heat distribution network

The distribution of heat in a centralized system, presents mainly in the urban areas and is declining in the recent years due to high production and transport costs, it tends to be replaced by smaller, efficient and effective systems.

An important aspect for the development of the region, including of the rural area, is the social infrastructure with respect to house constructions, education and health system.

The house construction consists of residential constructions (residential population) and residential buildings for the communities. The house construction in the rural area, including some of the household annexes, which have double role: living and/or employment. The house construction is privately owned or majority owned by the state.

Infrastructure for education

The educational system, both at national level and at the level of South-Muntenia Region, includes infrastructure for education, represented by buildings in which education operates, respectively kindergartens, schools, colleges, universities and vocational education and special locations. It can be mentioned that the school infrastructure is well represented in the region and thus it can support the development in good conditions of education, noting that in the rural area, this type of social infrastructure may be considered inappropriate to the rural development process, requiring a restructuring of the school structures and investment projects correlated with the local needs and requirements.

Table 3. The structure, on counties, of the education units in South-Muntenia Region, year 2011

Developm ent region /county	Kinderg artens	Schools	High schools	Post high schools	Facu ltati
	no	no	no	no	No
Romania	1367	4022	1615	86	108
South-Muntenia Region	145	684	210	12	4
Argeş	25	128	45	2	2
Călăraşi	16	65	17	1	-
Dâmboviţa	18	106	31	-	1
Giurgiu	6	66	13	1	-
Ialomiţa	20	75	27	1	-
Prahova	41	137	54	6	1
Teleorman	19	107	23	1	-

Processed according to Romania Statistical Yearbook, 2012

Health infrastructure

Health infrastructure is represented by units of care and health care, respectively hospitals, clinics, diagnostic and treatment centres, medical and rural health centres, and other public and private health units.

Medical assistance infrastructure, recorded in

South-Muntenia Region in 2010, a share of 14.19% of the national level for the equipment of the hospitals and a share of 16.65% for the general medicine offices, while for polyclinics the share was only 7.06% and a relatively low share of 10.55% was recorded for other hospitals. The highest values of the number of units of health profile on counties were achieved in the Northern counties: Prahova, Arges, Dâmbovița. South Muntenia Region had the least developed medical system (4.8 hospital beds per 1,000 inhabitants by the end of 2010 to 6.4 hospital beds per 1,000 population - the national average), large variations recording from one county to another.

CONCLUSIONS

From the analysis of the main features of the South Muntenia region's infrastructure, the following conclusions result:

- The road transport had an ascendant trend, while registering a decline the rail transport; - the public roads in the region increased slightly while increasing the modernization and their density relative to the territorial units. Regarding these aspects, better results were achieved in the counties in the North part;
- The railway network was very well developed and facilitated links with important areas and urban centres of the country: by the total length of railways, the region held 6th place in the country; the communications infrastructure developed in the rural area, but the gap remains significant.
- The network of post units provided a low volume of the counties in the North part developed a more intense activity;
- The telecommunications system facilitated increased access of the citizens to the national and international network. The number of telephone and television subscriptions and television increased significantly;
- The water supply network expanded continuously, including in 2011, 385 villages;
- The sewerage network in the rural area of the region had an average degree of coverage, respectively 96 localities

- It is noted that most localities in the rural area with sewerage network were in the counties in the North part;

- The natural gas distribution network in the area comprised 158 localities in 2011, with a share of 15% compared to the national level;

- The infrastructure of house construction had a higher share in the rural area of the region, numbering 783,670 (60.2% of the total) which 99.32% is in private ownership;

-The infrastructure of education was appropriate at the regional level but for the rural area it did not provided the needs, therefore it is required a restructuring of the school infrastructure and implementation of investment projects in correlation with the local needs;

- The health infrastructure was characterized by an underdeveloped health system compared to the national level and in the rural area it was extremely poor. A more favorable situation was recorded in the counties in the North part.

With the help of the rural infrastructure strategy the rural area in the region can be developed properly. This needs the efforts of the local authorities to access funds and to attract investments in the region.

REFERENCES

- [1]Details about South-Muntenia Region, Source: http://www.adrmuntenia.ro/pagini/detalii_despre_regiunea_sud_muntenia_si_harti.html
- [2]Details about South-Muntenia Region, Source: http://www.adrmuntenia.ro/pagini/detalii_despre_regiunea_ud_muntenia_si_harti.html
- [3]Lascar Elena, Draghici Manea, 2012, Re-evaluation of the potential of South-Muntenia Region for the improvement of the rural development strategies. Symposium Agrarian Economy and rural development – realities and perspectives for Romania”, Institute of Research for Agriculture economics and Rural Development, 11th-13th October 2012, Bucharest

AGROCHEMICAL SERVICE OF AGRICULTURE IN THE REPUBLIC OF MOLDOVA: PAST AND PRESENT

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Abstract

The paper presents the brief history of the agrochemical service development and its importance for Moldovan agriculture. According to this study, agrochemical service assisted methodical agriculture in the period 1956-1990. In this period were created 33 specialized laboratories were established long- and short-term experiments to test the mineral and organic fertilizers, were performed 4 cycles agrochemical soil mapping. According to the results was determined the balance of nutrients in soils, were developed soil agrochemical research for farms. After 1990 agrochemical cyclic mapping is not performed, the soils are fragmented into many plots, land degradation has accelerated. In this context agricultural policies are targeted at land consolidation, implementing action plans include measures to halt land degradation and land protection.

Key words: agriculture, agrochemical service, fertilizers, nutrient regimes, soil properties

INTRODUCTION

The development stages of Agrochemical Service in Moldova. Agrochemical Service of agriculture was officially started in 1956. In the next year was created the 19 agrochemical laboratories. Their tasks are to carry out experiments with mineral and organic fertilizers for kolkhozes and, to determine their efficiency and quality assessment of soil fertility status. The field experiments schemes were consisted from 4-5 variants, which studied the separate action of phosphorus fertilizers and common action with manure. Fertilizer application rates were very low, which indicates a low chemical treatment of agriculture in that period. In 1960, the agrochemical laboratories were created in the other 14 districts.. Its broad research themes, fertilizers management is carried out taking into account the climatic zones, diagnoses and prospects of fertilizers. Technical and material base does not meet the time requirements, was specialists lack. Laboratories was subordinate to districts, but were routed methodical and scientifically by research institutions. Thus was established the link between science and production. [4, 13]. In connection with the accelerated increase of fertilization, in 1964 was created Agrochemical Service. Thus in

the Republic of Moldova have created 3 zonal agrochemical laboratories: North (Balti), Central (Chisinau), South (Cahul).

Northern Laboratory served area of 10 districts in the north part with an area of 780 thousand ha of agricultural land, of which 86% were occupied by perennial crops and pastures. In this area was concentrated 95% of sugar beet, 45% of cereals.

Central Laboratory served area of 12 districts in the Central part with a total land area of 900 thousand ha. The arable and perennial crops made up 83%. During this period, households producing zone consist the 35% of the total grape quantity and a significant proportion of cereals and industrial crops.

Southern Laboratory comprising 8 districts with an area of 850 thousand ha of agricultural land, of which 86% were occupied by arable land and perennial crops. The main activities of the farming households were vegetable, fruit, grapes [4].

In 1988 the zonal agrochemical laboratories were reorganized into the Chemical Stations of design and prospecting, in which 150 employees were working. Each station was made up of 5-6 units: design and pedoagrochemical studies, experimental researches, control over use of fertilizers, chemical, radiological, toxicology analyzes

amelioration and technical-material services. Scientific and production activities of Service heads by a single program.

Main activities in 1965-1990 yrs. were:

- Pedoagrochemical investigation of land and protected areas with vegetable to the rational organization of fertilizer use and soil quality status assessment;
- Drafting, cartograms and other documents on the effectiveness of fertilizers;
- Planning the necessary quantities of fertilizers and distributing them according to the requirements of households;
- Founding experiences with fertilizers for developing norms and doses;
- Determination of humus content and nutrient balance in the soils;
- State control of quality and fertilizer use, the terms and application rates;
- Determining the economic efficiency of fertilizer given by households and district;
- Development of agrochemical maps of soils;
- Processing and generalization of data on the chemical composition and nutrients;
- Control of environmental pollution by nutrients from agriculture;
- Dissemination and implementation in agricultural practice the scientific and technical achievements of agrochemistry and pedology [8].

The main scientific results of the 1965-1990.

Over this period were performed 4 cycles of agrochemical researches on the content of humus, mobile phosphorus, exchangeable potassium, nitrification capacity, trace of the soils. In order to obtain the expected yields with high quality, from 1980 the Agrochemical Service performed the complex diagnostic of mineral soil-plant nitrogen nutrition. The results obtained were developed in the recommendations on the application of fertilizers for each crop and field [5, 6].

A major activity of the Agrochemical Service was the foundation of field experiences with application of mineral and organic fertilizers and conducting research in order to establish the optimal doses. During this period the Agrochemical Service founded and researched 3200 experiences with fertilizer (stationary, short and long-term factors, production). The

results were elaborated and presented in the recommendations on the application of fertilizers, norms and legislation on household needs, district, and country.

During agrochemical servicing were performed analyzes on soils, plants, feed and fodder, mineral fertilizers, organic wastes, pesticides. The results were used to develop the bulletins on the nutritional quality of feeds, based on 10 indicators: content of dry matter, protein, ash, fat, fiber, carbohydrates, calcium, phosphorus, carotene, trace elements, acetic and oleic acids.

In the 1971-1990 yrs were made about 70 thousand of analysis on the content of pesticides in the soils and plants. Systematic monitoring of the state of toxicological farm fields and the application of plant protection systems has substantially reduced the risk of soil and plant pollution with residues of chemicals. Zonal agrochemical laboratories were managed by the Chemical Division of Ministry of Agriculture, the methodical and scientifically by the Research Institute for Soil Science and Agrochemistry "Nicolae Dima".

In 1995 the Chisinau Branch was reorganized in Scientific Production Center for Agrochemical Service. Currently this Center does not meet a service center for agriculture, has no scientific methodological plan. Agrochemical zonal and district laboratories have been closed.

RESULTS AND DISCUSSIONS

The use of fertilizers and nutrients balance in the soil. Moldovan soils are characterized with a high fertility. The research carried out in the 1950-1960 yrs. demonstrated that the chernozems of Moldova contained in that period 340 t ha^{-1} of humus in the layer of 100 cm. In the composition of organic matter was contained 20 t ha^{-1} of nitrogen and 5 t ha^{-1} of phosphorus. The total quantity of P_2O_5 in the plowed layer was about 160-180 mg and at the depth of 90-100 cm – up to 100 mg in 100 g of soil. The reserve of the total phosphorus in the layer of 1 m was 17 t ha^{-1} . Moldovan soils are rich in minerals containing potassium. The total content of these soils is 10-15%. The reserve of the total potassium in

the layer of 1 m of chernozems constitutes 170-290 t ha⁻¹ [1, 12]. In the period 1950-1960 the plant crop harvests were modest and constituted (Table 1).

Table 1. The dynamics of the harvest of the main crops in the Republic of Moldova, t ha⁻¹

Years	Winter wheat	Maize grains	Sun-flower	Sugar beet
1963-1965	1.6	2.8	1.5	19.2
1966-1970	2.0	3.4	1.6	25.6
1971-1975	3.4	3.6	1.8	27.9
1976-1980	3.5	3.6	1.7	27.8
1981-1985	3.4	2.7	1.8	28.7
1986-1990	3.8	3.9	2.0	24.8
1991-1995	3.5	2.7	1.4	24.8
1996-2000	2.6	3.0	1.1	19.0
2001-2005	2.2	2.8	1.2	22.7
2006-2010	2.2	2.7	1.3	27.1

Obtaining the high crops was limited by two natural factors: the moisture insufficiency and the low level of nutrients in the soils. The possible harvests calculated according to the degree of humidity were by 60-70% higher than those obtained of that time (Table 2).

Table 2. Field crop harvests forecast in function of the degree of water supply, t ha⁻¹ [8]

Degree of water supply, t/ha		[5]		
Crop plants	Water consumption for 1 tone of production, t	Soil humidity, t/ha		
		North	Center	South
		4010	3620	2920
Harvest, t/ha				
Wheat	820	4.9	4.4	3.6
Maize	640	6.3	5.6	4.7
Sunflower	1330	3.0	2.7	2.2

By the 1965 the input of fertilizers was insignificant.

Table 3. Dynamics of the use of mineral and organic fertilizers in the agriculture of Moldova

Years	Mineral and organic fertilizers (in active substances) t ha ⁻¹ , arable land and perennial plantations		
	N	P ₂ O ₅	K ₂ O
1961-1965	12.7	12.0	11.4
1966-1970	22.7	19.3	15.6
1971-1975	49.9	33.4	33.4
1976-1980	66.1	50.4	52.5
1981-1985	101.4	65.1	92.6
1986-1990	52.0	37.0	42.0
1991-1995	28.0	17.5	17.2
1996-2000	4.2	0.4	0.9
2001-2005	6.5	0.32	0.3
2006-2010	18.5	2.7	2.0

According to the statistic data, in the 1961-1965 period on the 1 ha of arable land and perennial plantations the 6.2 kg ha⁻¹ N, 8.7 kg ha⁻¹ P₂O₅ and 3 kg/ha K₂O were introduced with mineral fertilizers. The average dose of organic fertilizers was 1.3 t ha⁻¹ (Table 3).

As a result, in the agriculture of Moldova was formed a deeply deficient of nutrients. During the considered period the deficits of nutrients per hectare were annually: 59 kg of N, 14 kg of P₂O₅ and 80 kg of K₂O (Table 4).

Table 4. Balance of nitrogen, phosphorus and potassium in the Moldovan soils, kg ha⁻¹ [8, 20]

Years	Sum of NPK
1913	-92
1940	-99
1945	-82
1950	-108
1951-1955	-102
1956-1960	-136
1961-1965	-132
1966-1970	-130
1971-1975	-103
1976-1980	-69
1981-1985	-4
1986-1990	-8
1991-1995	-113
1996-2000	-134
2001-2005	-128
2005-2010	-132

The volume of mineral fertilizers applied to the arable lands and the perennial plantations grew rapidly. In 1970 the agrarian sector of Moldova received fertilizers by 2.5 times more in comparison with the 1963 year. The dose of used fertilizers accounted for 62.7 kg ha⁻¹ NPK. As a result, the balance of nutrients was rapidly improved.

In the period of 1981-1988 yrs for the first time in the history of Moldova's agriculture the nutrient balance became positive. During of this period per 1 ha of the arable lands and plantations of fruits, with mineral and organic fertilizers, 100 kg N, 66 kg P₂O₅ and 87 kg K₂O were applied. The average dose of manure applied in the agriculture was 6.0-6.6 t ha⁻¹. As a result the productivity of crop plants increased significantly. The average harvest of the winter wheat amounted to 3.8 t ha⁻¹, of the maize for grains was 2.4 t ha⁻¹ and for sunflower was 2.0 t ha⁻¹. During the period

of chimization, which lasted for 25 years (1965-1990) there were applied 1200 kg of nitrogen, 960 kg of phosphorus and 860 kg of potassium. The accumulation of nutrients in the soil was relatively small in comparison with their export throughout the entire history of agriculture. Just for 100 years on each arable land with the harvest were exported 2300 kg of nitrogen, 1000 kg of phosphorus and 5000 kg of potassium [2, 9].

After the 1998 year, the volume of fertilizers increased substantially, reaching the minimum level in the period of 1996-2005 yrs. During that period, there were applied about 4-6 kg of nitrogen, 0.3-0.4 kg of phosphorus and 0.3-0.9 kg of potassium per hectare. The nutritional balance again became deeply negative, minus 30 kg of nitrogen, 21 kg of phosphorus and 83 kg of potassium. As a result, the productivity of crop plants dropped to the level of the 60 years of the last century (Table 5).

Table 5. Doses of mineral fertilizers applied to the crop plant fertilization, kg/ha

Crop plants	Dose of NPK, kg/ha	Harvest, t/ha
Potatoes	193	9.5
Sugar beets	70	27.0
Vegetables	52	9.0
Winter wheat	27	2.2
Maize for grains	12	2.7
Sunflower	7	1.2

In the recent years (2006-2014) the volume of fertilizers has increased in comparison with the 1996-2006, but it has not been touched even the 1961-1965 years. Currently the fertilizers with nitrogen are preponderantly applied. Practically, the fertilizers with phosphorus are not applied - the first necessary element in the soils. In the last 10-12 years the dose of the applied manure in Moldova's agriculture constitutes 0.02 t ha⁻¹, the optimal rule being about 10 t ha⁻¹ [1, 3, 14]. *In the 2005-2014 yrs. the average norm of fertilizers applied in Moldova's agriculture amounted to 25 t ha⁻¹ of the total dose of fertilizers about 90-95% is nitrogen one.*

The largest quantities of fertilizers are applied to the production of potatoes, sugar beets and vegetable crops – 193, 70 and 52 kg ha⁻¹, respectively. The insufficient quantities of

NPK fertilizers is applied to the cultivation of winter wheat -27 kg, maize and sunflower - 7-12 t ha⁻¹. *The soil nutrient balance is negative the chemical degradation of the soil takes place and as a result the harvests are small and of low quality.*

Humus It has been experimentally determined that increasing the content of humus with 1% gives 0.5 t ha⁻¹ of the winter wheat [5, 7, 10]. Since the 1953 the research institutions have been carried out the agrochemical monitoring. At the same time the balance of humus in the soils has been calculated. It was established that before the period of the intensive chimization (1965-1990) the humus balance was negative (Table 6).

Table 6. The evolution of the humus balance in arable soils, kg/ha [15]

Years	Organic fertilizers applied, t/ha	Balance of humus	
		without erosion losses	with erosion losses
1971-1975	2.9	500	-900
1976-1980	3.9	400	-800
1981-1985	6.0	100	-500
1986-1990	5.6	100	-500
1991-1995	2.6	400	-800
1996-2000	0.1	700	-1100
2001-2005	0.1	700	-1100
2006-2010	0.01	700	-1100

Annually 500 kg ha⁻¹ of organic matter is mineralized [11, 15]. The systematic use of fertilizers, including 5-7 kg ha⁻¹ of manure, the cultivation of perennial grasses on about 10% of the arable land (180-210 thousand ha) contributed to the formation during the 1975-1990 yrs to a slightly deficient balance of humus in soils of about minus 100 kg ha⁻¹.

Over the past 10-15 years the insufficient quantities of manure (0.01-0.6 t ha⁻¹) has been incorporated into the soil. The balance of organic matter is negative, minus 700 kg ha⁻¹, while with the losses by erosion is minus 1100 kg ha⁻¹.

Nitrification capacity. According to the Agrochemical Service [4] approximately 39% of farmlands are characterized with a low content of organic matter (less than 2%), 40% with moderate (2-4% of humus) and only 20% with the humus content higher than 3.0%. As

a result, about 80% of soils are characterized by a very low and low nitrification capacity. On agricultural lands with the humus content of less than 2% by the nitrification processes in the soil only 50-60 kg ha⁻¹ of nitrogen is accumulated and the soils with 3.0-4.5% of organic matter – up to 75-110 kg ha⁻¹ of the mineral nitrogen. These quantities of the mineral nitrogen are sufficient for the formation of 1.7-2.0 t ha⁻¹ and 2.5-3.7 t ha⁻¹ respectively of the winter wheat [1, 6, 12]. *At present the content of organic matter in the soils of Moldova is about 3.0%. As a result of the mineralization of organic matter, the soils produce annually about 70 kg ha⁻¹ of nitrogen. This quantity of nitrogen is sufficient for the formation of 2.4 t ha⁻¹ of the wheat.*

Phosphorus. Chernozems as well as the grey soils are characterized by the low content of phosphorus in soil [7, 8, 14]. The intensity of phosphate regime has been confirmed by the research results carried out by the Agrochemical Service [4, 14]. In the 1971-1975 yrs the soils areas with low phosphorus content was quite large and constituted approximately 68% [4, 12].

In the period of 1965-1990 yrs about 960 kg ha⁻¹ of phosphorus was incorporated into the soils. This agrochemical measure influences beneficially on the phosphorus regime of soils. To the 1990 year the surface of soils with low phosphorus content decreased by 2.0 times, while that with a high phosphorus content increased by 3.0 times. On average per republic the mobile phosphorus content in the soil increased by 2.0 times, as a result the productivity of crop plants has been increased. *In the recent years (2000-2014) in Moldova's agriculture insufficient quantities of P₂O₅ (up to 1 t ha⁻¹) were applied. The export of phosphorus with the harvest is high and constitutes annually about 25-30 kg ha⁻¹. The balance of this nutrient element is negative. Currently the post action with phosphorus fertilizers is practically exhausted. With the natural low background of the mobile phosphorus in soil it is possible to get about 2.5 t ha⁻¹ of the winter wheat.*

Potassium. It was found experimentally that the potassium content for 15-20 mg per 100 g

of soil is sufficient for the optimal growth and development of plants [10, 15]. According to data [6] only 13% of the farmlands are characterized with a moderate content (10-20 mg) of exchangeable potassium; 87-95% of the total area – with a high content. The systematic use of fertilizers in the 1965-2000 yrs provided an equilibrated balance of potassium in soil. Therefore, the quantity of exchangeable potassium increased average by 2 mg per 100 g of soil [2]. Nowadays, the potassium and organic fertilizers are applied in very small doses. The balance of the K₂O in soil is negative. *The soils of Moldova are rich in accessible potassium to plants, but these reserves in a quite long period (50-100 years) may be exhausted. Hence, it is necessary to maintain an optimal regime of potassium already present in the soil by applying fertilizers.*

The requirement of mineral fertilizers for soil application. In conditions of Moldova the natural factors which limited the production of high harvests are the insufficiency of nutrients in the soils as well the moisture deficit. In order to achieve the growth rate in harvest of 40-50% it is necessary to compensate the deficit of nutrients by using the fertilizers and rational utilization of the soil moisture [1, 3, 13, 15].

In determining the amount of fertilizers for agriculture of Moldova, were used the Government decisions on the development of the various branches of agriculture by the year 2020, the statistical data for the recent years, the recommendations and norms concerning the application of fertilizers, typical crop rotations models of zones have been used.

The optimal application of fertilizers is required for a modern agriculture, soil no-till with respecting of zonal crop rotations, the soil no-till, the integrated protection of plants, extension of irrigation, the development of the livestock sector, the implementation of intensive technologies of plant cultivation. The system is based on the combined application of fertilizers in couple with fuller use of the biologic nitrogen.

The norms of fertilizers vary depending on the crop from 50 kg ha⁻¹ NPK for peas up to 225

kg ha⁻¹ NPK for sugar beets. According to the Programme [5, 6] the average annual dose of fertilizers on the crop rotation of the agropedoclimatic zones constitutes: North – 5 t ha⁻¹ manure and N₆₁P₅₀K₂₀; Center – 4 t ha⁻¹ manure and N₅₄P₄₅K₁₈; South – 4 t ha⁻¹ manure and N₄₇P₄₃K₁₈.

The implementation of the crop rotation with the optimum share of leguminous will allow the accumulation in soil of 30-35 kg ha⁻¹ per year by the biological nitrogen fixation. The systematic application of fertilizers and organic minerals in doses of P₅₅₋₆₀ will allow forming into a multiannual cycle a positive balance and an optimal level of phosphorus in the soils for obtaining high crops. The average dosage of K₁₉ fertilizers will be insufficient for the stabilization of potassium in soil. The compensation of the potassium loss will be covered by the local fertilizers and the application of the secondary production as organic fertilizer. The nitrogen deficit will be compensated by the biologic nitrogen (30-35 kg ha⁻¹), manure (25-30 kg ha⁻¹) and mineral fertilizers (50-60 kg ha⁻¹). The share of nitrogen from mineral fertilizers will constitute about 50% of the total content. The optimal demand for nitrogenous fertilizers for the crop rotation will be 82.3 thousand t of the active substance or N₅₅ on average per 1 ha.

The use of the optimal fertilization system coupled with other technological links of cultivation of the crop plants will allow to get 4.0-4.2 t of winter wheat, 3.6 t of grain maize and will form an equilibrated nutrient balance in Moldova's agriculture.

CONCLUSIONS

Priority measures for conservation and enhancement of soil's effective fertility include [10, 12]:

- optimization of crop rotation and their implementation in each pedoclimatical zone;
- increasing the quota of perennial grasses (alfalfa, sainfoin) in field cropping up to 20%; annual legume crops (peas, beans, soya) in field cropping up to 20%.
- annual incorporation into soil of 5-6 t ha⁻¹ of manure; a total of 9-10 million tons;

- application of 100 thousand t of nitrogen and 90 thousand t of phosphorus;
- minimizing the soil erosion in the admissible limits about 5 t/ha.

Over the past years the State Programs have been developed in order to remediate the chemical, physical and biological soil properties as well as soil and water protection by the pollution with nutrients and substances of plant protection. The documents determine goals, actions (measures), performance indices, terms of implementation and those responsible for implementation.

REFERENCES

- [1] Andrieș, S., 2007, Optimization of soil nutritive regimes and the productivity of crop plants. Chișinău: Pontos. 374 p. (Rom.)
- [2] Andrieș, S., Lungu, V., Donos, A., 2012., Recommendations for the application of fertilizers on different types and subtypes of soil for the field crops. – Chișinău: Pontos. - 68 p. (Rom.)
- [3] Bulletin of ecopedologic monitoring (Agrochemistry). The VII Edition. Chișinău: Pontos. 2000., 67 p. (Rom.)
- [4] Burlacu, I., 2000, Agrochemical preservation of the agriculture in the Republic of Moldova.. Chișinău: Pontos, 228 p. (Rom.)
- [5] Complex Program of valorification of degraded lands and improvement of the soil fertility. Part I. Improvement of soils. Chișinău: Pontos. 2004, 212 p. (Rom.)
- [6] Complex Program of valorification of the degraded lands and improvement of the soil fertility. Part II. Improvement of the soil fertility. Chișinău: Pontos. 2004, 212 p. (Rom.)
- [7] Krupenikov, I.A., 2008, Chernozems. Occurrence, perfection, tragedy of degradation, ways of protection and revival. Chișinău: Pontos., 285 p. (Rus.)
- [8] Krupenikov, I.A., 1992, Soil covers of Moldova. The past, present, management, forecast. Chisinau: Știința, 1992, 263 p. (Rus.)
- [9] Land Cadastre of the Republic of Moldova. Tipografia Centrala, Chișinău. 2009, 985 p. (Rom.)
- [10] Monitoring of soil quality. (Bank data, forecasts, conclusions, recommendations). Chișinău: Pontos. 2010, 475 p. (Rom.)
- [11] Normative on the use of mineral and organic fertilizers in the agriculture of the Moldavian Soviet Socialist Republic. Chișinău. 1987, 37 p. (Rus.)
- [12] Programme for the conservation and improvement of soil fertility for the years 2011-2020, approved by decision of the Government of the Republic of Moldova No. 626 from 20 August 2011. Published: 26.08.2011 in the Official Gazette. 139-145 Art. No.: 696. (Rom.)

[13]Soils of Moldova. V.3. Chisinau: Știința, 1986., 336 p. (Rus.)

[14]Ursu, A., 2011, Soils of Moldova. Chișinău: Știința, 321 p. (Rom.)

[15]Zagorcea, C., 1989, The evolution of the circuit and balance of the biofile elements in agrofito-chenoze from the Republic of Moldova over the last century. Land and water resources. Superior valorification and their protection. V.2. Pontos, Chișinău. p.121-125. (Rom.)

COMPETITIVENESS AND QUALITY OF AGRIFOOD PRODUCTS - KEY FACTORS FOR THE SUCCESS OF EXPORT PROMOTION

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Abstract

Article reflects the competitiveness and quality management from the perspective of enunciated historical and methodological approaches. They are listed by management functions and show interrelation between quality and profit, thus addressing the economic entity as the core of acting for promotion of exports. Also, we set the calculation of indicators of competitiveness of agri-food exports from the Republic of Moldova and establish the priorities and the necessary conclusions.

Key words: agri-food export, competitiveness, quality, promotion

INTRODUCTION

At different stages of business development, factors that provided competitiveness were different: from the end of the XIXth century until 1930 - low production costs, 1940-1960 - the quality of products/services, since 1960 - adaptive capacity to the complex, dynamic and unpredictable business environment. The twenty-first century adds to the flexibility, as a requirement, also a high innovative high degree.

Thus we can mention six parameters that being touched, they ensure competitiveness in a constantly changing environment [5]:

- 1) product/service required by consumer,
- 2) a desired quality,
- 3) in a certain amount (the customer buys only the amount that he needs)
- 4) at a certain price,
- 5) at the appropriate time
- 6) in the respective place.

MATERIALS AND METHODS

This paper involves comparative study in evaluating the impact of different approaches on determinations of competitiveness and quality. Moreover, we use interrelation between quality and profit, so that later to calculate important indicators such as: the effect of competitiveness, the relative change

of the share in the global market, the effect of adaptation, export growth in value, exports per capita and the share on global market.

RESULTS AND DISCUSSIONS

In the Republic of Moldova the competitiveness has not attracted the attention of researchers and policy makers for a long time, which may be explained by the following points:

- until the 90s of the XX century the domestic enterprises advocated for sale of its products on secure and stable markets within the union republics and socialist countries;
- in the 1990s, the economic system changes aimed, mainly, the creation of private system foundations and institutional environment of market economy, the key-issues of economic policy being privatization and macroeconomic stabilization.

The concept of competitiveness of the enterprise began to be updated by academics and practitioners in the early 1970s due to changes that have occurred in the global market and competition change. The experience of the USA, Japan and other countries proves that the increase of competitiveness of these countries has begun at the level of concrete businesses. Hence the need to cross the economic activity on

providing strong and competitive companies, also taking into account the fact that the competitiveness of a company can not be maintained without the continuous improvement of the determinants of competitiveness of the country [2]. Local economist Gr. Belostecinic considers: "as the country's competitiveness, the notion of competitiveness of the enterprise is treated differently and so far it lacks a single opinion [1, p.163]. Product competitiveness is a complex notion, reflecting, on the one hand, the interests of producers, and on the other hand, the interests of consumers. In the first case it is considered competitive the product which ensures the efficiency of the manufacturer's activity. In the second case, it is the product, which ensures a maximal useful effect per unit of consumption [5]. This suggests that in assessing the competitiveness of products is necessary to take into account the interests of producers and consumers.

The competitiveness of agricultural products is determined by a set of qualitative, technical, economic, aesthetic, organizational characteristics etc. The presence of these features confers some competitive advantages on the market and facilitate the distribution in competition conditions. Determination of the competitiveness of agri-food products appears from need to formulate of specific aspects of this production. D. Sparling and S. Thomspson [7] explains the agrifood sector competitiveness as being an indicator influenced by the costs of agrifood production, resource use efficiency and also market factors, macroeconomic tools on the agri-food sector. Meanwhile, in French literature, Jacques Gallezot and Emmanuelle Chevassus-Lozza [3, pag.143-154] presents the agri-food competitiveness based on concepts of price-non-price, but also in terms of agri-food trade. Russian economists' studies on the competitiveness of agri-food products are of particular complexity. For example, Болоболов А. [10, p.25-28] treats the agri-food production competitiveness through the productivity of internal resources of the sector enterprise, and also of economic

resources, and Трыхачев В. [11, p.21-24] understand this competitiveness, not only from the viewpoint of internal resources as of ensuring criteria and factors that fit and ensure a high level of agri-food competitiveness - the creation of competitive advantages of agri-food products across all economic hierarchies, involving technological and institutional instruments etc.

Romanian economists expose a highly diversified approach to the phenomenon of agri-food competitiveness. They reveal and argue the internal and external branch that this competitiveness can be assessed on. Since the internal branch is characterized by internal factors (production yields, infrastructure, etc.), the external one is directly linked to commercial expression of agri-food sector. Such an understanding of the agri-food competitiveness manifestation is encountered in the study "Romanian agriculture and rural area from perspective of sustainable development" [4]. There are here reflected such aspects of agri-food competitiveness, as: competitive performance of agri-food trade, measuring of agri-food competitiveness etc., which allows, in our opinion, to focus a number of specific indicators and to understand their dynamic evolution. In this way, one can already appeal to the respective functional tools for the purposes of influencing those factors that determine a certain resultant development (using logic and economic chain: tools-factors-indicators result). Namely the agri-food competitiveness approach methodology allows us revealing the internal considerations within the agri-food sector, which generate positive developments, or the reverse.

The author, after analyzing the exposures of different scholars on the issue, states own reflections on the constituent elements of agrifood competitiveness and concludes that it manifests, particularly, in the export process of the production.

Assessment of agrifood competitiveness is achieved through various methods. These methodologies, used in certain circumstances, and for certain categories of agrifood products, are complicating, from the recital of

specificity of a particular product (or group), but it helps in understanding the economic essence of respective competitiveness. In the same vein, the assessment of agrifood production competitiveness can be also carried out under the aspect of the tendency to maximize quality and minimize price.

Economic conditions in which Moldovan enterprises operate impose certain requirements for criteria and indicators for assessing firms' competitiveness. In our opinion, the competitiveness indicator should reflect not only the current situation of the enterprise, but also development trends; to be stable to changes in the market conditions, to be applicable in practice, not to depend on the degree of monopoly of the company. It should be noted that the methodology for assessing the competitiveness of enterprises, in the specialty literature there is no a unique approach and researches on this subject are scarce, carry a fragmentary character and does not address all methodological and practical aspects of competitiveness. Scientific researches in the area of enterprise competitiveness show that a more objective appreciation of it may be obtained using the method of comprehensive assessment, which includes the determination of unitary and group indicators of enterprise competitiveness. An agrifood product of a better quality is generally, more expensive. The farmer must know, but if superior sale price advantage is not somewhat canceled by the additional expenses for "quality increase", or, in some cases, inferior yield obtained per hectare. A quality real policy does not always permit farmers to increase the sales prices of their products, it ensuring, generally, a security of selling and a low fluctuation of sales prices.

Consumers are willing to pay more expensive for a quality product, but they need to know:

- what constitutes the quality of ?
- what and how many are the consumers of that product ?
- up to what price to accept its purchase ?

In the monograph "Efficiency and competitiveness in agriculture" [8, p.48-49], Timofti E. exposes the classification of factors

of economic competitiveness of enterprises in the agricultural sector in 2 categories: internal factors and external factors, at the same time presenting new trends in competitiveness strategy of these businesses. Based on the condition of product competitiveness (K_{prod}), the consumer will buy the product which will satisfy the condition [8, p. 291]:

$$K_{prod} = P/C \longrightarrow \max$$

where:

P - utility effect,

C - consumptions of acquisition and use.

As it is known, the competitiveness of production is influenced primarily by 2 main factors - quality and price. But also the conditions for the product promotion to consumer, sales and after-sales services, advertising, demand fluctuations affect the competitiveness level of products. The author emphasizes thus the new dynamics with a focus on quality, on a promotion of more and more efficient. In this way, we can see a great diversity in the research of agrifood products competitiveness within international studies, or national. This results, in our opinion, from the complex nature of the respective competitiveness, but also from the multitude of issues that can be treated. Argumentation of the increase of market share of a particular entity is presented as a direct result of how this economic agent manages and increases its competitiveness. An increase in the competitiveness of the economic entity involves an increase in its market share. So the more important are structural, innovative and instrumental approaches, as these project considerable effects on demand and market positioning, bringing thus an important financial gain.

Thus, the importance of the quality management results from at least the following reasons:

1. First, for an enterprise, to obtain and maintain the quality required by the customer is a business necessity. Achieving this goal is conditioned by planned and efficient use of human, material and financial resources, available to the enterprise.
2. On the other hand, the client wants to have a fuse on the company's capacity to provide

the production required quality in the future too. To gain the customer's trust, the company must demonstrate that it has implemented a quality effective system.

The most important precursors of quality management are considered: W. Edward Deming, Joseph M. Juran, A.V. Feigenbaum, K. Ishikawa and Philip B. Crosby. Deming program on quality improvement "14 points program" is intended to management of the company that Deming consider rewarding for ensuring the framework necessary to achieve this profitability, following the "14 points" [6]. Juran's contribution in the field of quality management is expressed by the fact that, arguing the need for continuous quality improvement, he distinguishes between "incidental problems" and "chronic problems"[6]. While the first can be solved by workers, the chronic ones are the responsibility of managers. The latter have a share of 80%, so, for the improvement of quality it is very important the resolving of chronic problems. Armand V. Feigenbaum is known, especially, for having introduced the concept of "Total Quality Control" [6]. Total Quality Control means the coordination of the actions of workers, machines and information to reach this goal. Like Deming and Juran, his opinion is that a product or service may be considered of a superior quality only when it meets the consumer's expectations. But he gives a great importance to the correlation between quality and price, demonstrating a "cost orientation" in definition of products quality.

According to authors, *the quality is the totality of characteristics of products capable of satisfying the consumers' demands, for which they are intended. While the management is the science that deals with the organization and leadership of a quality system through managerial functions.*

The quality planning function consists of a set of processes through which the firm determines the main objectives of quality, and the resources and means to achieve them [6]. The coordination function consists of all processes through there are harmonizing the decisions and actions of the firm and of its

subsystems on the quality, in order to achieve the objectives defined, within the previously established quality system.

The mobilization function covers all the processes by which the company staff is attracted and determined to participate in achieving the objectives planned in the quality area, taking into account the motivational factors. The controlling function relates to the whole processes conduct surveillance activities and evaluation of results in the quality field, within every stage of the product trajectory, to predetermined objectives and standards, in order to eliminate deficiencies and prevention of their occurrence in subsequent processes. Quality assurance function refers to the whole preventive activities, which seeks, systematically, to ensure the accuracy and effectiveness of planning, organization, coordination, training and controlling activities, in order to secure the results at desired qualitative level. Quality improvement function refers to activities undertaken at each stage of the product trajectory, in order to improve performance of all processes and outcomes of these processes to ensure better satisfaction of customers' needs in conditions of efficiency.

Favorable effects of increasing products quality are materialized in increased profitability, labor productivity and competitiveness.

➤ **Increase of profitability.** Dependence of the profitability of quality is well reflected in Figure 1. According to the figure, on the one hand, an improvement in product quality causes an increase in "value" as perceived by the customer, that can be achieved by a higher price and increase of market share, which leads to the increase in sales volume and hence the profit, on the other hand, an improvement of manufacturing processes will lead to lower operating costs and increase of productivity and therefore to the increase of profit.

➤ **Increase of productivity.** Any improvement of the processes that take place in the enterprise will lead to more efficient use of resources and a reduction of "waste".

Productivity is, in fact, a determining element in assessing the competitiveness of a company, industry or nation.

➤ **Competitiveness.** A firm reputation for a competitive quality is the best asset of the company. National reputation for the quality is perhaps the most illustrative thing that can characterize a country.

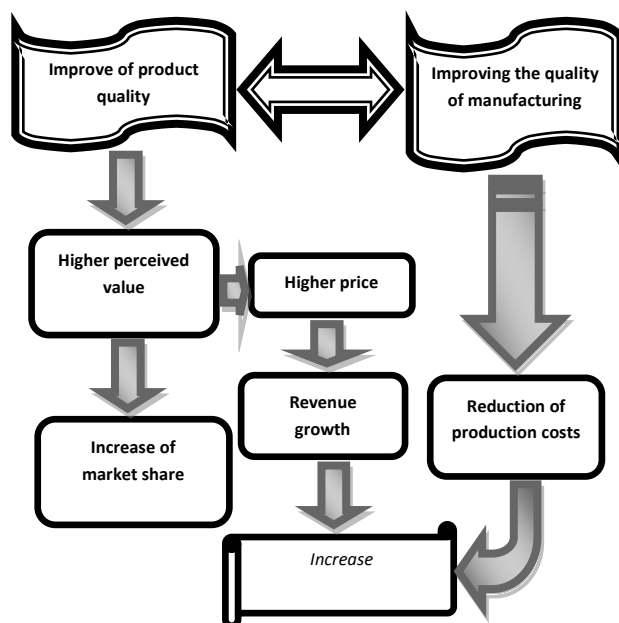


Fig.1. The relationship between quality and profit

Ensuring competitive products on export markets of Moldovan agrifood positions is possible given the actions resulting from the quantification competitiveness, by key indices synthesis, features of real situation [9].

A patterning in this respect is shown in Table 1, where indicators of Moldovan agrifood export competitiveness are exposed under dynamic and comparative report, with specific aspect of adapting to the market, increasing exports, and also the share on international market.

In terms of primary relevance, expressing the number of partner countries on the respective positions, we see that the most pronounced dynamic and as such, the very number of importer partners more significant is characteristic for *Fruit and nuts*, *Oilseeds*, *Cereals and milk preparations* and *Drinks*. In contrast, the lowest numerical values are concentrated in groups of animal products, dairy, vegetables, meat.

However, the most comprehensive and

objectively reflect the situation namely the indicators that quantify the share, market response, market penetration etc. by domestic exporters.

Table 1. Moldovan agrifood export competitiveness indices

Positions/group of positions	Number of partner countries			Quantifying agrifood products competitiveness		
	2008	2010	2012	Indexes	Fresh agrifood products, result: 2010, 2011, 2012	Processed agrifood products, result: 2010, 2011, 2012
01 Live animals	4	5	6	Competitiveness effect (2006, 2007, 2008 – reporting years), p.a., %	12.96 (position 19 in the world)	-4.03 (position 128 in the world)
02 Meat and edible meat offal	4	4	4		15.44 (21)	0.62 (76)
03 Fish, crustaceans, molluscs	2	3	2		6.63 (36)	1.21 (63)
04 Dairy products, eggs, honey	13	10	13	Relative change of the share on the global market, p.a., %	13.24	-4.41
05 Products of animal origin	6	5	9		15.75	-3.13
07 Edible vegetables	9	13	13		8.76	1.02
08 Edible fruit, nuts	35	36	48	Adaptation effect (2006, 2007, 2008 – reporting years), p.a., %	-13.17 (position 173 in the world)	-6.30 (position 144 in the world)
09 Coffee, tea, spices	6	4	3		-1.00 (108)	-3.91 (141)
10 Cereals	23	29	16		2.02 (55)	-0.39 (98)
12 Oil seed, oleaginous fruits	31	37	39	Export growth in value, p.a., %	25 (position 16 in the world)	3 (position 129 in the world)
15 Animal, vegetable fats and oils	21	19	20		29 (20)	5 (119)
16 Meat, fish and seafood food preparations	6	3	2		16 (32)	5 (71)
17 Sugars	25	23	24	Exports per capita (USD/capita)	107.2 (position 70 in the world)	100.8 (position 66 in the world)
18 Cocoa and cocoa preparations	22	19	22		146.8 (66)	114.1 (70)
19 Cereal, flour, starch, milk preparations and products	23	26	27		114.9 (73)	134.3 (60)
20 Vegetable, fruit, nut food preparations	30	34	33	Share on global market (%)	0.06 (position 93 in the world)	0.06 (position 88 in the world)
21 Miscellaneous edible preparations	16	16	18		0.07 (93)	0.06 (86)
22 Beverages, spirits and vinegar	50	54	59		0.05 (93)	0.07 (79)
24 Tobacco and manufactured tobacco substitutes	19	20	18			

Source: Elaborated on the basis of data from Trade Competitiveness Map, Intracen 2013. <http://legacy.intracen.org>

Thus:

Competitiveness effect highlights reflection of percentage change in exports

competitiveness of a country on global market, for the selected sector, in selected period. In this way, the index reflects the change in share of the exporting country to import markets, related to the initial share of countries' imports:

$$\sum_j \left(\frac{X_{djs}^t}{X_{js}^t} - \frac{X_{djs}^{t_0}}{X_{js}^{t_0}} \right) \times \frac{X_{js}^{t_0}}{X_{ws}^{t_0}}$$

Here, t is the current year, t_0 - the first year under consideration, d - the country considered, j - partner country(s), s is the sector, X is exports and X_s - global exports for sector s .

Very important in its essence, the analyzed competitiveness effect for Moldovan fresh and processed agrifood products illustrates the positive percentage changes, which means gains on desired market due to increased competitiveness on the world market for those sectors. The most favorable situation was registered for fresh products, in terms of indicator value, in the reporting period 2011/2007 (15.44%) and as position, during the period 2010/2006 - 19th world place, a performance that has not been recorded for this indicator during the reporting period. On the other hand, processed products are less competitive, the effect index records negative values (-4.03) for 2010/2006, and for 2011/2007 and 2012/2008 the values are already positive with advancement including the position of the Republic of Moldova in the world. They tell us about the excessive cantonment of diminished competitiveness on processed segments, with added value, which assumes, implicitly, a specialization and higher competitiveness effect for fresh products, which significantly reduces the processing industry contribution and, overall, gives an weakened image to the capacities of those sectors, which have to be primarily taken into consideration.

Relative change of the share on the global market - shows the percentage change in exports of a country on the world market for a particular sector, between time 0 and time t . Positive values of this index reveals increased importance of that sector of the country on

foreign market:

$$\left(\frac{X_{djs}^t}{X_{ws}^t} - \frac{X_{djs}^{t_0}}{X_{ws}^{t_0}} \right) = \sum_j \left[\left(\frac{X_{djs}^t}{X_{js}^t} \times \frac{X_{js}^t}{X_{ws}^t} \right) - \left(\frac{X_{djs}^{t_0}}{X_{js}^{t_0}} \times \frac{X_{js}^{t_0}}{X_{ws}^{t_0}} \right) \right]$$

consideration, d is the country under consideration, s - respective sector, j is importing markets group, X - exports, X_{ws}^t - world exports of sector s .

In this case, there is a slight increase (from 2010/2009 to 2011/2010) of the index for fresh products (from 13.24 to 15.75%), ie an increase in the importance of these products in the domestic export structure; thereafter (2012/2011) value of the indicator falls below the level of the first period. Processed products, however, albeit they register negative values (-4.41 and -3.13%) in the first 2 reference periods, the third period confirms the positive dynamics of the index by the value of 1.02% for 2012/2011, thus confirming an increase in the significance of these products having, however, quite slow paces.

Adaptation effect shows the ability to adjust the export supply of a particular sector to changes in global demand. We believe that this indicator reflects thus the mobility performance on markets, such as the exchange of flows depending on the state reflected by the partner country.

The effect is positive if:

- country's market share is increasing on a growing importing market (scenario 1);
- country's market share is diminishing on a declining importing market (scenario 2).

However, the effect is negative if:

- country's market share is increasing on a declining importing market (scenario 3);
- country's market share is diminishing on a growing importing market (scenario 4).

As a formula, this indicator is as follows:

$$\sum_j \left(\frac{X_{djs}^t}{X_{js}^t} - \frac{X_{djs}^{t_0}}{X_{js}^{t_0}} \right) \times \left(\frac{X_{js}^t}{X_w^t} - \frac{X_{js}^{t_0}}{X_w^{t_0}} \right)$$

Here, t is the current year, t_0 - the first year under consideration, d is the country under consideration, j - partner country(s), s - respective sector, w - group of all exporting countries and X is exports.

Past in the light of of this index, both *fresh*

products developments, as well as the *processed products* are geared towards improving the situation. However, the effect is negative for 2 of 3 reference periods of fresh products, suggesting scenario 3 and scenario 4 above, both quite dangerous for the future competitiveness of the agri-food exports. More highlighted and positive is shown the adaptation index for 2012/2008 period (2.02%), which contributed to Moldova's 55 th worldwide ranking in the manifestation of these processes. The situation of processed products is more complex and complicated; although the dynamics is presented as one of positive growth, positive effect values have not yet been achieved, which is essentially normal, since the respective product range is very diverse one and the whole related infrastructure could be slower tailored to the market situation.

Confirmation of positive dynamics and values greater than "0" will show, certainly, a continuously adapting of national exporters to external market conditions, particularly by directing the flow to the EU and Asian emerging markets and framing in the most favorable scenario - scenario 1.

Export growth in value - reflects the development of a sector exports in the period under review, and positive index indicates that exports increased in value. The formula is as follows:

$$GVX_{ds}^t = 100 \times \left[\left(\frac{X_{ds}^t}{X_{ds}^{t_0}} \right)^{1/(t-t_0)} - 1 \right]$$

Here, t and t_0 are the current time, respectively, reference period time, d - the country studied, s - respective sector, X - exports.

While 2010 proved for fresh products 16th worldwide positioning at the chapter of growth dynamics of exports, subsequently the latter has reduced rates to 16% annually in 2012, ie below the level of 2010 and processed products showed modest increases (3-5%), but without elucidating any trends of diminishing. Most likely, being influenced by such factors as: lack of a massive manifestation on already well established

markets, lack of a diversification that would correspond to final consumption, etc., the processed products experience low dynamic as value in export growth. On the other hand, in most respects, these products reveal positive trends, which inspires safety in the continuity of their manifestation on the external market, of course on condition with an appropriate and comprehensive support.

Exports per capita express the extent to which a country's population produces for the world market. Expression of quantification is as follows:

$$Xcap_{ds}^t = X_{ds}^t / Pop_d^t$$

Here, d - the target country, s - respective sector, X - exports and Pop_d^t represents total population for the period t . For both categories of products this index ranks the Republic of Moldova globally within the limits of 60-73 places, ie quite favorable compared to other indicators of the above, at least from the point of view of the extremes achieved. However, of value point of view, this report proved to be one with fragmented tendency but growing for fresh products (107.2 USD in 2010, 146.8 in 2011 and 114.9 in 2012) and one growing continuously for the processed products. The year 2012 was the period when processed products surpassed to the values of per capita exports the fresh products and, thanks to such exceedances, there was achieved the 60th position worldwide.

The share on the global market indicates how important is the country concerned in world export profile for a particular sector. In this way, higher values indicate more significant importance of the state under research. The results are obtained by applying the formula:

$$SHWX_{ds}^t = \frac{X_{ds}^t}{X_{ws}^t} \times 100$$

Here, d - the target country, s - respective sector, w - group of all exporting countries and X represents exports. Obviously, the worst situation is presented for Moldova namely at the values of this indicator, since, both for fresh products, and for processed

ones the share on the global market is a very small one, almost negligible (0.05-0.07%), which leads implicitly to a rank on the last places. Lack of a massive base of production, the inefficiency of national operators and the limited nature of investments, availability of an incipient infrastructure other factors have catalyzed the establishment of present situation.

CONCLUSIONS

The concept of competitiveness of the enterprise began to be updated by academics and practitioners in the early 1970s due to changes that have occurred in the global market and competition change.

Romanian, Russian, local and foreign economists expressed different opinions on competitiveness and quality management.

Favorable effects of increasing products quality are materialized in increased profitability, labor productivity and competitiveness.

In practical terms, measuring Moldovan agrifood export competitiveness indices, they reveal that in terms of primary relevance, expressing the number of partner countries on the respective positions, we see that the most pronounced dynamic and as such, the very number of importer partners more significant is characteristic for *Fruit and nuts*, *Oilseeds*, *Cereals and milk preparations* and *Drinks*. In contrast, the lowest numerical values are concentrated in groups of animal products, dairy, vegetables, meat. However, the most comprehensive and objectively reflect the situation namely the indicators that quantify the share, market response, market penetration etc. by domestic exporters.

The analyzed competitiveness effect for Moldovan fresh and processed agrifood products illustrates the positive percentage changes. The most favorable situation was registered for fresh products, in terms of indicator value, in the reporting period 2011/2007 (15.44%) and as position, during the period 2010/2006 - 19th world place, a performance that has not been recorded for this indicator during the reporting period. On

the other hand, processed products are less competitive, the effect index records negative values (-4.03) for 2010/2006, and for 2011/2007 and 2012/2008 the values are already positive with advancement including the position of the Republic of Moldova in the world.

While 2010 proved for fresh products 16th worldwide positioning at the chapter of growth dynamics of exports, subsequently the latter has reduced rates to 16% annually in 2012, and processed products showed modest increases (3-5%), but without elucidating any trends of diminishing.

REFERENCES

- [1]Belostecinic, G., 1999, Concurență. Marketing. Competitivitate., Complexul editorial – poligrafic al ASEM, Chișinău, 163
- [2]Bugaian, L., Gumeniuc, I., 2008, Reducerea costurilor și sporirea competitivității producției întreprinderilor industriei de zahăr, USM, Chișinău, 178
- [3]Gallezot, J., Chevassus-Lozza, E., 1995, La compétitivité hors-prix dans les échanges de produits agricoles et agro-alimentaires français sur le marché communautaire, *Économie&prévision, Agriculture et environnement*, 1995-1-2, 117-118 (117): 143-154
- [4]Gavrilescu, D., 2006, Agricultura și spațiul rural românesc din perspectiva dezvoltării durabile, Academia Română, Institutul Național de Cercetări Economice, Institutul de Economie Agrară, București, 240
- [5]Litvin, A., 2011, Îmbunătățirea calității ca o pirghie de bază în stimularea competitivității produselor agroalimentare, in: *Materialele conferinței internaționale „Economia în condițiile globalizării”*, IEFS, Chișinău.
- [6]Litvin, A., 2011, Managementul calității – premisă a creșterii competitivității întreprinderilor, Chișinău, 213
- [7]Sparling, D., Thompsom, S., 2011, Competitiveness of the Canadian Agri-Food Sector, Series II: Addressing Issues and Perspective on Policy Options, Canadian Agri-Food Policy Institute, Canada, 20
- [8]Timofti, E., 2009, Eficiență și competitivitate în agricultură, IEFS, Chișinău, 48-49, 291
- [9]Trade Competitiveness Map, Intracen, 2013, <http://legacy.intracen.org>
- [10]Болоболов, А., 2003, Конкурентоспособность аграрного производства, *Международный сельскохозяйственный журнал*, 2003, 3: 25-28
- [11]Трухачев, В., Кусакина, О., 2011, Конкурентоспособность продовольственного подкомплекса, АПК: экономика, управление: ежемесячный теоретический и научно-практический журнал, 2011, 4: 21-24

THE FOREIGN ECONOMIC ACTIVITY - AN IMPORTANT FACTOR IN SUSTAINABLE DEVELOPMENT OF THE REPUBLIC OF MOLDOVA

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Abstract

The Foreign economic activity plays an important role in the economic development of each country. Organizing and carrying out foreign economic activity is an area of major importance in the creation of a new economic mechanism by which the country is classified is performed in the global economy. World experience confirms that many countries have achieved a significant increase of socio-economic development, because of their open "economy", which involves relatively free movement of goods, capital, technology, labor and knowledge. Integration evolution contributes to the increase of the import-export potential of any country. Global competition and domestic market protection prevent, however, the expansion of export flows. Thus, the external links of a country are conditioned and regulated by the interaction of the factors listed above. This paper aims to present some considerations on foreign economic activity as an important factor in the sustainable development of the Republic of Moldova.

Key words: economic activity, export, import, foreign capital investment, sustainable development

INTRODUCTION

It is known, that the national market economy of a country can exist and can be viable only within and in relation with the market economies of other countries.

Also, we must take into account the fact that the contemporary global economy includes a wide variety of national economies, which are at different stages of their development: some are economically highly developed countries and have a significant share in world GDP (USA, Germany, Japan, England, France, Italy, Canada, etc.), others are developing countries and many other countries are underdeveloped.

Corresponding to the study of business activity, the foreign economic activity is based on the following principles:

1. incentives and mutual benefit;
2. free enterprise;
3. legal equality of all the subjects of the foreign economic activity, regardless of ownership;
4. defending the interests of the subjects of the foreign economic activity;
5. preventing the illegal limit of the rights of

the subjects of the foreign economic activity.

The modalities of carrying out the foreign economic activity are:

- **Direct** - this method involves organizing and running the export and import of goods, work performance services rendering by manufacturing units on their own account and risk.

- **Indirect** envisages organizing and conducting import and export foreign trade through the units of foreign trade.

According to the legislation, the content of external business includes import and export of goods, works, services in accordance with the nomenclature and the way prescribed by the Government.

The economic activity in the Republic of Moldova has been determined by the need for economic reforms since independence. In all these years, the country has done a lot to reform the national economy, the transition it from a centralized socialist command economy to a market economy.

At present in the Republic of Moldova essential reforms were carried out successful by and unsuccessfully privatization of enterprises, price liberalization and reducing

the deficit of goods and services, the introduction of the national currency and inflation control; the establishment of the market economy infrastructure, banking establishment. However, the national economy is poorly structured, the legislative support is as incoherent and contradictory. Without the foreign economic activity there would not be possible the sustainable development of the country.

MATERIALS AND METHODS

The reflected researches were achieved on informational materials of the National Bureau of Statistics of the Republic, the National Bank, etc. There were used the following research methods: monographs, comparison, analysis, inference.

RESULTS AND DISCUSSIONS

Taking into account the purpose of the work, we should mention that trade by the nature of the carried out activities is one of the most important sectors of a country or a community of countries.

At the same time, trade through its functions, play an important social role, being a point of contact both between the citizens of a country and between the citizens of different countries.

Along with goods, a large sector of international trade belongs to services that are at global market as a highly dynamic, trade flow exceeding 23% of the world trade (Table 1).

Moreover, for some developed countries, foreign trade in services has a much higher share than the world average, with an outstanding contribution in their balance of payments.

International trade with services includes various types of activity:

- services related to foreign trade, including additional costs for freight, transport etc. ;
- the trade-related services, which may be included in capital constructions, technical collaboration, administrative services;
- trips that include revenue and profits from

- tourism and business travels;
- bank charges, leasing, financial services etc.

Table 1. The evolution of global international trade in services

Indicator	Value, mld doll.	Annual percentage change,%			
		2009	2010	2011	2005-2011
Total trade services, including:	4,149	11	10	11	9
Transport	855	-23	15	8	7
Travels	1,063	-9	9	12	7
Other business services	2,228	-7	8	11	10

Source: prepared by the author based on the data from World Trade Report, 2012, p. 22

According to tab. 1, the largest share of the total global trade services belongs to the group "other business services", which is 54%, the growth percentage changes being positive.

On the second place is traveling, which includes tourism and business travel, which holds 26% share of global commercial services. In 2011 they were up by 12%. Transport services ranked the third with 20% share. If we analyze the evolution of these types of services, we can see their decrease. The consequences of trade freedom increase are overwhelming. Lately, trade in goods and services have a greater growth than production. Trade volume increase exceeds twice the global production growth. The analysis of international trade in the postwar period highlights specific trends of this period, which occurred under the influence of scientific-technical progress, economic integration processes of different regions of the world, global nationalizing etc.

The first main feature of the international trade is the fact that in the postwar period, compared to the previous, international trade registered the highest growth rate. In the period 1950-1995 the total value of world exports, expressed in current prices increased by 80 times the physical volume of

commercial products increased approximately 14 times and prices - about 5.8 times. In the period 1995-2000 world exports of goods recorded a 7% percent change and global gross product grew by 3%. So we can say that the changes of the period are positive but not as huge as in the previous period. The analysis of the dynamics of world merchandise exports shows that it suffered two major crises: in 2001 and 2009.

The second feature of the international trade is that its increase surpasses the growth rate of industrial production, agricultural output, GDP and GNP in the world.

The third feature of the international trade results from the comparison of the international trade volume of gold and currency reserves and the state capitalist countries.

Amazing consequences of scientific and technical progress on interdependencies (in deepening their meaning) is reflected in the structural changes that take place in international economic relations. Regarding international trade, there is a diversification of trade in tangible goods through the development of new products, particularly in machinery and equipment, of chemicals, and other industries and manufacturing sectors, as well as through the increase of previous trade in services. Thus, the share of processed industrial products in world exports, and the machinery and equipment doubled, in some countries the increase being much higher.

However, we emphasize that the import - export of Moldova has a relatively simple nature. Businesses export mostly raw materials, they have insufficient information about the situation and prices on the export market, which presents a significant barrier to determine the effect of commercial operations. Being a country with a small domestic market, Moldova is dependent largely on foreign trade. If we refer to the structure of exports and imports, then we find that in 2007-2012 foreign trade goods groups are run by a small number of products. According to the data in Figure 1, the largest share of total exports throughout the period under review, belongs to food, excluding the

group of miscellaneous items.

If we analyze the dynamics of this group, we find that it is floating. In 2007 it holds the share of 18.8% and has a positive growth trend until 2010, where it reaches 25.2% share.

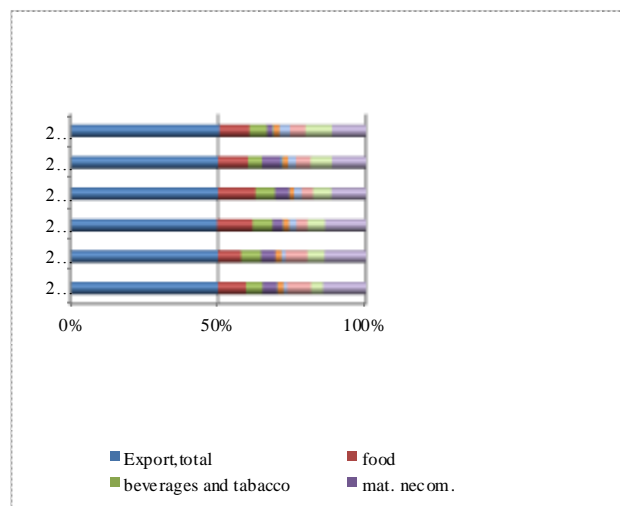


Fig. 1. Structure and dynamics of Moldovan exports, %
Source: prepared by the author based on the data from statistical yearbooks of the NBS

In the next period there is a decrease in the export of food by about 5%, reaching 20.3% in 2012. The same floating is observed in the other categories of products.

If we analyze the structure of Moldovan exports by special groups (fig. 1), we see that the group food and live stock, the largest share in the period 2007-2012, is held by vegetables and fruits. In 2012 there were exported fruits and vegetables worth 279.8 million. dollars USA

In the second place group of cereals and cereal products. In 2012 there were exported products from this group amounting to 51.9 million. dollars USA.

On the third place are sugar exports. Analyzing the dynamics of exports, we mention that it mostly has a positive trend since 2008.

As export agroindustrial products prevail at a rate of about 35% of total exports.

Referring to the import one of the main problems is to ensure the national economy and the population with mineral products as Moldova imports 98% of its. This group has about 30-40% of total imports.

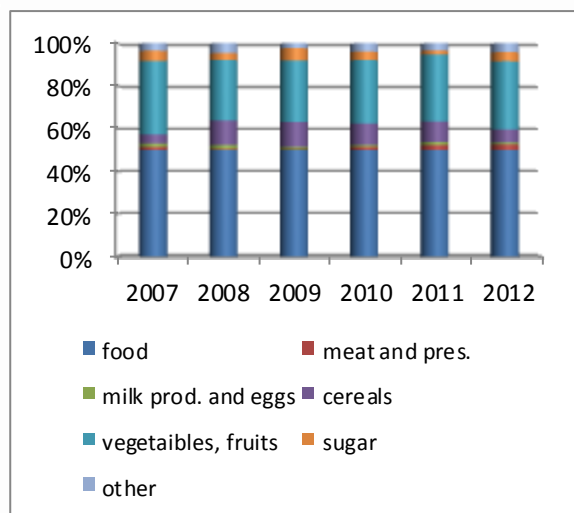


Fig. 2. The structure of Moldovan exports of food and livestock group, mil. dollars USA

Source: prepared by the author based on the data from statistical yearbooks of the NBS.

Table 2. Dynamics and structure of goods imports in Moldova

	2007		2010		2011		2012	
	mil.\$ USA	%	mil.\$ USA	%	mil. \$USA	%	mil. \$USA	%
Import	3689,5	100	3855,3	100	5191,3	100	5213,0	100
Food and livestock	301,0	8,16	410,0	10,6	500,9	9,7	537,7	10,3
Beverages and tobacco	113,7	3,07	136,3	3,5	140,8	2,7	150,1	2,9
Inedible raw materials	96,9	2,61	86,5	2,2	108,0	2,1	104,5	2,0
Mineral fuels, lubricants	774,8	21,0	791,1	20,5	1165,4	22,5	1198,0	23,0
Oils, fats	10,1	0,26	8,8	0,2	11,1	0,2	16,6	0,3
Chemicals	438,5	11,9	520,7	13,5	673,2	13,0	705,8	13,5
Manufactured goods	795,7	21,6	738,0	19,1	975,9	18,8	942,5	18,1
Machinery and equipment	818,5	22,2	805,3	20,9	1157,5	22,3	1083,6	22,7
Miscellaneous articles	339,5	9,2	358,5	9,5	458,1	8,7	474,0	7,2

Source: the author's calculations based on the data from statistical yearbooks of the NBS

Imports growth is increasing and in 2012 they reached a value of 5213.0 million dollars. Compared to 2007, they increased by 1523.5 million dollars. It's a pretty impressive figure. If we analyze by categories, then we can mention that the food group is growing. The structure of imports is dominated by imports of fuels and lubricants, which have a share of 23.0% in 2012. Practically the entire analyzed period this group of goods is dominant in the structure of exports. After energy and fuel imports, imports of goods from the group machinery and equipment prevail, which have

a share of 22.7% in 2012.

The structure of imports of goods, according to the Standard International Trade Classification, indicates continued dominance of the products necessary for the functioning of the economy and the population consumption.

Low competitiveness of domestic products and increasing consumer capacity of the population and other factors, led to imports increased imports according to the country's income Moldova can join the group of countries that have a low income economy, which is characterized by low capital accumulation. That's why the fact that Moldova is structurally inadequate for import-export operations.

Export orientation of Moldova essentially to agroindustrial complex production and import orientation to energy resources and raw materials for light industry, heavy industry and so on the imposes urgent problem of improving external economic relations. The development of optimal structure of import-export flow determines the creditworthiness of the country on the world market and contribute to the stability of the national currency, to raising the socio-economic level of the country, to the increase of its authority in the world community.

Also, Moldova's foreign economic activity can be attributed to the external debt of the Republic, which is now a particularly acute problem. The external debt of the Republic is increasing due to attracting foreign loans to finance the balance of payments deficit. Therefore, it is important to promote policies for managing the flow of foreign capital entering the country, which would allot these investments in the leading sectors of the national economy, with productive character. External debt crisis is a problem for all the countries of the former socialist space and its solution requires great effort from both international organizations and the countries themselves. The external debt crisis often happens because of errors in the orientation of economic and financial exchange rates, the use of foreign loans to finance unproductive targets or with low economic efficiency,

which does not ensure the repayment of external loans, including payment of interest. Therefore, we can mention that Moldova has a significant economic potential for the world of business abroad, but its financial and material resources both internal and external, must be managed effectively to ensure the rational and sustainable development objectives.

International economic cooperation is a form of intergovernmental cooperation between economic agents held on a contractual basis, and having a continuous character aiming at joint efforts of material, financial, technological and human resources of the partners to carry out activities related to the production, circulation, research and development field etc. in order to achieve mutual benefits. Cooperation, as economic partnership involves combining economic resources of two or more companies from different countries to achieve the interests of each in the proportion much higher than in the version of their independent actions.

As the world experience for small countries, shows the only way to use their real priority is cooperation with other countries, namely the development, production and marketing of goods and services on their own markets and on the market of other countries. World-class economists confirm that international economic cooperation is the most effective means of achieving balanced economic growth of restructuring and ensuring sustainable development. There are many international economic cooperation influences on the economy and, respectively on businesses. Benefits that are created by economic cooperation for economic growth are the following:

-cooperative relationship better reflects the convergence of interests of the partners, the thing that exchange relationship doesn't do. In terms of relations between countries, cooperation fits their mutual interest, while foreign trade in terms of different levels of economic development of the partners, meets the interests of some opposite partners those of others. So cooperation is a much more accessible form, as it meets the interests of the

countries, regardless of the level of development and economic system;

-cooperative relationship directly stimulates production growth which is the field of economic growth where a country place in the global division of labor can be changed. Cooperation provides the missing elements of production of a country or of an economic agent for development;

-cooperative relationship is the product of explosive development of the most advanced science and technology;

-cooperative relationship more easily remove barriers, discrimination and other obstacles to international economic relations. Partners can enjoy the facilities that host countries grant to them their producers, the facilities that could not be obtained by a foreign partner;

-cooperation is an effective means to develop and diversify trade, it influence the transformation of international trade into a factor of economic growth for all the countries, in particular developing ones. Cooperation stimulates additional material, paves way for expanding trade;

-cooperative relationship generates stability in international economic relations, gives them insight as partners commit to lasting action. Partners set long-term goals together take decisions on investment, specialization and technical progress.

Cooperation in production and services has favorable effects on the growth of the national economy, or on the other hand, or international economic relations as a whole. It also stimulates the growth and diversification of national economies by creating new targets in different sectors of the economy or expanding existing ones. Cooperation is also a factor of technical progress as it allows the transfer of modern technology and mutual learning at the same time partners join forces for new scientific and technical projects.

International investment banking practices emerged with the generalization and slow formation of modern states in the late Middle Ages, but true progress, investments made in the early nineteenth century. These investments were mainly from Europe exclusively from a single country - Great Britain.

From 1914 to 1939, due to great political disturbances in the European area, the hierarchy of capital exporting countries reversed - the USA becoming a leader in the export of capital, and Germany - the first of import.

After World War II, one can distinguish three major waves of foreign investment: The first wave is done since 1950 and lasted until 1965, This period corresponds to the flow of American investment firms in Western Europe. The second wave (1965-1975) is characterized by the fact that American and European companies are turning to low-wage countries in Southeast Asia.

The third wave is done nowadays and is characterized by continuous increase of investment flows.

This expansion of FDI can be explained by the following facts:

- changing international economic environment;
- privatization is a means of transferring the economic activities from public sector to private one;
- countries continue to reduce restrictions on FDI and unilateral trade policies liberalization takes place within multilateral negotiations;

In these years the number of treaties and agreements on investment promotion and protection has tripled, for example, the North American Free Trade Agreement (ALENA) multilateral agreement on investment (AMI). With an average growth rate two times higher than production, global trade is at the root of economic internationalization.

This has prompted businesses to develop investment abroad, to create multiple international networks of multiple and diffuse. Following the trends of internationalization we can clearly identify two developments:

- increasing the flow of commerce on one hand;
- increasing foreign investments on the other hand, that scored in the early 1980s.

As a result, the growth of trade and investment, led to an increase in the level of competition in many markets, which means an intensification of competition faced by domestic firms of receptive countries.

Table 3. Direct Foreign investments in the Republic of Moldova, the period 2003-2012, mln.\$ USD

Years	2006	2007	2008	2009	2010	2011	2012
Total FDI	233,2	541,3	711,5	145,3	197,41	274,0	159,21
Social capital	119,1	227,4	441,7	161,6	156,98	143,9	144,55
Reinvestments	41,6	112,8	99,7	11,6	14,6	94,4	-11,7
Other capital	72,3	201,1	171,1	4,7	25,9	35,7	41,6
FDI / GDP, %	*	12,29	11,75	2,67	3,40	3,91	2,5

Source: Based on the data provided by the National Bank of Moldova

According to Table 3 data in we can mention that Moldova was able to attract FDI only after credible economic recovery. A considerable growth of FDI in Moldova's economy was registered merely in 2007, when it ran to \$ 539.3 million. In 2009 a dramatic decrease of the FDI amount occurred in our economy. It can be justified by political and economic instability in the country. As a result, foreign investors preferred to invest in geographically outlandish countries, but economically and politically steady. Also, there is a high FDI decrease in 2012. It can be explained by the difficult situation of the global economy.

Economic experts mention that Moldova lost in 2012 the struggle in attracting FDI, in comparison with the other countries of this area. "All this proves that the government, generally, didn't sufficiently reveal its ability to systematically approach about the business climate deficiencies in the country," says the study of the analytical center "Expert Group". Over wise, the same study of the Analytical Center "Expert Group" shows that in 2012, the private investment continued to decline and the most prominent decline was attested at foreign investments. "Moldova has lost not only regional struggle in attracting FDI, but risks to lose investors who already set up in the country. In this context, the public investment could be considered the redemption funds of the Moldovan economy in 2012", said experts.

Regarding the FDI in GDP share, we can mention that during the analyzed period this index was unstable and in 2009, as a result of the global crisis, this index decreased to

2.67%. The same situation is repeated in 2012. The main sources of foreign capital are from Netherlands - 18.2%. It is succeeded by Cyprus - 12.4%, Italy - 12.3%, Russia - 7.8%, Germany - 6.1% etc. A considerable amount of investment in Moldovan enterprise capital comes from European Union (EU).

CONCLUSIONS

In a relatively small and open economy like that of the Republic of Moldova, agricultural trade benefits can be one of the possible ways to significant economic growth, increasing incomes, and consequent poverty reduction. Taking into the account the fact that the local market is relatively small and has a limited absorption capacity in the near future agriculture will continue to be the essential source of Moldovan exports and increasing exports of agricultural production will have the potential to produce a positive impact on consumption and medium and long term income. In turn, this will serve as a major incentive non-farm economy in rural areas. However, export growth will depend on Moldova's capacity to exploit its comparative advantages intensively and quickly connect them to the world trading system.

We consider that foreign economic activity is an important factor in the development of the country. The top four most important export partners are Russia, Romania, Italy and Ukraine, and imports partners are: Russia, Romania, Ukraine and China.

The reasons that led to reduced exports from the Republic of Moldova are Russian ban of Moldovan food products.

The reduction of the volume of textile production that is processed and exported to the EU, the Eurozone crisis and the reduction of metal production are other reasons that led to reduced exports.

In this regard, the Ministry of Economy has proposed to undertake a series of actions. They include the elimination of all trade and non-trade barriers, existing in foreign trade recorded both in Moldova and abroad. The simplification of customs procedures and the simplification of all the restrictions that are

placed on the market of Moldovan origin countries. Also, another purpose would be raising the competitiveness of domestic products.

We also, consider the role of foreign investments is quite important for developing countries, including Moldova, where internal resources are insufficient to reach the level of development and prosperity that modern countries have today. The influence of FDI on the domestic economy is twofold. On the one hand, it is credit, loans and investments through which foreign capital can complement national financial resources in implementing the macro stabilization. On the other hand, foreign capital plays a key role in the restructuring and modernization of the national economy.

Along with the capital invested with the corresponding effects on the growth of economic activity, foreign investment stimulates the transfer of modern technology, they help the country's balance of payments in which they are implemented.

Thus, we conclude that foreign economic activity, which consists of the following types of activity: export and import of goods (works and services) in accordance with the nomenclature in the manner prescribed by the Government, trade in goods (barter transactions) and other types of activity, based on the principles of commerce greeting; co-operation in production and other subjects of economic activity abroad; entrepreneurial activity carried out jointly with the subjects of economic activity abroad; activity of foreign investors, form one of the main factors for sustainable development of the country.

REFERENCES

- [1]Armenia Androceanu, 2004, Project Management with the External Funds, University Publishing, Bucharest, 2004
- [2]Allaire, Y., Farsiroty, 1998,Strategic Management, ed. Economica, Bucharest,
- [3]Bargaoan Alina, 2006, Project managements, Ed. Economica, Bucharest
- [4]Cruceru, A., Project management adjustment to the new world tends,Romania Economic business review, vol.6
- [5]Stanley E. Portny, 2001, Project Management for

Dummies, wiley publishing, inc. [6] www.aipa.md

[7] www.mec.gov.md

[8] www.statistica.md

[9] https://www.bnm.md/md/bnm_publications

A SOCIO-ECONOMIC ANALYSIS OF THE RURAL AREA IN THE WESTERN REGION

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Abstract

The analysis presented in this paper points out the fact that we need to make fundamental improvements in the Western Region if we want to be able to face the future challenges generated by new investments with a view to increase economic activities, to improve institutional activities, and to make short-term specific investments in both human resources and infrastructure. The authors of this paper have reached the conclusion that the Western Region needs investments in the business environment in both developed areas and underdeveloped areas or unfavoured areas.

Key words: analysis, development, infrastructure, region, rural area

INTRODUCTION

The Region West has known a quick economic growth before the vertiginous crisis at the end of the 2000s. Despite all this, economic expansion has not lead to increases of the employment rate; it increased inequalities between different areas in the region.

The Region West is the second representative region of Romania, with a GDP 13% higher than the national average but much lower than that of the Capital city, Bucharest. The Region West was the region with the quickest growth rate during 2000-2007 and, together with Bucharest, the region with the highest growth of the decade. In fact, compared to other regions in Europe, the Region West was a winner in the last decade.

Overall, economic growth of the Region West contributed to a significant convergence with the mean of the European Union (E.U.). However, the gap between it and Europe is substantial: its GDP per capita from the point of view of the purchase power) is still less than half of the E.U. mean.

MATERIALS AND METHODS

The research methodology includes a bibliographical study (scientific documentation) in several steps: source

information, data collection, study of documentary sources and their classification, evaluation and study of documentary sources. The main method the authors have used is content analysis.

RESULTS AND DISCUSSIONS

a) Rural Area in the Region West

The rural area is the land area where predominate crops, forests and green areas, that relies on a predominantly agricultural society. Etymologically, *rural* comes from the Latin *rus*, meaning crop, fields, land that is occupied, inhabited, worked and managed by man.

In Romania, most of the labour force of a rural locality works in agriculture, forestry and fishery, supplying a specific and viable lifestyle for its inhabitants; modernisation policies will allow it to preserve its rural specificity in the future. From the point of view of administrative-territorial units, on December 11, 2011, there were, in the Region West, 12 municipia, 30 towns, and 281 communes with 1,327 villages.

As far as the residence environment is concerned, about 37.2% of the population in Region West lived in the rural area; at national level, in 2011, about 45.1% of the total population lived in the rural area, which

means that Region West had a lower concentration of the population in the rural area than at national level.

Table 1. Rural localities in region West per counties (2011)

County of the Region West	Communes	Villages
Arad	68	270
Caraș-Severin	69	287
Hunedoara	55	457
Timiș	89	313
REGION WEST	281	1,327
ROMANIA	2,861	12,957

Source: INS – Anuarul statistic al României, 2012

b) Demographics

In Region West, in 2011, **population density was 59.7 inhabitants/km²**. There are, in the field, two models of population distribution and two area types, respectively: an area more intensely populated, in the west, particularly in the periurban area, and a less populated area, in the mountain area, where population density is much below 30 inhabitants/km².

Table 2. Share of the population depending on residence environment (2011)

County/Region	Total population	Urban population	% urban	Rural population	% rural	Density
Arad	455,126	250,742	55	204,384	45	58.7
Caraș-Severin	320,391	179,575	56	140,816	44	37.6
Hunedoara	459,967	352,569	76.7	107,398	23.3	65.1
Timiș	678,347	418,109	61.6	260,238	38.4	78
Region West	1,913,831	1,200,995	62.8	712,836	37.2	59.7
Romania	21,413,815	11,778,195	55	9,635,620	45	89.8

Source: INS – Populația României pe localități la 1 ianuarie 2011

In the rural area, the natural growth of the population is, in general, lower than in the urban area, i.e. -5.8‰ compared to -2.5‰ in the urban area. At county level, there were values below the regional mean in the counties of Hunedoara (-9.7‰) and Caraș-Severin (-8.5‰), and values above the regional mean in the counties of Arad (-5.3‰) and Timiș (-3.2‰).

The sold of internal migration in Region West was positive in 2011; it was, together with

Region North-West and București-Ilfov, among the only regions with a positive sold of internal migration (total departed and arrived), which denotes the attractiveness of the region within the national area.

Taking into account the structure per ages of the rural population, the current death rate seems to have reached its peak. In the future, there seems to be some relative stagnation and then a slight decrease of the death rate.

Though it might seem paradoxical, the current level of death rate will lead to a rejuvenation of the population: thus, in 2015, rural population will be much younger, but less numerous than at present.

c) Agriculture in Region West. General Data

At national level, Region West has 12.80% of Romania's agricultural lands, with an important valorisation potential.

In Region West, there are certain differences at county level: thus, agricultural lands in the counties of Arad and Timiș are superior to those in the counties of Caraș-Severin and Hunedoara; the explanation is that the former benefit from the potential of the Western Plain, while the latter are dominated mainly by hills and mountains, but have high forest resources.

d) Structure of Agricultural Lands

At regional level, there are two categories of ownership, i.e. small lands (below 20 ha), not competitive and valorised for one's own production, and lands above 50 ha, well technologised (in general, owned by large companies) on which they practice high-productivity agriculture.

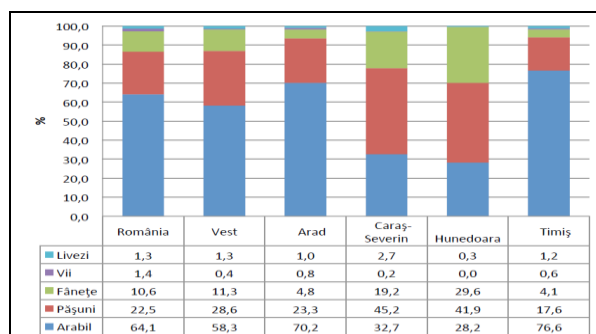


Fig. 1. Agricultural areas per use categories (2011)

Source: INS – Anuarul statistic al României 2012

In 2011, the agricultural area of the region was 1,868,417 ha (12.80% of Romania's agricultural area).

As for agricultural land use categories, there are differences between the regional and the national levels.

The specificity of the natural landscape determines the individualisation of certain agricultural activities. Thus:

-The western area of the region (overlapping the Western Plain) as well as the Mureş Passage (the Deva area up to the Haţeg Depression) is remarkable for the large share of arable lands favourable to cropping (particularly cereals) and animal raising;

-The hill area (Lipovei Hills, Pogănişului Hills) and the passage and depression areas (the Bistrei Passage, the Cernei Passage, the Haţeg Depression, the Zărandului Depression, the Brad-Hălmagiu Depression) are favourable to fruit cultivation and particularly favourable to grapevine cultivation.

-The mountain area (particularly in the counties of Caraş-Severin and Hunedoara) are remarkable for the large share of grasslands and haymaking fields, favourable for animal raising.

e) Plant Cultivation

As for agricultural production in Region West, it is mainly vegetal. Agricultural production represents 10.64% of the total national production and 69.6% of the total regional production; it is more developed in the counties of Timiş and Arad.

Table 3. Agricultural production

Agricultural branch, of which:	2011 (thousand RON)	%
Vegetal	5,664,685	69.6
Animal	2,423,474	29.8
Agricultural services	53,213	0.6
TOTAL	8,141,372	100
Private ownership	7,873,546	96.7

Source: INS – Anuarul Statistic al României 2011

Cereals are the most frequently cultivated in Region West. At county level, the highest productivity is in the Timiş County—1,416,496 t, Arad County—926,607 t, Caraş-Severin County—182,569 t and Hunedoara County—119,986 t.

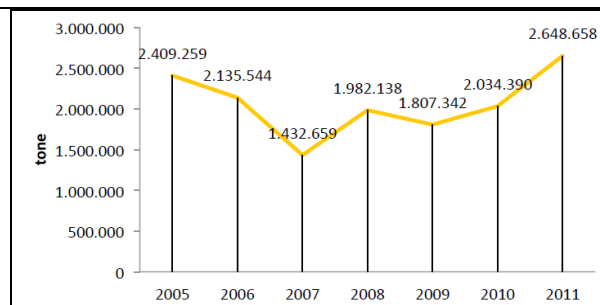


Fig. 2. Evolution of cereal production during 2005-2011

Source: INS – Statistică teritorială 2012, Anuarul Statistic al României, 2012

In Region West, they have chosen to cultivate potatoes and sugar beet because they are staple foods in the area. In 2011, potato production reached 366,713 t, an amount inferior to that of 2005, when production was 20% higher.

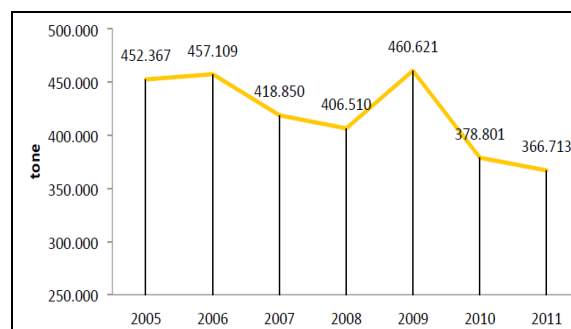


Fig. 3. Evolution of potato production during 2005-2011

Source: INS – Statistică teritorială 2012, Anuarul Statistic al României, 2012

In Region West, **sunflower** production is superior to that of 2005; starting with 2009, sunflower production increased constantly in the region.

Sunflower production is rather modest in Region West (114,047 t): thus, the region ranked 5th among other development regions. Mean production per ha in sunflower 2,166 kg/ha, being superior to the national mean.

In Region West, in 2011, **vegetable** production was above the level of 2005; there was no clear trend, but rather a fluctuation of the production, as in most crops; vegetable production decreased during 2008-2010 but increased later on to 434,772 t.

In Region West, the area of **fructifying vineyards** is 8,400 ha, of which most are in the counties of Timiş and Arad.

Among the most important viticultural areas in the Arad County are the Aradului Vineyard, the Măderat-Bocsig area and, in the Timiș County, the Recașului, Buziașului, and Sânnicolaului Mare areas.

In the counties of Caraș-Severin and Hunedoara, the areas of vineyards are smaller; however, we need to remind the areas Berzovia-Doclin, Ciclova Română in the Caraș-Severin County.

In the Hunedoara County, though there are some vineyards, their areas are small and only within households.

Table 4. Vineyards areas per counties

County/Development region	Vineyards and viticultural nurseries (ha)
Arad	3,746
Caraș-Severin	772
Hunedoara	-
Timiș	3,882
Region West	8,400
Romania	211,347

Source: INS – Statistică teritorială 2012

Region West has important traditions in the cultivation of grapevine: it is spread mainly in the counties of Timiș and Arad, but also in the Caraș-Severin County.

However, after 2005, grape production fluctuated: in 2011 the grape production reached 20,566 t, much above the level of 2005 but, after 2009, when there was a record production of 30,062 t, grape production decreased constantly.

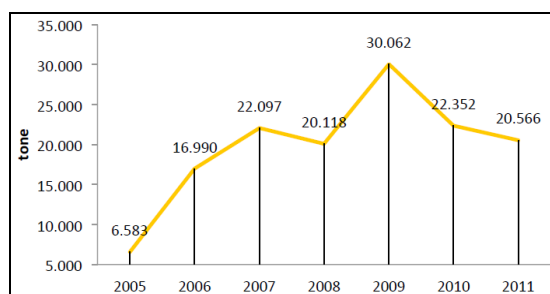


Fig. 4. Evolution of grape production during 2000-2011

Source: INS – Statistică teritorială 2012

In 2011, total **fruit** production was, in Region West, about 126,877 t, i.e. a little above the level of 2010, but much below the level of 2005, when production was about 25%

higher.

f) Animal Husbandry

Animal production represents the second branch of agricultural production in the Region West, with a production reaching, in 2011, 2,423,474 thousand RON, i.e. 11.12% of the total animal production of Romania.

Animal production in Region West is characterised by the following: 4,194,000 hl milk, of which 3,554,000 hl cow and buffalo cow milk, 2,468 t wool, 505,000,000 eggs, and 3,512 t of honey.

Table 5. Animal production in Region West (2011)

Specification	Live weight (t)	%
Beef	15,742	8.3
Pork	134,815	71.5
Mutton and goat	15,095	8.00
Poultry	22,927	12.2
TOTAL	188,620	100

Source: INS – Anuarul Statistic al României 2012

g) Population Active in Agriculture

Of the total population employed in agriculture in Region West (811,000 people), 141,000 (i.e. 17.3%) carry on activities in agriculture. Among the causes of the decrease of the share of population employed in agriculture are retirement of old people from agriculture, small incomes from the sector (which make it unattractive for the youth), low rural investments that absorb younger labour force, etc.

As for the population employed in agriculture per age groups, only a small share of the young population carries on activities in the sector.

i) Specific Infrastructure

The park of agricultural machines in the Region West is superior to the national mean (it is the third region from this point of view with its 70,619 equipments), being outnumbered by Region North-West with 75,097 equipments (2nd rank) and Region South-Muntenia with 88,791 equipments (1st rank) in 2011.

The arable land in Region West represents 11.6% of the total national land area, while the park of agricultural machines in Region West represents 14.9% of the total park of agricultural machines in Romania.

j) Forestry

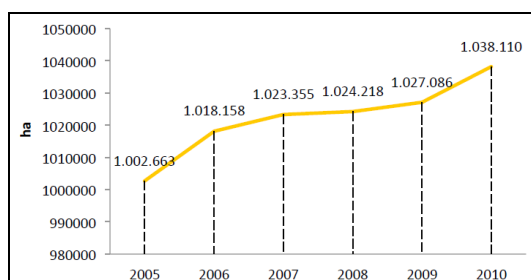
In 2011, in Region West, the area covered by forests and other lands covered by forest vegetation represented 34.5% of the total area of the region.

Table 6. Park of tractors and main agricultural machines in Region West

Specification	2010 (pieces)	2011 (pieces)
Physical agricultural tractors	27,891	28,755
Ploughs	20,630	21,772
Mechanical cultivators	4,784	4,943
Mechanical sowing machines	10,234	10,209
Mechanical spraying and dusting machines	215	245
Cereal self-propelled combines	3,557	3,376
Harvesting self-propelled combines	100	112
Cereal self-propelled wind rovers	72	75
Straw and hay bale pressing machines	985	1,132
Arable area per physical tractor (ha)	39	-

Source: INS – Anuarul Statistic al României 2011, 2012

At regional level, during 2000-2010, the forest areas increased. At county level, the highest increase was in the Caraş-Severin County—19,488 ha more, then the Arad County with 6,927 ha more, the Hunedoara County with 3,160 ha more, and the Timiş County with 2,858 ha more.



Source: INS – Statistică teritorială 2012

Fig. 5. Evolution of forest areas in region West (2005-2010)

CONCLUSIONS

In order to re-launch economy in the rural area of Region West, we need to take the following measures per development areas:

a) rural development:

- Stopping the decline of traditional life;
- Recovering traditions in the rural area, traditional trades and crafts;
- Diminishing the poverty level in unfavoured rural areas.

b) agriculture:

- Producing relatively constant vegetal production;
- Reducing crop fragility in case of extreme climate phenomena (drought, lack of rainfall);
- Increasing soil quality;
- Introducing medicinal and technical plants (much demanded on the market) into cultivation;
- Reaching quality standards with a view to integrate on the European markets and reach the standards of the great traders on domestic markets;
- Diminishing massive imports of agricultural products;
- Developing an informational network in agriculture and forestry;
- Developing works meant to control soil erosion and land glides and stopping massive lumbering;
- Valorising agricultural production properly;
- Increasing the knowledge of legislation in agriculture and the opportunities of accessing EC funding;
- Increasing entrepreneurial spirit and climate.

c) forestry:

- Increasing responsibility in preserving and managing forests sustainably;
- Exploiting forests reasonably and reducing land glide risks;
- Observing current regulations in forestry to protect private heritage.

d) demographics:

- Increasing labour force renewal chances;
- Taking measures to attract labour force and young population to the rural area;
- Ensuring decent living conditions in agricultural area;
- Taking measures to increase employment offer in the rural area;
- Stopping youth migration from the rural to the urban areas and/or abroad.

e) rural tourism:

- Developing policies regarding the

conservation of some tourism potential sites in the rural area (mills, houses, equipments, etc.);

-Increasing the quality of services in the rural area;

-Using all rural tourism opportunities.

f) industry:

-Increasing the confidence of the inhabitants of the rural area in carrying on non-agricultural activities;

-Increasing the interest of the investors in the rural area.

g) society:

-Reducing the number of dropouts ;

-Eliminating social issues caused by industry restructuring.

h) ecology:

-Developing proper policies in environmental protection;

-Eliminating the permanent risk of degrading environmental factors and improving legislation in the field;

-Stopping massive lumbering.

REFERENCES

- [1]Davidovici, I., Gavrilescu, D., 2003, Politica agricolă și de dezvoltare rurală în dezvoltarea economică a României, Ed. Academiei Române
- [2]Mateoc-Sîrb Nicoleta, 1999, Exploatația agricolă, Ed. Agroprint, Timișoara
- [3]Mateoc-Sîrb Nicoleta, 2004, Dezvoltare rurală și regională în România, Ed. Agroprint, Timișoara
- [4]Man T.E., Mateoc-Sîrb Nicoleta, 2007, Dezvoltarea rurală și regională durabilă a satului românesc, Editura Politehnica, Timișoara
- [5]Mateoc-Sîrb Nicoleta, Ungureanu, G., 2010, Dezvoltarea regională și rurală. Evoluții și tendințe, Editura Mirton, Timișoara
- [6]Oțiman, P.I., 1997, Dezvoltare rurală în România. Ed. Agroprint, Timișoara
- [7]Oțiman, P.I., 2000, Economie rurală II, Ed. Agroprint, Timișoara
- [8]Oțiman, P.I., 2002, Agricultură României, Ed. Agroprint, Timișoara
- [9]Oțiman, P.I., Goșa, V., Mateoc-Sîrb Nicoleta ET AL, 2006, Dezvoltarea rurală durabilă în România, Editura Academiei Române
- [10]Oțiman, P.I., Mateoc-Sîrb N., Mănescu, C., 2013, Economie rurală, Editura Mirton, Timișoara
- [11]INS – Anuarul statistic al României 2010
- [12]INS – Anuarul statistic al României 2011
- [13]INS – Anuarul statistic al României 2012
- [14]<http://www.adrvest.ro>
- [15]<http://www.madr.ro>

INTERNATIONAL TRADE WITH WHEAT (2009-2011)

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Abstract

The study relates to the situation of international trade activities related to wheat for 2009-2011. It starts with the presentation of the current situation in the continents (Africa, Americas, Asia, Europe and Oceania), then create an overview of global imports and exports and specifying Romania's role in the market. Regarding the import situation, the main importer is represented by Asia, followed by Africa and Europe - 35.89, 26.18 and 23.28% respectively (in terms of quantity). Quantities of imported wheat ranged uniformly worldwide, which is due to situations in Asia and Europe (sinuous trend of decline and strictly downward evolution) - on the one hand, and trends from Africa, Oceania and the Americas (the first two strictly ascending last ascending-uniformly). Romania is not a major player, in terms of imports, the global market share accounting for 0.44 and 0.35% respectively of the quantities imported values - even less beneficial. Changes in indicators was one uneven - both quantitative and ascending - at value level during the period. When referring to the situation of exports in terms of quantity, the main actors are represented by Europe and Americas. They have dominated the world market, achieving 47.21 and 37.68% respectively of world export quantity. Oceania ranks third with a share of 11.03%, while Asia and Africa have very low weights (4.0 and 0.08% respectively). Quantities exported globally evolved unevenly (as in the African continent), the rest have been descending Europe and ascending Asia, Oceania and Americas. As for imports, and exports Romania is not a major player in the global market (average weights of 1.45 and 1.23% respectively for quantities exported values) - favorable situation.

Key words: export, import, trade balance, wheat

INTRODUCTION

To farm wheat are important food industry, feed, agricultural technology - technology, export and source of profit [1].

Analysis of international wheat trade is done in the context, the existence of global organizations and regional bodies which have created ways for members making proper conduct.

European Union is the largest importer of agricultural products in the world and the second largest exporter after the United States. Progress in global trade make changes the role and functions of agriculture under the impact of globalization, environmental and quality requirements of food [3].

The main instruments of the common commercial policy were customs duties, taxes or preferential quotas, contingents (quotas), voluntary export restrictions, duties, price ceilings, regulatory barriers (technical), export subsidies (agricultural products), domestic

subsidies, licenses. The range of instruments narrowed in the 90s after the previous fiscal relaxation was accompanied by a veritable proliferation of non-tariff barriers [2].

Global agricultural trade has a small share of total agricultural production (approx. 15%), most of which is intended, primarily, domestic consumption. The main reason is that countries of the world exporting which is extra than domestic demand, agricultural trade having a residual character.

The most important products are marketed cereals, oilseeds, dairy products, beverages, vegetable oils and fats. The largest exporters are the USA and the EU, which have each a share of 19% of global exports. [3]

In this context it seems interesting to present the development of international trade of wheat (2009 - 2011) worldwide.

MATERIALS AND METHODS

For the design and implementation phase of the work was done documentation data using

statistical reporting [4]. Therefore we used a system of indicators to highlight specific trade in some agricultural products system used and recommended by the United Nations Food and Agriculture Organization - FAO.

Was selected quantitative information on the volume and value of imports and exports volume of wheat made the world and to the five continental units (Africa, Americas, Asia, Europe and Oceania).

Study conducted and positioning Romania in the global market in terms of foreign trade of wheat.

The data collected and analyzed, covers the period 2009-2011, operating with the average period. Average was determined by calculating the following relation:

$$A = \frac{X_1 + X_2 + \dots + X_n}{n}$$

RESULTS AND DISCUSSIONS

Table 1 presents the evolution and structure of global imports.

Worldwide, in 2009, the total value of imports was 37,230.6 million. \$

Value is based on continental contributions: 169.0 million \$ for Oceania, 5041.2 million \$ from the american continent, 7872.6 million \$ for Europe, 9722.7 million \$ in the African continent, 14425.1 million \$ for Asia. Following these values indicator the structure is as follows: 0.45% Oceania, 13.54% Americas, 21.15% European, 26.11% and

38.75% Africa, Asia.

If we look at the specific situation of 2010 can be seen limits of variation for the indicator, from 188.9 million \$ for Oceania (0.52%) to 12,597.7 million \$ in Asia (34.70%). Taking into question the rest of continental indicator values - 9893.7 million \$ Africa (27.25%), 7956.5 million \$ Europe (21.92%), 5668.1 million \$ Americas (15.61%) - to reach a total global imports of 36,304.9 million \$.

For 2011 there is a total world imports for wheat reach 51,184.3 million \$. Setting this value is based on the contributions sequential continents: 257.2 million \$ Oceania (0.50%), 7225.4 million \$ Americas (14.12%), 10602.4 million \$ Europe (20.71%), 14361.7 million \$ Africa (28.06%), 18737.6 million \$ Asia (36.61%).

Calculating the average of the period been reached a total value of world imports of 41,573.3 million \$ value is based on the following structure: 36.69% Asia (15253.5 million \$), 27.24% Africa (11326.0 million \$) 21.19% Europe (8810.5 million \$) 14.39% Americas (5978.2 million \$) 0.49% Oceania (205.1 million \$).

For Romania the wheat imports reached an average of 143.5 million \$, which represented 0.35% of the world. Sequential, we are talking about Romanian weights, global: 0.41% in 2010 - 149.2 million \$, 0.34% for the year 2011 - 172.9 million \$ and 0.29% for 2009 - 108.4 million \$.

Table 1. Wheat - World Imports (2009–2011)

Specification	2009			2010			2011			Average 2009 – 2011		
	Mil. \$*	Str. %**	Din. Ibf**	Mil. \$*	Str. %**	Din. Ibf**	Mil. \$*	Str. %**	Din. Ibf**	Mil. \$**	Str. %**	Din. Ibf**
Africa	9722,7	26,11	100	9893,7	27,25	101,8	14361,7	28,06	147,7	11326,0	27,24	116,5
Americas	5041,2	13,54	100	5668,1	15,61	112,4	7225,4	14,12	143,3	5978,2	14,39	118,6
Asia	14425,1	38,75	100	12597,7	34,70	87,3	18737,6	36,61	129,9	15253,5	36,69	105,7
Europe	7872,6	21,15	100	7956,5	21,92	101,1	10602,4	20,71	134,7	8810,5	21,19	111,9
Oceania	169,0	0,45	100	188,9	0,52	111,8	257,2	0,50	152,2	205,1	0,49	121,3
Total	37230,6	100	100	36304,9	100	97,5	51184,3	100	137,5	41573,3	100	111,7
Romania	108,4	0,29	100	149,2	0,41	137,6	172,9	0,34	159,5	143,5	0,35	132,4

* <http://faostat.fao.org/site/535/DesktopDefault.aspx?PageID=535#ancor>

** own calculations

Table 2 presents the wheat exports and food aid carried worldwide.

In the year 2009, the five continental units recorded values of exports: 40.1 million \$

Africa, 882.9 million \$ Asia, 2766.9 million \$ Oceania, 12,447.8 million \$ Americas and 14913, 4 million \$ Europe. These values led to an overall world indicator of 31,051.1

million \$, which has seen percentage contributions (in structure) of: 48.03% Europa, 40.09% Americas, 8.91% Oceania 2.84% 0.13% Asia and Africa.

Table 2. Wheat - World Exports (2009-2011)

Specification	2009			2010			2011			Average 2009 – 2011		
	Mil. \$*	Str. %**	Din. Ib ^f **	Mil. \$*	Str. %**	Din. Ib ^f **	Mil. \$*	Str. %**	Din. Ib ^f **	Mil. \$**	Str. %**	Din. Ib ^f **
Africa	40,1	0,13	100	28,1	0,09	70,1	50,6	0,11	126,2	39,6	0,11	98,8
Americas	12447,8	40,09	100	12954,6	39,75	104,1	20845,2	44,50	167,5	15415,8	41,86	123,8
Asia	882,9	2,84	100	1504,9	4,62	170,4	1536,4	3,27	174,0	1308,1	3,55	148,2
Europe	14913,4	48,03	100	14248,6	43,73	95,5	18706,2	39,93	125,4	15956,1	43,33	107,0
Oceania	2766,9	8,91	100	3847,3	11,81	139,0	5709,2	12,19	206,3	4107,8	11,15	148,5
Total	31051,1	100	100	32583,5	100	104,9	46847,6	100	150,9	36827,4	100	118,6
Romania	422,7	1,36	100	503,1	1,54	119,0	430,9	0,92	101,9	452,2	1,23	107,0

* <http://faostat.fao.org/site/535/DesktopDefault.aspx?PageID=535#ancor>

** own calculations

In the case of the total value of exports in 2010 has been 32,583.5 million. \$ At which the five continental units have contributed variable as follows: Africa 0.09%, 4.62% Asia, 11.81% Oceania 39.75% Americas, Europe 43.73%. Corresponding to these weights continental actual indicator values were 28.1 million \$ for Africa 1504.9 million \$ for Asia, 3847.3 million \$ for Oceania, 12,954.6 million \$ Americas and 14248,6 million \$ in Europe.

If we analyze the situation specific to 2011 reveals variations of indicator from 50.6 million \$ for Africa to 20,845.2 million \$ in the american continent, while the global level indicator achieved an amount of 46,847.6 million \$. Index structure is as follows: 0.11% Africa 3.27% Asia - 1536.4 million \$, 12.19% Oceania - 5709.2 million \$, 39.93% Europe - 18,706.2 million \$ and 44.50% Americas.

The average period is characterized by a total, global export of 36,827.4 million \$, in structure of which is recorded in mainland shares: 43.33% Europe (15956.1 million \$) 41.86% Americas (15415.8 million \$) 11.15% Oceania (4107.8 million \$), 3.55% Asia (1308.1 million \$), 0.11% Africa (39.6 million \$).

Regarding Romania's situation can be observed the following:

-Romanian exports of wheat values ranged from 422.7 million \$ in 2009 to 503.1 million

\$ in 2010, and the average of the period has been 452.2 million \$;

-Worldwide Romania held variables shares in total exports structure: 0.92% in 2011, 1.23% for the period average, 1.36% in 2009 and 1.54% in case of 2010.

Table 3 shows the trade balance achieved at the level of global wheat trade.

In the year 2009 world commercial balance was poor -6179.5 million \$, which is based on aspects deficits in Asia and Africa: -13542.2 and -9682.6 million \$. Rest of the world realized trade surpluses: 2597.9 million \$ Oceania, 7040.8 million \$ Europe and 7,406.6 million \$ Americas.

In 2010, the global commercial balance is deficient -3721.4 million \$, being determined by specific deficits in Africa and Asia: -9865.6 million \$ -11092.8 million \$. Reducing the trade deficit has been caused by two continents, achieved due to specific surpluses in Oceania, Europe and Americas - 3658.4, 6292.1 and 7286.5 million \$.

If we look at the specific situation of 2011, we see that it is still deficient (-4336.7 million \$) worldwide, which is determined by specific negative state of affairs for Asia and Africa:

-17,201.2 respectively -14,311.1 million \$. as in previous years, Oceania, Europe and Americas present excess balances (5452.0, 8103.8 and 13619.8 million \$), but it cannot compensate for deficits above.

Table 3. Wheat - Trade balance of world trade (2009–2011)

- Mil. \$ -

Specification	2009			2010			2011			Average 2009 – 2011		
	export*	import*	±**	export*	import*	±**	export*	import*	±**	export**	import**	±**
Africa	40,1	9722,7	-9682,6	28,1	9893,7	-9865,6	50,6	14361,7	-14311,1	39,6	11326,0	-11286,4
Americas	12447,8	5041,2	+7406,6	12954,6	5668,1	+7286,5	20845,2	7225,4	+13619,8	15415,8	5978,2	+9437,6
Asia	882,9	14425,1	-13542,2	1504,9	12597,7	-11092,8	1536,4	18737,6	-17201,2	1308,1	15253,5	-13945,4
Europe	14913,4	7872,6	+7040,8	14248,6	7956,5	+6292,1	18706,2	10602,4	+8103,8	15956,1	8810,5	+7145,6
Oceania	2766,9	169,0	+2597,9	3847,3	188,9	+3658,4	5709,2	257,2	+5452,0	4107,8	205,1	+3902,7
Total	31051,1	37230,6	-6179,5	32583,5	36304,9	-3721,4	46847,6	51184,3	-4336,7	36827,4	41573,3	-4745,9
Romania	422,7	108,4	+314,3	503,1	149,2	+353,9	430,9	172,9	+258,0	452,2	143,5	+308,7

* <http://faostat.fao.org/site/535/DesktopDefault.aspx?PageID=535#ancor>

** own calculations

Determining the average of the period it can be seen (Fig. 1) its poor character (-4745.9 million \$) determined by the following state aspect of things: -13,945.5 million \$ Asia; -11,286.4 million \$ Africa; 3902.7 million \$ Oceania; 7145.6 million \$ Europe; 9437.6 million \$ Americas.

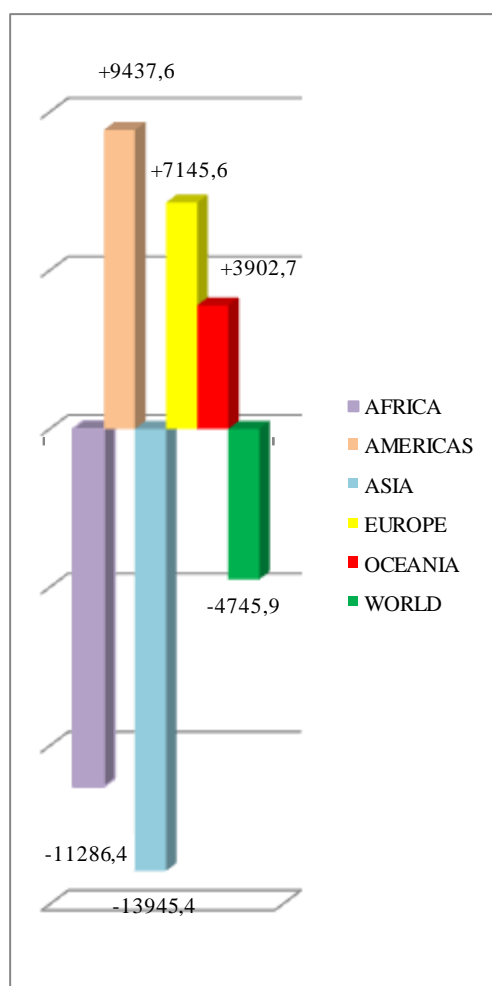


Fig. 1. World Trade Balance - period average (mil. \$)

Figure 2 presents the trade balance for wheat during the period analyzed (2009-2011).

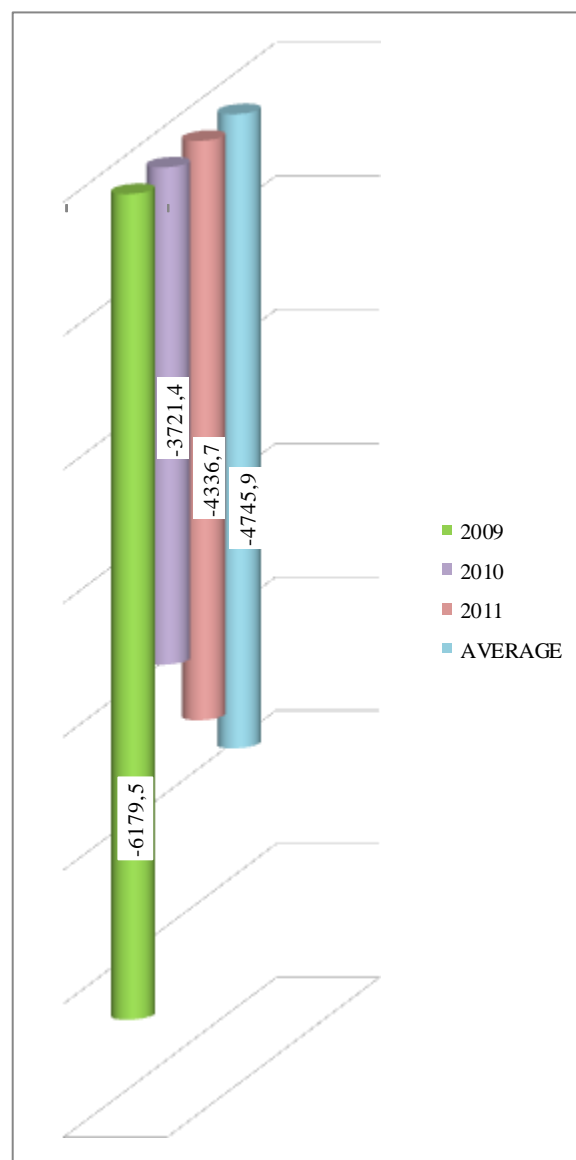


Fig. 2. World Trade balance - annual evolution (mil. \$)

For Romania (fig. 3) it can be seen that the trade balance of external trade, with wheat, is strictly in surplus: 258.0 million \$ 2011; 308.7 million \$ for period average; 314.3 million \$ 2009; 353.9 million \$ in 2010.

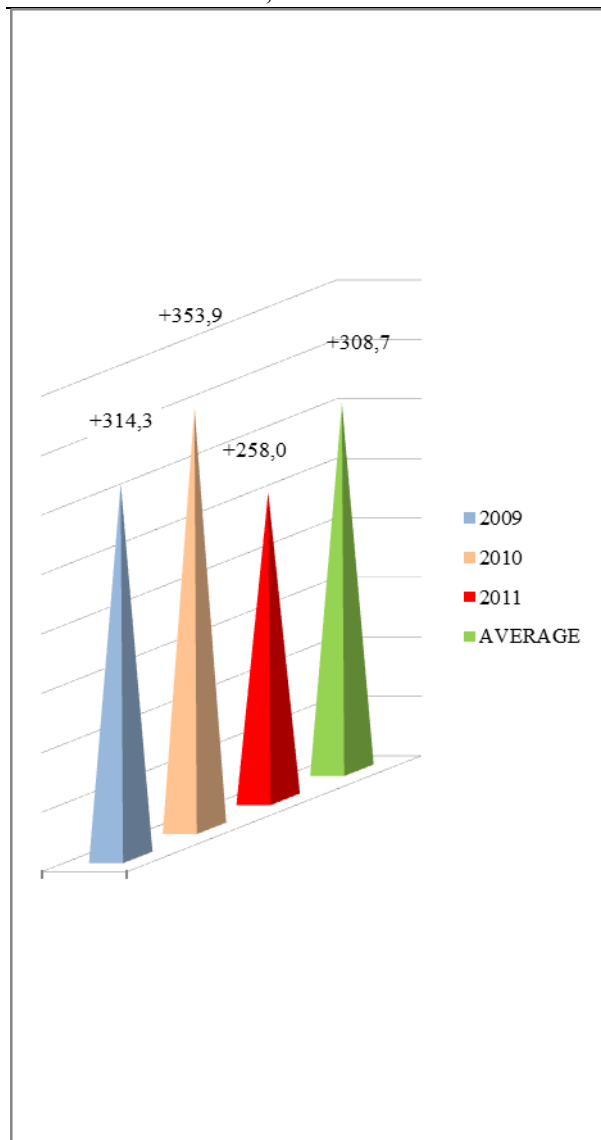


Fig. 3. Romania. National Trade balance (mil. \$)

CONCLUSIONS

Regarding import situation appear the following conclusions:

-value of imports was dominated by operations in Asia, Africa and Europe - weights of 36.69, 27.24 and 21.19% (increased weights in Asia and Africa, declines in Europe compared to the quantities imported). Therefore it can be concluded that African and Asian markets trading unit prices are higher than European markets level;

-dynamics of wheat imports has been uneven worldwide, similar to the situation in Asia. For other continents the indicator ranged ascending;

-Romania is not a major player, in terms of

imports, the global market share accounting for 0.44 and 0.35% respectively of the quantities imported values - even less beneficial. Changes in indicators was one uneven - both quantitative and ascending - at value level during the period. When referring to the case of exports, there are a number of outstanding issues such as:

- world exports were dominated by Europe and America (43.33 and 41.86% respectively), with a downward trend in the share of Europe and growth share in Americas (compared to the specific situation of the quantities exported);

-evolution in time of the indicator is ascending, the essential difference manifested for Europe (uneven trend with ascending aspects);

-as for imports and exports Romania is a major player in the global market (average weights of 1.45 and 1.23% respectively for quantities exported values) - favorable situation.

In terms of trade balance for trade in wheat, the situation existing global and national sequence is characterized by:

✓ the weak global balance, dominant phenomenon (-4745.9 million. \$);

✓ analyzing the situation in each continent stands out the exceeding situations specific to Oceania, Europe and Americas. Unfortunately they could not offset the decisive deficits, consistent, on Africa and Asia;

✓ Romanian trade balance surplus is strictly a phenomenon that emphasizes the ability of our country to ensure their consumption needs from their own production.

Appear though often problems with the quality of production and sales prices, in some cases, making the market to have difficulties in ensuring adequate domestic consumer demand.

REFERENCES

- [1]Barbu, C., Pânzaru, R. L., 2000, Agrarian economy, Ed. Hyperion, Craiova, Chapter 8, Part II, p. 125 -168
- [2]Miron, D. et al., 2005, EU Economy, Ed. Luceafărul, Bucharest, p. 486, cited by Letitia Zahiu et al., 2006, European Union Agriculture under the impact of the common agricultural policy, Ed. Ceres,

București, Chapter XII, p. 330-352

[3] Zahiu Letiția et al., 2006, European Union agriculture under the impact of the Common Agricultural Policy, Ed. Ceres, București, Chapter XII, p. 330-352

[4] <http://faostat.fao.org>

INTERNATIONAL COMMERCIAL TRADE WITH POTATOES (2009 - 2011)

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Abstract

The paper refers to the situation related to the potato world trade, 2009-2011. Defining aspects of this issue begin by presenting the sequence of continental entities defined by the FAO (Africa, Americas, Asia, Europe and Oceania), and then presents the study of global imports and exports, and positioning Romania in performing acts of international exchange - in the context of those mentioned above. During the material, given the composition of the trade balance of international trade presents strict export and import situation - in terms of value, subject to quantitative aspects of other scientific approaches. This (look value) is more relevant to what is happening on the international market.

Keywords: export, import, potato, trade balance

INTRODUCTION

Potato production are important for food, industrial, technological agricultural technology, fodder export item and source of profit [2].

Potato is part of agricultural and food products group, which determines subordination to international trade principles. Trade in agricultural products and foodstuffs play in ancient times an important place in the global economy. In the short and medium term agricultural trade is characterized by fluctuations and tensions, and long-term by disparities and gaps between rich and poor, between different areas and geographic regions.

In recent decades, world trade has grown significantly, and the globalization of economies. Need parts for agricultural products is determined by the uneven spread of food sources and hence food resources. Agricultural trade expansion was faster than agricultural production, which shows increasing interdependence between countries and increasing global economic integration [3].

Regarding the export of agricultural products, it should be understood that all commercial operations through plant and animal products

- unprocessed or processed in varying degrees
- are sold on the external market.

Factors that influence the export of agricultural products of vegetable and animal are:

- supply and demand of the internal market of agricultural products - direct and indirect supply for industrial population;
- changes in demand and supply on the world market of agricultural products [1].

The idea of focusing on international trade situation, are taken into account a number of issues, related to states or groups of states.

Therefore "the basic principles of EU trade policy are related to uniformity (uniqueness) and group-level rules of EU competence. According to Article 113 of the Treaty of Rome CCP is built on common principles regarding changes in tariff rates, trade and tariff agreements.

Develop and adopt customs and trade policy measures against third parties and the signing of tariff and trade agreements are the European Union and not attribute to the Member States "[3].

MATERIALS AND METHODS

For the design and implementation phase of the work has traveled documentation by using

statistical reporting [4]. We used a system of indicators related underlining some agricultural trade system into practice by the United Nations Food and Agriculture Organization - FAO.

Therefore data were collected on the volume value of potato imports and exports made global world and five major continental units (Africa, Americas, Asia, Europe and Oceania). The study highlights Romania's position on the world market in terms of foreign trade.

The data collected and analyzed, covers the period 2009-2011, dealing with the average period. Average was established according to the following relation for calculating:

$$A = \frac{X_1 + X_2 + \dots + X_n}{n}$$

The indices are marked by using fixed-base indices, which allow comparison - over time - the phenomenon analyzed.

RESULTS AND DISCUSSIONS

Table 1 presents the evolution and structure of global imports.

The year 2009 is characterized by a total value of imports of 3284.6 million. \$ Value is based on the contributions continental point as follows: 11.1 million, \$ Oceania (0.34%), 354.8 million, \$ Africa (10.8%), 384.5 million, \$ Americas (11.71%), 429.0 million, \$ Asia (13.06%), 2105.2 million, \$ Europe (64.09 %).

For 2010 there is a total value of world imports of 3759.0 million \$, whose structure is based on the percentage contribution of 62.98% Europe - 2367.5 million \$, 18.18% Asia - 683, 4 million \$, 10.08% Americas -

378.9 million \$, 8.42% Africa - 316.4 million \$, 0.34% Oceania - 12.8 million \$.

If we analyze the situation of 2011 can be seen that in each continent there were different values of the indicator, from \$ 16.5 million for Oceania (0.33%) to \$ 3,331.0 million for Europe (67, 48%). The rest of the world have experienced levels of indicator 387.4 million \$ Africa (7.85%), 480.7 million \$ Americas (9.74%) and 720.9 million \$ Asia (14.60%). The total value of the indicator was 4,936.5 million \$.

Average period are characterized by a total world imports of 3993.4 million \$, from which at each continent are included contributions effective variables (fig. 1): 13.5 million \$ Oceania (0.34 %), 352.9 million \$ Africa (8.84%), 414.7 million \$ Americas (10.38%), 611.1 million \$ Asia (15.30%), 2601.2 million \$ Europe (65.14%).

Romania has contributed in varying proportions to achieving global level indicator (fig. 2): 13.9 million \$ in 2009 to 0.42%, 15.5 million \$ in the year 2010 to 0.41%, 32 7 million \$ for the year 2011 to 0.66% to 20.7 million \$ for period average - 0.52%.

Table 2 presents the potato exports and food aid developed worldwide.

In the case 2009, the index ranged from 26.6 million \$ in Oceania, to 2071.5 million \$ in Europe, and the overall level indicator reached \$ 3057.7 million. Therefore are found variables continental weights in total, as follows: 0.87% Oceania, 5.53% Africa - 169.1 million \$, 11.65% Americas - 356.3 million \$ 14.20 % Asia - 434.2 million \$ and 67.75% Europe.

Table 1. Potato - Imports worldwide (2009-2011)

Specification	2009			2010			2011			Average 2009 – 2011		
	Mil. \$*	Str. %**	Din. Ibf**	Mil. \$*	Str. %**	Din. Ibf**	Mil. \$*	Str. %**	Din. Ibf**	Mil. \$**	Str. %**	Din. Ibf**
Africa	354,8	10,80	100	316,4	8,42	89,2	387,4	7,85	109,2	352,9	8,84	99,5
Americas	384,5	11,71	100	378,9	10,08	98,5	480,7	9,74	125,0	414,7	10,38	107,9
Asia	429,0	13,06	100	683,4	18,18	159,3	720,9	14,60	168,0	611,1	15,30	142,4
Europe	2105,2	64,09	100	2367,5	62,98	112,5	3331,0	67,48	158,2	2601,2	65,14	123,6
Oceania	11,1	0,34	100	12,8	0,34	115,3	16,5	0,33	148,6	13,5	0,34	121,6
Total	3284,6	100	100	3759,0	100	114,4	4936,5	100	150,3	3993,4	100	121,6
România	13,9	0,42	100	15,5	0,41	111,5	32,7	0,66	235,2	20,7	0,52	148,9

<http://faostat.fao.org/site/535/DesktopDefault.aspx?PageID=535#ancor>

** own calculations

If we look at the specific situation of 2010, it is clear that the overall index was 3620.0 million \$, where continents have made contributions: 2477.1 million \$ Europe -

68.43%, 577.8 million \$ Asia - 15.96%, 363.3 million \$ Americas - 10.04%, 167.4 million \$ Africa - 4.62%, 34.4 million \$ Oceania - 0.95%.

Table 2. Potato - Worldwide exports (2009-2011)

Specification	2009			2010			2011			Media 2009 – 2011		
	Mil. \$*	Str. %**	Din. Ibf**	Mil. \$*	Str. %**	Din. Ibf**	Mil. \$*	Str. %**	Din. Ibf**	Mil. \$**	Str. %**	Din. Ibf**
Africa	169,1	5,53	100	167,4	4,62	99,0	305,8	6,72	180,8	214,1	5,72	126,6
Americas	356,3	11,65	100	363,3	10,04	102,0	482,1	10,60	135,3	400,5	10,70	112,4
Asia	434,2	14,20	100	577,8	15,96	133,1	751,3	16,51	173,0	587,8	15,70	135,4
Europe	2071,5	67,75	100	2477,1	68,43	119,6	2970,8	65,30	143,4	2506,5	66,98	121,0
Oceania	26,6	0,87	100	34,4	0,95	129,3	39,4	0,87	148,1	33,5	0,90	125,8
Total	3057,7	100	100	3620,0	100	118,4	4549,4	100	148,8	3742,4	100	122,4
România	1,0	0,03	100	2,6	0,07	260,0	3,2	0,07	320,0	2,3	0,06	230,0

* <http://faostat.fao.org/site/535/DesktopDefault.aspx?PageID=535#ancor>

** own calculations

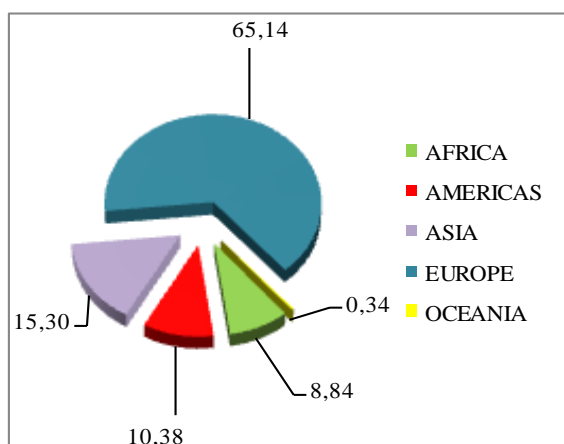


Fig. 1. The structure of world imports - the average period (%)

Oceania (0.87%) to 2,970.8 million \$ at European level (65.30%). Rest of the world have been 305.8 million \$ Africa (6.72%), 482.1 million \$ Americas (10.60%), 751.3 million \$ Asia (16.51%).

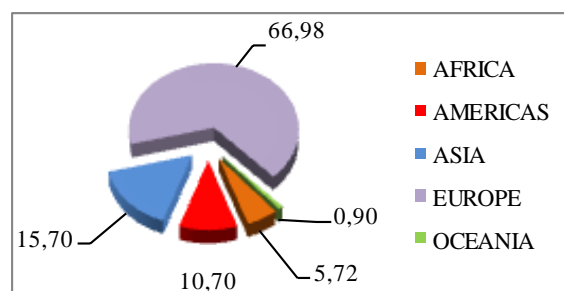


Fig. 3. Structure of world exports - average for the period (%)

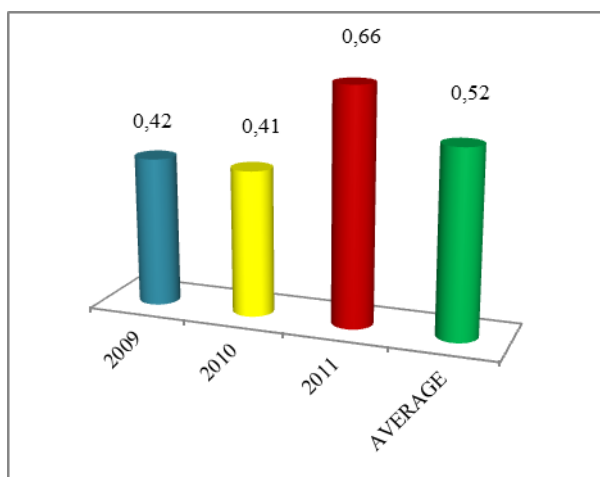


Fig. 2. Romania – share in global structure (%)

For 2011 it can be observed a variation of, level indicator, from 39.4 million \$ for

Talking about the average period is found that worldwide the indicator reached a level of 3742.4 million \$ Level is based on percentage contributions - continental - variables (fig 3): 0.90% Oceania (33.5 million \$), 5.72% Africa (214.1 million \$) Americas 10.70% (400.5 million \$), 15.70% Asian (587.8 million \$) 66.98% European (2506.5 million \$). For Romania it can be seen an average indicator 2.3 million \$ (0.06% compared to the worldwide), which is based on average annual contribution of 1.0 million \$ In 2009 (0.03 %), 2.6 million \$ in 2010 (0.07%), 3.2 million \$ for 2011 (0.07%) - figure 4.

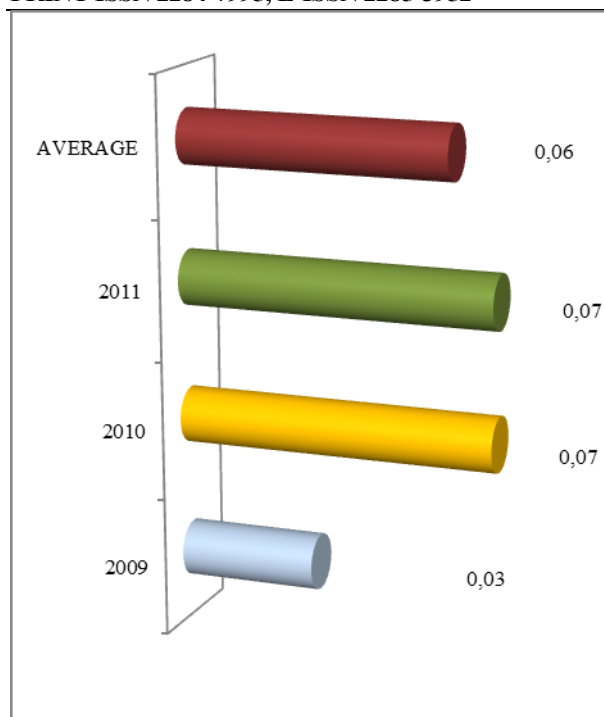


Fig. 4. Romania - share in the global structure of exports (%)

Table 3 shows the trade balance global exchanges of the product made to the level of potato.

Table 3. Potato - The commercial balance of world trade (2009-2011)

- Mil. \$ -

Specification	2009			2010			2011			Average 2009 – 2011		
	export*	import*	±**	export*	import*	±**	export*	import*	±**	export**	import**	±**
Africa	169,1	354,8	-185,7	167,4	316,4	-149,0	305,8	387,4	-81,6	214,1	352,9	-138,8
Americas	356,3	384,5	-28,2	363,3	378,9	-15,6	482,1	480,7	+1,4	400,5	414,7	-14,2
Asia	434,2	429,0	+5,2	577,8	683,4	-105,6	751,3	720,9	+30,4	587,8	611,1	-23,3
Europe	2071,5	2105,2	-33,7	2477,1	2367,5	+109,6	2970,8	3331,0	-360,2	2506,5	2601,2	-94,7
Oceania	26,6	11,1	+15,5	34,4	12,8	+21,6	39,4	16,5	+22,9	33,5	13,5	+20,0
Total	3057,7	3284,6	-226,9	3620,0	3759,0	-139,0	4549,4	4936,5	-387,1	3742,4	3993,4	-251,0
România	1,0	13,9	-12,9	2,6	15,5	-12,9	3,2	32,7	-29,5	2,3	20,7	-18,4

* <http://faostat.fao.org/site/535/DesktopDefault.aspx?PageID=535#ancor>

** own calculations

At the level of average of the period (fig. 5) there is a balance of trade deficit (-251.0 million \$), a situation that is based on the continental level: 20.0 million \$ Oceania, -14.2 million \$ Americas, 23.3 million \$ Asia -94.7 million \$ Europe -138.8 million \$ in Africa.

Figure 6 shows the evolution of the potato trade balance during the period analyzed (2009-2011).

At the national level can be seen that the balance of trade in potatoes is strictly poor, negative aspect. Deficient character is manifested throughout the period analyzed

The commercial balance of global exchanges in potatoes was poor in 2009 (-226.9 million \$), this situation is caused by surpluses recorded for Asia and Oceania - 5.2 and 15.5 million \$ respectively and especially specific deficits for the remaining continents: -28.2, -33.7 and -185.7 million \$ recorded in Americas, Europe and Africa.

For 2010, the trade balance maintains its poor character (-139.0 million \$) aspect specific determined by deficits in Africa, Asia and Americas (-149.0, -105.6 and -15.6 million \$ respectively). The balance has been in surplus for Europe and Oceania - 109.6 and 21.6 million respectively. \$.

When referring to the situation 2011 can be seen that only appear two continents with trade balance deficit - Africa and Europe (-81.6 million \$, -360.2 million \$ respectively), While the surplus character is specifically for Americas, Oceania and Asia - 1.4, 22.9 and 30.4 million \$. Therefore we discuss a global trade balance deficit (-387.1 million \$).

(fig. 7) \$ -12.9 million in 2009 and 2010, \$ -29.5 million in 2011, \$ -18.4 million for the period average.

CONCLUSIONS

For imports appear as defining the following aspects:

- from value point of view imports were dominated still of Europe and Asia (65.14%), the lowest percentage recorded an Oceania (0.34%). Rest of the world reached nearly 35%;

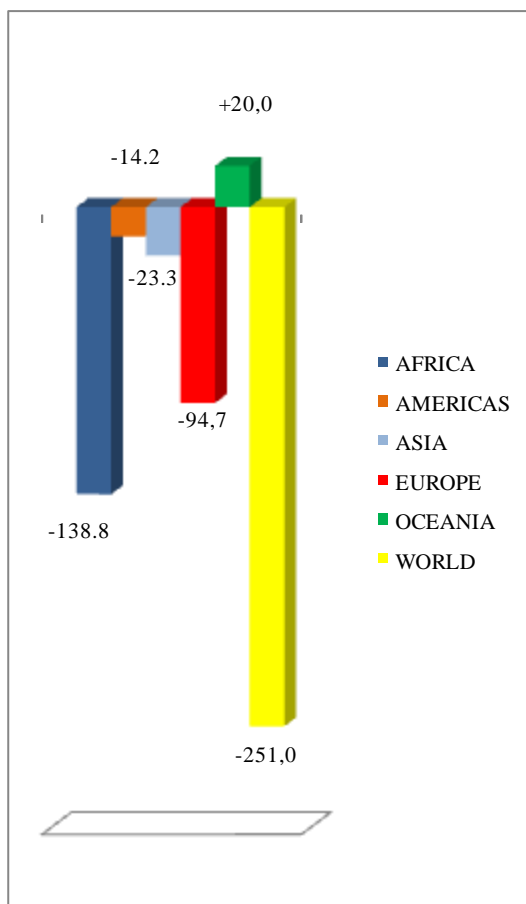


Fig. 5 World commercial balance - period average (mil. \$)

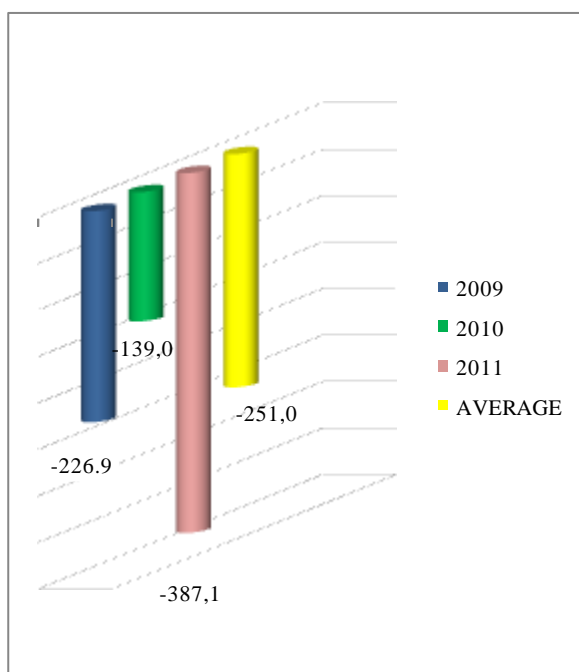


Fig. 6 World commercial balance - annual trend (mil. \$)

- Romania is part, worldwide, with a share of 0.52% slightly lower than imports existing quantitative;

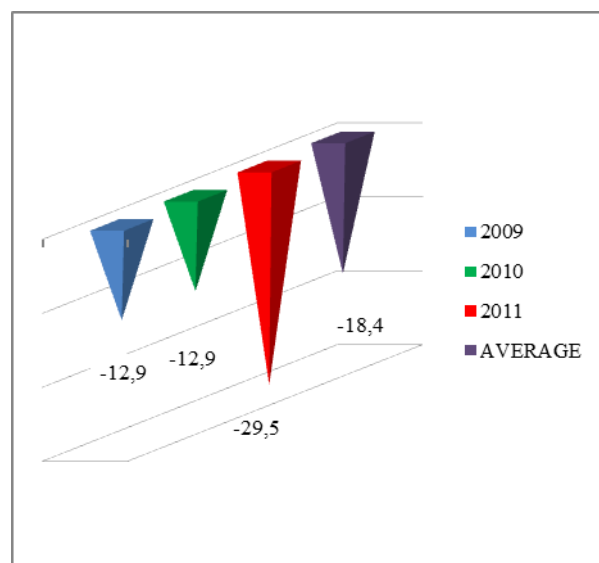


Fig. 7. Romania. National commercial balance (mil. \$)

- the dynamic of the indicator is ascending; this trend was not observed for African and American continents - uneven trend.

When referring to the case of exports, there are a number of features such as:

-major global player remains Europe, followed at a considerable distance from Asia - 66.98 and 15.70% respectively (compared to the share decline at the level of index expressed quantitative). Rests of the world have experienced increases in worldwide weights compared to the quantities exported situation: Oceania from 0.56 to 0.90%, Africa from 4.37 to 5.72%, from 8.86 to 10 Americas, 70%;

-the dynamics of index it is one ascending worldwide similar to the situation of the indicator expressed in quantitative units.

Regarding the trade balance of global exchanges can distinguish the following:

- worldwide balance is strictly poor, both average and sequentially;

- this state of affairs is due to the deficit, especially in Africa, but also for Europe, Asia and Americas;

- Oceania is the only entity that has a surplus balance, both sequentially and averaged;

- generally the level of trade balance has evolved unevenly for Americas, Asia and Europe (both deficit and surplus), and consistently Africa (only deficits) and

Oceania (only surpluses);

- nationally, we can say that the situation is unfavorable, the weak balance being permanent.

REFERENCES

[1]Barbu, C, Pânzaru, R.L, 2000, Agricultural Economics, Ed. Hyperion, Craiova, Chapter 8, Part I, p. 110-123

[2]Pânzaru, R.L, Medelele, D.M, Ștefan, G., 2009, The Economics of crop production, Ed. Universitaria, Craiova, Chapter 3, p. 141-188

[3]Zahiu Letitia et al., 2006, EU Agriculture under the impact of the common agricultural policy, Ed. Ceres, București, Chapter XII, p. 330-352

[4] <http://faostat.fao.org>

STUDIES ON THE FORMATION AND SPREADING OF THE MINERAL SOIL SLOPES IN CARAS-SEVERIN

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Abstract

Since ancient times, man has been preoccupied with knowledge of the origin and composition of the Earth, the great variety of rocks and minerals from which it is made. Over time, the Earth's surface has undergone major changes, changes due largely to various processes and climate phenomena that have succeeded in over millions of years. The term geological processes formed the rock new mineral deposits, which led ultimately to change the soil composition. The feedstock mineral soil resulting transformation is known as the parent rock or mother rock. In soils, rock or parent material, begins where biotic factor intervenes not exactly the depth at which the influence of living organisms (whether microorganisms, animals or roots, disappears. It is therefore the depth at which the content of organic matter is insignificant in terms of fertility of the soil. In the formation and spread of the mineral part of the soil, the first attempts were as starting point pedogenetical one or more factors, which led to a multiplicity of concepts and formulations. Among the first who realized pedologists such studies included the N. FLOREA, stating in 1985 that the formation of soil cover, in addition to pedogenesis processes involved and some geological processes that interfere with the formation of soil cover and they called processes pedogeological. To explain the genesis of soils and for determining their time evolution, both in natural conditions and in terms of their use by humans, it is necessary to analyze the specific and coordinated actions of all the factors involved in these processes (by Gh. IANOȘ and et Al., 1995).

Key words: fertility, mineral deposits, rock, soil

INTRODUCTION

In terms of geomorphology relief Caras-Severin is characterized by a great variety of forms: mountains 65,4% depressions, 16,5%, hills 10,8% and plains 7,3%.

Space mountain range comprises many groups belonging to the following geographical units: The Banat Mountains - compartment which includes: the Semenice Mountains, the Almaj Mountains, the Locvei Mountains, the Anina Mountains (Caras Mountains), the Dognecei Mountains; the western group of Southern Carpathians include: the Cerna Mountains, the Mehedinți Mountains, the Țarcu Mountains, the Small Mountain, the Southern peaks Poiana Rusca Mountains.

Hills have a relatively limited spread within the county. Major units are the Bozoviciului Hills, the Oravița Hills, the Doclin Hills and the Sacos – Zăgajeni Hills.

Plains form the lowest step of the relief, which occupies a small area within Timis Plain, with the following subunits: the Plain

between the rivers Pogăniș and Bârzava coffer; the Moraviței Plain situated at South from the Bârzava River; the Caras Plain drained by the river with the same name.

Banat relief arose after a lengthy trial period accompanied by morphological and morpho-tectonic sculptural modeling units formed. Genesis relief Banat is closely linked to the dynamics of the base plate. The mountain area is composed of crystalline rocks foundation formed by the metamorphosis of the old Paleozoic sediments and precambian during hercynian orogenesis.

MATERIALS AND METHODS

This paper is based on the selective evaluation of data from the literature on general and specific fundamental aspects concerning the formation and spread of the mineral part of the soil in Caras –Severin.

In order to establish the main specific minerals and rocks in the studied area, in addition to study literature, there have been

numerous trips in the study zone.

To determine the mineral and rock properties were studied them both with naked eye and with a magnifying glass. In addition to this simple method, to study in detail of the minerals have been used more accurate methods, microscopy, cristalo-chemicals, thermal and chemical properties. The morphological properties are related to the physical state of the mineral, their mode of presentation input, habitus and pairing mode. The main feature is that the mineralogical microscope using polarized light.

Transparent minerals are studied using transmitted light microscopes mineralogy. To study different types of minerals transparent constructive use of polarizing microscopes, including Leitz - Wetzlar, MIN, AMPLIVAL etc.

In order to make the mineral microscopic observations, it is necessary that they be prepared in advance in the form of thin sections transparent to allow light to pass through. These thin sections are obtained as follows: cut the sample to be investigated piece thinning by grinding to polishing, to obtain two flat surfaces. Opaque minerals are studied using reflected light by calcograhycs microscopes.

Some minerals, such as Azurite (blue) and malachite (green) can be identified on the basis of color. But color can often be misleading because many minerals may occur in varied colors. These variations may be due to: the impurities, heat, light, irradiation, and aging.

Determination of mineral properties is through the knowledge of individuals: - color - gloss - breach (fresh, unoxidized) - hardness - cleavage (burst mode), density, magnetic properties and radioactives etc.

RESULTS AND DISCUSSIONS

In terms of the constitution geological Poiana Rusca Mountains are three main assemblies lithological formations:

- Metamorphic formations spread across most of the area with mountainous;
- In the southern half of the mountains, south

of alignment Tâncova - Ruschita, marked by several major tectonic dislocations, flourish intensely metamorphosed rocks, known as the "lens tems". These shales are represented by mica granite, gneiss and gneiss eye. Metamorphic age of these formations is estimated at 850,000-1,000,000 years. Magmatic formations with limited distribution are represented by massive Granodiorite intrusive occurring Vârciorova Valley. Sedimentary occur in peripheral areas hilly and sedimentary basins. Within these formations are two main associations of rocks with different effects on modeling relief: highly consolidated rocks, represented by Jurassic limestone, sandstone and marl Cretaceous conglomerates and poorly consolidated rocks represented by marl and sandstone sandy, sands and gravels age myo-Pliocene. Jurassic limestones forming steep wooded valley Vălișoara left side and white cliffs, isolated southwest of Rusca Montana. Țarcu Mountains are founded on local geological lens of Retezat massif.

Petrographic constitution of local mountain is represented by chlorite - sericite schists, quartzites and age amfilolite autihercinic with intercalations of crystalline limestone. In some areas dominated gneiss and granodiorites textured borders. Over the Bistra Mărului Valley insertions are powerful Dorit (Boșcaiu N., 1971). Even before the main orogenic mezocretatic phase over autochthonous crystalline lodged infragetic series of sedimentary deposits. Clearing areas of Mesozoic Mărului consist of black shale and phyllite belonging to this series.

The chemical composition of rocks (Table 1), can greatly influence soil nutrient content and pace of soil formation. Such influence have rocks with complex mineralogical composition, such as loess, which is formed fertile soils. If calcium carbonate-rich rocks in sodium, iron oxides, stands clearly influence their chemical composition, the rate of soil formation and soil composition results. Soil reaction printed by its parent rock may affect the mobility of elements: for example, phosphorus has a higher mobility in the pH

range of 5.5 to 7.0.

Oprea (1960), based on lengthy research, says the rocks which have in their composition sodium behave like rocks of delay the process of soil formation, and those containing calcium acts as rocks favoring these processes.

Apart from the direct influence of soil chemistry, mineralogy of rocks, especially the clay fraction, prints certain peculiarities of physical properties of soils.

Table 1. The main types of soils, materials, parental rocks and minerals prevalent in them (after G. Găță 1973, cited by C. Chiriță, 1974)

Soils	Materials and parental rocks	Minerals
Kastanoziomur, chernozem and chernozem leachates	Loess and loess materials	Diocedric vermiculite, illite, interstratificații
	Proluvial and alluvial deposits with medium texture	Montmorillonit vermiculite, illite and interstratificații
Sands and soils formed on sand	Sand	Illite, vermiculite, interstratificații
Preluvissols and chernozem	Loess and loess materials	Diocedric vermiculite, illite, interstratificații, chlorite
	Sedimentary deposits with medium texture	Diocedric vermiculite, illite, interstratificații, montmorillonite
Prepodzoluri and podzols clay illuviated	Sedimentary deposits with medium texture	Diocedric partially chloritized vermiculite, illite, interstratificații
	Compacted sands, sandstones	Chloritized vermiculite, chlorite, illite, interstratificații
Districambisoluri and prepodzoluri, humic podzolic-feriluviale	Micașturi	Illite, vermiculite, minerals mixed
	Granite, gnaissuri	Partially chloritized vermiculite, illite, mixed mineral
	Chlorite schists, sandstones with chlorite cement	Chlorite partially vermiculizat, illite, mixed mineral
Brown soils (mountain)	Andesite, basaltic rocks	Partially chloritized vermiculite, illite, interstratificații, montmorillonite
Humosiosoluri	Granite, gnaissuri	Chloritized vermiculite, illite, mixed mineral
Soils formed on tuffs	Tuffs, pyroclastic materials	Montmorillonite, illite, interstratificații
Rendzinic and pseudorendzine	Marly clays, marl, limestone	Diocedric vermiculite, montmorillonite, illite, interstratificații
Vertisols	Clay, loamy clays carbonate	Diocedric vermiculite, illite, chlorite, interstratificații
soils halomorfe	Marly clays, marl Salif	Montmorillonite, illite, vermiculite, interstratificații

Some processes, including bioaccumulation, are strongly influenced by the nature of the parent rock, which prints the specific morphology of the soil profile, hence the name lithomorfe soils.

Calcareous rocks in humid regions where leaching process is particularly active, release large amounts of calcium ions, which will saturate organic acids and mineral colloids

will give stability during the process of soil formation resulted. Through such action, such soils are formed rendzines the site of Albic Luvisols also rich in ferric oxides in rocks, soils evolve well stocked in iron as preluvisols, preluvisols redheads and on rocks rich in soluble salts is formed halomorfe soils, such solonchaks and aquisals (Obrejanu, G., Puiu, S., 1972). The chemical properties of rocks and especially exert an indirect influence. This is reflected by the vegetation. The chemical composition of the rock is reflected in the composition of the plant and the dead organic matter in the soil quality, which in turn affects the composition of humus.

From what it appears that rock soil can print some specific features. However, the influence of generating the ground rock is subject to other factors, the decisive factor is the influence of bioclimatic.

Following the movements made in the field was recognized today: borders, granitoids, dacites, quartz porphyry, diorite, debris, conglomerates, boulders, sandstones, sands, clays, marls, clays, limestone, tuff, limestone, quartzite, sericites schists and the chlorite, crystalline limestones and pegmatites many objects of dimensions of a few tens of centimeters to several tens of meters. In no event was highlighted that the presence of microcline porphyroblasts varieties (or other minerals) to discordant note in terms of size. As a result, choosing the terminology proposed by Ianovici et al. (1976), all samples of granitic rocks have been classified as solid (granular) or gneiss (schist) from the time of procurement.

Macroscopic study of samples taken showed that the granitoids gneiss texture is determined by the arrangement oriented micaceous minerals. Meanwhile, it was observed that the varieties gneiss rock, with biotites (major mineral) and muscovite occurs participation reducing its quantity from east to west. In some cases (mostly in the central parts of the massif) distinguish textural varieties of granite gneiss and massive but not exactly easy on macroscopic considerations. The mineral soil comes from rocks that make

up the lithosphere, subject to various physical and chemical processes of transformation through environmental factors. These transformations take place with different intensity depending on the nature of the mineral material originally. Minerals are inorganic, solid, homogeneous physico-chemical. They are classified according to the chemical composition of the five classes, the last oxygen salts, including the most common minerals in the lithosphere. We mention that silicates, which make up 75% of the weight of the lithosphere and all components are mineral rock.

Following alteration and disintegration resulting borders loam soil sandy or clayey, rich in potassium, phosphorus and moderately stocked poor in calcium. These soils have a low to medium fertility. In the Western part of the country there is a variety of granodioritic rocks called banned.

Soils formed on granodiorites are soils with a sandy loam to loamy, rich in calcium, the diorite are formed on soils rich in hydroxides of iron, calcium and other nutrients textured loamy to clayey and fertility good natural. On these rocks are formed shallow soils rich in skeleton (litho) and wetlands formed districambosols podzols and low in minerals. In the lowlands, the deposits of gravel and limestone boulders forming rendzines. Sands are spread along rivers in the county and are of several types: limestone, quartz, ferruginous, micaceous, dolomite etc. After their origin, sands can be: alluvial, wind, moraine, abysmal and so on, and the size of the particles, sand can be: fine and coarse. The sands and sandstones formed sandy soil type and psamo-pelitic alluvisols, permeable soils with a brief profile on the plains and long hills and hillocks. These are soils with different fertility according to the state of solidification and mineralogical nature of the sands.

Of metamorphic rocks, quartz rock, hard rock disaggregated and are practically not altered. Following the disintegration give rise to quartz sandy sediments are therefore unsuitable for soil formation. Hard rock sericites schists are perishable. Soils formed on clayey soils they are superficial, low

calcium and phosphorus. These soils have low fertility. Chlorite schists from disintegration and alteration processes give rise to a material fine, loamy, rich in nutrients.

Crystalline limestones are composed of calcite, quartz, talc, chlorite, hematite or coal. Because impurities embedded in them, marbles have different colors. At Rușchița, their color is pinkish white and has a lower duriorate compared to other crystalline valcare.

CONCLUSIONS

Banat relief arose after a lengthy trial period accompanied by morphological and morpho-tectonic sculptural modeling units formed. Genesis relief Banat is closely linked to the dynamics of the base plate. The mountainous area, which occupies 65,4 % of the Caras-Severin, (followed by depression, 16,5%; hills 10,8%, and plains 7,3%) has its foundation composed of crystalline rocks formed by the metamorphosis of old Paleozoic sediments and precambien during hercynian orogenesis.

The area has a rocky foundation, generally built of crystalline limestone, mica and volcanic and sedimentary formations, is a mixture of metamorphic, sedimentary precipitation over the valley and metamorphic Bistra, above the alpine and subalpine.

These are covered by colluvial slopes and terraces and eluvium coarse (cobble), the valley is largely covered by a thin blanket of clay dust.

Of igneous rocks encountered in the study area, granodiorites family, there is a variety of rocks called Banat unique to this area.

The fertility of the soil in the area is different in rock or mineral according to which they were formed.

REFERENCES

- [1]<http://webmineral.brgm.fr:8003/mineraux/Main.html>
- [2]Florea, N., 1985, Concept development of soil and soil cover, soil science, no. 1, 10-32
- [3]Florea N., 1992, Grouping rocks in terms of pedogenesis, the report of the Committee of Geology, vol Bucharest, 443-460
- [4]Ianoș, G., Goian, M., 1995, Banat - genesis and soil agrochemical characteristics Publishing Mirton,

Timisoara

[5]Lazarescu, V., 1980, Physical Geology. Technical Publishing House, Bucharest

[6]Mihailescu, N., Gregory, I., Schmiedigen, V., 1957, Natural stone construction. Technical Publishing, Bucharest

[7]Mihuț Casiana, Radulov Isidora, 2012, Soil Sciences. Ed Eurobit, Timisoara

[8]Mutihac, V., 1990, The geological structure of the territory of Romania, Technical Publishing House, Bucharest

[9]Rogobete, G., 1994, Soil Science Publishing Mirton, Timisoara

[10]Săndulescu, M., 1984, Geotectonics of Romania. Technical Publishing House, Bucharest

[11]Tataram, N., 1984, Stratigraphic Geology and Paleogeography, Vol.I., Technical Publishing House, Bucharest

[12]Tataram N., 1988, Stratigraphic Geology and Paleogeography, Vol. II, Technical Publishing House

STUDIES AND RESEARCH ON THE SOILS COATING FROM ZAVOI COMMUNE, CARAS - SEVERIN COUNTY

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Abstract

The soil is considered as a great wealth of mankind and its protection and rational use of stringency is for each of us. The soil is involved in society, established in the area of human settlement and infrastructure for all human activities contributing to the achievement of all requirements of society and the continuity of life on Earth. Investigation was carried out jointly Zăvoi, Caraș-Severin and soils studied were: Aluviosoil, Districambosols, Eutricambosols, Luvosols and on limestone, intrazonal, meet Rendzina and Gleysol in lower areas. The most common pedogenesis processes that influence soil development in the territory are: bioaccumulation is argilization, argilloiluviation, migration and accumulation of carbonates, processes and stagnogleyization gleyization, the contractilo-inflating etc.

Key words: porosity of aeration, soil, studies, total porosity

INTRODUCTION

The Zăvoi commune is located in the Bistrica corridor and belongs to the Caraș-Severin County which is located in the south-west extremity of the country. County is bordered to the Northwest and North with Timiș County, North-East with Hunedoara County, to the east with Gorj County, South-East with Mehedinți County, in the South with the Danube River and in the South-west with Serbia.

The Zăvoi Commune consists of six localities: Zăvoi, commune residence, Măgura, Măru, Poiana Mărului, Bistra and Voislova.

In terms of geomorphological the Zăvoi Commune is located in the depression corridor of the Bistra, bounded to the East and Southeast by the Țarcu Mountains, in the north by the Poiana Rusca Mountains, in the west by the Sacos-Zăgujeni hills and communicate with Timis depression.

MATERIALS AND METHODS

Following the movements made in the field, soil samples were taken which were brought to the laboratory's research in the discipline of Soil Science USAMVB, "King Michael The

First of Romania" from Timisoara and prepared for analysis, determining the next indicators: the composition size, bulk density, specific gravity, determination of soil reaction, hydrolytic acidity, total exchange acidity, the determination of humus, total nitrogen, alkaline earth carbonates, phosphorus and moving potassium.

The following determinations were done: total porosity, the porosity of aeration, field capacity, the capacity of useful water; fading coefficient, supply of mold (t/ha) of Nitrogen index (IN) and the degree of compaction.

RESULTS AND DISCUSSIONS

The Zăvoi Commune is bordered to the north by Rusca Montana Commune, to the East by the Marga and Bautar Communes, then with Gorj and Hunedoara counties to the South-East, in the South-West with Teregova commune, in the West by the Bolvașnița, Turnu Ruieni, Obreja commune and Oțelu-Roșu city (Fig. 1.).

Maru Village is situated along the Bistra River, DJ 683 to Poiana Mărului at a distance of about 7 km from the commune residence.

The main watercourse crossing from East to West Zăvoi commune is the Bistra River, the

main tributary of the river Timiș. The Bistra Valley appearance today is due to river erosion and successive catches, which occurred early in the Quaternary. The Bistra River consists of two major water courses, which have their origin in the Tarcu Mountain massif: the Bistra Ardealului and the Bistra Marului. The area has a rocky foundation, generally built of crystalline limestone, mica and volcanic sedimentary formations.



Fig. 1. Map of Caras-Severin
(<http://www.pescarul.com/judete/timis>)

Climatology is characterized by average annual temperatures ranging from 11-12°C, annual average rainfall is around 600-750 mm.

On the strength of natural setting of the relief, climate and vegetation, the soils from Bistra Valley has a zonal distribution with characteristic types of steppe, steppe, forest and grassland regions.

In the Bistra valleys there are Aluviosols and high in the mountains meet Țarcu Dystricambosols and Eutricambosols, slightly below meet Luvisols and on limestone, Intrazonal, meet Rendzina and Gleysols in lower areas.

1. Aluviosoil strongly gleyed. Aluviosols properties are shown in Table 1.

Strongly gleyed aluviosol properties are: soil texture is medium throughout the profile, soil

reaction is slightly acid between 0-124 cm, moderately acidic between 124-170 cm humus content in Ap is weak; reserves of humus in the top 50 cm is small, the index shows a low nitrogen supply nitrogen Ap, Ap mobile P content is very low, the contents of the cell K Ap is weak, the degree of soil base saturation shows an eutric soil between 0-124 cm, a mesobasic soil between 124-170 cm. Variation of the essential characteristics of morphological and chemical characteristics of the soil in the unit main unit soils associated with soil and keeping the soil condition (erosion, landslides, etc.): small variations. Drainage (internal, external, global) and permeability: very high.

The water regime of the soil flooded every 2-5 years by spills.

Table 1. Strongly gleyed alluvial soil properties

Horizon	Ap	Ao	A/Cg ₂	CG ₀	IICG ₀	IICG ₀	IVCG ₅
Depth (cm)	0-16	16-28	28-40	40-65	65-89	89-124	124-170
Coarse sand 2-0.2 mm	3.4	2.6	7.7	5.4	6.3	20.5	19.0
Fine sand 0.2-0.02 mm	55.7	56.3	63.2	60.6	55.1	49.5	41.6
Dust from 0.02-0.00 mm	13.4	12.5	9.8	11.8	10.9	9.3	8.1
Dust 0.001 - 0.002 mm	9.1	11.0	6.8	8.5	10.0	6.8	11.3
Clay < 0.002 mm	18.4	17.6	12.5	13.7	17.7	13.9	18.3
Fine clay < 0.01 mm	27.5	28.6	19.30	22.2	27.7	20.7	31.3
Texture	LN	LN	LN	LN	LN	LN	LN
Density (g/cm ³)		2.65	2.60	2.62			
Aparent Density (g/cm ³)		1.17		1.32			
Total porosity (%)		55.9		49.7			
Aeration porosity (%)		35.0		26.3			
Coef. of the higr. (%)		3.24	2.86	3.38			
Field capacity (%)		17.88		17.77			
Cover. useful water (%)		11.72		12.92			
Conduct.hydraulics (mm/hour)		60.0		85.0			
Coef. of wilting (%)		6.16		4.85			
Floor of moisture (%)		12.02		11.31			
pH in H ₂ O	6.35	6.20	6.45	6.60	6.40	6.40	5.40
Humus (%)	1.73	1.11	0.62	0.43			
Total N (%)	1.63	1.04	0.59	0.41			
P(ppm) in Al	6.3	5.7	7.5	8.6	12.3	24.2	29.4
K(ppm) in Al	50	52	38	36	34	36	36
SB me/100g soil	15.60	15.40	16.00	16.50	15.20	12.60	11.40
SH me/100g soil	2.90	3.12	2.83	2.45	2.64	2.59	5.09
Tme/100g soil	18.50	18.52	18.83	18.45	17.84	15.19	16.49
V (%)	84.32	83.15	84.97	86.72	85.20	82.95	69.13
Book of humus (0-50 cm)	62 t/ha						

2. Stagnic Luvosol. Luvosol properties are shown in Table 2.

Stagnic luvosol properties are: soil reaction is

moderately between 0-34 cm, slightly acidic between 34-147 cm, neutral between 147-180 cm humus content in AP is weak; reserve humus (0-50 cm) is small, the index shows a low nitrogen supply nitrogen Press; mobile P content in Ap is medium, cell K content is medium, the degree of soil base saturation shows a mesobasic soil between 0-50 cm, an eubasic soil between 50-180 cm, soil texture is medium between 0-34 cm, medium-fine between 34-71 cm, fine between 71-180 cm high bulk density is between 21 -71 cm, midway between 71-90 cm, the degree of compaction is high between 21-71 cm, 71-90 cm emphasized between, total porosity is small between 21-50 cm, between 50-90 cm very small.

Table 2. Physical and chemical properties of stagnic luvisoils

Horizon	Ap	El	E/B	Bt _{1w}	B ₂ W ₃	B/CW ₃	CW ₄	IICW ₅
Depth (cm)	0-21	21-34	34-50	50-71	71-96	96-117	117-147	147-180
Coarse sand 2-0.2 mm	2.2	2.0	2.8	2.0	1.8	1.5	1.4	1.1
Fine sand 0.2-0.02 mm	32.2	32.0	28.0	29.4	22.1	24.1	23.1	26.6
Dust from 0.02-0.00 mm	16.0	17.6	15.7	12.0	12.9	10.8	10.2	13.5
Dust 0.001 - 0.002 mm	17.5	15.4	16.8	16.2	14.2	11.1	12.1	11.1
Clay < 0.002 mm	32.1	33.0	36.7	40.4	49.0	52.5	53.2	47.7
Fine clay < 0.01 mm	49.6	48.4	53.5	56.6	63.2	63.6	65.3	58.8
Texture	PL	PL	LA	LA	AL	AL	AL	AL
Density (g/cm ³)		2.41	2.44	2.43	2.36			
Aparent Density (g/cm ³)		1.40	1.41		1.35			
Total porosity (%)		42.0	42.3		42.8			
Aeration porosity (%)		9.42	10.16		10.04			
Degree of compaction		15	16		19			
Coef. of the higr. (%)				8.33	10.22			
Field capacity (%)		23.27	23.5		24.27			
Cover. of useful water (%)		11.67	10.6		7.07			
Conduct.hydraluics (mm/hour)		2.4	1.8		1.2			
Coef. of wilting (%)		17.44	18.2		20.74			
Floor of moisture (%)		11.60	12.9		17.20			
pH in H ₂ O	5.20	5.40	5.85	5.85	6.00	6.15	6.30	6.90
Humus	1.49	0.87	0.74					
Total N (%)	1.22	0.72	0.66					
P(ppm) in AL	22.2	16.6	8.4	5.1	3.9	4.5	4.4	5.7
K(ppm) in AL	132	86	86	88	121	126	139	110
SBme/100g soil	11.2	12.0	14.8	16.8	19.6	18.0	21.0	22.0
SH me/100g soil	6.29	6.38	5.06	5.16	5.04	4.70	4.37	2.97
Ah me/100g soil	4.71	4.13						
Al mobile me/100 g soil	0.528	0.496						
Tme/100g soil	17.49	18.38	19.8	21.96	24.64	22.70	25.70	24.97
V (%)	64.04	65.29	74.5	76.50	79.54	79.29	82.77	88.10
Book of humus (0-50)	77 t/ha							

3.Eutricambosoils moderately gleyed. Eutricambosoils properties are shown in Table 3.

Table 3. Physical and chemical properties of eutricambosoil

Horizon	Ap	Ao	Bv	B/C	CGo3	IICGo4	IICGr5
Depth (cm)	0-14	14-33	33-58	58-82	82-105	105-127	127-150
Coarse sand (2-0.2 mm)	1.4	1.2	0.5	0.6	1.2	0.5	0.6
Fine sand (0.2 - 0.02 mm)	30.6	32.8	28.5	40.0	41.7	45.6	46.3
Dust from 0.02-0.002 mm	14.1	12.8	15.1	14.7	16.5	16.2	16.0
Dust 0.001 - 0.002 mm	19.1	20.5	21.8	17.3	16.8	14.5	14.7
Clay < 0.002 mm	34.8	32.7	34.1	27.4	23.8	23.2	22.4
Fine clay < 0.01 mm	53.9	53.2	55.9	44.7	40.6	37.7	37.1
Texture	LA	LA	LA	LL	LL	LL	LL
Density (g/cm ³)		14.7	1.25	1.35			
Total porosity (%)		42.2	49.8	46.5			
Aeration porosity (%)		4.6	17.7	11.8			
Degree of compaction		15	1	4			
Coef. of the higr. (%)		6.08	6.61	4.64			
Field capacity (%)		14.07	13.70	16.08			
Cover. of useful water (%)		2	1.1	2.1			
Conduct. hydraulics (mm/hour)		11.50	11.99	9.64			
Coef. of wilting (%)		18.54	18.84	17.68			
Humus (%)	1.86	1.24	1.05				
pH in H ₂ O	5.70	6.20	6.00	5.85	5.80	6.10	6.10
Total N (%)	1.71	1.15	0.98				
P(ppm) in AL	6.4	7.6	4.5	7.1	9.1	10.5	12.0
K(ppm) in AL	91	93	82	52	48	58	54
SBme/100g soil	20.0	20.80	20.60	14.40	15.80	17.2	17.4
SH me/100g soil	5.42	4.68	4.92	4.13	4.03	3.67	3.84
Tme/100g soil	25.42	25.48	25.52	18.53	19.83	20.87	20.64
V (%)	78.64	81.63	80.72	77.71	79.68	82.41	84.30

Eutricambosoils have the following properties: soil reaction is moderately acid 0-14 cm, 14-15 cm slightly acidic, humus content in the top 20 cm is low, supply of humus (0-50 cm) is small; nitrogen index shows a low nitrogen supply in the first 20 cm cell P content in the top 20 cm is very low; cell K content in the first 20 cm is medium, the degree of soil base saturation shows an eubazic soil, soil texture is medium-fine between 0-58 cm, midway between 58-150 cm high bulk density is between 14-33 cm, between 33-82 cm is a middle density.

CONCLUSIONS

Soils are one of the great richness that nature has endowed our planet. They were created over millions of years by the interaction between the atmosphere, hydrosphere and lithosphere in the wonderful natural laboratory. They became, during the evolution of the planet, a complex envelope, its qualities, provides the possibility of developing vegetation - the basis of the food chain in any ecosystem. In the Zăvoi commune, soils are arranged in increments of altitude, depending on topography and climate, which determines the character of their area.

In the high area of land, in the mountain area, one can meet Districambosols ensuring the development of beech forest floor and beech forests mixed with other species, lower we will meet eutricambosols and Luvisols, and in the Bistra valley Gleiosols, alluviosols and on the limestone Intrazonal, Rendzinas soils.

On the strength of natural setting of the relief, climate and vegetation, Bistra soils have a zonal distribution with characteristic types: steppe, steppe, forest and grassland regions.

Fluvisols are used for agriculture, and are the most fertile soils of the Zăvoi commune and the most cultivated with crop plants: maize, wheat, sugar beet, vegetables etc.

Eutricambosols have a medium natural fertility and are cultivated with cereals, corn, fruit trees, vines.

Dystricambosols are the least fertile soils of the commune, in general, are filled with forests, pastures and meadows of low productivity and cultivated with potato.

Luvisols have a low to medium fertility are filled with fruit, especially plum and apple trees, meadow and pasture and some forest.

REFERENCES

- [1]Bucur N., Lixandru G., 1997, Fundamentals of Soil Science: formation, evolution, physical and chemical soil Dosoftei Publishing, Iași
- [2]Canarache, A.,1997, Physical properties of agricultural soils in Banat, Timisoara SNRSS Scientific papers
- [3]Florea, N., 1985, Concept development of soil and soil cover, soil science, no. 1:10-32

- [4]Ghibedea, V., E., Grigeresik Lucia Băcanu, 1970, Banat Plain rainfall in the hills nearby. Geography Studies Banat, vol. II, University of Timisoara
- [5]Ianoș, G., 1985, Banat soils. In heavy and compacted soil improvement affected by humidity, the Banat- guide tours of the XII National Conference of Soil Science", Timisoara
- [6]Ianoș, G., Goian, M., 1992, Influence of agricultural systems on soil quality in Banat. Agrofit problems. theory and apply., vol 1 , no. 3-4 Fundulea
- [7]Ianoș, G., Pusca, I., Tarau, D., Borza, I., 1994, Assessment of the current situation of soils in Banat as a result of drainage - drainage works and directions for improvement in future workers. kn SNRSS, Bucharest, No. 28
- [8]Ianoș, G., Pusca, I., Goian, M., 1997, Soils Banat-natural conditions and fertility Mirton Press, Timisoara
- [9]Mihuț Casiana, Radulov Isidora, 2012, Soil Sciences. Ed Eurobit, Timisoara
- [10]Rogobete, G., Tarau, D., 1997, Soils and their improvement. Marineasa Publishing, Timișoara
- [11]Lorant, D., *et al.*,2007, Characteristics of ecological conditions and soil fertility restoration in western Romania. Ed Eurobit, Timisoara
- [12] <http://www.pescarul.com/judete/timis>

ELECTROCHEMICAL METHODS DETERMINATION OF HEAVY METALS IN WINE BEVERAGE ACHIEVING ECOSANOGENE

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Abstract

In this work, we estimated reproducibility and procedures to improve the selectivity of the method and to determine the influence of different analytical parameters (pH, electrolyte composition, deposition time and potential, presence of ligands). Detection limit of copper in samples of white wine and red Blaj (Romania) is 2.4 ppm, with a deviation of 1.5-2,0%. The results were compared with the results by atomic adsorption classical method. The sensitivity of the method is two times smaller, Daton this Pb²⁺ ions.

Key words: wine, heavy metals, electrochemical methods

INTRODUCTION

In recent years, methods of "stripping" were used increasingly frequently in the food industry for the control of trace metal ions both in food and in wine [2,7].

Lead contamination of wine is a consequence of using the facilities of this metal in wine [3,7]. Normal limit for lead in wine recommended is 200 mg / L [5], considerably higher than the maximum limit for drinking water in different countries, taking into account the relative consumption of water and wine. Regarding the maximum admissible concentration of copper in wine, it must be kept below the 0.3-0.5mg / L [6].

The main source of copper in wine is a consequence of practicing added copper sulphate (II) Removal that emit sulphurous odor. The large amount of residual copper is related to a high degree of damage to oxidants, which eventually lead to the brown coloring of wine, especially white wine [2,3]. Copper (II) may contribute to disorder wine, a phenomenon that becomes visible only after bottling occurs. Knowing the chemical forms of copper in the wine rather than knowing its total concentration may be the best indicator for the extent of damage to wine.

The method involves two steps [4]:

- pre concentration, which consists in applying a constant potential reduction for a period of time when there is accumulation of metal adsorption on the surface of the mercury electrode: $\text{Men}^{++} + \text{us} \rightarrow \text{Me} (\text{Hg})$.
- Stripping when oxidation occurs free ions or metal ions on the surface of mercury; oxidation current is proportional to the concentration of metal ions.

MATERIALS AND METHODS

The work was performed in two stages: in the first part was devised method of "stripping" L71, and the second part was the actual frame analysis of copper concentration in commercial wines from Blaj.

Volt meter control to use a device connected to a computer equipped with 100W BAS Controlled Growth Mercury Electrode (CGME West Lafayette, USA) and a portable analyzer for trace elements (PTEA - WAGTECH) equipped with a glassy carbon electrode (CV), covered a thin film of mercury. To determine the cyclic volt meter was used classical three- electrode cell (El - CV, CE - Pt wire ER Ag / AgCl). Results electrochemical control was made spectro photometric metrically with a UV-VIS device unique computer assisted Helios β.

Before first use and at the beginning of each day of work, CV electrode was cleaned with an aqueous suspension of Al_2O_3 powder ($0.25 \mu\text{m}$) on a polishing fabric and cleaned by ultrasonic for 3 minutes. Experimental part for determination concentration of copper ions will be detailed in the following.

RESULTS AND DISCUSSIONS

To improve selectivity and reproducibility of the method (see right calibration, Fig. 1) The action of mercury droplet size - Fig.2 and storage time - Fig.3, the peak current in synthetic wine solutions. Synthetic wine solution has the following composition: (12% by volume of ethanol solution, saturated Potassium tartrate and brought to pH 3.2 with tartaric acid)

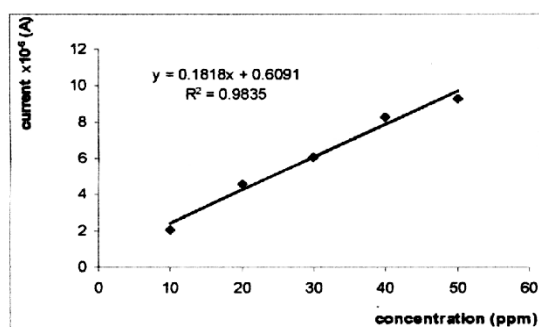


Fig.1. Calibration curve - polarographic data size

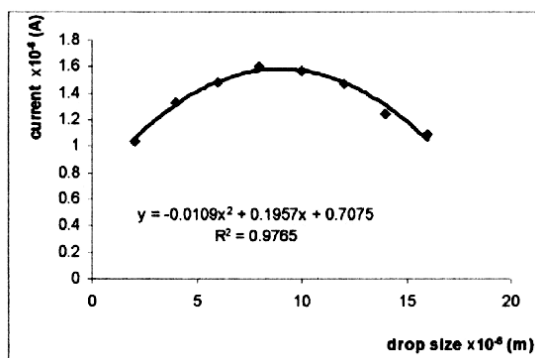


Fig.2. Influence of mercury droplet size

Reproducibility response Volt ($R^2 = 0.97$) corresponds to a standard deviation of 4.5% to 6 determinations. Addition is described the equation $y = -0.0109x^2 + 0.1957x + 0.7075$ and the current maximum 0,1957x was obtained for the mercury droplet size of 8-10 μm . Regarding storage time, it can work to its

value of 500 s - Fig.3, depending also on the concentration of copper in wine.

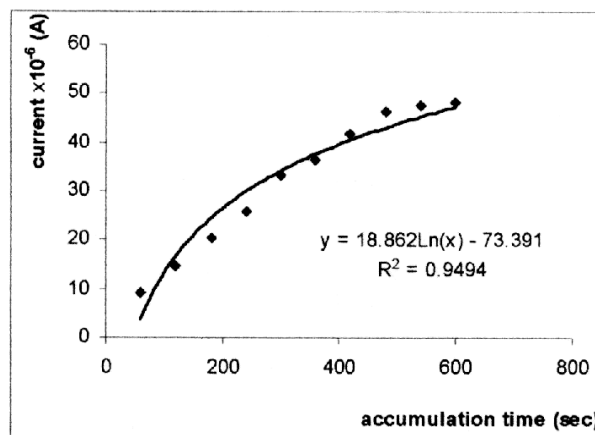


Fig.3. Influence of accumulation time on the peak current

Detection limit for copper ion is 0.05 ppm ($R = 0.9992$), but in the presence of Pb^{2+} detection limit increases to 1.5 ppm.

Control of copper concentration in wines from Blaj

Potentiometric stripping was used to measure the concentration of labile and total copper in wine and tomatoes have.

Conditions were optimized for a supporting electrolyte having the following composition: 1 mol / L hydrochloric acid and 0.5mol / L CaCl_2 . It was observed that mercury is a convenient oxidant than oxygen, and to determine the labile copper concentration was necessary exchange agent.

It was observed that red wine "bind" lead quickly added, demonstrating that the wine has a great ability to lead complexifica.

A similar effect was observed intrication white wine, but the degree of Pb complexity was lower than in red wine.

The aim of this study was to examine the ability of striped potentiometers technique for direct in-situ determination of labile copper concentration in wine.

Determination of labile copper wine

Striped curve was recorded as described above the total concentration of copper. Quantification was performed from a right calibration generated by the introduction of incremental additions of copper to a model base wine as the test sample.

Determination of total copper in white wine

Dilute wine (20 mL) containing about 50 mg / L copper was mixed with electrolyte - 2.0 mol / L HCl, 1.0 mol / L CaCl₂ and 600 mg / L Hg (II) - in electrochemical cell (Table 1).

The potential enrichment of 700 mV was applied 300-500 seconds, depending on the concentration of copper in the sample tested. There was no need for venting (removal of oxygen) as the major oxidant was used Hg (II).

After execution stripedului electrode is at a potential of 100 mV for 15 seconds to clean and stabilize the new film of mercury. Potentiostatic stops and striped curve is recorded in the potential range of 900-100 mV.

Table 1. Total copper and white wine labile striped analyzed by potentiometer and controlled by flam photometric

Wine	AAS (mg/L)	Total cooper (mg/L)	Dilution factor	Labile cooper (mg/L)
Feteasca Alba	0,28±0,01 (5)	0,23 ±0,01 (8)	8	0,18 ±0,01(3)
Sauvignon		0,27 ± 0,01 (7)	4	
Traminer	0,27±0,01 (8)	0,23 ±0,01 (9)	20	0,18 ± 0,01 (2)
Riesling	0,69 ± 0,05 (3)	0,65 ± 0,02 (10)	20	
Pinot gris	0,64 ± 0,01 (6)	0,53 ± 0,03 (4)	8	0,52 ± 0,01 (3)
		0,67 ± 0,01 (5)	4	

Note: We give the mean and 95% confidence limit. Number of determinations is given in parentheses

Detection limit for copper ion is 0.05 ppm (R = 0.9992), but the results are given in Table 1 to determine total copper in many wines have, using optimized enrichment potential of 700 mV to 500 seconds. From the table it is observed that the sample dilution factor is an essential parameter of determination.

For a high dilution factor, total copper concentration is underestimated by potentiometer flam photometric striped compared with AAS (Atomic Adsorption Spectrophotometry). Varying the enrichment and use of additional cycles of enrichment / striped with shorter enrichment times have not improved results.

To overcome this dilemma, the dilution factor was changed so that the concentration of copper in test sotutia always be greater than 50 mg / L. In these conditions, for all wines, no significant differences at the 5% mtre

results by potentiometer striped and the obtmute by flamfotometne.

CONCLUSIONS

Striped potentiometric analysis is a simple analytical procedure for monitoring copper in wines.

The methodology can also be applied to beer and other alcoholic beverages.

Striped volt meters was used for the anode (VSA) as the decomposition of the sample is often necessary to remove interfering substances prior to the measuring step.

Application of striped potentiometers to determine speciation is still limited, mainly because the usual method requires the addition of high concentrations of Hg (II) as a chemical oxidant.

The concentration of copper in Traminer, Pinot Gris and Riesling exceeds recommended limits (0.3-0.5mg / L [1]).

As the need monitoring other metals in wine will probably increase in the future, we need simple analytical methods that can simultaneously determine the content of lead and cadmium.

Preliminary determinations (unpublished results) have shown this to be possible.

REFERENCES

- [1]Clark, A.C., Scollary, G.R., 2000, Anai Chim Acta 413:25
- [2]Green Alison, M., Clark, A. C., Scollary G. R., 1997, Fresenjuss J. Anal. Chem., 358:711
- [3]Jagner, D., Weterlund, S., 1980, Analytica Chim. Acta, 117:159
- [4]Jitaru Maria, Iacob Ramona, Popa Mana, 2003, Studia Universitatis Babes-Bolyai, Chemia, XLVIII, 1(2), 161
- [5]Oehme, M., Lund W., Fresenius Z., 1979, Anal. Chem., 294: 39
- [6]Wai. C. M., Knowles, C. R., Keely, J. F., 1979, Bull. Environ. Contam. Toxicol., 21: 4
- [7]Wiese Claudia, Schwedt, G., Fresenjuss, J., 1997, Anal. Chem. 358:718.

INFLUENCE OF COMMERCIALIZATION ON FOOD SECURITY STATUS OF CASSAVA PRODUCING HOUSEHOLDS IN ABIA STATE, NIGERIA

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Abstract

The study examined the influence of commercialization on food security status of cassava producing households in Abia State, Nigeria. It specifically assessed the current level of commercialization among the households and estimated the food security status of the households operating at different levels of commercialization. The study employed multistage sampling technique in the selection of location and respondents from whom data and information were elicited using pretested and structured questionnaire. In the course of data analysis, descriptive statistics, household commercialization index and food security index were used. The current level of commercialization revealed that a typical cassava producing household sold on the average 51 percent of its output with total sales ranging from 5.60% to 90.00%, implying that the most commercialized cassava producing household sold 90.00% of the gross value of its total cassava production. More so, the food security status of the households at different levels of commercialization depicted that households operating at a low level of commercialization were few and there was a slight disparity between the proportion of those that were food secure and those that were food insecure while the majority seemed to operate at a medium level with more of the people attaining food security. On the overall, the proportion of households that were food insecure is more than those that were food secure as indicated by the food insecurity incidence. On the basis of the findings, the study recommended that government and other stakeholders should shoulder the responsibility of developing new initiatives that will transform the smallholders from subsistence oriented to market – oriented production system among others.

Key words: agricultural commercialization, cassava, food security, smallholder

INTRODUCTION

Commercial transformation of subsistence agriculture is an indispensable pathway towards economic growth and development for many agriculture dependent developing countries [21]. Sustainable household food security and welfare also requires commercial transformation of subsistence agriculture. This is likely to result in welfare gains through the realization of comparative advantages, economies of scale, and from dynamic technological, organizational and institutional change effects that arise from the flow of ideas due to exchange-based interactions. This enhances the links between the input and output sides of agricultural markets [9]. Commercialization entails market orientation

(agricultural production destined for market based on market signals) and market participation (produce offered for sale and use of purchased inputs) [17]. However, the literature on commercialization of smallholders makes little distinction between market orientation and market participation of smallholders [11].

Increasing per capita food production and raising rural incomes are arguably the greatest challenges facing Sub-Saharan Africa and the developing world more generally. The history of economic development in other regions of the world indicates that agricultural productivity growth has been the major source of sustained improvements in rural welfare [20]. The argument that productivity growth and food security in smallholder agriculture

will require a more commercialized orientation implies that policy must be designed to encourage a transformation out of the semi-subsistence, low-input, low-productivity agriculture that characterizes much of rural Nigeria.

Due to the usual thought of commercialization as large scale, economists usually tend to ignore the fact that even the small farmers and poor farm households participate in the market either because they produce a little surplus or sell to earn cash income to meet other family necessities. Further clarification of commercialization can be observed in the desperation among some of the poor households who sell their crops even before it is being harvested (distress sales). This is particularly the case when food is being sold and then the households are forced to buy back the same (or indeed a greater) quantity of food later in the year when the price is much higher [4].

As convincing as the scenario may seem coupled with the participation of smallholders in commercialization of subsistence agricultural economy, more than 800 million people throughout the world and particularly in developing countries do not still have enough food to meet their basic nutritional needs. Constraints on access to food and continuing inadequacy of household and national incomes to purchase food, instability of supply and demand, as well as natural and man-made disasters have been held culprit. This creates a nutritional gap which leaves the individual, state or nation insecure [16].

As part of the efforts to bridge the widening nutritional gap and its concomitant food insecurity in Nigeria, government has tried several agricultural programmes and projects and while some of the efforts are still on course, many have since gone moribund [13]. The intervention in root and tuber crops particularly in cassava in the form of Presidential Initiative and Strategic Plan for the Development of the cassava Industry in 2003 and 2006 respectively is significant in the fight against food insecurity. This is because Nigeria has comparative advantage in the production of cassava and has remained its leading global producer since 2006 [6, 19].

Today, cassava ranks highly as a major staple food particularly for the low income earners and resource poor farmers in the developing economies of Sub-Saharan Africa. It serves over 200 million Africans, second only to maize in its calories contribution and a large population of Nigerians depends on a daily basis on it as their main dish. Therefore, its comparative production advantage over other staples serves to encourage its cultivation even, by the resource poor farmers who are greater in number [7, 14, 2].

The current reality shows that commercialization of smallholder farming is not yet high enough to enable farmers benefit from increased income and the farmers are not yet out of the subsistence-oriented agriculture [12]. Market imperfections and high transaction costs have hindered smallholder farmers from exploiting the welfare outcomes of commercialization. Thus, it is not possible for the smallholder farmers to integrate with the market and enjoy the benefits of commercialization unless the already existing hurdles are removed and better environment is created [3].

In fact nowadays, 75 percent of the poor in developing countries live in rural areas, so strengthening the agricultural sector means not only improving access to nutritious food, but also the necessity of creating a sustainable environment for enhancing food security and economic development. The majority of small farmers experience difficulties in food production with heavy post-harvest losses; moreover smallholder farmers suffer from weak connections to national and international markets and fail to add value to their agricultural production. They have insufficient water supplies and lack access to technology, due to inadequate investments and depletion of natural resources. All these factors negatively affect their incomes, causing food insecurity for their families [8]. On the basis of the foregoing, this study is articulated to examine the influence of commercialization on the food security status of Cassava producing Households in Abia State, Nigeria with specific focus on (i) assess the current level of commercialization among

cassava producing households; (ii) estimate the food security status of the households operating at different levels of commercialization.

MATERIALS AND METHODS

The study was conducted in Abia state and is located within the southeastern Nigeria which lies between longitudes 04° 45' and 06° 07' E and Latitudes 07° 00' and 08° 10' N. Households employed for the study were selected using multistage sampling technique drawn from the local governments within the agricultural zones. The sample size was 120. The survey instrument was well structured and pre-tested questionnaire administered to elicit data and information from the selected households. Data were analyzed using commercialization index, food security index and descriptive statistics. The indices are specified as follows:

$$\text{Commercialization Index} = \frac{\text{Value of crop sold}}{\text{Total value of crop produced}} \times \frac{100}{1} \dots (1)$$

This is in line with previous studies who employed the index [10, 20].

F_i = Per capita food expenditure for the i^{th} household/ $2/3$ mean per capita food expenditure of all households.....(2)

Where F_i = food security index

When $F_i \geq 1$ = food secure i^{th} household

$F_i \leq 1$ = food insecure i^{th} household.

A food secure household is therefore that whose per capita monthly food expenditure fall above or is equal to two-third of the mean per capita food expenditure. On the other hand, a food insecure household is that whose per capita food expenditure falls below two-third of the mean monthly per capita food expenditure [15, 1].

RESULTS AND DISCUSSIONS

Assessment of the current level of commercialization

The assessment of the current level of

commercialization among the households using the commercialization index showed in Table 1 that a typical cassava producing household sold on the average about 51 percent of its output with total sales ranging from 5.60% to 90.00%.

Table 1. Current level of commercialization among the households

Degree of Commercialization	Frequency
Low (1 – 25% of output sold)	8
Medium (26 – 50% of output sold)	70
High (51 – 100% of output sold)	42
Mean Commercialization Index	51.48
Minimum Commercialization Index	5.60
Maximum Commercialization Index	90.00

Source: Field Survey, 2013

The implication is that the most commercialized cassava producing household sold 90.00% of the gross value of its total cassava production. This level of commercialization can be compared to the national average of 33 – 36% in Ethiopia [18]. However, this commercialization level can be adjudged low given the fact that Nigeria remains the largest producer of cassava and Abia state belongs to the South east zone that contributes about 20% to the national basket. The Nigerian Cassava belt is composed of the North Central Zone (Benue, Nasarawa, Plateau, Niger, Kogi, Taraba and kwara States) which produces the largest quantity (about 29%) followed by the South South States (24%), South east (20%), South west (20%) while North east and North west contributed 7% [5].

Food Security Status of the households at different levels of commercialization

In ascertaining the food security status of the households at different levels of commercialization, simple descriptive statistics and food security index were employed (Table 2).

From the result, households operating at a low level of commercialization are few and there is a slight disparity between the proportion of those that are food secure and those that are food insecure.

Table 2. Estimates of food security status at different levels of commercialization

Level of Commercialization	Food secure		Food insecure	
	Freq	%	Freq	%
Low (1 – 25%)	3	6.12	5	7.04
Medium (26 – 50%)	32	65.31	38	53.52
High (51 – 100%)	14	28.57	28	39.44
Total	49	100.00	71	100.00
Food insecurity incidence	0.59			

Source: Field Survey, 2013

Those that are food insecure are more in number. However, majority (65.31% for food secure; 53.52% for food insecure) of the households seem to operate at a medium level with more of the people attaining food security. Also, at high commercialization level, the scenario is no different from that of those operating at a low level of commercialization. On the overall, the proportion of households that are food insecure is more than those that are food secure as indicated by the food insecurity incidence. This is comparable to the food insecurity incidence of 0.49 for Lagos Urban households [15]. Although households who are food secure tend to be more commercialized, this result does not wholly support the assertion because the proportion of both food secure and food insecure households increased with increasing level of commercialization of cassava [6]. This could be attributable to the farming system in Nigeria where mixed cropping and farming are dominant. The attainment of food security may not be tied to a particular enterprise in a mixed cropping and farming operational milieu.

CONCLUSIONS

Having examined the effect of commercialization on food security status of cassava producing households in Abia State, the need to re-orientate farmers has become

imperative if the transformation agenda is anticipated to see the light of reality. As shown by the results, the current level of commercialization revealed that a typical cassava producing household sold on the average 51 percent of its output with total sales ranging from 5.60% to 90.00%. the food security status of the households at different levels of commercialization depicted that households operating at a low level of commercialization were few and there was a slight disparity between the proportion of those that were food secure and those that were food insecure while the majority seemed to operate at a medium level with more of the people attaining food security. It is therefore necessary to use incentives to attract people especially young entrepreneurs to the promotion of commercial cassava production. Programmes such as CAD (Commercial Agriculture Development) assisted by the World Bank should be encouraged. This is one laudable effort that will make the transformation agenda and diversification of the economy a tangible reality. The need to formulate new agricultural policies (input subsidy, market access policy etc) to promote commercialization of cassava which Nigeria has huge comparative advantage in as well as assist producing households and communities in attaining food security has become imperative.

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REFERENCES

- [1]Arene, C.J., Anyaeji, B.C., 2010, Determinants of Food Security among Households in Metropolis of Enugu, Nigeria, Pakistan Journal of Social Sciences, 30(1): 9 – 16.
- [2]Bamidele, F. S., Babatunde, R.O., Rasheed, A., 2008, Productivity Analysis of Cassava-Based Production Systems in the Guinea Savannah: Case Study of Kwara State, Nigeria. American-Eurasian Journal of Scientific Research, 3(1): 33-39
- [3]Bernard, T., Eleni, G., Alemayehu, S.T., 2007, Smallholder's Commercialization through Cooperatives: A Diagnostic for Ethiopia, IFPRI

Discussion Paper No. 00722.

[4]Borbala, B., 2004, Determinants of Commercialization of the Individual Farms in Romania,Conference on International Agricultural Research for Development, Deutscher Tropentag Berlin, October 5 – 7

[5]Cassava Master Plan, 2006, A strategic Action Plan for the development of the Nigerian Cassava industry, Prepared by The United Nations Industrial Development Organization In Cooperation With The Ministry of Trade and Industry and The Presidential Initiative on Cassava.

[6]Chirwa, E.W., Matita, M., 2012, From Subsistence to Smallholder Commercial farming in Malawi: A Case of NASFAM Commercialization Initiatives, Future Agricultures, Working Paper 037.

[7]FAO, 2000, The State of Food and Agriculture, Food and Agriculture Organization of the United Nations, Rome, Italy.

[8]FAO, 2013, Food Security through Commercialization of Agriculture (FSCA) Strategy. FAO/Italy Cooperative Programme. A Publication of Food and Agriculture Organization of the United Nations.

[9]Gebremedhin, B., Moti, J., 2010, Commercialization of Smallholders: Is Market Participation Enough? Contributed Paper Presented at the Joint 3rd African Association of Agricultural Economists (AAAE) and 48th Agricultural Economists Association of South Africa (AEASA) Conference, Cape Town, South Africa, September 19 -23.

[10]Govere, J., Jayne, T.S., Nyoro, J., 1999, *Smallholder Commercialization Interlinked Markets and Food Crop Productivity: Cross Country Evidence in Eastern and Southern Africa*, the Department of Agricultural Economics and the Department of Economics, Michigan State University, June 1999. Available

on: www.aec.msu.edu/fs2/ag_transformation/atw_govereh.PDF, [Accessed on 20.09.12]

[11]Jaleta, M., Gebremedhin, B., Hoekstra, D., 2009, *Smallholder Commercialization :Processes, Determinants and Impact*. Discussion Paper No. 18. Improving Productivity and Market Success (IPMS) of Ethiopian Farmers Project, ILKRI, Nairobi, Kenya. 55pp.

[12]Mahelet, G.F., 2007, Factors Affecting Commercialization of Smallholder Farmers in Ethiopia: The Case of North Omo Zone, SNNP Region. Paper Presented at the Fifth International Conference on the Ethiopia Economy.

[13]Nwachukwu, I.N., Ezech, C.I., 2007, Impact of Selected Rural Development Programmes on Poverty Alleviation in Ikwuano LGA of Abia State, Nigeria. African Journal of Food, Agriculture, Nutrition and Development. 7(5): 1 – 17.

[14]Nweke F., Haggblade, S., Zulu, B., 2004, Building on Successes In African Agriculture: Recent Growth in African Cassava. International Food Policy Research Institute, www.ifpri.org

[15]Omonona, B.T., Agoi, G.A., 2007, An Analysis of Food Security Situation among Nigerian Urban Households: Evidence from Lagos State, Nigeria, Journal of Central European Agriculture, 8(3): 397 – 406.

[16]Omotesho, O.A, Adewumi, M.O., Muhammad – Lawal, A., Ayinde, O.E., 2006, Determinants of Food Security among the Rural Farming Households in Kwara State, Nigeria, African Journal of General Agriculture, 2(1): 7 – 15.

[17]Otieno, D.J., Omiti, J., Nyanamba, T., McCullough, E., 2009, Market Participation by Vegetable Farmers in Kenya: A comparison of Rural and Peri-urban Areas. African Journal of Agricultural Research, 4(5): 451-460.

[18]Samuel G., Sharp K., 2007, Commercialization of Smallholder Agriculture in Selected Tef-Growing Areas of Ethiopia, Ethiopian Journal of Economics, Volume XVI, No1, April 2007. Available on <http://www.ajol.info/viewissue.php>, [Accessed on 15.10.12]

[19]Sanni L. O., Onadipe, O.O., Ilona, P., Mussagy, M.D., Abass, A., Dixon, A.G.O., 2009, Successes and Challenges of Cassava Enterprises in West Africa: A Case Study of Nigeria, Bénin, and Sierra Leone: International Institute of Tropical Agriculture (IITA).

[20]Strasberg, P.J., Jayne, T.S., Yamano, T., Nyoro, J., Karanja, D., Strauss, J., 1999, A Summary of Report in Titillated: Effect of Agricultural Commercialization on Food Crop Input Use and Productivity in Kenya, policy Synthesis No. 41, Mus Agricultural Economics.

[21]World Bank, 2008, World Development Report 2008: Agriculture for Development, Washington D.C.

CONTRIBUTIONS OF MICROFINANCE INSTITUTIONS TO ECONOMIC EFFICIENCY OF CASSAVA FARMERS IN ABIA STATE, NIGERIA

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Abstract

The study examined contributions of microfinance institutions to economic efficiency of cassava farmers in Abia state, Nigeria. A multistage random sampling technique was adopted in collecting cross sectional data on a sample size of 240 respondents (120 MFI beneficiaries and 120 non beneficiaries). Primary Data was collected by administering questionnaire on cassava farmers. The result showed that economic efficiency of MFI beneficiaries was influenced by wage rate, price of fertilizer and adjusted Y (output), while wage rate, price of fertilizer and price of cassava cutting s are variables that influenced economic efficiency of non beneficiaries. The t – test analysis confirmed that MFI beneficiaries had higher economic efficiency advantage compared with non beneficiaries. It is recommended that government agricultural policy should take positive steps to reduce interest rate to encourage MFI efforts in providing the necessary platform to encourage higher efficiency in cassava production in Abia state, Nigeria.

Key words: economic efficiency, microfinance institution

INTRODUCTION

Microfinance in Nigeria is long operated as an informal sector arrangement. In the non – institutional markets, the activities of savings and acquisition of credits are done by individuals on their own or through person to person arrangement. The activities include self financing by relations, friends and well wishers, professional money lenders, jackpot, raffle and pool winning trust system of credit transaction. Institutional market on the other hand refers to any organizational or institutional arrangement that aims at mobilization savings and credit [28]. Found in this market are Rotating Savings and Credit Association (ROSCAS), thrift association, savings mobilization groups (which are traditionally called ESUSU, bam ago and adashi by different ethnic groups in Nigeria), daily savings or contribution organization, cooperative societies, religious organizations,

social clubs and village or town unions. The informal system of advancing credit irrespective of the meager amount it generates remains the major source of finance for the poor who see the formal institution as being too bureaucratic costly and cumbersome [27]. Microfinance can play important roles in reducing poverty amongst farmers by promoting their productive use of farm inputs. Micro finance is particularly relevant in increasing productivity of rural economy, especially agriculture [11]. This can be done by creating opportunities for accessing micro-credits geared towards raising agricultural productivity among small farmers. Where there is economic growth microfinance has the capacity to transmit benefits of the growth more rapidly and more equitably through the informal sector [16]. Financial capital have been recognized as vehicles for economic development and to provide them, microfinance is necessary [25]. The

prominence of microfinance is built on the fact that it encourages diversified agriculture which stabilizes and perhaps increases size of farm operations and resource productivity.

In Abia state there is paucity of microfinance groups in the rural areas [1], or where they are present, their services to farmers cannot be ascertained as farmers productivity remains low [26]. Increase in productivity is directly related to production efficiency arising from not only the optimal combination of farm inputs but also from the state of credit availability [4; 5]. It is therefore necessary to ascertain the contribution of microfinance to economic efficiency of food crops especially cassava because of the economic advantage it has in the agricultural sector. Determining the efficiency of farmers according to [31] is very important from policy perspective. This is because in an economy where new and improved technologies are lacking, efficiency study can show the possibilities of raising productivity by improving efficiency without increasing the resource base or developing new technologies. Such studies will as well help to determine the under utilization or over utilization of factor inputs. Gains in efficiency of agricultural production, according to [16] are viewed as being necessary for economic growth and rural poverty alleviation.

Since Microfinance has remained strategic in financing the rural poor [9]. It has become necessary to evaluate the effect of microfinance on farmers who produce staple foods such as cassava. Some important natural and socio economic variables of farmers and microfinance institutions vary over time and geographic location. It is therefore necessary to periodically verify the performance of microfinance institutions with a view to revealing their strength and weaknesses as to remedy and reposition them for effective performance. This in turn will suggest ways for efficient delivery of services to farmers that guarantee improved productivity. Bio – fuel from cassava (as a raw material) seems to be the choice of many nations [15]. It is therefore important to improve the financing of the many small holder cassava producers for food and alternative uses.

Early studies on efficiency by [14] focused primarily on efficiency using deterministic production function with parameters computed using mathematical programming techniques [19]. They however noted that the approach had inherent limitations of the statistical interpretation of parameters estimating efficiency due to inadequate characteristics of the assumed error term. The stochastic frontier approach developed independently by [2; 21] overcame this deficiency and this model as used in this study has been used in determining farm level economic efficiency with cross sectional data [17]. The study objective was to determine the difference between the economic efficiencies of cassava farmers who are beneficiaries and non beneficiaries of MFI.

Theoretical framework. The flexibility and ability to closely marry economic concepts with modeling reality has made stochastic frontier very popular. According to [14], Technical Efficiency (TE) is associated with the ability of a firm to produce on the Isoquant frontier, while Allocative Efficiency (AE) refers to the ability of a firm to produce at a given level of output using the cost minimizing input ratios. Economic Efficiency (EE) is the capacity of a firm to produce a predetermined quantity of output at a minimum cost for a given level of technology [7]. Farrell's methodology had been applied widely, while undergoing many refinements and improvements. And of such improvement is the development of stochastic frontier model which enable one to measure a firm's level of technical and economic efficiency using maximum likelihood estimate (a corrected form of ordinary least square – COLS). [2; 21] were first to propose stochastic frontier production function and since then a lot of modification had been made to stochastic frontier analysis. The model used in this paper is based on the one proposed by [6] in which the stochastic frontier specification incorporates models for the technical inefficiencies effects and simultaneous estimate all the parameters involved in the production and cost function model. Following the pioneering but

independent works by [2; 6]. The stochastic frontier production function can be written as

$$Y_i = F(X_i; \beta) \exp(V_i - U_i) \quad i = 1, 2, \dots, n$$
...eqn (1)

where Y_i represents the value of output, which is measured in (₦); X_i represents the quantity of input used in the production. The V_i 's are assumed to be independent and identically distributed random errors, having normal $N(0, \sigma_v^2)$ distribution and independent of the U_i 's. The U_i 's are technical inefficiency effects, which are assumed to be non-negative truncation of the half normal distribution $N(0, \sigma_u^2)$. The technical efficiency of individual farmers is defined in terms of the ratio of observed output to the corresponding frontiers output, conditional on the level of input used by the farmers. Hence the technical efficiency of the frontiers output, conditional on the level of input used by the farmers. Hence the technical efficiency of the farmer can be expressed as:

$$TE = Y_i / Y_i^* = f(X_i; \beta) \exp(V_i - U_i) / f(X_i; \beta) \exp V_i = \exp(-U_i) \quad \dots \text{eqn}(2)$$

Where Y_i is the observed output and Y^* is the frontiers output. The TE ranges between 0 and 1 that is $0 \leq TE \leq 1$. The corresponding cost frontier of cob – Douglas functional form which is the basis of estimating the economic efficiencies of farmers is specified as follows:

$$C_i = g(P_i; \alpha) \exp(V_i + U_i) \quad i = 1, 2, \dots, n$$
...eqn(3)

where C_i represents the total input cost of the i th farmer; g is a suitable function such as the cob – Douglas function; P_i represents input prices employed by the i th farm production and measured in naira(₦); α is the parameter to be estimated; V_i 's and U_i 's are random errors and assumed to be independent and identically distributed truncations (at zero) of the $N(\mu_i, \sigma^2)$ distribution. μ_i provides information on the level of allocative efficiency of the i th farmer. The allocative efficiency of individual farmer is defined in terms of the ratio of the predicted minimum cost (C_i^*) to observed cost (C_i) that is $AE_i = C_i^* / C_i = \exp(\mu_i)$. Hence allocative efficiency ranges between zero and one also.

MATERIALS AND METHODS

This study was carried out in Abia State Nigeria. Abia is a state located in the South Eastern zone of Nigeria. The state was chosen for the study because of its agrarian disposition and endowment in food crop production. The state is endowed with land suitable for growth of various tropical crops including cassava. In the state it has been observed that major Clients of Microfinance Institutions (CMFI) are mostly cassava farmers [1]. The climate is essentially tropical humid with average annual rainfall of 229.20mm distributed evenly throughout its wet season, which covers a period of seven months (April to October). Diurnal temperature varies between 27°C and 31.9°C . Its annual rainfall range is 1500-2600mm on a mean elevation of 122m above sea level [24]. Abia state is located between longitudes $7^\circ 23' \text{E}$ and $8^\circ 02' \text{E}$ and latitudes $5^\circ 47' \text{N}$ and $6^\circ 12' \text{N}$ [23]. It is bounded by Enugu state in the North, Rivers state in the South, Akwa Ibom and Cross River states in the East and Imo State in the West.

Abia state was created on 22nd August, 1991 out of the then Imo state and has its capital at Umuahia. The state covers a total land area of 7677.20 square kilometers, with a total population of 2,833,999 persons made up of 1,434,193 or 55.0% males and 1,399,806 or 45.0 % females [22]. The state has 17 Local Government Areas (LGAs) clustered in three 3 agricultural zones namely Aba, Ohafia and Umuahia zones. The constituent LGAs of the zones are as follows:

1. Ohafia Agricultural Zone: Arochuku, Bende, Isuikwuato, Ohafia and Umunneochi Local Government Areas.
2. Umuahia Agricultural Zone: Ikwuano, Isiala-Ngwa South, Isiala-Ngwa North, Umuahia North, Umuahia South Local Government Areas and Osisioma Ngwa.
3. Aba Agricultural Zone: Aba North, Aba South, Obingwa, Ugwuagbo, Ukwu East and Ukwu West Local Government Areas.

About Seventy five percent (75.0%) of the state population live in rural areas and engage in agricultural production [13] producing food

crops which include Cassava, Yam, Rice, Plantains, Maize, Melon, Pepper, and vegetables. Some cash crops grown in the state include Cocoa, Rubber, Cashew and Oil Palm [1].

Sampling Technique

This study adopted multi-stage random sampling method in selecting the respondents for the survey. First, random sampling method was adopted in selecting two (2) Local Government Areas (L.G.As) from each of the three (3) agricultural zones. From Ohafia zone (Ohafia LGA, Bende LGA), From Umuahia zone (Umuahia LGA, Isiala Ngwa South LGA) and from Aba zone (Ukwa East LGA, Ugwunabo LGA). This gave a total of six (6) local government areas.

The list of all Microfinance Institutions was obtained from each local government area office. The composite formed a sampling frame used in selecting MFIs (banks). A simple random sampling was used in selecting three (3) MFIs from each of the six Local Government Area selected. Thus a total sample of 18 MFIs were selected and involved in the study. These MFIs are as follows: from Ohafia zone- Ohafia Microfinance Bank (MFB), Arochukwu MFB, Abiriba MFB, Uzuakoli MFB, Umuneochi MFB and Abia State University MFB; from Umuahia zone central, Umuchukwu MFB, Decency MFB, Ovuma MFB, Ohha MFB, Chibueze MFB and LAPO MFB. While from Aba zone we chose Ukwa MFB, Ecosal MFB, Easygate MFB, Ugwu MFB, Swift MFB and Umuike MFB.

The list of small scale cassava farmers who are beneficiaries of services of MFIs was obtained from the chosen MFIs through the assistance of the MFB managers. This formed a sample frame for a simple random selection of credit beneficiaries of MFIs credit. Six cassava farmers were randomly selected equally from each MFIs this gave one hundred and eight (108) cassava farmers MFI loan beneficiaries. Cassava farmer Non – beneficiaries in the selected local government areas were listed with the assistance of Abia ADP staff in the agricultural zones. This second list was subjected to Simple Random

Sampling (SRS) and one hundred and twenty (120) cassava farmer non beneficiaries of micro finance institution loan were also randomly selected from the composite sampling frame provided by the MFIs and ADP offices in each of the agricultural zones. This gave a sample of 240 farmer MFI loan beneficiaries and non beneficiaries in the state. The non beneficiaries were included in the analysis to serve as control group for meaningful comparison.

Data Collection

Data for this study was obtained from primary source. Primary data was collected through field survey using a pre- tested structured questionnaire. The researcher with the help of some extension staff of the ADP administered the questionnaire in the 3 agricultural zones of the state. In addition 8 enumerators who are indigenes of the areas were trained and assisted in data collection.

Cross sectional socio-economic survey was conducted on the selected cassava farmers ((both beneficiaries and non beneficiaries of MFI loans). Information collected included volume of loans received from microfinance banks in naira, volume of deposits (savings) made in microfinance banks in naira, number of training and advisory services received, access to information and technology services rendered by microfinance banks to the farmers, amount of microcredit used for cassava production, microcredit processing periods, microcredit processing cost, interest rate, total amount of loan repaid, amount of microcredit diverted to other uses as well as problems encountered in cassava production, output of cassava in kg, the cassava cultivated area of the land (hectares), total labour (household/hired labour) used in man-days, fertilizer used in kg (or bags i.e. 50kg/bag), value of other agrochemicals used (naira); and some farmer specific variables like household size, educational status of the household head, experience of the head of cassava farmer household in years among others.

Model Specification

The study used the stochastic frontier regression model following maximum

likelihood approach, and the Cobb Douglas functional form in particular; t test and the test of difference between means of factors. The model to be chosen allowed for the test of the presence of technical efficiency while accepting random shocks.

The stochastic frontier production function according to [10] is stated as follows:

$$Y_i = X_i \beta + (V_i - U_i) \quad \dots\dots\dots (1)$$

where:

Y_i = the logarithm of the cassava output of the i^{th} farmer;

X_i = Vector of (transformed input quantity) of the i^{th} farmer;

β = Vector of unknown parameters estimates;

V_i = is the usual symmetric noise associated

with random variable which are not under the control of the farmer (such as rainfall, natural hazards) and which are assumed to be $iid \sim N(0, \sigma_v^2)$ and independent of the U_i , which refers to negative random variables assumed to account for the technical inefficiency in cassava production and often assumed to be $iid \sim N(0, \sigma_u^2)$.

The parameters estimate (β) and the variance of the parameters in term of

$\delta^2 = \delta_v^2 + \delta_u^2$ and $\gamma = \delta_u^2 / \delta^2$ would be obtained through a maximum likelihood estimation procedure.

The Cobb Douglas logarithm model for clients of microfinance institution (CMFI) that was estimated in this study is defined as follows:

$$\ln Y_i = \beta_0 + \sum_{j=1}^4 \beta_j \ln X_{ij} + \sum_{i \geq j=1}^4 \sum_k \beta_{jk} \ln X_{ij} \ln X_{ik} + (V_i - U_i) \quad [12] \dots (2)$$

where:

$\ln Y$ = Natural logarithm of Quantity of cassava harvested by farmer (kg);

$\ln X_1$ = Natural logarithm of Total land area planted with cassava (ha);

$\ln X_2$ = Natural logarithm of Total labour (household and non- household) used in cassava production (man days);

$\ln X_3$ = Natural logarithm of Quantity of fertilizer used on farm (kg);

$\ln X_4$ = Natural logarithm of Cassava stems planted (in bundles); A bundle of cassava stems (equivalent to 50 cassava stems);

$\ln X_5$ = Natural logarithm of Amount of borrowed funds invested (₦)

Technical efficiency determinant model for CMFI

$$\mu_i = \delta_0 + \sum_{j=1}^{11} \delta_j M_{ji} \quad \dots (3)$$

where:

δ s are unknown scalar parameters to be estimated;

M_1 = Total amount of micro loan used in cassava production (Naira);

M_2 = Total amount of deposits (mobilized savings + equity contribution) used in cassava production (Naira);

M_3 = Training and advisory services (Number of times);

M_4 = Membership of group / co operative (number of groups to which farmer belongs);

M_5 = Access to insurance policy (1 for access to insurance policy, otherwise=0);

M_6 = Microfinance access (accessed=1, otherwise=0);

M_7 = Age of the household head (years);

M_8 = Household size (in number);

M_9 = Experience of the head of household in cassava production (years);

M_{10} = Educational level of the head of household (years);

M_{11} = Health status of the household (1 for sick, 0 otherwise);

The technical inefficiency of individual farm was determined as ratio of the observed output (Y_i) to the corresponding frontier output (Y_i^*) given the available technology. That is,

$$TE = Y_i / Y_i^* \quad \dots (4)$$

$$= f(X_i, \beta) + \exp(V_i - U_i) / f(X_i, \beta) + V_i \quad \dots (5)$$

$$= \exp(-U_i) \text{ such that } 0 \leq TE \leq 1 \quad \dots (6)$$

Estimates of the parameters for the stochastic frontier production function model was

obtained using the computer program, FRONTIER version 4.1, written by [10] in which the variance parameters are in terms of

$$\sigma^2 = \sigma_v^2 + \sigma_u^2 \quad \text{and} \quad \gamma = \sigma_u^2 / \sigma^2$$

Tests of hypotheses for the parameter of the frontier model was carried out using the generalized likelihood ratio statistic, λ , defined as

$$\lambda = -2\ln \dots (7)$$

Where $L(H_0)$ is the value of the likelihood function for the frontier model, in which the parameters that are stated by the appropriate hypothesis, H_0 , will be imposed; and $L(H_1)$ is the value of the likelihood function for the general frontier model.

The generalized likelihood ratio has approximately a chi-square (or mixed chi square) distribution. The degree of freedom was the number of restricted parameters which was equal to the difference between the parameters estimated under H_1 and H_0 if the null hypothesis is true. That is if the estimated chi-square is less than the table value, we accept H_0 but reject if otherwise.

For Economic efficiency functional form, the stochastic frontier cost function is defined thus:

$$C = F(W_i, Y_i; \alpha) \exp V_i - U_i \quad i = 1, 2, \dots, n \quad \dots (8)$$

where:

C = Minimum cost associated with cassava production

W = Vector of Input prices

Y = Cassava output

α = Vector of parameters

$V_i - U_i$ = Composite error term

Substituting a farm's input prices and quantity of output in equation 9 yields the economically efficient input vectors. The cost measures can then be used to compute the economic efficiency indices.

Using Sheppard's Lemma the following equation was obtained

$$\frac{\partial C}{\partial P_i} = X_i(W, Y; \alpha) \quad \dots (9)$$

This is a system of minimum cost input demand equations [7]. Substituting a farm's input prices and quantity of output in equation (9) yields the economically efficient input vector X_c . With observed levels of output given, the corresponding technically and economically efficient costs of production was equal to $X_{ii} P$ and X_{ie} , respectively. While the actual operating input combination of the farm was $X_i P$. The cost measures were used to compute the economic efficiency indices as follows:

$$EE = (X_{ie} \cdot P) / (X_i \cdot P) \quad \dots (10)$$

However the efficient production was represented by an index value of 1.0 while the lower values indicated a greater degree of inefficiency. Using the method by [7] which was based on the work of [18], u was estimated as

$$E(u_i / \epsilon_i) = \frac{\phi \lambda f^*(\epsilon_i \lambda / \sigma)}{1 + \lambda^2} \frac{1 - F^*(\epsilon_i \lambda)}{\sigma} \quad \dots (11)$$

where:

$f^*(\epsilon_i \lambda / \sigma)$ and $F^*(\epsilon_i \lambda)$ are normal density and cumulative distribution functions respectively, $\lambda = \sigma_u / \sigma_v$

$\epsilon = V_i - U_i$ and When ϵ_i , σ and λ estimates, are replaced in equation (11), it provided estimates for u and v . The term V was symmetric error, which accounted for random variations in output due to factors beyond the control of the farmer e.g. weather, disease outbreaks, measurements errors, etc. The term u was a non negative random variables representing inefficiency in production relative to the stochastic frontier. The random error v_i was assumed to be independent and identically distributed as $N(0, \sigma_v^2)$ random variables independent of the u is which are assumed to be non negative truncation of the $N(0, \sigma_u^2)$ distribution (i.e. half normal distribution) or have exponential.

In this study the empirical model for the Cobb–Douglas cost frontier function was thus:

$$\ln C = \alpha_0 + \alpha_1 \ln W_1 + \alpha_2 \ln W_2 + \alpha_3 \ln W_3 + \alpha_4 \ln W_4 + \alpha_5 \ln W_5 + V_i - U_i \quad \dots (12)$$

where:

W_0 = Constant term

W_1 = Wage rate

W_2 = Price of fertilizer

W_3 = Land rent

W_4 = Price of cassava cuttings

W_5 = Output (Y^*)

Using the same model for technical inefficiency, and same parameter to be estimated.

Comparison was analyzed using paired t- test

RESULTS AND DISCUSSIONS

Sources of Economic Efficiency (MFI microcredit beneficiaries)

The cob-Douglas cost frontier result presented in Table 1.0 shows that the coefficient for variable inputs such as wage rate for labour, price of fertilizer and adjusted Y (output) had the desired positive signs.

Table 1. Maximum Likelihood Estimates of Economic Efficiency of Cassava Farmer MFI Credit Beneficiaries by Stochastic Frontier Production Function

Variables of Cobb- Douglas Frontier Model		Estimates (MFI microcredit Beneficiaries)
Constant	β_0	10.359*** (23.549)
Land rent for Area of land of cassava cultivated	β_1	-0.039 (-1.029)
Wage rate for Labour used in cassava cultivation	β_2	0.073** (2.131)
Price of fertilizer	β_3	0.090*** (2.925)
Price of cassava cutting bundle	β_4	-0.301 (-0.722)
Adjusted Y(Output)	β_5	0.142** (2.529)
Inefficiency function		
Constant	δ^0	0.0386 (0.301)
Total Microloan used (M_1)	δ^1	2.569 (3.423)***
Total amount of deposit (M_2)	δ^2	-0.077** (-2.672)
Training and advisory service(M_3)	δ^3	0.138*** (3.141)
Membership of group(M_4)	δ^4	-0.066 (-0.812)
Access to Insurance (M_5)	δ^5	0.199 (0.290)
Level of microloan accessibility(M_6)	δ^6	-2.780E-05*** (-7.776)
Age (M_7)	δ^7	-0.103 (-0.721)
Household size(M_8)	δ^8	-3.109E-06 (-2.466)
Farming experience(M_9)	δ^9	0.011 (0.030)
Educational level(M_{10})	δ^{10}	0.001 (0.033)
Health Status(M_{11})	δ^{11}	-0.792* (-1.934)
Diagnostic statistics		
Sigma – squared	r^2	1.137*** (4.162)
Gamma	R	0.990*** (203.637)
Log likelihood function	LLF	-26.739
Likelihood ratio test	LRT	136.609
Mean technical efficiency	MTE	0.808

Source: Field Survey, 2014. Figures in parenthesis are t - ratios

*, **, *** Significant at 10.0%, 5.0%, and 1.0% levels respectively

The coefficients for wage rate, price of fertilizer and adjusted Y (output) which were positive and significant at 5.0%, 1.0% and 5.0% levels of probability respectively implies that increasing the wage rate, price of fertilizer and adjusted Y (output) by 1.0% would increase total cost of production by 0.073, 0.090 and 0.142 respectively.

The value of these coefficients indicates the importance of these variables in the cost structure of the farmers.

The Inefficiency Model shows that the total microloan used and training/advisory services are negative and highly significant at 1.0% level of probability showing an indirect relationship with economic efficiency. This is however against *a priori* expectation which uphold that microloan and training/advisory services positively influence economic efficiency [12], this implies that microloan used and training /advisory services may not be regarded as a factor causing economic inefficiency in the study area. The coefficients for total amount of deposit, level of microloan access and health status were positive and significant at 5.0%, 1.0%, and 10.0% level of probability respectively indicating a direct relationship with economic efficiency. The volume of deposit made by farmers in a credit institution according to [29] have been shown to be a sure means to getting microcredit and as such can positively influence a farmer's economic efficiency. Also the level of microloan access shows that many cassava farmers had high level of microloan access and as such responded to *a priori* expectation that postulated that high level microloan access have direct influence on economic efficiency [20]. More so, the healthier a farmer is the better his productive capacity to engage in farming activities increases [8]

The variance (r^2) of 1.356 for MFI microcredit beneficiaries is statistically significant and different from zero at 1.0% level. This indicates a good fit and correction of the specified disturbance assumption of the composite error term. The variance ratio (r) is estimated to be very high at 99.03. This suggests that 99.03% of discrepancy between

the observed and the frontier output are due to economic inefficiencies. The result of the diagnostic statistic suggests the presence of one sided error component and confirms the relevance of stochastic parametric economic production function and maximum likelihood estimation.

Sources of Economic Efficiency (Non Credit farmer Beneficiaries of MFI)

The result presented in Table 2.0 showed that the coefficients for land rent, wage rate, price of fertilizer and cassava cuttings were positive. The positive coefficient for land rent and wage rate were both significant at 10.0% level of probability each. This implies that increasing the land rent and wage rate by 1.0% will lead to corresponding increase in the total cost of production by 0.072 and 0.102 respectively. Meanwhile, the positive coefficient for price of fertilizer and price of cassava cutting bundles were both significant at 1.0% level of probability each. This implies that increasing the price of fertilizer and the price of cassava cuttings bundle by 1.0% would increase the total cost of production by 1.663 and 5.012 respectively.

The inefficiency model shows that access to insurance and level of microloan access are positive and significant at 10.0% and 5.0% probability level showing a direct relationship with economic efficiency. While the coefficients for age, household size and education are negative and significant at 1.0%, 5.0% and 1.0% probability levels respectively. The implication is that the older a farmer becomes, the more he or she is unable to combine his or her resources in an optimal technology [17]. Most of the farming household in the area had large household sizes and such have a very high tendency of diverting microcredit to consumption purposes other than productive purposes thereby influencing economic efficiency negatively, this is in tandem with [3] that large family sizes have indirect effect on economic efficiency. However, the lack education of may not be regarded as a factor causing economic inefficiency.

The variance (r^2) of 0.125 was statistically significant and different from zero at 5.0%

level. This is an indication of a good fit and correctness of the specified distribution assumption of the composite error term. The variance error estimate for non credit farmer beneficiaries of MFI is high at 83.56%. This

suggest that 83.56% of discrepancies between the observed and the frontier output are due to economic efficiency, this result confirms the work of [17; 30] who got a similar outcome in their study.

Table 2. Maximum Likelihood Estimates of Economic Efficiency of Non MFI credit Cassava Farmer Beneficiaries by Stochastic Frontier Production Function

Variables of Cobb- Douglas Frontier Model		Estimates (Non credit beneficiaries)
	Parameters	
Constant	β_0	10.716*** (21.788)
Land rent for Area of land of cassava cultivated	β_1	0.072* (1.616)
Wage rate for Labour used in cassava cultivation	β_2	0.102* (1.663)
Price of fertilizer	β_3	0.030*** (5.012)
Price of cassava cutting bundle	β_4	0.010*** (4.827)
Adjusted Y(Output)	β_5	-0.038 (-1.409)
Inefficiency Function		
Constant	δ^0	0.0973 (0.234)
Total Microloan used (M_1)	δ^1	-0.122 (-0.900)
Total amount of deposit (M_2)	δ^2	-0.018 (-1.409)
Training and advisory service(M_3)	δ^3	-0.019 (-1.139)
Membership of group(M_4)	δ^4	0.048 (1.343)
Access to Insurance (M_5)	δ^5	-0.877* (-1.744)
Level of microloan accessibility(M_6)	δ^6	-0.258** (-2.445)
Age (M_7)	δ^7	0.054*** (7.735)
Household size(M_8)	δ^8	5.761E-05** (15.380)
Farming experience(M_9)	δ^9	0.002 (0.017)
Educational level(M_{10})	δ^{10}	0.010*** (8.574)
Health Status(M_{11})	δ^{11}	4.678E-05 (1.164)
Diagnostic statistics		
Sigma – squared	r^2	0.126** (2.244)
Gamma	r	0.836*** (9.328)
Log likelihood function	LLF	16.476
Likelihood ratio test	LRT	25.32
Mean technical efficiency	MTE	0.706

Source: Field Survey, 2014. Figures in parenthesis are t- ratios

*, **, *** Significant at 10.0%, 5.0%, and 1.0% levels respectively

The result of the ranges of the frequency distribution of economic efficiency estimates

for the farmers is shown in Table 3.0. The table revealed that the economic efficiency

estimates of microcredit beneficiaries ranges from 0.405 – 0.964 and the mean economic efficiency is 0.829. The estimates shows that for an average microcredit beneficiary to attain the utmost level of economic efficiency in cassava production, whereas, the economic efficiency estimates for non microcredit beneficiaries ranges from 0.126 -0.951 with a mean of 0.750. In this case, for the average non microcredit beneficiary to attain the level of utmost economic efficiency in the sample

the farmer would need to experience a cost saving of 21.100 ($1 - 0.750/0.951$) percent. Meanwhile, the least economically efficient cassava farmer for the microcredit beneficiary will have an economic efficiency gain of 57($1 - 0.405/0.951$) percent if the farmer is to attain efficiency level of utmost economic efficiency in the study area, while, the case of non credit beneficiary is estimated to be 83.200 ($1 - 0.126/0.750$) percent.

Table 3.Estimates of Economic Efficiency Ranges for Microcredit Beneficiaries and Non Credit Farmer Beneficiaries

Economic Efficiency Level	Microcredit Beneficiaries	Percentage	Non Beneficiaries	Percentage
≤ 0.20	-	-	3	2.50
0.21 – 0.30	-	-	1	0.83
0.31 – 0.40	1	0.88	3	2.50
0.41 – 0.50	2	1.75	6	5.00
0.51 – 0.60	8	7.02	9	7.50
0.61 – 0.70	5	4.39	11	9.17
0.71 – 0.80	13	11.40	28	23.33
0.81 – 0.90	43	37.72	27	22.50
0.91 - 1.00	42	36.84	32	26.50
Mean	0.829		0.750	
Minimum	0.405		0.126	
Maximum	0.964		0.951	

Source: Field Survey, 2014.

Table 4 revealed the paired t – test analysis for economic efficiency of microcredit beneficiaries and non microcredit beneficiaries. The table showed that the mean for microcredit beneficiaries was 82.851 while that of non microcredit beneficiaries was 74.98. This result shows a mean deviation

of 7.876 and t – statistic of 3.854 at a significant level of 1.0%.The implication is that there is a significant difference in the economic efficiency of the two groups of farmers. Thus the microcredit beneficiaries displayed higher economic efficiency than non microcredit beneficiaries.

Table 4.Paired t – test Analysis for Economic Efficiency of microcredit Beneficiaries and non credit farmer Beneficiaries

Variable	Mean	Std Deviation	Mean Deviation	T- Statistics
MFI beneficiaries	82.851	12.363	7.876	3.854***
Non beneficiaries	73.975	18.191		

Source: Field Survey Data, 2014.

CONCLUSIONS

The research focused on the contributions of microfinance institutions to economic efficiency of cassava farmers in Abia state, Nigeria. Cobb-Douglas production frontier cost function was estimated by Maximum Likelihood (ML) estimation to obtain ML estimates and inefficiency determinants. The

parameters obtained were found to be asymptotically efficient and consistent. The diagnostic statistics confirmed the superiority of stochastic production cost function. More MFI farmer related variables determined economic efficiency among the farmers. The MFI services beneficiaries were found to be more economically efficient in cassava production with a mean of 82.851 than

farmers who were non beneficiaries with a mean of 74.98.

Based on this research it is recommended that government agricultural policy can take positive step to reduce interest rate to encourage MFI effort as a veritable platform that can positively influence economic efficiency in cassava production in Abia state, Nigeria.

Taking of insurance policies encouraged farmers to have great confidence in their production activities. Government extension outfit can encourage more cassava farmers to take up arable crop protection policies with the Nigeria Agricultural Insurance Cooperation (NAIC) or any insurance agency with specialty in agriculture.

Extension intervention efforts in policy formulation can focus on bridging the gap in supply of farm inputs such as fertilizer and cassava cuttings as this is strategic in cost efficient production of cassava.

REFERENCES

- [1]Abia State Agricultural Development Project (ABSADP), 2005, A colossus in Agricultural Transformation P. 1-6.
- [2]Aigner D.J., Lovell, C.A.K and Schmidt, P (1977). Formation and Estimation of Stochastic Frontier Production model. *Journal of econometrics*, 6, 21-37
- [3] Akiram, W., Hussaini, Z. Sial, M.H., Hussain, I., 2008, "Agricultural Credit Constraints and Borrowing Behaviour of Farmers in Rural Punjab". *European Journal of Scientific Research*, 23(2), 294-304
- [4]Amaza, P.S., Olayemi, J.K., 2002, Analysis of Technical Inefficiency in Food Crop Production in Gombe State, Nigeria. *Applied Economics letter*, 9, 51-54
- [5]Amaza P.S., Onu, J.I., Okunmadewa, F.Y., 2001, Identification of Factors that Influence the Technical Efficiency of Cotton Farmers in Nigeria. *Agricultural Development Studies*, 2(1), 133-145
- [6]Battese, G., 1992, Frontier Production Functions and Technical Efficiency. A Survey of Empirical Application in Agricultural Economics. *Agricultural Economics*, 20, 185-208
- [7]Bravo-Ureta, B. E., Pinheiro, A.R., 1997, "Technical, Economics and Allocative Efficiency in Peasant Farming. Evidence from the Dominican Republic. "The Development Economics" 35(1) 48 – 07
- [8]Brian, F.C., 2001, Access and Control of Resources: Lessons from SANREM – CRSP. *Agriculture and Human Value*, 18 (1): 41- 48
- [9]Central Bank of Nigeria (CBN), 2005, Microfinance Policy, Regulatory and Supervisory Framework for Nigeria. Abuja, Nigeria Pp. 1-6
- [10]Coelli, T.J., 1996, Recent Developments in Frontier Version 4.1c; A Computer Programme for Stochastic Frontier Production and Cost Function Estimation. Mimeo Department of Economics, University of England, Amidale.
- [11]Consultative Group to Assist the Poor (CGAP), 2009, Branchless Banking-Scenarios for 2010. <http://technology.Cgap.org/.Papers/105-9.htm>
- [12]David, A. M., Okoye, C.U., 2010, "Accessibility of Microfinance Services and its Implication on Technical Efficiency among Cassava Farmers in Kogi State, Nigeria. *Journal of Applied Agricultural Research* 1(2), 11- 19
- [13]Emerole, C.O., 2004, "Determinants of Household Income and Consumption Expenditure of Small holder farmers in Ikwuano LGA Abia State, Nigeria" PhD Dissertation, Michael Okpara University of Agriculture, Umudike, Abia State Nigeria.
- [14] Farrell, J.M., 1957, The Measurement of Productive Efficiency. *Journal of Royal Statistics Society*, 120:253-81.
- [15]Food and Agriculture Organization (FAO), 2000, Agriculture Towards 20 15/30. Technical Interim Report. April, 2000. Rome.
- [16]Hazarika, G., Awang, J., 2003, Access to Credit, Plot Size and Cost Inefficiency Among Small Holder Tobacco Cultivators in Malawi. *Agricultural Economics Journal*, 29, 99-100.
- [17]Idiong, I.C., 2007, Estimation of Farm Level Technical Efficiency In Small Scale Swamp Rice Production in Cross River State of Nigeria. A stochastic frontier approach. *World Journal of Agricultural Science*, 3(5),653-658.
- [18]Jondrow, J. C., Lovell, A.K., Materoy, I.S., Schmidt, P., 1982, "On the Estimation of Technical Inefficiency in the Stochastic Frontier Production Function Model" *Journal of Econometrics* 1(9) 233 – 238
- [19]Kalu, C.A., Mbanasor, J.A., 2008, Economic Efficiency of Commercial Vegetable Farmers In Akwa-Ibom State, Nigerian Agricultural Journal, 39 (2) 101-106.
- [20]Kohansal, M.R., Ghorbani, M., Mansowi, H., 2008, "Effect of Credit Accessibility of Farmers on Agricultural Investigation of Policy options in khorasan Razavi Province". *Journal of Applied Sciences*, 8 (23), 4455-4459.
- [21]Meausen, W., Broeck, J.V.D., 1997, Efficiency estimation from Cobb-Donglas production functions, with composed error. *International Economics Review*, 18: 435-444.
- [22]National Population Commission. (NPC), 2006, Preliminary 2006 census figures. Retrieved September, 2007 from <http://www.population.gov.ng/pop-figure>
- [23]National Root Crops Research Institute (NRCRI), 2003, NRCRI Annual Report. Umudike, Umuahia, Abia State Nigeria.
- [24] National Root Crops Research Institute (NRCRI),

2008, Annual Report. Umudike, Umuahia, Abia State Nigeria.

[25]Odiase-Alemenlen, O.A., 2004, Impact of Capital/Investment, Technology and other factors on the economic development of Nigeria, Journal of Sustainable Development in Africa, 6,1-13.

[26]Ohajianya, D.O., Onyenweaku, C.E. , 2001, Gender and Relative Efficiency in Rice Production Systems in Ebonyi State: A Profit Functions Analysis. Journal of sustainable Agriculture and Environment, 3, 384-392.

[27] Okpara, G.C., 1990, Informal Financial System in Economic Development: The Case of Nigeria. In I.C. Okonkwo et al. (eds), Issues in National Development, pp. 260-268.

[28]Olaitan, M.A., 2001, Engineering Issues on Micro and Rural Financing in Nigeria. Central Bank of Nigeria Bullion. 125(1), 64-71.

[29]Toluyemi, T., 1996, "Impact of Rural Credit Programmes on Rural Development: A Comparative Review of the India and Nigeria Experience" The Nigeria Journal of Agricultural and Rural Management. 1(1):38 -50

[30] Umoh, G.S., 2006, Resource use Efficiency in Urban Farming: An Application of Stochastic Frontier Production Function. International Journal of Agriculture and Biology, 8(1), 38-44.

[31]Yusuf, S.A., Malomo, O., 2007, Technical Efficiency of Poultry Egg Production in Ogun State. A Data Envelopment Analysis (DEA) Approach. International Journal of Poultry Science, 6(9), 622-629

EFFECT OF COMMERCIALIZATION ON PRODUCTIVE CAPACITY AMONG CASSAVA PRODUCING HOUSEHOLDS IN IKWUANO LOCAL GOVERNMENT AREA OF ABIA STATE, NIGERIA

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Abstract

The study investigated factors affecting commercialization of cassava producing household in Ikwuano Local Government Area, Abia State, Nigeria. It specifically examined the socio-economic characteristics of cassava household; determine commercialization index and analyzed factors that influence commercialization among cassava producing households. The study employed purposive sampling technique in the selection of 120 respondents from one local government area (LGA) based on characteristics of interest, nearness and other related features. The selection was done from 6 communities at the rate of 20 respondents per community. Analytically, descriptive statistics, household commercialization index (HCI), and multiple regression analysis were used. The results showed that the mean age of the cassava producing household was about 40 years with a mean farming experience of 14 years. They are mostly married with an average of 5 persons per households. The result further revealed that only a few households (less than 2%) have very high commercialization orientation, which exposes the level of farming in the area. With respect to determinants of factors that influence commercialization, value of output, farm size, sex, nearness to market, membership of cooperative and farming experience were significant and found to exhibit varying degree. The study therefore recommends that support policies that sustain and improve the productivity among farming household especially land tenure policy issues, greater incentives policies for farmers in the rural areas; linkages between farm households and the markets; increase access and exchange of information on markets.

Key words: Abia state, commercialization, cassava, food production, orientation

INTRODUCTION

In 2011, the World Bank Group put the total population of Africa at approximately 1.03 billion, with a growth rate of 24 million births per annum - 168 million out of the above number are Nigerians with an annual growth rate of 3.2%. This means that the birth rate in Africa produces about 65,754 children on a daily basis. Today, Africa's population is increasing on a geometric progression, without an appreciable increase in food production to cater for the growing number of these people. The challenge affects the achievement of broad economic growth and food security, which is constrained by gap in food supply and food demand.

Agriculture remains a very good platform to reverse gaps in food production; supply and

demand because its objective is to guarantee food security, employ labour; and provides income for many households. In Nigeria, current agricultural transformation agenda has identified cassava as strategic in curbing challenges of poverty reduction and accelerate economic recovery, growth and development in addition to food security in Sub-Saharan Africa (FMARD, 2006; FAO, 2011) [12, 11]. This became the thrust behind the Presidential Initiative on Cassava in 2003 and Strategic Action Plan for the Development of the Nigeria Cassava Industry of 2006 (Cassava Master Plan, 2006) [7].

Cassava (*Manihot esculenta*) is an important staple food and cash crop in most developing world, providing basic diet to more than half billion people (FAO, 2011) [11]. It serves over 200 million Africans, second only to

maize in its calories contribution [23]. A large population of Nigerians depended on daily basis of it as their main dish. Therefore, its comparative production advantage over other stable serves to encourage its cultivation even, by the resource poor farmers who constitute over 80% of all farm holdings in Nigeria (FAO, 2000) [10, 22, 6].

Increasing demand, usage and economic value of cassava has nearly doubled the worldwide production of cassava for the last 30 years, reaching 213 million tonnes in 2005 (IITA, 2009) [14]. It is estimated that world cassava utilization will reach 275 million tonnes by the year 2020 [33], with some researcher estimating the number closer to 291 million tones. Africa currently produces more than 50 percent of the world production, with Nigeria producing nearly two-third of total cassava production in Africa, making it the highest producer in the world; a third more than Brazil and almost double the production capacity of Thailand and Indonesia (IITA, 2009) [14]. From 3.81 million hectares, it produced 45.72 million tonnes in 2006; 18% higher than its production in 2004 [29]. This figure is expected to double by 2020. Despite her advantage in cassava production, Nigeria is not an active participant in cassava trade in both regional and international markets. Most of her output is unprocessed and only targeted at the domestic food market. The reason is total lack of supply chain structure for the commercialization of secondary cassava product as a primary source of raw material for agro industries [9]. The contribution of cassava to economic growth and poverty reduction has been limited because, in time past, Nigerians see cassava as just a food security, or self sufficiency crop (FAO, 2011) [11]. It is not thought of as an agric-food enterprise capable of moving Nigeria economy forward, or able to bridge food scarcity occasioned by increasing population nor as an export earning provider.

Commercialization of household agriculture in Nigeria is a smooth conduit to increasing the productive capacity of smallholder farmers to reduce poverty; economic recovery, growth and development.

Commercialization from agricultural perspective refers to the process of increasing the proportion of agricultural production that is sold by farmers. Commercialization of agriculture as a characteristic of agricultural change is more than whether or not a cash crop is present to a certain extent in a production system. It can take many different forms by either occurring on the output side of production with increased marketed surplus or occur on the input side with increased use of purchased inputs. Commercialization is the outcome of a simultaneous decision making behavior of farm households in production and marketing [32].

The definition of commercialization adopted in this work is based on market participation and orientation. In the views of [15] and [30], a farm household is assumed to be commercialized if it is producing a significant amount of cash commodities, allocating a proportion of its marketable commodities, or selling a considerable proportion of its agricultural outputs. In this context, cassava commercialization is seen as the aggregate of household surplus presented by smallholder farmers in the market for acquisition and income.

Increasing per capita food production and raising rural incomes are arguably the greatest challenges facing Sub-Saharan Africa and the developing world more generally. The history of economic development in other regions of the world indicates that agricultural productivity growth has been the major source of sustained improvements in rural welfare [30]. The argument that productivity growth and food security in smallholder agriculture will require a more commercialized orientation implies that policy must be designed to encourage a transformation out of the semi-subsistence, low-input, low-productivity agriculture that characterizes much of rural Nigeria.

2. Commercialization allows increased participation of individuals and poor households in the domestic, national and international exchange economy and results in higher average farm incomes and lower farm income inequality. The farming sector has a

dual structure with subsistence farmers, who produce for their own consumption and farmers who sell at least a part of their output in the market. However, majority of the farmers from developing countries produce for own consumption and marginal surplus for the markets. As such, they do not derive fully the benefits of the market economy. Despite all these hurdles, the farmers have managed to participate in the markets by delivering food crops, fruits, vegetables and livestock products [28]. This represents a degree of commercialization.

3. It is a general understanding that food security is constrained by gap in food supply and food demand. Great imbalance exists in the demand and supply of cassava in Nigeria. It is estimated that her output is by far less than what would be required to satisfy the demand for processed by-products of cassava [24]. Unfortunately, supply for this product is grossly inadequate in Nigeria due in part to certain identified constraints to agricultural productivity. Many researchers such as [25, 23, 6, 22] have highlighted the challenges of agricultural and cassava productivity.

Cassava is generally believed to be cultivated by small scale farmers with low resources [9]. These smallholders, mostly subsistence producers' account for 80% of all farm-holding in Nigeria [22]. This limits their ability to compete favorably with the remaining 20% medium and large scale commercial farmers in Nigeria and other countries that have attained the desired allocative/economic and technical efficiency in cassava production. Smallholder commercialization is assumed to lead towards more specialized production systems based on comparative advantages in resource use. Today, agriculture has metamorphosed into a competitive business and it is difficult to imagine that any Nigeria can achieve its food security policy and other economic objectives without enhancing the productivity capacity of household farmers who constitute a large chunk of the market participants to improve cassava production and marketing. This has made the consideration of this study

necessary. Accordingly, this study examines the effect of commercialization on the productive capacity of cassava producing households in Abia State, Nigeria. The specific objectives are to: identify the socio-economic profile of cassava farmers in Ikwuano LGA; determine and analyze the commercialization index among the compared households and analyze factors that influence commercialization among producing households.

MATERIALS AND METHODS

The study area is Ikwuano Local Government Area of Abia State, Nigeria. The state is located within the southeastern Nigeria and lies between longitude $04^{\circ} 45'$ and $06^{\circ} 07'$ North and Latitude $07^{\circ} 00'$ and $08^{\circ} 10'$ East. Abia state is bounded by Imo state at the western border; Ebonyi and Enugu states at the North; Cross River and Akwa-Ibom states at the East and Rivers state at the south. Its population stood at about 2,883,999 persons with a relatively high density at 580 persons per square kilometer (NPC, 2007) [20]. At an annual growth rate of 2.83%, the population is projected at about 3.2 million in 2004. About 30% of the population lives in major urban areas.

Abia State is divided into administrative blocks called Local Government Areas which is grouped into three (3) agricultural Zones namely Ohafia, Umuahia and Aba Zones. In terms of occupation, about 70% of Abians are farmers and have the potentials for the production of agricultural produce and products such as palm oil, cassava, vegetables, palm kernel, yam, rice, cocoa etc, livestock, fish and also engage in food processing (ABSG, 1992) [1]. The presence of a good numbers of agricultural institutions eg. National Root Crops Research Institute, Michael Okpara University of Agriculture, Faculty of Agriculture of Abia State University, Extension outfit of Ahmadu Bello University etc in the state guarantees an unquantifiable advantage and adds to their capacity in their agricultural production.

The study adopted purposive sampling

technique in the selection of location. One LGA were selected on purpose based on characteristics of interest, nearness and other related features and 120 respondents was drawn from the area. The selection was done from 6 communities at the rate of 20 respondents per community. Primary data was used and collected with questionnaire to the selected respondents.

Analytically, descriptive statistics such as means, percentages and t-test, Household Commercialization Index (HCI) and multiple regression models was employed in realizing objectives of the study.

Following [30, 13], Household commercialization index (defined as the sum of the value of household crop sales as a proportion of the value of crop expressed in percentage terms). It is presented mathematically below.

Agricultural HCI =

$$\frac{\text{Value of crop sold}}{\text{Total value of crop produced}} \times \frac{100}{1}$$

The index measures the ratio of the gross value of crop sales by household i in year j to the gross value of all crops produced by the same household i in the same year j expressed as a percentage. The index measures the extent to which household crop production is oriented toward the market. A value of zero would signify a totally subsistence oriented household and the closer the index is to 100, the higher the degree of commercialization. The advantage of this approach is that commercialization is treated as a continuum thereby avoiding crude distinction between “commercialized” and “non-commercialized” households. They effectively bring subsistence food production to the centre of discussions about commercialization [5, 16]. The multiple regression models is specified as follows:

$$Y_1 = f(X_1, X_2, X_3, X_4, \dots, X_7 + e_1) \dots \dots \dots (1)$$

Where:

Y_1 = Index of commercialization

X_1 = Farm size (hectares)

X_2 = Household size (No)

X_3 = Sex (male = 1; female = 0)

X_4 = Education (years)

X_5 = Age (years)

X_6 = Output (kg)

X_7 = Nearest to market (km)

X_8 = Membership of cooperative (Yes = 1; No = 0)

X_9 = Monthly Income (Naira)

X_{10} = Farm experience (years)

e_1 = Error term

In this study, double log model was chosen as the lead equation. The formula is stated below

$$\log Y = b_0 + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5 + b_6 \log X_6 + b_7 \log X_7 + b_8 \log X_8 + \dots + b_n X_n + e \dots \dots (2)$$

RESULTS AND DISCUSSIONS

Socio-Economic Characteristics of Cassava Producing Households

Table 1 shows the socio-economic characteristics of cassava producing households. The age of the farmers producing cassava in household ranged from 19 to 68 years with a mean of (40.47 years). 47.50% of them fell within the age bracket of 38 to 57. This implies that most of producing households are still active towards cassava production. This result is consistent with the similar studies conducted by [2, 21]. The adult age of active farmers accounts for 47.32% of the population sampled, close to that is the middle class age (18 to 37), which has a fair share in the distribution of active farmers as it accounted for 41.67% of the total population sampled. The old age group (58 to 77 years) has the lowest impact in farm work with only (10.83%) contributing to active farming among the sampled population. Naturally, younger people tend to be more productive than their older counterparts. Educationally, 33.04% of the farmers had acquired primary education, this represent a mean of 11.32%, while 42.61% of the farmers had secondary education. Only 24.35% of the respondents possess a higher education. Little education affects household ability to embrace changes and innovations especially the adoption of modern farming technology. The level of

education attained not only increase productivity but also enhances the ability to understand and adopt new methods of operations [3]. By implication, the study shows fairly high literacy level. The number of year spent in farming (farming experience) gives an indication that the cassava farmers in the area have practical knowledge about farming. Although majority of the farmers are new entrants, the mean farming experience of the farmers 14.90. This implies that they are fairly experienced in cassava production. This result is consistent with [31], who had a similar outcome in their study on Cocoyam production. The dominant household size category ranged from 2-5 persons and represented by an overwhelming percentage of 60%. This gave a mean of approximately 6 persons per household. It implies that cassava farmers in the area have fairly large household size. This is not surprising because large family sizes are common in rural areas in Nigeria.

Table 1. Distribution of the socio-economic profile of the households

Variables		
Age	Frequency	Percentage
18-37	50	41.67
38-57	57	47.50
58-77	13	10.83
Total	120	100
Mean	40.4667	
Education		
1-6 (primary)	38	33.04
7-12 (secondary)	49	42.61
13-18 (tertiary)	28	24.35
Total	115	100
Mean	11.3220	
Farming Experience		
5-20 (new entrant)	108	90
21-36 (semi-experience)	7	5.83
37-52 (highly experienced)	5	4.17
Total	120	100
Mean	14.900	
Households size		
2-5	72	60
6-9	47	39.17
10-13	1	0.83
Total	120	100
Mean	5.553	

Source: Field Survey (2014)

Determination and Analysis of Commercialization Index among Households

Commercialization index were used to ascertain the determination and the analysis of

commercialization among households using the formulae as stated below

$$\text{Agricultural commercialization Index} = \frac{\text{value of crop sold}}{\text{total value of crop produced}} \times \frac{100}{1}$$

Only very few Cassava producing households (1.67%) have very high commercialization orientation.

Table 2. Level of Commercialization among households

Level of commercialization	Frequency	Percentage
2-20	19	15.83
21-39	99	82.5
40-58	2	1.67
Mean	28.2327	
Total	120	100

Source: Field Survey Data (2014)

This commercialization level can be adjudged low given the fact that Nigeria remains the largest producer of cassava and Abia state belongs to the South east zone that contributes about 20% to the national basket. According to Cassava Master Plan (2006), the Nigerian Cassava belt is composed of the North Central Zone (Benue, Nasarawa, Plateau, Niger, Kogi, Taraba and kwara States) which produces the largest quantity (about 29%) followed by the South South States (24%), South east (20%), South west (20%) while North east and North west contributed 7%.

Factors that Influence Commercialization among Producing Households

The result of the multiple regression models to investigate the extent of variations contributed by these variables is presented in table 3. Double log functional form was chosen as the lead equation, since it had the highest value of R^2 of 0.72. This implies that 72% of the observed variations in the household cassava commercialized were explained by the included variables. Also, the F ratio (67.00) was significant at 1% indicating regression of best fit.

The coefficients of the following variables: sex, marital status, membership of cooperatives, farm size and nearness to market were found to be negatively signed and significant at various confidence levels. This suggests that an increase in these

variables will lead to a decrease in the productive capacity of cassava producing households, which affects commercialization orientation and market participation in the study area. The negative Size of land is in line with the findings of [18, 17], which had the same outcome. However, this result contradicts [26, 5, 27]. For instance, it is expected that increased area cultivated would have been associated with gross output, so the sign of the coefficient for land would have been positive.

Table 3. Determinants of Agricultural Commercialization

Variables	Linear	+Doubling log	Semi-log	Exponential
Constant	32.393*** (4.278)	2.814** (3.081)	-29.235 (-0.631)	3.600*** (23.427)
Sex	-0.939 (-0.345)	-0.385*** (-4.583)	-0.246 (-0.058)	-0.063 (-1.137)
Age	0.086 (0.570)	0.204 (1.139)	13.767 (1.514)	0.002 (0.531)
Marital status	3.165* (2.025)	-0.195* (-2.127)	10.010* (2.154)	0.066* (2.094)
Education	0.458 (1.384)	0.090 (0.889)	8.940* (1.733)	0.066 (0.869)
Membership of cooperative	-3.727 (-1.175)	-0.223* (-2.588)	-5.887 (-1.345)	-0.150* (-2.338)
Experience	-0.162 (0.726)	0.754*** (6.732)	-9.680* (-1710)	0.001 (0.259)
Household size	-0.884 (-0.963)	-0.225 (-1.395)	3.369** (3.803)	-0.053** (-2.834)
Income	1.622E-6 (0.170)	-0.015 (-0.274)	3.098*** (5.533)	0.023* (2.318)
Nearness to market	-0.677*** (-4.702)	-0.217*** (-3.875)	0.658 (0.234)	0.001 (-0.379)
Farm size	-0.442 (-0.423)	-0.654*** (-4.139)	-3.547 (-0.442)	0.004 (-0.174)
Value of output	1.240E-8 (0.005)	0.043* (1.697)	0.115 (0.089)	5.457 (1.089)
R ²	0.683	0.719	0.442	0.450
F-Ratio	2.979	67.000***	8.196***	1.625*

Source: computed from field survey data (2014)

***, **, * = significant at 1%, 5% and 1% probability level

Land size (farm size) indicates the potential to produce surplus for the market [19]. Also, membership of associations and groups possess the potentials of increased access to information important to production and marketing decisions [5]. However, value of output and experience are positively signed and significant at 10% and 1% probable level respectively. This implies that any increase in these two variables will lead to a corresponding increase in cassava production

and subsequently greater income for the cassava households. This result is in line with *a priori* expectation and in line with the results posted by [4].

CONCLUSIONS

Having assessed the factor affecting commercialization among cassava producing households, it is glaring that on the average, cassava producing farmers lacks the required inputs necessary for increase cassava production and commercialization. This is because; rural cassava producing farmers are subsistence farmer, in order words their products are consumed most by their households. The result indicates that only less than 2% of the farmers are highly commercialized, which exposes to level of farming practice in the study. Therefore, in order to sustain and improve the productivity among farming household, the need to review land tenure policy issues, labour and capital cannot be over emphasized. For instance, most of the productive agricultural areas in Nigeria are under cultivation. Developing strategies to increase the value of agricultural production per unit of land is a top priority. On a general level, this study recommends support policies for farmers in the rural areas; linkages between farm households and the markets; increase access and exchange of information on markets. From evidence, women are much more involved in cassava production than their male counterparts. Therefore, men should also be encouraged to be involved in order to ensure greater productivity.

REFERENCES

- [1] Abia State Government (ABSG), 1992, Abia in Brief. Published by the Abia State Government Press, Government House, Umuahia. Pp. 1 – 3.
- [2] Afolabi, J. A., 2009, An Assessment of Garri Marketing in South Western Nigeria. Journal of Social Science 21(1) 33-38
- [3] Agwu, A. E., Dimalu, M. U., Madukwe, M. C., 2008, Innovation System Approaches to Agricultural Development: Policy Implementation for Agricultural Extension Delivery in Nigeria, African Journal of Biotechnology, 7(ii)
- [4] Agwu, N.M., 2009, Determinants of profitability

- among plantain marketers in Abia State, Nigeria. The Nigerian Journal of Development Studies, 7(1): 49–58
- [5]Agwu, N. M., Anyanwu, C. I., Mendie, E. I., 2013, Socio-Economic Determinants of Commercialization among Smallholder Farmers in Abia State, Nigeria. Greener Journal of Agricultural Science, 2(8)392-397
- [6]Bamidele, F. S., Babatunde, R.O. and Ajao R., 2008, Productivity Analysis of Cassava-Based Production Systems in the Guinea Savannah: Case Study of Kwara State, Nigeria. American-Eurasian Journal of Scientific Research 3 (1): 33-39, 2008
- [7]Cassava Master Plan, 2006, A strategic Action Plan for the development of the Nigerian Cassava industry, Prepared By The United Nations Industrial Development Organization In Cooperation With The Ministry Of Trade And Industry And The Presidential Initiative On Cassava
- [8]Ezebuio, N. O., Chukwo, G. O., Okoye, B. C., Oboajigs, I. C., 2008, Policy Issue and Adoption of Improved Cassava Varieties. Gender Consideration in Umuahia Zone of Abia State, pp. 1056-1059
- [9]Ezedinma C.I., Kormawa, P., Adekunle, A., Okechukwu, R., 2002, Linking producers to the market: the RUSEP Approach. Paper presented at the international workshop on cassava competitiveness in Nigeria, November 18-22, 2002, IITA, Ibandan.
- [10]FAO (Food and Agricultural Organisation), 2000, *The State of Food Insecurity in The World*. Food and Agricultural Organisation of the United Nations.
- [11] FAO (Food and Agricultural Organisation), 2011, A Cassava Industrial Revolution in Nigeria. www.fao.org/doerep/007/y5548e/y5548e0b.htm (Accessed on January 8, 2014)
- [12]Federal Ministry of Agriculture and Rural Development (FMARD), 2006, National Programme for Food Security, Expansion Phase Project 2006 (2010) (Main Report)
- [13]Govere, J., Jayne, T.S., Nyoro, J., 1999, *Smallholder Commercialization, Interlinked Markets and Food Crop Productivity: Cross Country Evidence in Eastern and Southern Africa*, the Department of Agricultural Economics and the Department of Economics, Michigan State University, June 1999. Available on: www.aec.msu.edu/fs2/ag_transformation/atw_govere.pdf, [Accessed on 20.09.12]
- [14]International Institute for Tropical Agriculture (IITA), 2009, Yam production in Africa. International Institute of Tropical Agriculture (IITA), Nigeria. Available from http://www.iita.org/cms/details/yam_project_details.aspx?zoneid=63&articleid=268. (Accessed on April 2009)
- [15]Immink MDC., Alarcon JA., 1993, Household income, food availability, and commercial Crop Production by Smallholder Farmers in the Western Highlands of Guatemala. Economic Development and Cultural Change 41(2):319–342.
- [16] Jaleta, M., Gebremedhin, B., Hoekstra, D., 2009, *Smallholder Commercialization: Processes, Determinants and Impact*. Discussion Paper No. 18. Improving Productivity and Market Success (IPMS) of Ethiopian Farmers Project, ILKRI, Nairobi, Kenya. 55pp
- [17]Mwakalobo, A. B. S., 2000, Resource Productivity and Allocation Efficiency in Smallerholder Coffee Farmers in Rugwe District, Tanzanian. Paper Published in the AGREST Conference proceeding series volume 4.
- [18]Onoja, A. O., Ibrahim, M. K., Achike, A. I., 2010, Econometric Analysis Of Credit And Farm Resource Technical Efficiencies' Determinants In Cassava Farms In Kogi State, Nigeria: A Diagnostic And Stochastic Frontier Approach.
- [19] Martey, E., Hassan, R. M. A., Kuwornu, J. K. M., 2012, Commercialization of Smallholder Agriculture in Ghana: A Tobit regression analysis. African Journal of Agricultural Research Vol. 7(14), pp. 2131-2141, 12 April, 2012 Available online at <http://www.academicjournals.org/AJAR> DOI: 10.5897/AJAR11.1743
- [20]National Population Commission (NPC), 2007, Details of the breakdown of the National and State Provincial Population Totals 2006 Census. National Population Commission, Federal Republic of Nigeria Official Gazette 24(94):1 – 26
- [21]Nto, P. O. O., Ekeagwu, I. C., Azubuike, I., 2013, Evaluation of Risk Management Strategies Among Garri Producers in Abia State, Nigeria. The Nigerian Agricultural Journal 44(1&2): 164-175
- [22]Nwajiuba, C.U., 2013, Nigeria's Agriculture and Food Security Challenges. Accessed from www.ng.boell.org/...agriculture-green_deal_nigeria_study.pdf
- [23]Nweke, F., Haggblade, S., Zulu, B., 2004, Building On Successes In African Agriculture: Recent Growth in African Cassava. International Food Policy Research Institute www.ifpri.org
- [24]Olomola, A. S., 2007, "Strategies for Managing the Opportunities and Challenges of the Current Agricultural Commodity Booms in SSA" In Seminar Paper on Managing Commodity Booms in Sub-Saharan Africa: A Publication of the AERC Senior Policy Seminar IX: African Economic Research Consortium (AERC) Nairobi, Kenya
- [25]Omonona, B. T., 2009, Efficiency of resource - use in cassava production in Kogi State, Nigeria: implications for food security and environmental degradation. Retrieved on 27th April, 2009 from <http://www.cababstractsplus.org/abstracts/SearchResults>.
- [26]Olwande, J., Mathenge, M., 2010, Market Participation among the Poor Rural Households in Kenya. Tegemeo Institute of Agricultural Policy and Development.
- [27]Omiti J. M., 2009, Factors Affecting the Intensity of Market Participation by Smallholder Farmers: A Case Study of Rural and Peri-urban Areas of Kenya. African Journal of Agricultural and Resource

Economics 3(1):57–82

[28] Rahut, D.B., Castellanos, I.V., Sahoo, P., 2010, Commercialization of Agriculture in the Himalayas, Institute of Developing Economies, IDE Discussion paper no. 265.

[29] Sanni L. O., Onadipe, O.O., Ilona, P., Mussagy, M.D., Abass, A., Dixon, A.G.O., 2009, Successes and challenges of cassava enterprises in West Africa: a case study of Nigeria, Bénin, and Sierra Leone: International Institute of Tropical Agriculture (IITA).

[30] Strasberg P.J, Jayne, T. S., Yamano, T., Nyoro, J., Karanja, D., Strauss J., 1999, Effects of Agricultural Commercialization on Food Crop Input Use and Productivity in Kenya. Michigan State University International Development Working Papers No. 71.

Michigan, USA.

[31] Ume, S. I., Uloh, V. E., Ochiaka, J. S., 2013, Socio-Economic Determinants of Cocoyam Production in Anambra State, Nigeria. The Nigerian Agricultural Journal, 44(1&2):276-288

[32] Von Braun J., Bouis, H., Kennedy, E., 1994, Conceptual framework. In: von Braun J and E. Kennedy (eds), Agricultural Commercialization, Economic Development, and Nutrition. Johns Hopkin University Press, Baltimore, Maryland, USA. pp. 9 – 33.

[33] Westby, A., 2008, Cassava Utilization, Storage and Small-scale Processing. In R. Hillock, J. Thresh, & A. C. Bellotti, eds., Cassava Biology, Production and Utilization. CABI Publishing.

DETERMINANTS OF MARKETING EFFICIENCY FOR PACKAGED WATER IN IMO STATE, NIGERIA: MAXIMIZING FIRMS ASSETS TO IMPROVE CONSUMER WELFARE

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Abstract

Competition is necessary for enhanced customer welfare and efficiency. This study focused on marketing efficiency of packaged water in Imo state Nigeria. It specifically examined the socio-economic profile of the respondents; levels of marketing efficiency of packaged water and its determinants. The study employed purposive and multistage sampling technique in the selection of location and respondents respectively from whom information were elicited. Analytically, descriptive statistics, schematic diagram and OLS multiple regression models were used. Results showed that the respondents were predominantly married male adults, with average household size of 7 persons. They were fairly educated and experienced in the business. The study further revealed that age, education, household size and income were the major determinants of marketing efficiency of packaged water marketing in the area. The result also showed that net income, marketing cost, and marketing margin were higher in urban area, which implies that marketer in semi-urban areas were operating below optimum efficiency levels. This study therefore suggested the need to incorporate integrated logistics management and marketing strategies as a measure to reduce unnecessary marketing costs; capacity enhancement programmes for marketers and improvement in infrastructural development as a means of addressing marketing efficiency and customer welfare.

Key words: channel, cost, efficiency, marketing, marketing cost, marketing margin, water

INTRODUCTION

Today, access to improved water supply is a major challenge in the world. Although significant progress has been recorded in terms of number but practically more than 780 million people globally lack access to improved drinking water sources (UNW-DWP, 2012) [45]. In Nigeria, the current water supply service coverage is 58 per cent, which covers only about 87 million people and implies that more about 73 million Nigerians lack access to potable water [33]. A development which has encourages alternative sources of improved water supply and distribution; and has opened up huge market opportunities for many businesses to package water in readily available sachets and bottles, competing side by side. Today, drinking of packaged water has become essentially part of our culture. According to NAFDAC (2014) [27], the daily consumption

expenditure on water in Nigeria has hit 10 billion from 8 billion Naria in 2013.

The increase in demand for packaged water in recent times was bolstered by the rising health awareness among consumers, and the inadequate performance of public utilities providers which has led to lack of public supply of safe drinking water in the cities, nay rural areas. Rising disposable incomes, new launches (particularly cheaper domestic brands), promotional activities and increase in formal education have also impacted positively on the demand for packaged water (NADFAC, 2014) [27] [26]. Health issues are currently being used in advertisement to spur up demand for packaged water against demand for soft/mineral drinks. Interestingly, producers find this concept an irresistible business opportunity and social marketing platform to educate people about health and weight loss [47, 26]; thus giving bottled water an edge over most mineral drinks. The growth

in this industry is expected to rise in the forecasted period surpassing its total volume Compound Annual Growth Rate (CAGR) relapse of 7% between 2011 and 2012 (Euromonitor, 2012) [18].

Globally, packaged water market is expected to expand by more than 27% in the five-year period ending 2015 generating more than \$126 billion in revenue. Although the industry has grown exponentially, it is yet to fully maximize its potential given that it is constrained by inefficient marketing system. The marketing of packaged water is characterized by poor marketing infrastructure, inadequate or low level of understanding of market requirements and supply chain related challenges that hinder prompt delivery of products. High cost of production is also another challenge which needs to be handled so as to reduce the number of people without access to safe and portable drinking water. These may have contributed to the reduction in the total volume Compound Annual Growth Rate (CAGR) of 7% in 2011 (Euromonitor, 2012) [18]. Marketing efficiency is considered to be a pre-requisite for prompt delivery of goods [38]. Prompt delivery of goods at a reasonable price is possible only when the market work in a competitive way; because absence of competition entrench inefficiency. It is expected that marketing efficiency will address the issue of efficiency and enhance overall welfare of consumers, since according to [46], there is no room for a firm which is inefficient and ineffective in marketing.

The degree of efficiency is often a criterion by which marketing systems are measured. [42] suggested that the objective of being efficient and effective is to get loyal customer at low marketing cost and consequently increase profit [36]. According to [2], marketing efficiency is necessary because consumers derive the greatest possible satisfaction at the least possible cost. To the consumer, marketing efficiency may mean getting his commodities at the lowest price while from the producer's perspective; it may imply selling at the highest price. For this study, marketing efficiency therefore refers to the

movement of goods and services from the producers to consumers at the lowest price consistent with the provision of the service consumer's desire/demand [12].

The efficiency of the marketing system has a link with customer welfare and by implication overall economic development of a country. Efficiency is an important factor of productivity growth as well as stability of production especially in developing economies [21]. Its contributions to improved (agricultural) productivity and performance for the welfare and satisfaction of consumers have been highlighted in several studies and literature [*eg.* 4, 8, 6, 37, 1, 9].

Marketing efficiency and performance are often regarded as synonymous. They are hinged on the overall economic performance of a firm based on its marketing activities that result in cost and can affect its long run profitability. The extent of a firm's achievement of the above depends on the evaluation of marketing enterprises for structure, conduct and performance (S-C-P) framework; that percolates in the form of capital formation, investment, income and savings.

Many studies on marketing efficiency [*eg.*, 6, 7, 10, 20] have focused on food related agricultural chain, and water is an extension in that conduit. The channel structure of packaged water market shared almost the same unique similarity with many agricultural markets. Only in a simplest marketing system will a producer sell directly to the final consumer, whose interest is pivotal to the demand for improve marketing efficiency.

It is in view of this that this study considers it imperative to look at the level of efficiency in the performance of marketing of packaged water in South-Eastern Nigeria with specific focus to (i) examine the marketing system and channel of packaged water in the study area; (ii) determine the levels of marketing efficiency and profitability of packaged water; and estimate the determinants of marketing efficiency of packaged water in the study area.

Theoretical Framework

Water is an essential commodity of life, hence it is important that it should be available to

consumers at the right place, right time, right price, in the right quality and quantity. Unfortunately, this is not the case as millions of people around the world lack access to portable drinking water, which raises serious concern among development experts and authorities. The zeal to improve access to safe drinking water has driven private businesses to exploit the gap in demand and supply for safe drinking water to package and distribute water in readily available sachets and other formats. Marketing therefore serves as a sort of a gearbox, which makes a profitable connection between demand and supply for products. According to [5] marketing systems play a decisive role in vibrant economies as mechanisms for both exchange (necessary for specialization and hence leads to higher economic growth) functions and the proper coordination of the exchange (through price signals) which reflect and shape producer and consumer incentives in supply and demand interaction. If small scale domestic producers are to take advantage of the projected domestic demand growth, then marketing systems in the supply chains linking producers to consumers must be able to support low of cost production and timely delivery of the product. According to [43], the primary aim of being efficient and effective is to get loyal customers at low marketing costs.

Unfortunately, it will be impossible to achieve the above glorious results without serious competition. Competition has an influence on firm's ability to effectively manage its resources. According to [38] competition in marketing is desirable for the reason of customer welfare and efficiency. In terms of customer welfare, it hands control to consumers and coerces sellers to offer an ever lower price in order to attract sales [19]. Furthermore, it optimizes marketing performance by addressing those constraints to efficient service delivery and marketing system. Increasing access to safe drinking water will be impossible without efficient marketing system, because, marketing efficiency is considered a pre-requisite for prompt delivery of goods. Prompt delivery of

goods at a reasonable price is possible only if the market works in a competitive way – allowing traders freedom to exercise their actions.

Despite the enormous contributions of marketing to customer welfare, many criticize and argue that marketing activities increase cost, and as such are inefficient, wasteful and costly. The cumulative effect of this justifies a study on marketing efficiency.

The concept of marketing efficiency can be approached from three different perspectives, which include:

(i) Maximization of input-output ratio

Among the early scholars that follow this perspective include [25, 11, 42]. Marketing efficiency was analyzed by [25] on the basis of optimizing behaviour of economic agents. It is the maximization of input-output ratio, output being consumer's satisfaction and input as labour, capital and management that marketing firms employed in the productive process. In this light, marketing efficiency is seen as the ratio of marketing output divided by the input.

(ii) Competition or effective market structure

According to [38] the three components of effectiveness, cost and their effect on performance on marketing functions and services which in turn affect production and consumption constitute marketing efficiency. To [24] marketing efficiency signifies the effectiveness or competence with which market structure performs its designated functions. The desirability of competition in promoting the operation of the markets, customer welfare, and productivity is no longer in doubt [38, 46]. Accordingly, when you destroy competition, you are invariably encouraging inefficiency. [46] opined that in a competitive market, there is no room for any firm which is inefficient and ineffective in marketing.

(iii) Lower price spread or marketing margin

The higher the price spread, the greater the inefficiency in the marketing system and a minimum price spread denotes an efficient marketing system. One can consider a marketing system efficient if it performs the following functions as observed by [41],

(a) An adequate marketable surplus to be ensured.

(b) Prevalence of lower price spread.

(c) Accessibility of agricultural inputs to be ensured to farmers at a reasonable price.

In practice, it is difficult to delineate a clear area of stoppage among these approaches because they are all relevant and intertwined. But the challenge lies on the acceptable balance of measurement for marketing inputs in delivering goods promptly. [35] mentioned marketing margin or farm to retail, price spread, and market integration as two major ways of measuring marketing efficiency in a given competitive market. This study adopts the same view - marketing margin analysis. This choice is sequel to the nature, type and length of channels through which packaged water passes. This margin method makes calculation of price spread less complex. This is consistent with the one adopted by [14].

Marketing margin is the difference between the product's value and retail price. It represents payments for all marketing activities such as assembling, processing, transporting and retail charges added to the products [15]. It is powered by marketing cost. The earliest attempt to evaluate performance focused on the cost of inputs used in the marketing process. Although, there is lack of precision in the use of cost as a measurement for performance, here, cost is seen in relation to returns on investment. Again, marketing margin usually suggest a cost-effective approach to measure performance. The notion of cost-effectiveness was first suggested by [17], who first used the term economic efficiency – net output per unit of input.

Marketing costs are measured in terms of marketing margin which simply reflect the share of the consumers currency that is required to cover the cost incurred in the marketing process [14]. It is total cost incurred on marketing by producer – seller and by the various intermediaries involved in the sale and purchase of the commodity till the commodity reaches the ultimate consumer [2].

MATERIALS AND METHODS

The study area was Imo state. Imo state is situated in the south eastern geopolitical zone of Nigeria. The state lies between latitude $4^{\circ} 45'$ and $7^{\circ} 15'$ north of equator as well as between longitude $6^{\circ} 50'$ and $7^{\circ} 25'$ east of Greenwich meridian. It is therefore in the tropical rainforest zone. The state parades many rivers such as Imo, Otamiri, Njaba and Urashi while the major lakes are Oguta lake in Oguta Local Government Area and Abadaba in Obowo Local Government area. The vegetation of the state, which was normally forest, has reduced to secondary vegetation and palm bush, otherwise known as low forest. In the northern part of the state along rivers banks, the vegetation is a rich savanna and tropical rainforest [28]. It has estimated population of 3.9 million with a growth rate of 2.8% per annual and the population density varies from 230-1, 400 people per square kilometer (IMSPEC, 2004) [22].

The opportunities opened by the increasing demand for improved water quality have opened the window for many businesses to open factories in the state. At present there are more than 20 registered packaged water factories in Imo state, Nigeria.

To realize the objective of the study, purposive and multi-stage random sampling techniques were employed. The first stage, involved the purposive selection of three local government areas (LGAs), one from each of the three zones in the State. For this purpose, Okigwe was chosen for Okigwe zone, Owerri-North was selected for Owerri zone and Orlu was picked for Orlu zone. These choices were informed by the nature of products understudy and the cosmopolitan nature of these cities. The second stage involved random sampling of 40 respondents from trade unions identified in the LGAs under study. This aggregated to 120 respondents used for this study. The respondents are traders of packaged water in the study area

Analytical Procedures

According to [44], four methods can be used to measure marketing efficiency. They include Shepherd's method; Acharya and

Aggarwal's method; Composite Method and Marketing Efficiency Index method.

Shepherd Method:

$$ME = (V/I) - 1 \quad \dots\dots\dots (1)$$

Where V= value added by marketing activities (value of goods sold)

I = total marketing cost

Acharya and Aggarwal's method:

$$E = (O/I) \times 100 \text{ or } \frac{\text{Nets price received by the traders}}{\text{Marketing cost} + \text{marketing margin}} \quad \dots\dots\dots (2)$$

Where E is marketing efficiency; O is output of the marketing system and I is cost of marketing including margin of intermediaries.

Composite Method:

$$MEI = R_j/N_j \quad \dots\dots\dots (3)$$

In this method, the percentage of producer's price, marketing cost and marketing margin to consumer's price are calculated and these are assigned ranks.

Marketing Efficiency Index method

$$ME = 1 + (\text{marketing margin} / \text{marketing cost}) \quad \dots\dots\dots (4)$$

In estimating marketing efficiency, this study tried three methods [equations 1, 2, and 4]. As per the formulas, higher values/ratio denotes higher level of efficiency and vice versa [44, 2, 16, 39].

In order to calculate marketing costs, which are measured in terms of marketing margin, the study employed

$$C = C_f + C_{m1} + C_{m2} + C_{m3} + \dots\dots C_{mi} \quad \dots\dots (5)$$

Where

C = total cost of marketing of the commodity,
C_f = cost incurred by the producer from the time the product leaves the factory and

C_{mi} = cost incurred by the *i*th middleman in the process of buying and selling the product.

This formula followed the one adopted by [2, 7].

In the analysis of determinants of efficiency four functional forms of multiple regression models were tried. The implicit form was stated as follows:

$$Y = f(X_1 + X_2 + X_3 + X_4 + X_5 + X_6 + X_7) \quad \dots\dots\dots (6)$$

Where: Y = Marketing efficiency (%)

X₁ = Age (years)

X₂ = Education (years)

X₃ = Household size (No of persons)

X₄ = monthly Income (Naira)

X₅ = Marketing cost per bottle

(Naira)

X₆ = marketing margin per bottle

(Naira)

X₇ = Membership of marketers/traders unit/ (1 for members and 0 for non members)

e₁ = sample error term

Four functional forms of multiple regressions were employed in order to select the one that provided the best fit. The forms included linear, double-log (Cobb Douglas), semi-log and exponential. The choice of which to adopt depended on the magnitude of the R² value, the significance and sign of the regression coefficient as they conform to *a priori* expectation. This method is consistent with the [13], who employed same in their study.

RESULTS AND DISCUSSIONS

Marketing Channel for Packaged Water in the Study Area

The complex network of participants in the marketing system of packaged water include: the factories from which goods moved to others – depot, sales force, traders/distributors, wholesalers, retailers, hawkers down to the final consumer. These people were necessary in fulfilling the four basic marketing system alternative goals: maximizing consumption, customer satisfaction, and choice and life quality. The nature of water compounds the task of marketing intermediaries, making their task more demanding and complex. Therefore, efficiency of the marketing system in enhancing the prompt delivery of goods cannot be overemphasized.

The emphasis on marketing channel and system analysis is to show the systematic linkages in performing marketing functions

and cost spread in moving water from the producer to the consumer and the quantity of services rendered to facilitate the flow. This study identified the following target markets for packaged water in the study area: 1.School

children, 2.Workers, 3.Business places, 4.Worship centers, 5.Market places, 6.Eateries and local restaurants and hotels, 7.Formal gathering events, 8.Parties and celebrations.

Table 1.Socio-economic characteristics of the respondents in Imo State, Nigeria

Variables	Frequency	(percentage)
Age (years)		
20 – 29	14	11.67
30 – 39	58	28.33
40 – 49	29	24.17
50 – Above	19	15.83
Total	120	100
Education level		
No formal education	17	14.17
Primary education	45	37.50
Secondary education	53	44.17
Tertiary education	5	4.16
Total	120	100
Household size		
1 - 5	55	45.83
6 - 10	47	39.17
11 - Above	18	15.00
Total	120	100
Trading experience		
1 -10	65	54.17
11- 20	42	35.00
21 - 30	11	9.17
31 – Above	2	1.66
Total	120	100
Marital status		
Single	20	16.67
Married	78	65.00
Divorced	9	7.50
Widowed	13	10.83
Total	120	100
Sex		
Male	69	57.50
Female	51	42.50
Total	120	100

Source: Computed from Field Survey, 2013.

Socio-Economic Profile of Respondents

Table 1 showed that the traders were mostly males. About 52.5% were mainly within the age range of 30-49 years. This implies that the traders are very active and fall within the productive age bracket. Majority were married with a mean household size of 7 persons per household. This implies that the traders have fairly large household sizes. They have had formal education as well as marketing experience ranging from 1-20 years. The implication is that the area was dominated by literates, with reasonable trading experience to manage their business effectively. The level of education attained not only increases

productivity but also enhances the ability to understand and adopt methods of operations [32, 3]. This result is consistent with the findings of [34], that male processors were technically more efficient than their female counterparts.

Estimates of Marketing Efficiency and Profitability

Table 2 and 3 shows that the net marketing margin (Naira) ranged from N0.90 in Orlu local government to N3.46 in Owerri-North on per bottle basis. The margin was highest in Owerri-North probably because that local government area is predominantly urban area where turnover rates are high due to increased

demand emanating from population density, than in Okigwe and Orlu local government areas where demand for packaged water is less. Urban areas were mostly inhabited by people who prefer portable and safe drinking water and as such, it was not surprising that the margin was high there also. However,

Orlu is greater as per marketing efficiency using Acharya and Aggrawal's method; It was highest in Okigwe using Shepherd's method and the average marketing efficiency was also highest in Owerri-North (2.84) and lowest in Orlu local government (2.28).

Table 2. Estimate of marketing efficiency of packaged water in Imo State, Nigeria

LGA	TR (₦)	TC (₦)	AR (₦)	AC (₦)	MM (₦)	MC (₦)	NM (₦)	ME (Acharya and Aggrawal Method)
Owerri-North	368,561	301,082	113.11	105.55	7.56	4.10	3.46	8.70
Okigwe	296,007	265,978	104.25	99.61	4.64	3.50	1.14	11.81
Orlu	302,296	296,096	103.91	99.51	4.40	3.45	0.90	12.24
Total	966,864	863,156	321.27	304.67	16.60	11.05	5.50	

Source: computed from field survey, 2013

NB: TSP/TR = Total Selling Price; TCP/TC = Total Cost Price; ASP/AR = Average Selling Price; ACP/AC = Average Cost price; MM = Marketing Margin; MC = Marketing Cost; NM = Net margin; ME = Marketing Efficiency

Table 3. Estimate of Marketing efficiency of packaged water in Imo State

LGA	ME method	Shepherd's ME method	index
Owerri-North	26.59	2.84	
Okigwe	28.76	2.33	
Orlu	29.12	2.28	

Source: Computed from field survey, 2013

The poor efficiency noticed in Owerri-North as shown in the table above is evidenced from the fact that total marketing cost was highest in this area. This result is in line with *a priori* expectation. An efficient market according to [2], when there is increase in competition, improve transportation system and improve customer relations. An efficient market also improve in response to demand and price change.

Determinants of Marketing Efficiency of Packaged Water

Four functional forms of multiple regression models were employed to estimate the determinants of marketing efficiency in the study area. The factors considered were Age (years), Educational level (years), Household size (No), Income (Naira), Marketing cost (Naira), Net margin (Naira), Membership of traders union (Dummy). The result of the analysis was presented in Table 4.

On the basis of statistical and econometric criteria such as R^2 , F-Ratio, the number and

signs of significant variables, the double log functional form gave the best fit and was chosen as the lead equation. The R^2 value indicated that the variable explained 73% variability in efficiency among traders sampled. The f ratio was highly significant at 1% indicating regression of best fit. At various levels, the coefficients of age, education, household size and income were statistically significant, while membership of union and net marketing margin is not significant, which suggest that they do not influence marketing efficiency in the study area.

The coefficient of age (-0.030) had negative sign and was significant at 1.0 percent level. This conforms to *a priori* expectation. Increase in age, by implication, will bring about decrease in marketing efficiency of packaged water. This result is inconsistent with the findings of [29] that increase in age leads to increase in marketing efficiency.

In terms of education, there was positive relationship between marketing efficiency and education. The coefficient of education (0.252) was positive and statistically significant at 1.0% risk level. The result implies that any 0.25% increase in education will engender 1% increase in marketing efficiency. This result is in agreement with the findings of [29] who observed that higher

level of education enables a marketer to process information and adopt innovation faster. The coefficient of household size (0.976) was positive and statistically significant at 1.0% risk level. In line with *a*

priori expectation, large household sizes are virtually seen as advantage in terms of contributing to labour and as such, perceived as a source of cost reduction.

Table 4. Determinants of packaged water marketing efficiency

Variables	Linear	Double	Semilog	Exponential
Constant	-80.203 (-0.350)	0.858 *** (8.455)	0.001 (0.274)	0.784 *** (5.896)
Age (X ₁)	3.593 (13.662)***	-0.030 (2.308) ***	1.021 (39.274) ***	0.006 (0.193)
Education (X ₂)	0.249 (0.604)	0.252 (3.073) ***	0.001 (0.101)	0.002 (0.186)
HH size (X ₃)	0.003 (0.942)	0.976*** (6.550)	0.168*** (2.730)	0.001 (-0.268)
Income (X ₄)	5.869*** (27.942)	0.318*** (4.282)	0.894* (1.989)	0.177*** (2.931)
MC (X ₅)	0.003*** (7.912)	-0.266 (1.589)	0.320** (2.256)	0.011 (0.071)
NM Margin (X ₆)	0.010 (1.064)	0.010 (1.064)	0.038 (0.204)	0.894* (-1.989)
Membership(X ₇)	0.156 (0.623)	0.104 (0.538)	0.040 (0.507)	0.140 (1.638)
R ²	0.45	0.73	0.51	0.68
F-Ratio	12.85	23.85	19.79	21.69

Source: computed from field survey, 2013

N/B ***, ** & * represents significant levels at 10%, 5% and 1% respectively. Values in parenthesis are t-values.

Although, this outcome is in disagreement with the findings of [30] who opined that large household sizes impose pressure on family income. Consistent with *a priori* expectation, the coefficient of income was positive and statistically significant at 99% confidence level. Thus 3.185% increase in income contributes 1% increase in the marketing efficiency. This result consolidates the findings of [31] that had a similar outcome.

CONCLUSIONS

This study critically examined efficiency of packaged water marketing in Imo state, Nigeria. The study became necessary because

of its contributions in enhancing the realization of the water component of millennium development goals (MDGs) of United Nations to which Nigeria is a signatory and improving customer overall welfare. Realizing this important goal requires an efficient marketing system that will match demand and supply in a balanced manner. The finding of this study that marketers in the semi urban areas are operating below optimum efficiency levels as depicted by efficiency index of Orlu and Okigwe local government areas is important in designing effective distribution strategies that will enhance greater access to water in these areas. The varied influence of age, education, household size and income on marketing

efficiency have huge implication for improving on economic well being of the marketer in the study areas. Therefore, this study suggests spread of education especially to marketers through capacity building seminars and workshop. There is also need to put in place a very robust and effective measure in order to eliminate wasteful marketing costs or competence of market structure. It is vital to note that if efficiency increases without a corresponding increase in effectiveness, the system has not succeeded in achieving anything. The link between education and productivity cannot be over emphasized; hence this study recommends periodic capacity building workshops and seminars for employees, distributors and marketers as a means of enhancing their productivity. Finally, the state of our infrastructure and other policies that inhibit smooth business operations and competition must be address by government. This has become necessary in order to reduce marketing cost occasioned by poor infrastructural development.

REFERENCES

- [1]Abay, C., Miran, B., Gunden, C., 2004, An analysis of Input Use Efficiency in tobacco production with respect to sustainability: The case study of Turkey, *Journal of sustainable Agriculture* Vol 24 (3) Pgs 123-126.
- [2]Acharya, S.S., Agarwal, N.L., 2006, *Agricultural Marketing in India*. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.
- [3]Agwu, N.M., Nwachukwu, I. N., Onyeweaku, C. E. , Elekwa, A., Asoronye, C. N., 2008, Impacts and Determinants of Demand for Agribusiness Credit in Ebonyi State. *Proceedings of the 42nd Conference of ASN held at EBSU Abakiliki, 19th-23rd October*.
- [4]Ali, M., Chaudry, M. A., 1990, "Inter Regional Farm Efficiency in Pakistan's Punjab: A Frontier Production Study", *Journal of Agricultural Economics*, 14: 45 – 60.
- [5] Andrew, D., Jonathan, K., Colin, P., 2008, *Village Chickens in Household and National Economies*. World development report.
- [6]Ashok, P., Ali, F., Shah, M.M.K., 1995, Measurement of Economic Efficiency in Pakistani Agriculture, *American Journal of Agriculture*, 77: 675 685.
- [7]Babu, D., Verma, N. K., 2010, Value Chains of Milk and Milks Products in Organized Sector of Tamil Nadu – A Comparative Analysis., *Agricultural Economic Research Review*. 23: 497-486
- [8]Bravo-Ureta, B., Pinheiro, A., 1993, Efficiency Analysis of Developing Countries Agriculture: A review of the Frontier Function Literature *Agriculture and Resource Economic Review* 22 (1), 88-101.
- [9]Chavas J.P., Petrie, R., Roth M., 2005, Farm Household Production Efficiency: Evidence from the Gambia. *American Journal of Agricultural Economics* 87(1) 160-179.
- [10]Chahal, S.S., Gill, K.S., 1991, "Measurement of Marketing Efficiency in Farm Sector: A Review", *Indian Journal of Agricultural Marketing*, 5(2,): 138-143.
- [11]Charnes, A., Cooper, W.W., Rhodes, E., 1978, Measuring the Efficiency of Decision Making Units. *European Journal of Operational Research*, 3: 429-444.
- [12]Crawford, I. M., 1997, *Marketing and Agribusiness business Text 2*. Food and Agricultural Organization's Publication
- [13]Daniel, J. D., Sanda, A. A., Adebayo, E. F., 2010, Net Income Analysis and Efficiency Resource use among Cotton Farmers in the Southern Part of Adamawa State, Nigeria *Agriculture and Biology Journal of North America*, 1 (6): 1215-1222
- [14]Downey, W.D., Erickson, S.P., 1987, *Agribusiness Management*, McGraw Hill Inc.
- [15]Elitzak, V., 1996, Food Cost Review, *Agricultural Economics Review Report No. 729* (US Department of Agriculture, Washington, DC.)
- [16]Emam, A. A., 2011, Evaluating Marketing Efficiency of Tomato in Khartoum State, Sudan, *Journal of Agriculture and Social Science*, 7:21-24
- [17]Engel, N. H., 1941, Measurement of Economic and Marketing Efficiency, *Journal of Marketing*, 5 (April), 335 – 349
- [18]Euromonitor International, 2012, Bottled Water in Nigeria. <http://www.euromonitor.com/bottled-water-in-nigeria/report>: Aceesed on 5/09/2012.
- [19]Fu W., 2003, Applying The Structure-Conduct-Performance Framework in the Media Industry Analysis. *International Journal on Media Management*. 5 (4) 275-284
- [20]Gandhi, V. P., Namboodiri, N. V., 2002, Fruit and Vegetables Marketing and its Efficiency in India: A study of Wholesale Markets in the Ahmeddabad. www.iiranhd.ernet Accessed 10/10/08.
- [21]Hazarika, C., Subramaniam, S. K., 1999, "Estimation of Technical Efficiency in Stochastic Frontier Prodcution Function Model" An Application to Tea Industry in Assan Industry. *Agricultural Assan* 54(2) 1-2.7
- [22]Imo State Planning and Economic Commission (IMSPEC), 2004, Imo State Statistical Year Report, Owerri: Imo State Planning and Economic Commission.
- [23]Iweke, C. C., 1987, Farmer Related Factors Influencing the Adoption of Innovation in Imo State.

Unpublished Ph.D Thesis. Department of Agricultural Extension, University of Nigeria, Nsukka.

[24]Jasdanwalla, Z. Y., 1966, Marketing Efficiency in Indian Agriculture, Bombay: Allied Publishers

[25] Kohls, R.L., Uhls, J.N., 1967, Marketing of Agricultural Products. Macmillan Publishing Company, New York.

[26] Klessing, L., Grossman, Z., 2004, Bottled Water Industry., accessed at www.academic.evergreen.edu/g/grossmaz/klessi11

[27]National Agency for Food and Drug Administration and Control (NAFDAC), 2014, N10bn Water Business Thrives in Nigeria Daily. Accessed on April 17, 2014 from www.punchng.com/news/n10bn-water-business-thrives-in-nigeria-daily-nafdac

[28] Nigeria Galleria, 2013, Imo State of Nigeria. Accessed from

www.nigeriagalleria.com/Nigeria/States_Nigeria/Imo_State.html on 23/05/2013

[29]Nwachukwu, C., 2002, Economics of Yam Marketing in Umuahia Zones. Unpublished B. Agric Thesis. Department of Agricultural Economics, Michael Okpara University of Agriculture, Umudike. Abia State.

[30]Nwachukwu, I. N., Onyenweaku, C.E., 2007, Economics Efficiency of Fadama Telferia Production in Imo State, Nigeria. A Translog Profit Function Approach. Journal of Agricultural Research and Politics, Nigeria. 2(4): 87-93.

[31]Nwachukwu, I. N., Ezeh, C.I., 2007, Impact of Selected Rural Development Programmes on Poverty Alleviation in Ikwuano L.G.A. of Abia State, Nigeria. African Journal of Food, Agricultural, Nutrition and Development, Kenya 7 (5): 1-17.

[32]Obasi, P. C., 1991, Resources Use Efficiency in Food Crop Production; A case of the Owerri Agricultural zone of Imo State. M. Sc. Thesis University of Ibadan, Nigeria.

[33] Ocheke, S., 2012, Can Nigeria Meet its Water Demand? National Mirror Newspapers, February 2, 2013. Accessed from <http://nationalmirroronline.net/new/can-nigeria-meet-its-water-demand/>

[34]Okoye, A. C., Okoye, F. U., 2013, Determinants of Technical Efficiency of Traditional Cocoa Bean Processing in Ikwuano Local Government Area of Abia State. Nigeria Agricultural Journal, Vol. 44(1&2), pp. 118-125

[35]Prasad J., 1999, Encyclopedia of Agricultural Marketing, Vol. 6. Mittai Publication, New Delhi.

[36] Rust, R.T., Ambler, T., Carpenter, G.S., Kumar, V., Srivastava, R.K., 2004, Measuring Marketing Productivity: Current Knowledge and Future Directions. Journal of Marketing, 68: 76-89.

[37] Seyoum, E.T., Battase, G.E., Flemming, E.M., 1998, Technical Efficiency Productivity of Maize Producers in Eastern Ethiopia: A Study of Farmers within and outside the Sasakawa Global 2000 Project. Agricultural Economics, 19 341- 34

[38]Shaw, E. H., 1987, Marketing Efficiency

and Performance: An Historical Analysis, Proceedings of the Third Conference on Historical Research in Marketing.

[39]Shepherd, G.S., 1965, Marketing Farm Products: Economic Analysis. Iowa College Press, Iowa, USA.

[40]Shehu, J.F; Tashikalma, A.K., Gabdo, G.H., 2007, Efficiency of Resource use in Small Scale Rain-Fed Upland Rice Production in Northwest Agricultural Zone of Adamawa State, Nigeria. 9th Annual National Conference of Nigeria Association of Agricultural Economics (NAAE) Held at ATBU, Bauchi, Nigeria.

[41]Singh, G.N, Singh, D .S., Rain, I. S., 1987, Agricultural Marketing in India, Analysis, Planning and Development, Chugh Publication, Allahabad, India.

[42]Sheth, J.N., Sisodia, R.S., Sharma, A., 2000, The Antecedents and Consequences of Customer-Centric Marketing. Journal of the Academy of Marketing Science, 28(1): 55-66.

[43]Sheth, J.N., Sisodea, R.S., Sharma, A., 2002, Marketing Productivity: Issues and Analysis. Journal of business Research. 55: 349-362.

[44]Thamizhselvan, K., Murugan, S. P., 2012, Marketing of Grapes in Thein District. International Journal of Marketing and Technology, 2(9):96-111

[45]UNW-DWP (United Nations Water Decade Programme on Capacity Development), 2012, MDG Update on Drinking Water and Sanitation. UNW-DPC's Quarterly magazine, May Issue No. 14

[46] Verma, H. V., 2013, Brand Management: Tesxt and Cases. New Delhi: Excel Books,

[47]Zenith International, 2008, Global Bottled Water. Zenith Annual Report.

www.zenithinternational.com Accessed 15/09/2008

ECONOMIC AND FINANCIAL ASPECTS OF ACTIVITY IN S. C. "AL THEO & DEA" S. R. L. - SALCIA COMMON, TELEORMAN COUNTY (2011 – 2013)

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Abstract

The unit was established in 2006, with the object of "Growing of cereals (except rice), leguminous crops and oil seeds plant" - CAEN code 0111 from 02.08.2006. Formation of the company was based on the association of two persons, Romanian citizens, which constituted a legal entity as a limited liability company. The declared company's office is located in the village of Salcia, County Teleorman, which may establish subsidiaries, as required by law. Life of the society is one unlimited share capital was 200 lei (by 50% for each partner), increase or reduce the capital and its transmission can be achieved in concrete terms stipulated in the articles of established. The company has various equipment (tractors, combines, various machinery, storage, etc.) that have experienced an upward trend - both in numbers and in terms of value - during the analyzed period (2011-2013).

Key words: assets, capital, customers, equipment, landscape, providers

INTRODUCTION

Besides the main activity - growing of cereals and other crops (field activity growing plants for market gardening, horticulture), the company may carry on business as a secondary objective: wholesale of grain, seeds feed; Growing of vegetables, horticultural specialties and greenhouse products; cultivation of fruits, nuts, beverage and spice plants; cattle; sheep, goats, horses, asses, mules and donkeys; pig breeding; poultry; Raising of other animals; activities (mixed farming of crops combined with farming of animals); service activities related to agriculture, gardening landscaping (landscape architecture); animal husbandry service activities, except veterinary activities; fisheries; fish; mill products; manufacture of starch and starch products; manufacture of bread, fresh pastry production; road transport of goods; Agricultural machinery and equipment rental; import-export.

Constitutive Act also contains provisions concerning the rights and obligations of members, their tasks, the organization and conduct of general meetings, appointments and tasks aspects, issues related to the dissolution,

liquidation, merger and division of society, staff of the company, the balance sheet and profit and loss account, calculation and allocation of profits, litigation and final provisions.

If we relate to the crop plan is worth noting that the company has marched on traditional cultures - like wheat and sunflowers - more being practiced on small areas of maize and fodder plants (121, 135 and 145 ha cultivated - in total - for 2011, 2012 and 2013 with the following distribution: 64, 55 and 2 ha for wheat, sunflower and maize in 2011, 84 and 51 ha in 2012 for wheat and sunflower, respectively, 70, 71, 3 and 1 ha for wheat, sunflower, corn fodder plants respectively for 2013) [4].

It can be seen that the company was focused on practicing a rotation 'commercial', which aimed particularly products that have been found, on the market capitalizing opportunities, technological side being one somewhat poor, if we consider the restriction of rotation about the selected wheat and sunflower.

The profit of firms is obtained plus from the fact that they earn more than they spend on sales to producing those goods. Total profit of

a firm (Pr) is the difference between total sales (VT) and total production costs (CT):

$$\text{Pr} = \text{VT} - \text{CT}$$

Maximizing profits requires to compare costs with revenues and to look at what level of production, profit will be maximized, and also what is the level of the profit. There are two ways in which this could be achieved. The first and easiest method is to use the total cost and total revenue curves. A second method is to use the average and marginal revenue curves and average and marginal cost curves. Although this second method is more complex than is recommended when we want to analyze and compare maximize profits in different market conditions [3].

In terms of making profit, any firm is related to the notion of economic efficiency.

Economic efficiency of agricultural production is an economic category that expresses ownership of maximum economic effect with minimum manpower costs and materialized.

In the broadest sense, economic efficiency refers to all economic activity, namely the sphere of material production, distribution process, the movement of products, as well as various forms of economic activity in the field unproductive.

Economic efficiency is directly related to the net difference between the value of agricultural products sold and total production costs, which relate to factors that the entrepreneur needs to acquire market (explicit costs), as a ratio between the effort made to obtain values use and economic effect achieved with this effort [2].

Increasing the efficiency of economic activity from agriculture depend on a number of factors: economic, technical, organizational, contextual and natural.

Among economic factors to increase the efficiency of agricultural mention: ensuring optimal production and means funds and use the most efficient; units to ensure optimal workforce more skilled and use them as full and uniform; increasing material incentives to workers their work.

Among the technical factors that contribute to raising economic efficiency, the most

important relate to the main directions of technical progress, namely: increased mechanization of agricultural operations; extension of electrification and automation of work processes; expanding irrigation and other hydrological works; widespread introduction of modern technologies in production; modernization of transport and communication lines; widespread use in the production of a high biological material productive capacity.

Organizational factors that increase economic efficiency of agricultural mention: territorial distribution judicious crop production and animal by its requirements to natural and economic conditions; profiling, concentration, specialization and cooperation in production and economic integration; scientific organization of production and labor in the agricultural units.

In the category of temporary factors, a significant influence on the economic efficiency of agriculture have: the prices for agricultural products and industrial products used in agriculture; rates of pay for work performed in agriculture practiced by various units providing services within or outside agriculture; system of taxes and fees charged for economic activity in agriculture; system of taxes and penalties.

Among natural factors highlighted: climate and weather conditions - temperature, rainfall, hours of sunshine, brightness, weather accidents; edaphic conditions or the type of soil and its intrinsic characteristics - the humus content, the reaction time of the pH, texture, structure, the depth of groundwater, etc. ; biological peculiarities of the material used in the production of goods: plants - clones, varieties of biological categories, hybrids; animals - breeds, half-breeds, hybrids, synthetic lines [1].

MATERIALS AND METHODS

In order to achieve the work was done documentation, on-site by consulting company accounting documents [4].

The phase for office assumed homogeneous grouping categories of indicators - income,

expenses, profit - and their analysis by building a dynamic that used mobile base pointers. For a comprehensive view in addition to the years 2011, 2012 and 2013 was included - the analysis - and the average period.

RESULTS AND DISCUSSIONS

Indicators of income. Table 1 presents the income indicators for the period 2011-2013.

The first indicator of income is presented for production sold. This index ranged from

221,333 lei in 2011 to 322,308 lei in the year 2012, while the average period reached 258,806 lei. It may be noted the uneven development of the indicator increases by 45.6% from 2012 to 2011, followed by reduction of 27.8% in 2013 (232,777 lei) compared with the previous term dynamic series, while the average period 1.11 times ahead specific state of things of 2013.

Revenue from sale of goods ranged from 4044 lei in 2013 to 5073 lei in 2012, the average period being 3039 lei. Dynamics of the indicator is lower in 2013 (79.7%) and the average period (75.1%).

Table 1. Indicators of income

- lei -

No.	Specification	2011	2012		2013		Average	
		Ef.	Ef.	2012 /2011**** (%)	Ef.	2013 /2012**** (%)	Ef.	Average /2013**** (%)
1.	Production sold *	221.333	322.308	145,6	232.777	72,2	258.806	111,2
2	Revenue from sale of goods *	-	5.073	-	4.044	79,7	3.039	75,1
3	Income from subsidies *	-	-	-	-	-	-	-
4	Net turnover (1+2+3) *	221.333	327.381	147,9	236.821	72,3	261.845	110,6
5	Income cost of production in progress *	-20.069	+57.833	100	+62.777	108,5	33513,67	57,9
5.1.	Sold C***	-	57.833	-	62.777	108,5	40.203,33	69,5
5.2.	Sold D**	20.069	-	-	-	-	6.689,66	33,3
6	Other income *	-	-	-	-	-	-	-
I	Operating revenue (4+5+6) *	201.264	385.214	191,4	299.598	77,8	295.358,67	146,8
7	Interest income *	9	9	100,0	1	11,1	6,33	6,33 times
8	Other financial income *	-	-	-	3.226	-	1.075,33	33,3
II	Financial income (7+8) *	9	9	100,0	3.227	358,5 times	1.081,66	33,5
III	Extraordinary income	-	-	-	-	-	-	-
IV	Total revenues (I+II+III)	201.273	385.223	191,4	302.825	78,6	296.440,33	97,9

* extracts from the profit and loss account (2011 – 2013)

** assigned revenue in balance D is subtracted from net turnover;

*** assigned revenue in balance C is added to net turnover;

**** own calculations;

It is worth noting that in 2011 is not recorded revenue from sale of goods.

Revenues from grants in the period 2011 -2013 missed because the net turnover was influenced by the production sold. It can be seen that it was between 221,333 lei in 2011 and 327,381 lei for 2012, and the average period reached 261,845 lei. The dynamics is similar to that of output sold. As a result it observed an increase of 47.9% in 2012 compared to the first term of the series dynamic and a decrease of 27.7% in 2013 compared to the previous time of dynamic series, and an increase of 1.10 times for 2013 than average.

Revenue from cost of production in progress

ranged from 57,833 lei in 2012 to 62777 lei for 2013 (+8.5% over the previous year), the average period was 40,203.337 lei (-30, 5% compared to 2013) - balance C, whereas for 2011 the value of 20,069 lei was placed to the balance D - 6689.66 lei in average (33.3% compared to the term comparison). Based on the situation described above is reached an overview of the average index of 33,513.67 lei, which dynamically represented only 57.9% compared to the specific situation of 2013.

The farm has recorded other revenue related to operating activities and therefore operating income reached: 201,264 lei in 2011; 385,214 lei for the year 2012 - 191.4% in dynamics;

299,598 lei for the year 2013 - 77.8%; 295,358.67 lei for the period average (+ 46.8%). Unit recorded interest income of 9 lei in 2011 and 2012, one leu in the year 2013 and the average period of 6.33 lei. Dynamics emphasizes equal value in 2012, sub-unitary in the year 2013 (11.1%) and supra-unitary for period average (6.33 outrunning the reporting base).

The unit also performs other financial income only in the year 2013 - 3226 lei, which leads to an average of 1075.33 lei - 33.3% in dynamics. Financial income is based on the two aforementioned sources, so they are equal interest in 2011 and 2012 (by 9 lei) and reach 3227 lei in 2013 (outrunning by 358.5 times the reference period). Under these conditions the average period is lei 1081.66 - 33.5% in dynamics.

It should be noted that the farm is not registered during the review period, any extraordinary income.

Based on the three income categories (operating, financial and extraordinary) shall be

constituted the total income of the farm, which is as follows: 201,273 lei for 2011; 385,223 lei in the year 2012 to 191.4% in dynamics; 302,825 lei for 2013 (decrease of 21.4% compared based reporting); 296,440.33 lei for the period average (-2.1% since 2013 - the reference period).

Indicators of expenditure. Table 2 presents the indicators of expenditure for the period 2011-2013.

Expenses with raw materials and consumables ranged from lei 62,506 in 2012 to 155,317 lei in the year 2013 while the average period was 95,279 lei. Dynamic stresses uneven trend indicator, decreases in 2012 (-8.1% compared to the year 2011 to 68,014 lei), followed by overtaking in 2013 (2.48 times compared with the previous term of dynamic series) and then appear decreases for average period (-38.7%).

Other material costs appear only in the years 2011 and 2012 - 1050 and respectively 8 lei, something that results in an average of the period of 352.67 lei.

Table 2. Spending indicators

-lei-

No.	Specification	2011	2012		2013		Average	
		Ef.	Ef.	2012 /2011** (%)	Ef.	2013 /2012** (%)	Ef.	Average /2013** (%)
1	Raw materials and consumables *	68.014	62.506	91,9	155.317	2,48 times	95.279	61,3
2	Other material expenses *	1.050	8	0,8	-	-	352,67	-
3	Spending on goods *	5.395	5.073	94,0	4.044	79,7	4.837,33	86,3
4	Trade discounts received *	110	330	3,0 times	-	-	146,67	-
5	Total expenses related materials and goods (1+2+3-4) *	74.349	67.257	90,5	159.361	2,37 times	100.322,33	63,0
6	Salaries *	5.873	13.490	2,29 times	17.346	128,9	12.236,33	70,5
7	Insurance expenses *	1.641	3.761	2,29 times	4.830	128,4	3.410,67	70,6
8	Personnel expenses (6+7) *	7.514	17.251	2,29 times	22.176	128,5	15.647	70,6
9	Adjustments on assets *	8.833	13.766	155,8	30.329	2,20 times	17.642,67	58,2
10	Spending on external services *	78.988	108.887	137,9	70.696	64,9	86.190,33	121,9
11	Other taxes, duties and similar *	3	1.256	418,66 times	2.756	2,19 times	1.338,33	48,6
12	Other expenses *	-	-	-	-	-	-	-
13	Other operating expenses (external services, other taxes - taxes - payments, compensation donations transferred assets) (10+11+12) *	78.991	110.143	139,4	73.452	66,7	87.528,66	119,2
I	Total operational expenses (4++8+9+13) *	169.687	208.417	122,8	285.318	136,9	221.140,66	77,5
14	Interest expense *	-	-	-	2.276	-	758,67	33,3
15	Other financial expense *	-	-	-	-	-	-	-
II	Financial expenses (11+12) *	-	-	-	2.276	-	758,67	33,3
III	Extraordinary expenses *	-	-	-	-	-	-	-
IV	Total expenditure (I+II+III) *	169.687	208.417	122,8	287.594	138,0	221.899,33	77,2

* extracts from the profit and loss account (2011 – 2013)

** own calculations

Spending on goods have averaged 4837.33 lei (-13.7% in dynamics) value is based on annual level indicator: 4044 lei in 2013 (79.7% in dynamics), 5073 lei for 2012 (94.0% compared to the reporting deadline) and 5395 lei for 2011. The company benefited from trade discounts for the years 2011 and 2012 - 110 and respectively 330 lei, a situation that resulted in an average of the period of 146.67 lei.

Due to this situation, the expenditure related materials and goods ranged from lei 67,257 in 2012 to lei 159,361 for 2013, and in 2011 they reached the 74,349 lei. Under these conditions the average of the period was 100,322.33 lei, which represented a decrease in dynamics with 37.0% reporting to base. Dynamic index is a uniform decrease of 9.5% in 2012, followed by exceeding of the reporting term in 2013 by 2.37 times

Salaries increased from 5873 lei in 2011 by 2.29% in 2012 (13,490 lei) and 28.9% for 2013 (17,346 lei). Average of the period reaches 12,236.33 lei, which represents only 70.5% of the comparison.

Security costs have averaged 3410.67 lei (-29.4% compared based reporting), with extremes of 1641 lei in 2011 and 4830 lei in 2013 - in the year 2012 indicator reached 3761 lei. Dynamics is similar to that recorded for wages.

Based on salaries and insurance costs were determined the personnel costs. This indicator has been rising values for the analyzed period from 7514 lei in 2011 to 22176 lei for the year 2013. It can discussed for increasing trend of index highlighted by exceeding the term of reference as follows: 2.29 for 2012 (17251 lei), 28.5% in 2013 (average - 15647 lei - is lower by 29.4% compared to base).

Another item of expenditure appears as the adjustments on property, which has an upward trend indicator net. The year 2011 is characterized by a value of lei 8833 adjustments, the value increases to 13,766 lei in 2012 and 30,329 lei for 2013 average conditions in the of the period reached 17,426.66 lei (58.2% compared to the base of the reporting). Dynamics is dominated by indexes above unit - 155.8% in 2012 and is ahead by 2.20 times (of comparison term) in the year 2013.

The expenses on external services were 78,988 lei in 2011 grew by 37.9% in 2012 (108,887 lei) decreased by 35.1% for the year 2013 (70,696 lei), while the average term exceeded 1.21 times the reporting deadline - 86,190.33 lei.

As regards the other taxes, fees and similar payments, it can be seen that they ranged from 3 lei in 2011 to 2,756 lei in the year 2013 while the average of the period was 1338.33 lei. In dynamics made can be seen supra-unitary values for 2012 and 2013 (exceeding by 418.66 and 2.19 respectively of the terms of reference) and subunit values for average period - 48.6%.

For the element other expenses the company did not record any indication.

Following the values quoted for the last three indicators were determined other operating expenses, which registered: 78991 lei in 2011, 110,143 lei for 2012 to 139.4% 73452 lei, 66.7% for the year 2013. With these values determined the average period was 87,528.66 lei, which represented the in dynamics an overrun by 19.2% of the reporting base.

Total operating expenses are based on total material costs, personnel costs, adjustments on assets and other operating expenses. Based on parameter values, remember earlier, it was sequential levels: lei 169,687 in 2011; lei 208,417 for 2012 (+ 22.8% in dynamics); lei 285,318 in the year 2013 - fig. 3.10. (+ 36.9% compared to the benchmark); lei 221,140.66 for period average (-22.5% in the dynamics composed).

These values notes the upward trend of operating expenses for the period considered.

The company realized interest expense in 2013 - 2276 lei, which led to a multi-annual average by 758.66 lei (33.3% in dynamics).

The same situation was reported in the total financial costs.

Concerning the total expenditure, it is noteworthy that it is identical to the previously index - total operating expenses - for the years 2011 and 2012, while in 2013 it reaches level of 287,594 lei (38.0 % in dynamics), and the average of the period reaches 221,899.33 lei (-22.8% in the dynamics composed).

Profitability indicators. Table 3 presents level of profitability indicators for the period 2011-2013. Operating profit is characterized by an

average of 74,218 lei, the resulting value of sequential annual levels by 31577 lei in 2011, 176,797 lei specific 14280 lei - 2012 and the year 2013 these values highlights the trend of indicator, exceeding of reference terms 2012 and the average for the period (5.59 and 5.19 times respectively), decreases in 2013 (-91.9%). Financial profit was every 9 lei in 2011 and 2012 respectively, and 951 lei for 2013 (equal value of dynamics indices in 2012 and supra-unitary for 2013 - outrunning by 105.66 times the reporting database). Due to this situation, the average of the period reaches 323 lei, or 34.0% compared to the benchmark.

Current profit appears as the sum of operating profit and financial profit. So talk about values 31,586 lei in 2011, 176,806 lei for 2012, 15,231 lei in the year 2013 and 74541 lei for of the period average. The dynamics is characterized by the values of the index components supra-unitary for the years 2012 and period average (exceeding by 5.59 and 4.89 times respectively compared bases), and the sub-unitary levels in

2013 (8.6%).

Gross profit is equal to current profit, as the company has not been extraordinary profit or loss.

Company paid income tax but not paid "other taxes". Therefore values are found of income tax as follows: 5054 lei in 2011, 28,289 lei in the year 2012 (5.59 outrunning or dynamics), 2437 lei in 2013 (-93.4%). Under these conditions the average of the period was 11,296.66 lei, a level exceeded 4.89 times the reporting base.

Net profit is characterized by an average of 62,614.33 lei, while the extreme values of the indicator appeared in 2013 to 12,794 lei and 2012 to 148,517 lei. The dynamics is one uneven of the reporting term overruns are 4.89 times and 5.59 times the average of the period in 2012 (compared to the value by 26532 lei specifies 2011), while the 2013 is a decrease of 93.4% compared to the reference period.

Table 3 Indicators of profitability

No.	Specification	M.U.	2011	2012		2013		Average	
			Ef.	Ef.	2012 /2011 ** (%)	Ef.	2013 /2012 ** (%)	Ef.	Average /2013 ** (%)
1	Operating profit *	lei	31.577	176.797	5,59 times	14.280	8,1	74.218	5,19 times
2	Financial profit *	lei	9	9	100,0	951	105,66 times	323	34,0
3	Current profit (1+2) *	lei	31.586	176.806	5,59 times	15.231	8,6	74.541	4,89 times
4	Extraordinary profit *	lei	-	-	-	-	-	-	-
5	Gross profit (3+4) *	lei	31.586	176.806	5,59 times	15.231	8,6	74.541	4,89 times
6	Income tax *	lei	5.054	28.289	5,59 times	2.437	8,6	11.926,66	4,89 times
7	Other taxes or levies *	lei	-	-	-	-	-	-	-
8	Net profit (5-6-7) *	lei	26.532	148.517	5,59 times	12.794	8,6	62.614,33	4,89 times
9	Operating profit rate **	%	18,61	84,8	4,56 times	5,0	5,9	33,56	6,71 times
10	Current profit rate **	%	18,62	84,82	4,55 times	5,30	6,2	33,59	6,34 times
11	Extraordinary profit rate **	%	-	-	-	-	-	-	-
12	The gross profit rate **	%	18,62	84,83	4,55 times	5,30	6,2	33,59	6,34 times
13	Net profit ratio **	%	15,64	71,26	4,55 times	4,45	6,2	28,22	6,34 times

* extracts from the profit and loss account (2011 – 2013)

** own calculations

Operating profit rate was 18.61% in 2011, 84.82% for 2012, 5.0% in 2013 and 33.56%

on average for the period. The evolution in time of the indicator is in the form of an

uneven trend, advancing the reference term 2012 by 4.56, followed by decreases of 94.1% in 2013 or 2010 and exceeded 6.71 times - the basis for comparison - for average of the period. It can be seen that the current profit rate is significantly higher than the previous indicator, the annual growth of 0.01% for 2011 and 2012, 0.03% for the average of the period and 0.3% in 2013.

The gross profit rate is equal to the current rate of profit as the company has not been extraordinary profit or loss.

The last indicator of profitability refers to net profit rate. It can be seen that this ratio averaged 28.22% (6.34 times the base outrunning of the reporting) with extremes by 4.45% for 2013 and 71.26% in 2012.

The consequence of this situation is a dynamic non-uniform reference period being exceeded 4.55 times in 2012 and there is a negative difference of 93.8% (compared with this - reference period) in the year 2013.

CONCLUSIONS

a. total revenue structure prevailing operating income of 99.63%, financial income was only 0.37% of the total. Components are included in operating income ratios: 88.33% turnover, 87.30% sold production, 11.31% of production costs related revenues, 1.02% proceeds from the sale of goods - Figure 1.;

b. total expenditure structure prevailing material costs and related goods - 45.21%, followed by operating expenses - 39.45% adjustments on assets - 7.95% and personnel costs - 7.05% - fig. 2 .;

c. the unit record operating profit and financial profit - 74218 and 323 lei respectively, which form the current profit - 74541 lei;

d. given that the unit has not reported profit or loss is found extraordinary similarity between current profit and profit, the latter decreasing by taxes paid, so to reach a net profit of 62,614.33 lei.

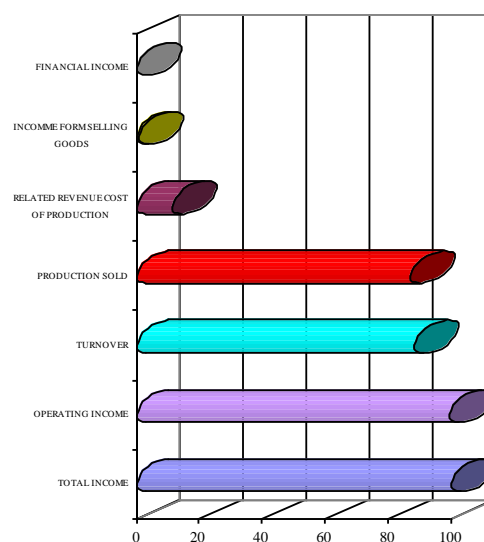


Fig.1. The ratio of total income and its main components (%)

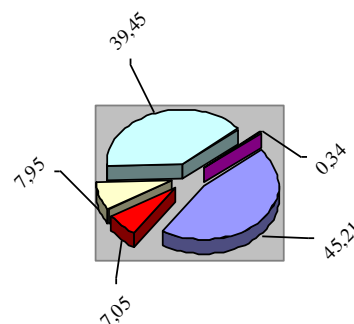


Fig.2. Structure of total expenditure (%)

REFERENCES

- [1]Barbu, C., Pânzaru, RL, 2000, Agricultural Economics, Ed. Hyperion, Craiova, Chapter 6, Part I, p. 89-99

- [2]Nica, S., Fintineru, A., Glăman, Gh., 1995, Rural Economy, Ed. Art Print, Bucharest, Chapter 12, p. 135-142
- [3]Stefan, G., Bodescu, D. Toma, AD, Pânzaru, R.L, 2007, Economy and agri-food chain, Ed. Alfa, Science, Chapter 8, p. 267-315
- [4]SC "THE THEO & DEA" SRL,Accounting data, 2011-2013

ECONOMIC AND FINANCIAL ASPECTS OF ACTIVITY IN SC "AGRO ANCA" SRL, ROȘIORII DE VEDE, COUNTY TELEORMAN (2011-2012)

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Abstract

The unit was established in 2008, with the object of activity "permanent cultivation of plants" - NACE Code 011 principal activity "Growing of cereals (except rice), leguminous crops and oil seeds plant". Besides main activity - growing of cereals and other crops, the company may carry on business as a secondary objective: wholesale of grain, seeds feed; Growing of vegetables, horticultural specialties and greenhouse products; cultivation of fruits, nuts, beverage and spice plants; cattle; sheep, goats, horses, asses, mules and donkeys; pig breeding; poultry; Raising of other animals; activities (mixed farming of crops combined with farming of animals); service activities related to agriculture, gardening landscaping (landscape architecture); animal husbandry service activities, except veterinary activities; fisheries; fish; mill products; manufacture of starch and starch products; manufacture of bread, fresh pastry production; road transport of goods; Agricultural machinery and equipment rental; import-export, etc. . The company is part of the Cooperative "VEDEA ROSIORI" - agricultural cooperative whose operating rules are set out in the Statute.

Keywords: assets, capital, customers, equipment, landscape, providers

INTRODUCTION

The unit was established in 2008, with the object of activity "permanent cultivation of plants" - NACE Code 011 principal activity "Growing of cereals (except rice), leguminous crops and oil seeds plant".

Formation of the company was based on a sole shareholder (Roșu Anca), Romanian citizen who was a legal entity as a limited liability company.

Said the company's headquarters is in the Vedas, County Teleorman, which may establish subsidiaries, as required by law.

Besides main activity - growing of cereals and other crops, the company may carry on business as a secondary objective: wholesale of grain, seeds feed; Growing of vegetables, horticultural specialties and greenhouse products; cultivation of fruits, nuts, beverage and spice plants; cattle; sheep, goats, horses, asses, mules and donkeys; pig breeding; poultry; Raising of other animals; activities (mixed farming of crops combined with farming of animals); service activities related to agriculture, gardening landscaping (landscape architecture); animal husbandry

service activities, except veterinary activities; fisheries; fish; mill products; manufacture of starch and starch products; manufacture of bread, fresh pastry production; road transport of goods; Agricultural machinery and equipment rental; import-export, etc.

Life of the society is one unlimited, the subscribed share capital was 200 lei, increasing or reducing the capital and its transmission can be achieved in concrete terms stipulated in the articles of incorporation.

Constitutive Act also contains provisions concerning the rights and obligations of the associate, tasks, appointments and tasks issues, issues related to the dissolution, liquidation, merger and division of society, company personnel, accounting, control of the company, litigation and other clauses.

The company is part of the Cooperative "VEDEA ROSIORI" - agricultural cooperative whose operating rules are set out in the Statute. Cooperative is registered with the Trade Register.

If we relate the crop plan is worth noting that the company has marched on traditional cultures - like wheat and sunflowers - more being

practiced on small areas rape, maize and sorghum - Table 1.

Table 1. Structure of arable cultivation *

No.	Year	Culture	Cultivated surface - ha -	Structure - % -
1	2011	Winter wheat	200	37,74
2		Rape	100	18,87
3		Sunflower	180	33,96
4		Sorghum	50	9,43
5		Total	530	100
6	2012	Winter wheat	250	47,17
7		Barley	35	6,60
8		Sunflower	230	43,40
9		Maize	15	2,83
10		Total	530	100

*S.C. "AGRO ANCA" SRL, statistical reporting data;

It can be seen that the company was focused on practicing a rotation 'commercial', which aimed particularly products that have been found, the market capitalization opportunities, technological side is one somewhat poor, if we consider the restriction of rotation about the selected wheat and sunflower. It is, however, noted that the company has tried (at least) diversifying crops by introducing besides wheat and rapeseed, sunflower and sorghum crops in 2011 (fig. 1), barley and maize for 2012 (fig. 2).

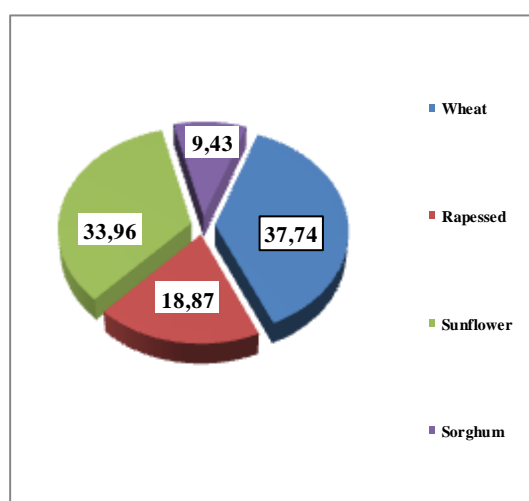


Fig. 1. Structure of arable cultivation – 2011 (%)

The economic and financial results of the company, appealed to a number of accounts,

including accounts which march on the profit and loss account.

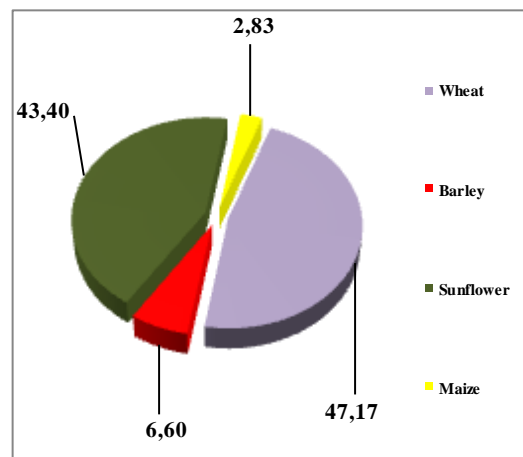


Fig. 2. Structure of arable cultivation – 2012 (%)

Each account with current accounting has an economic content, as determined by the economic content of the element itself reflected with the account and can represent: an economic good with a particular destination, a source of financing, business processes as expenditure and revenue, the final result for the year as profit or loss.

Accounts fulfill several functions, among which: economic position, function of information, position computation, statistical function, recording function, function group, function systematization, control function and accounting function.

For accurate recording of economic and financial operations account was designed in some form, to allow correct identification of each element patrimonial and provide information on the existence and changes (increases, decreases), occurring in a year financially on the item [1].

The unit tries to follow the rules of manifestation of the financial mechanism. The financial mechanism represents technology specific work, consisting of financial management methods and tools.

The components of the financial mechanism are: methods and tools for the collection, storage and processing; methods and tools used for the distribution of farm financial results; methods and tools adopted and decisions materialize. Financial mechanism

features include: economic and financial autonomy; material incentives and accountability; financial control [2].

MATERIALS AND METHODS

In order to achieve the paper movement was done in the territory, for data collection, after which we switched to office stage when by processed the data taken from the financial statements prepared at the company [3]. Data processing based on using time comparison method and realization of structures for certain indicators - indicators with mobile. Presentation of indicators was done using three distinct categories, namely: indicators of income, expenditure indicators and indicators of profitability. The analysis covers the period 2011-2012 and using period average.

RESULTS AND DISCUSSIONS

Indicators of income. Table 2 shows the income indicators for the period 2011-2012.

The first indicator of income is the production sold. This index ranged from lei 812,388 in

2011 to lei 959,629 in the year 2012, while the average period reached 886,008.5 lei. It may be noted the upward trend of the indicator increases by 18.1% from 2012 to 2011, followed by 7.7% discount to the average of the period.

Revenue from sale of goods and subsidies obtained for the period 2011 -2012 missed as a result of net turnover was identical to the production sold.

Revenue from cost of production in progress ranged from 25,234 lei in 2011 to 219,526 lei in 2012 (the first value assigned to balance D, the second to balance C) and the average period was 97146 lei (-55.7% compared with 2012).

Incomes related to cost of production in progress ranged from 25,234 lei in 2011 to 219,526 lei in 2012 (the first value assigned to balance D, the second to balance C) and the average of the period was 97146 lei (-55.7% compared with 2012).

Producer recorded other income both in 2011 - 245,319 lei, and as for the year 2012 - 337,261 lei (+ 37.5% in dynamics), which resulted in an average of 291,290 lei (-15.6%).

Table 2. Indicators of incomes

No.	Specification	2011	2012		Average	
		Ef.	Ef.	2012 /2011 **** (%)	Ef. ****	Average /2012 **** (%)
1.	Production sold *	812388	959.629	118,1	886008,5	92,3
2	Revenue from sale of goods *	-	-	-	-	-
3	Income from subsidies *	-	-	-	-	-
4	Net turnover (1+2+3) *	812388	959.629	118,1	886008,5	92,3
5	Income cost of production in progress *	-25.234	+219.526	100	97146	44,3
5.1.	Sold C ***	-	219.526	-	109763	50,0
5.2.	Sold D **	25.234	-	-	12617	50,0
6	Other income *	245319	337.261	137,5	291290	86,4
I	Operating revenue (4+5+6) *	1.032.473	1.516.416	146,8	1274444,5	84,1
7	Interest income *	65	28	43,1	46,5	166,1
8	Other financial income *	-	-	-	-	-
II	Financial income (7+8) *	65	28	43,1	46,5	166,1
III	Extraordinary income	-	-	-	-	-
IV	Total revenues (I+II+III)	1.032.538	1.516.444	146,9	1274491	84,0

* extracts from the profit and loss account (2011 – 2012)

** assigned revenue in balance D is subtracted from net turnover;

*** assigned revenue in balance C is added to net turnover;

**** own calculations;

The farm has been operating revenues, which reached levels: 1032473 lei in 2011; 1516416

lei for the year 2012 - 146,% dynamic; 1274444.5 lei period average (-15.9%).

The unit recorded interest income of 65 lei in 2011 and 28 lei for 2012, so the average of the period was 46.5 lei. Dynamics reveals subunit values in 2012 (43.1%) and above par for the average of the period (exceeding 1.66 base reporting).

Financial revenues are identical to those carried interest.

It should be noted that the farm is not registered during the review period, any extraordinary income.

Based on the three income categories (operating, financial and extraordinary) represents the total income of the farm, which is as follows: 1,032,538 lei for 2011; 1516444 lei for the year 2012 to 146.9% in dynamics; 1274491 lei period average (-16.0% since 2012 - the reference period).

Indicators of expenditure. Table 3 presents the indicators of expenditure for the period 2011-2012.

Reference is made to operating expenses, financial expenses, extraordinary expenses and total expenses. It can be seen that the unit performs only operating costs and financial expenses (quite low compared to operating), following the total expenditure is influenced - to a large extent - the amount of operating costs.

Expenses with raw materials and consumables ranged from 415,822 lei in 2011 to 983,552 lei for the year 2012, while the average of the period was 699,687 lei. The dynamic underlines an uneven trend of the indicator, overtaking from 2012 (2.36 times compared with the previous term of the dynamic series) being followed by decreases for average of the period (-28.9%).

Table 3. Indicators of spending

No.	Specification	2011	2012		Average	
		Ef.	Ef.	2012 /2011 ** (%)	Ef. **	Average /2012 ** (%)
1	Raw materials and consumables *	415.822	983.552	236,5	699687	71,1
2	Other material expenses *	4.227	2.625	62,1	3426	130,5
3	Spending on goods *	4.411	5.547	125,8	4887	88,1
4	Total expenses related to materials and goods (1+2+3) *	424.459	991.724	233,6	708091,5	71,4
6	Salary *	42.100	46.560	110,6	44330	95,2
7	Insurance expenses *	11.724	12.960	110,5	12342	95,2
8	Personnel expenses (6+7) *	53.824	59.520	110,6	56672	95,2
9	Adjustments on assets *	34.081	105.152	308,5	69616,5	66,2
10	Expenditure on external services *	202994	285.625	140,7	244309,5	85,5
11	Other taxes, duties and similar payments *	5.336	6.184	115,9	5760	93,1
12	Other expenses *	32.325	2.048	6,3	17186,5	8,39 ori
13	Other operating expenses (external services, other taxes - taxes - payments, compensation donations transferred assets) (10+11+12) *	240.655	293.857	122,1	267256	90,9
I	Total operational expenses (4++8+9+13) *	753.020	1.450.253	192,6	1101636,5	76,0
14	Interest expense *	18.262	28.354	155,3	23308	82,2
15	Other financial expense *	-	-	-	-	-
II	Financial expenses (11+12) *	18.262	28.354	155,3	23308	82,2
III	Extraordinary expenses *	-	-	-	-	-
IV	Total expenditure (I+II+III) *	771.282	1.478.607	191,7	1124944,5	76,1

* extracts from the profit and loss account (2011 – 2012)

** own calculations

Other materials expenses appear in 2011 and 2012 - 4227 and 2625 lei respectively (-37.9% in dynamics) aspect leading to an average of the period of 3426 lei (+ 30.5%). Spending on

goods have averaged 4887 lei (-11.9% in dynamics) value that is based on annual level indicator: 4411 lei in 2011 and 5547 lei for 2012 (1.25 times the reference level).

Due to this situation, the expenditure related to materials and goods ranged from lei 424,459 in 2011 to 991,724 lei for 2012 (2.34 times compared to the first term of the series dynamic). Under these conditions the average of the period was lei 708,091.5, which in dynamics represented a decrease of 29.6% compared based reporting. The dynamics is one uneven.

Wages increased from lei 42,100 in 2011 to 1.10 times in 2012 (46,560 lei). Average period reaches lei 44,330, which represents 95.2% of the comparison.

Insurance spending have averaged 12,342 lei (-4.8% compared to base of reporting), with extremes of 11 724 lei in 2011 and 12,960 lei in the year 2012. The dynamics is similar to that recorded for wages.

Based on salaries and insurance were determined the personnel costs. This indicator has been ascending values for the period under review from 53,824 lei in 2011 to 59,520 lei in the year 2012, while the average period was 56,672 lei. We can discuss the uneven trend for the indicator, underlined by exceeding of reference period in 2012 (1.10 times) and it decreases beside that (-4.8%) for the average.

Another item of expenditure appears as the adjustments on property, indicator which has an upward trend net. The year 2011 is characterized by a value of 34,081 lei adjustments, value increases to lei 105,152 in 2012. Under these conditions the average period reached 69,616.5 lei (66.2% versus based reporting). The dynamics contains both indexes above unit (308.5% in the case of 2012) and below par for the average period.

Expenditure on external services were 202,994 lei in 2011, increased by 40.7% in 2012 (285,625 lei) and the average period reached 244,309.5 lei (14.5% versus dynamic reporting deadline).

Regarding the other taxes, fees and similar payments, it can be seen that they ranged from lei 5336 in 2011 to 6184 lei in the year 2012, while the average period was 5760 lei. In the dynamics can be observed above par value in 2012 (exceeding 1.15 times the reference period) and subunit values for average period - 93.1%.

For the element other expenses, the company recorded an average of 17,186.5 lei (outrunning by 8.39 times the base of comparing) whose average value are 32,325 lei in 2011 and 2048 lei registered in 2012 (6.3% in dynamic).

Following the values quoted for the last three indicators were determined other operating expenses, which registered: 240,655 lei in 2011 and 293,857 lei for 2012 to 122.1%, the average period being 267,256 lei. Based on these values was constituted the dynamics, characterized by values above par in 2012 and subunit for period average (90.9%).

Total operating expenses are based on total material costs, personnel costs, adjustments on assets and other operating expenses. Based on the values of the indicators mentioned above it was reached sequential levels of: 753,020 lei in 2011; 1450253 lei for 2012 - fig. 3.20. (+ 92.6% dynamic); 1101636.5 lei period average (-24.0% in the dynamics composed).

These values noted upward trend of operating expenses for the period considered.

The company realized interest expenses in 2011 and 2012, 18262 and respectively 28354 lei (+55.3% dynamic), which led to a multi-annual average of 23,308 lei (82.2% dynamic). This situation has been reported in the total financial costs, since they were not recorded other financial expenses.

Regarding the total expenditure, it is noteworthy that it has reached lei 771,282 in 2011 and 1,478,607 in the year 2012, while the average period reaches lei 1,124,944.5. The dynamics is composed of indices below par - 76.1% for the average of the period, equal in 2011 and above unit at the level of 2012 - 191.7%.

Profitability indicators. Table 4 presents the profitability indicators for the period 2011-2012. Operating profit is characterized by an average of 172,808 lei, the resulting value of sequential annual levels of 279,453 lei in 2011, and 66,163 lei specific to 2012. These values show fluctuating trend of the indicator exceeding the terms of reference for the average period (2.61-times) and decreasing in 2012 (-76.3%). Financial loss was 18,197 lei in 2011 and 28326 lei for 2012 (in dynamics, values of

Table 4. Profitability indicators

No.	Specification	M.U.	2011	2012		Average	
			Eff.	Eff.	2012 /2011** (%)	Eff. **	Average /2012** (%)
1	Operating profit or loss *	lei	279.453	66.163	23,7	172808	261,2
2	Profit or loss for the financial *	lei	-18.197	-28.326	155,7	-23261,5	82,1
3	Present profit or loss (1+2) *	lei	261.256	37.837	14,5	149546,5	395,2
4	Extraordinary profit or loss *	lei	-	-	-	-	-
5	Gross profit or loss (3+4) *	lei	261.256	37.837	14,5	149546,5	395,2
6	Income tax *	lei	46.986	6.381	13,6	26683,5	418,2
7	Other taxes or levies *	lei	-	-	-	-	-
8	Net profit or loss (5-6-7) *	lei	214.270	31.456	14,7	122863	390,6
9	The rate of profit or loss from operations **	%	37,11	4,56	12,3	15,68	343,9
10	The rate of profit or financial loss	%	-99,64	-99,90	100,3	-99,80	99,9
11	Current rate of profit or loss **	%	33,87	2,56	7,6	13,29	5,19 ori
12	Rates of extraordinary profit or loss **	%	-	-	-	-	-
13	Gross profit or loss rate **	%	33,87	2,56	7,6	13,29	5,19 ori
14	Rate of net profit or loss **	%	27,78	2,12	7,7	10,92	5,15 ori

* extracts from the profit and loss account (2011 – 2012)

** own calculations

the indices was above par in 2012 - outrunning by 1.55 times the reporting base). Due to this situation, the average period reaches 23261.5 lei, meaning 82.1% compared to term of reference.

Current profit appears as the difference between operating profit and financial loss. So we talk about values of 261,256 lei in 2011, 37837 lei -2012 and 149,546.5 lei for period average. The dynamics is characterized by sub unitary values for the component indices for 2012 (-85.5% compared to the base), and through level above par for period average (3.95 times the land outrunning for comparison). The gross profit is equal to current profit, as the company has not been extraordinary profit or loss. Company paid income tax but not paid "other taxes". Such values are found of income tax as follows: 46 986 lei in 2011, 6381 lei for the year 2012 (-86.4% dynamic) 26683.5 for average - level exceeded 4.18 times the base of reporting.

Net profit is characterized by an average of 122,863 lei, while the extreme values of the indicator appeared in 2012 - 31,456 lei and 2011 - 214,270 lei. The dynamics is one uniform, exceeding of reporting term being 3.90 times for period average while 2012 sees a decrease of 85.3% compared to the

reference term.

Operating profit rate was 37.11% in 2011, 4.56% for 2012 and 15.68% on average for the period. The evolution in time of the indicator is in the form of an uneven trend, decreases of 87.7% in 2012, followed by exceeding 3.43 times - the basis for comparison - for average period.

The company registered a loss of -99.80% for the financial period average (99.9% dynamic), a situation which is based on -99.64 and -99.90% rates specific to the years 2011 and 2012.

It can be seen that the current profit rate is substantially lower than the operating profit (normal situation due to financial losses existing): 33.87% in 2011, 2.56% for 2012 (7.6% dynamic), 13 29% for period average (5.19 times outrunning the term of comparison).

The gross profit rate is equal to the current rate of profit as the company has not made extraordinary profit or loss.

The last indicator of profitability refers to net profit rate. It can be seen that this ratio averaged 10.92%, with extreme values of 2, 12% for 2012 and 27.78% in 2011.

The consequence of this situation is non-uniform dynamic, the reference term being

exceeded 5.15 times by the average of the period and there was a negative difference of 92.3% (compared to reporting base) for the year 2012.

CONCLUSIONS

a. total revenue structure prevailing operating revenue 99.99%, financial income being only 0.01% of the total. Operating income are found in proportions: 69.52% turnover and that production sold, 7.62% income for production costs – fig. 1;

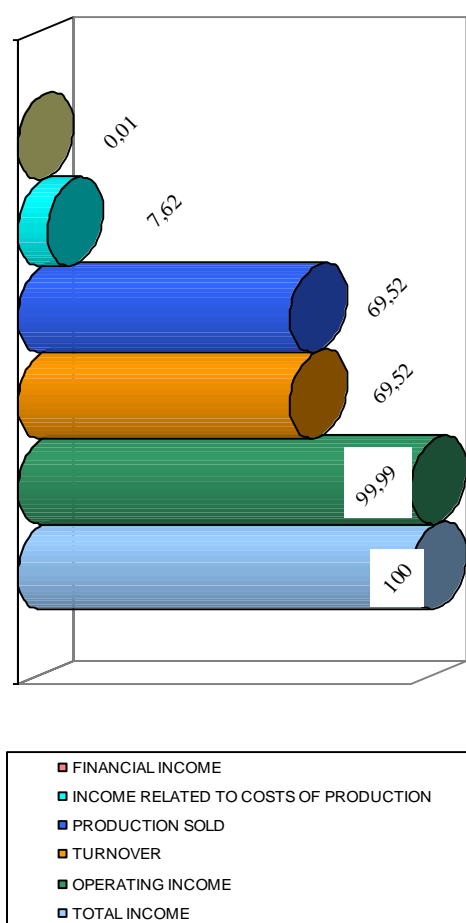


Fig.1. The ratio of total income and its main components (%)

b.in the structure of total expenditure prevailing material costs and related goods - 62.94%, followed by operating expenses - 23.76% adjustments on assets - 6.19% personnel costs - 5.04%, and the financial costs - 2.07% (fig. 2);

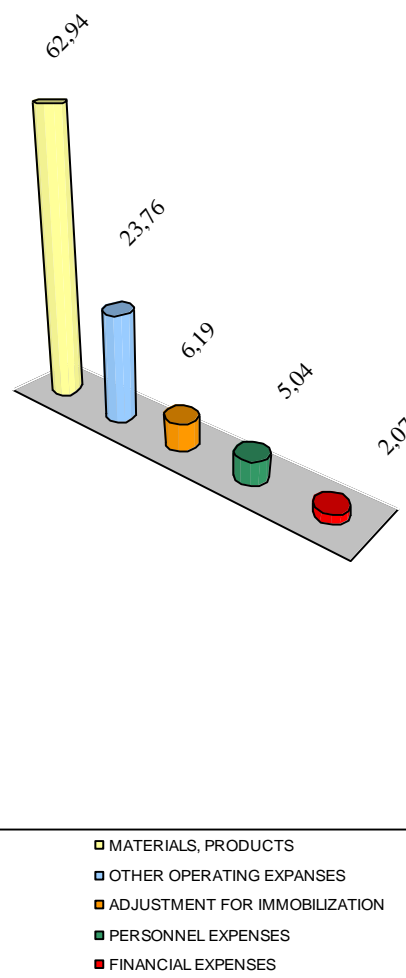


Fig.2. Structure of total expenditure (%)

c.the unit recorded operating profit and financial loss - 172,808 lei 23261.5 respectively, which made the current profit - 149546.5 lei;

d.given that the unit has not reported profit or loss is found extraordinary similarity between current profit and gross;

e.resulting net income by reducing the gross profit, because paying of the related taxes average index reaching a value of 122,863 lei.

REFERENCES

- [1]Goagără, D., 2012, Elements of agricultural accounting, Theme 4, Ed. Universitaria, Craiova, p. 65-97
- [2]Pânzaru, R. L., Medelete, D. M., Ștefan, G., 2007, Elements of management and marketing in agriculture,

FACTOR ANALYSIS OF LABOR PRODUCTIVITY IN AGRICULTURE IN TERMS OF SUSTAINABLE DEVELOPMENT

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Abstract

This paper represents an analysis of the level of labor productivity in agriculture for each development region of Romania. Labor productivity in agriculture was analyzed by two parameters, namely: the value of agricultural production and the number of employees in agriculture for the period 2011 – 2012. The level of labor productivity is influenced by the quality of biological and bio-capacity of plants and animals as well, as well as the equipment and quality of work performed. From the factorial analysis it can be noticed a decrease of labor productivity caused by a decrease in the value of agricultural production.

Key words: European found, financing, productivity.

INTRODUCTION

In Romanian economy, agriculture contributes with a significant share to GDP and GVA, but the use of agricultural production in industry is still low. Thus, the objectives of specialized organizations should focus on developing agriculture while achieving investment in processing capacity. Local farms should receive European funds to enable the development of processing and marketing activities in an integrated farming system. Thus the newly created full amount will remain in the same unit and would create the conditions for competitive competitions able to stimulate the development sector and provide products at reasonable prices, thereby stimulating consumption and at the same time offer.

MATERIALS AND METHODS

In this paper, have been used data from National Institute of Statistics regarding value of the agricultural production and number of occupied persons in agriculture for a time series of 2 years. It has been calculated the labor productivity in agriculture for each of the 8 development regions and it has been used the factor analysis in order to calculate the evolution of each factor (labor

productivity and number of occupied persons) upon the variation of the value of agricultural production.

RESULTS AND DISCUSSIONS

Factor analysis of labor productivity in agriculture

Work is the most important factor of production as condition of human development and wellbeing of any society. Unlike other factors of production, land and capital work involves a number of traits of human nature: motivations, satisfactions derived from the fact that the work is done by people, and any activity that initiates or generates no need to labor in society.

Regarding work in agriculture, finds its importance by the high share of labor costs in total production costs, a percentage that varies depending on: the system of production, type of holding, etc.

A special situation it is found in agriculture because of the high number of subsistence farms and of the seasonal character of the agricultural activities that led to a partial utilization of the working time [2]. The agricultural productions are significantly influenced by the work factor because through it combine and put in capital value of land and the exploitation [4].

Table 1. Value of the agricultural production

-thousands lei-

Regions	2011	2012
TOTAL	76,508,656	64,259,474
NORD-WEST	9,695,484	8,101,213
CENTER	8,793,035	7,124,789
NORD-EAST	12,639,425	10,646,133
SOUTH-EAST	13,170,545	10,301,573
SOUTH-MUNTENIA	14,604,812	12,534,763
BUCHAREST-ILFOV	723,148	662,698
SOUTH-WEST OLTENIA	8,740,835	7260647
WEST	8,141,372	7,627,658

Source: data processing, INS, TEMPO ONLINE

From the analysis of the value of agricultural production, it is found that it decreased by 16% in 2012 compared to 2011. The regions North-East, South-East and South-Muntenia are the regions with the greatest agricultural potential, especially for crop production, they totaled 52% of the agricultural production. The highest value of agricultural production is found in the South-Muntenia (19% of total) because the region is largely agricultural (2.449 hectares, representing 71.1% of the total area of the region), as demonstrated by the size of the agricultural area of 2449 hectares, and its share of 71.1% of the total area of the region; The remaining area is occupied by forests (19.3%) and wetlands (3.4%).

The structure of agricultural land dominates arable land 80.2%, followed by 15.7% pastures and meadows, and the last are vineyards and orchards (4.1%).

Regarding employment, Romania has almost 30% of total employment in agriculture, hunting and forestry, which ranks our country first in the European Union. Predominantly agrarian character of the South region and North East is supported by the large number of people working in agriculture. Compared to all other branches of the national economy, agriculture is the most employed people between 55-65 and older.

Romanian agriculture is facing a lot of problems regarding the productivity due to several factors.

Table 2. Number of occupied persons in agriculture (Ns)

-thousands pers-

Regions	2011	2012
TOTAL	2,442	2,510
NORD-WEST	367.5	377.3
CENTER	244	251.5
NORD-EAST	495.5	508.4
SOUTH-EAST	332.7	340.9
SOUTH-MUNTENIA	429.6	442.8
BUCHAREST-ILFOV	37	38
SOUTH-WEST OLTENIA	332.3	341.5
WEST	203.4	209.6

Source: data processing, INS, TEMPO ONLINE

Table 3. Labor productivity in agriculture (W)

- lei/employee-

Regions	2011	2012
TOTAL	31,330.33	25,601.38
NORD-WEST	26,382.27	21,471.54
CENTER	36,037.03	28,329.18
NORD-EAST	25,508.43	20,940.47
SOUTH-EAST	39,586.85	30,218.75
SOUTH-MUNTENIA	33,996.30	28,307.96
BUCHAREST-ILFOV	19,544.54	17,439.42
SOUTH-WEST OLTENIA	26,304.05	21,261.05
WEST	40,026.41	36,391.50

Source: data processing, INS, TEMPO ONLINE

One of the most important factor concerns lack of mechanization and the big share of people occupied in agriculture, most of them aged over 55 years [3]. Agriculture has the most employed people over 65, about 16% of the industry, which means that these people, although reached retirement age are forced to work due to the low level of pensions (the lowest of all social categories professional). The lowest share of population employed in agriculture is found in the age groups between 15-24 years of only 9.4%, so if we consider that in the next 10 years, the age group between 55 - 64 years will reach retirement age, means that a large part of the workforce cannot be replaced because this category has the highest percentage 20.1%. In these conditions, labor productivity growth by successive allocations technologies could lead

to positive considerations manifestation of this phenomenon.

Table 4. Indices of the value of agriculture production, number of occupied persons in agriculture and labor productivity in agriculture

Regions	Value	Ns	W
TOTAL	83.99	102.78	81.71
NORD-WEST	83.56	102.67	81.39
CENTER	81.03	103.07	78.61
NORD-EAST	84.23	102.60	82.09
SOUTH-EAST	78.22	102.46	76.34
SOUTH-MUNTENIA	85.83	103.07	83.27
BUCHAREST – ILFOV	91.64	102.70	89.23
SOUTH-WEST OLTENIA	83.07	102.77	80.83
WEST	93.69	103.05	90.92

Source: data processing, INS, TEMPO ONLINE

The influence of both factors was calculated using variable structure index shows a decrease of 18.29% in labor productivity due to variations in labor productivity in each development region, and the number of employees. Although it has a high agricultural potential, we find that the region recorded the largest decrease in labor productivity (23.66%) and the Western region of the smallest decrease (9.8%), due to the availability of equipment labor.

Table 5. Decreasing of the labor productivity in agriculture in the period 2011 – 2012

Regions	Lei
TOTAL	-5728.94
NORD-WEST	-4910.73
CENTER	-7707.85
NORD-EAST	-4567.96
SOUTH-EAST	-9368.10
SOUTH-MUNTENIA	-5688.35
BUCHAREST-ILFOV	-2105.12
SOUTH-WEST OLTENIA	-5043.00
WEST	-3634.91

Source: data processing, INS, TEMPO ONLINE

$$\Delta W = \frac{\sum_i W_{i1}T_{i1}}{\sum_i T_{i1}} - \frac{\sum_i W_{i0}T_{i0}}{\sum_i T_{i0}} = 24601,24 \text{ lei} - 31330,32 \text{ lei} = -5728,94 \text{ lei}$$

Average labor productivity fell by 5728,94 lei due to the influence of both factors. In the context of accessing European funds for rural development is an increase in the number of employees in agriculture because the beneficiaries have established businesses and are required to hire according to each measure of the National Rural Development Programme. In this respect, European funds have positive effects on employment in rural areas by reducing hidden unemployment. In 2012, Romania's unemployment rate was 7%, compared to 10.5% in the EU and rural employment rate was much higher representing actually a hidden unemployment (the unemployment rate in urban areas is 8.6 % compared to 5.1% in rural areas). By age, we find that the most affected is the category 15-24 years, reaching a level of 15.9% in 2012.

In countries from Central and East Europe like Czech Republic, Hungary, Letonia, Poland and Romania, in average the rural population occupies almost 38% in comparison of UE15 where it covers 22,9% [5].

In order to ensure sustainable development in the Romanian countryside, it requires financial support of this group experiencing significant decreases in the number of persons and an increase in unemployment. Encouraging young people to remain in rural areas and their financial support for the installation and management of a farm affects labor productivity in this sector.

Factor analysis of the value of agricultural production

Decomposition of output growth based on value chain substitution process [1]:

- Based on the variation in labor productivity:

$$\Delta = \sum W_{i1}T_{i1} - \sum W_{i0}T_{i1} = 64259474 - 76508656 = -14379644,17 \text{ lei}$$

- Based on the variation in the number of employees:

$$\Delta = \sum_i W_{i0}T_{i1} - \sum_i W_{i0}T_{i0} = 78639118.17 - 76508656 = 2130462 \text{ lei}$$

Table 6. Decomposition of output growth based on value chain substitution process

Regions	Decrease of the value of production
TOTAL	-12249182
NORD-WEST	-1594271
CENTER	-1668246
NORD-EAST	-1993292
SOUTH-EAST	-2868972
SOUTH-MUNTENIA	-2070049
BUCURESTI – ILFOV	-60450
SOUTH-WEST OLTENIA	-1480188
WEST	-513714

Source: data processing, INS, TEMPO ONLINE

Table 7. Based on the labor productivity variation

Regions	Based on productivity variation
TOTAL	-14379644.17
NORD-WEST	-1852817.24
CENTER	-1938523.715
NORD-EAST	-2322350.693
SOUTH-EAST	-3193584.17
SOUTH-MUNTENIA	-2518800.207
BUCURESTI – ILFOV	-79994.54054
SOUTH-WEST OLTENIA	-1722185.237
WEST	-761877.7483

Source: data processing, INS, TEMPO ONLINE

Table 8. Based on the variation of the occupied persons agriculture

Regions	Based on number of occupied pers
TOTAL	2130462
NORD-WEST	258546
CENTER	270278
NORD-EAST	329059
SOUTH-EAST	324612
SOUTH-MUNTENIA	448751
BUCURESTI – ILFOV	19545
SOUTH-WEST OLTENIA	241997
WEST	248164

Source: data processing, INS, TEMPO ONLINE

CONCLUSIONS

Labor productivity in agriculture depends not only on the quality of biological and bio-capacity of plants and animals but, and the availability of equipment and quality of work performed. The European funds for rural development represent an opportunity for both the purchase and renewal of farm machinery, as well as to increase the quality of work done by involving and encouraging young people who have knowledge in the field. In the study conducted, labor productivity is calculated based on the value of agricultural production. Although labor productivity in agriculture has decreased during the analyzed period, this was influenced by the increase in the number of employees. Accessing of European funds for rural development involves hiring a number of individuals and organization of semi-subsistence exploitations. In this respect, European funds in the agricultural sector contribute to reduction of unemployment. Also, labor productivity declined in the period under review as agricultural production in Romania is still dependent on climatic factors. Most affected age group in rural areas is between 18 to 24 years which decreases the number of people increases in the unemployment rate. Thus, for the period 2014 - 2020 should be undertaken to stabilize and installing these young people in rural areas to change the management of the farm and rural diversification activities.

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REFERENCES

- [1] Harja Eugenia, 2009, Statistică și econometrie, Bacau, Editura Alma Mater a Universitatii din Bacau, 2009.

[2]Istudor Nicolae, 2006, Dezvoltarea rurală și regională a României în condițiile integrării în Uniunea Europeană, ASE Publishing, Bucharest 2006.

[3]Istudor N, Petrescu I.E, Lucov B., 2012, The opportunity of applying the measures that support young farmers and early retirement for the next period 2014 – 2020, international conference Competitiveness of agro-food and ENVIRONMENTAL economy, 8 – 11 noiembrie 2012.

[4]Petrescu Irina Elena, Lucov Bogdan, Accessing the European Funds for rural development - opportunity for rural labour, Paper Calitatea – Acces la succes.

[5]Segre Andrea, Hanjalka Petrics, 2005, EU Enlargement and its Influence on Agriculture and Mechanisation, Agricultural Engineering International: the CIGR Journal of Scientific Research and Development, vol. VII, 2005.

CONSIDERATIONS REGARDING THE CRITERIA OF EFFICIENCY FOR THE CLASSIFICATION OF DAIRY FARMS

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Abstract

The paper aimed to present several criteria for dairy farms classification using a sample of 8 dairy farms from the Southern Romania whose data were collected for the year 2013. The most important indicator characterizing farm efficiency and size is milk yield because it has a direct impact on gross margin or profit. Milk production cost should be also taken into account, as it has a negative impact on the financial results. The application of the point method placed two farms on the top position: F5 and F3, each one getting 45 points for the criteria taken into account. However, the farm F5 came on the 1st position for milk yield, marketed milk yield, gross product from milk, total gross product per cow and year and gross margin/cow/year and on the 7th position for variable costs, while the farms F3 came on the 3rd position for milk yield and variable cost, on the 2nd position for gross product from milk, total gross product per cow and year, and standard gross margin, and on the 1st position for heifer cost and own mechanical works as well. As a conclusion, dairy farmers should keep under control all the production cost items looking for measures to reduce costs as much as they can without affecting yield performance. Under an increased competition, farmers should pay attention to all the factors stimulating the growth of milk yield, as the higher milk production, the higher financial results.

Key words: classification criteria, dairy farms, point method, standard gross margin

INTRODUCTION

Farm classification is very important for farmers in order to stimulate them to improve their performance under the continuous competition growth.

Most of authors consider that in dairy farming, farm size is given by the number of dairy cows [11]. Other authors consider that farm size is given by milk production or standard output [8, 18], others' opinion is that farm size is based on gross margin [6,17,19]. What is recognized by every author is the fact that farm classification or hierarchy depends on their financial results: gross margin or profit and that the optimum farm size is a mixture between the technical and economic optimum level which are still a subject enough controversial as long as they do not fit each other [13,15].

This controversial situation is created by the fact that clear and correct criteria to evaluate farm performance and position are not yet established, because there are so many

restraining factors with a deep influence on the financial results in dairy farming [2].

Milk yield is determined both by genetic factors, such as: individuality, cow breed, age, body shape and weight, constitution, udder size and shape, breeding value of the bulls used in artificial insemination and environment factors such as: geographical position of the farm, possibilities to produce forages in the farm as much as the farmer is able to do so that just a few forages to be bought from the market and only what is really needed, grazing opportunities, feeding system, a balanced diet regarding the content of protein and starch, vitamins and microelements, reproduction system, cow age at the first calving and lactation, calving interval, season and month of calving, milking system, length of lactation, housing and comfort factors: resting bed, temperature, air moisture, wind currents, cow movement and hygiene conditions, weather conditions etc.[5,12, 14, 16].

Profit is a function of the amount of delivered

milk in the market, production cost per milk kg and milk price [13]. Marketed milk is a function of milk production obtained per cow and year and milk used for feeding calved till the weaning age. Milk price is conditioned demand/offer ration in the milk market and milk quality in terms of fat percentage, protein percentage, acidity, density, content of germs, somatic cells etc. [10].

Milk production cost depends on all the cost items with a direct influence of milk production. In this category one can mention: feeding cost with the highest share in total production cost, cost of the heifer used for replacing the culled cow in close relationship with culling percentage applied by farmer, heifer breeding value determined by its mother cow and father bull, heifer market price, cost of labor force, veterinary services involving cost of medicines, treatments, cost of artificial insemination involving the price per frozen semen varying according to the bull breeding value for milk production, tariff per insemination service, water consumption and tariff per cubic meter, electricity consumption and tariff per Kwh, fuel and lubricants, land rental, repairs of shed installations and equipment for milking, watering, food distribution, manure collection etc, depreciation of fixed assets (cow sheds, milking parlor, milk tank, installation of manure evacuation, watering installation etc) [21,22].

Also, milk production cost is divided into two categories of costs: variable costs, varying at the same time with production and fixed costs (depreciation, taxes, interest etc), which do not affect milk production, but only the financial results in term of profit. For this reason, it is recognized that the most important part of cost is the variable cost represented mainly by feed cost, replacement cost and labor cost [20]

For this reason, during the last decade, the EU established gross margin and standard gross margin as a barometer of farm efficiency and also a basis for farm classification according to the economic size unit (ESU= Euro 1,200) [6, 17,19].

Recently, the EU changed its opinion about

the criteria of farm classification and introduced the gross production standard, as an average during a period of five years [9].

In this context, the paper goal was to evaluate farm performance based on the indicators taken into consideration for gross margin calculation, but the comparison between dairy farms to be based on the number of points received for each indicator according to the points method. The hypothesis the study started is that the application of the pint method could lead to the same results as the gross margin method. In this way, farm classification could be more precisely taking into consideration more criteria.

MATERIALS AND METHODS

A number of 8 dairy farms from the Southern Romania were included in this experiment. With the farmers support, the data were collected for the year 2013 from the farm book-keeping.

The economic indicators taken into consideration were the following ones: milk yield (kg/cow/year), marketed milk yield (kg/cow/year), milk price (Euro/kg milk), gross product from milk (Euro/cow/year), calf weight at delivery (kg/head) and price per kilogram live weight (Euro/kg), gross product from sold calf (Euro/cow/year), culling percentage (%), cow live weight at the culling moment (kg/cow), price per kg cow live weight (Euro/kg), gross product from sold culled cow (Euro/cow/year), amount of manure collected from cow per year (cubic meters/cow/year) and manure market price (Euro/cubic meter), gross product from cow manure collection (Euro/cow/year), total gross product (Euro/cow/year), variable cost items such as: feed cost in terms of Euro/cow/year (determined using cow daily diet and price per kg of each feed component), cost of the replacing heifer, taking into account the culling rate and the heifer market price (Euro/cow/year), cost of own mechanical works (Euro/cow/year), cost of veterinary services, electricity, water consumption, artificial insemination (Euro/cow/year), total variable cost (Euro/cow/year).

Based on the value of these indicators, it was

calculated gross margin, SGM, in terms of Euro/cow/year, as a difference between gross product per cow and year, GP, and variable cost per cow and year, VC, according to the formula: $SGM = GP - VC$.

Based on the data collected for these indicators from the 8 dairy farms, it was calculated the average, standard deviation and variation coefficient according to the formulas: [4,23]

$$\text{Average), } A = \frac{X_1 + X_2 + \dots X_n}{n},$$

(1)

where n = number of farms and X = economic indicator (milk yield, marketed milk, etc)

$$\text{Standard Deviation, } S = \sqrt{\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{n-1}} \quad (2)$$

$$\text{Variation Coefficient, } V_{\%} = \frac{S}{\bar{X}} \times 100 \quad (3)$$

Also, the coefficients of simple linear correlation were calculated using the formula: $r_{xy} = S_{xy} / S_x \cdot S_y$ in order to identify the sense and intensity of the interrelationship between various economic indicators. [4,23]

Finally, the Classification Method by Points, a quantitative assessment method largely used in enterprise management, [1,3] was applied so that each farm was evaluated based on a total number of points, resulting from the sum of points received for each economic indicator, according to the rating scale which varied between 1, the maximum mark and 8 the minimum mark.

This methodology allowed the classification of dairy farms, according to the principles:

- (a) a farm which got the lowest number of points should be classified on the top position and
- (b) a farm with the highest number of points should be classified on the last position.

RESULTS AND DISCUSSIONS

The economic indicators characterising each farm included in this experiment are

presented in Table 1.

Milk yield was 5,933 kg/cow/year in average for the all 8 dairy farms. It varied between 5,115 kg/cow/year for the farm F8, the minimum level, and 6,730 kg/cow/year in case of the farm F5, the maximum level. The variation coefficient was 10 % reflecting a relative low variation among farms (Table 1 and 2).

Marketed milk yield was 5,375 kg/cow/year in average, and varied between 4,501 kg/cow/year in case of F8, the minimum level, and 5,940 kg/cow/year for the farm F4. The variation coefficient accounted for 10.21 % (Table 1 and 2).

Gross product from milk was Euro 1,894/cow/year in average for the 8 farms, and varied between Euro 1,520 per cow and year in case of F8 and Euro 2,333/cow/year in case of F5. The variation coefficient was 14.26 % reflecting a relatively high difference among farms regarding this economic indicator.

Gross product was determined by milk yield and milk price. Milk price varied between Euro 0.31/kg, the maximum level and Euro 0.26/kg, the minimum level (Table 1 and 2).

Gross product from calf accounted for Euro 82.6/cow/year in average, ranging between Euro 86/cow/year in case of F6 and Euro 80/cow/year in case of F2 and F3. Its level was influenced by calf live weight which varied between 80 and 90 kg/head at delivery and price per kilogram live weight, which ranged between Euro 0.93 and Euro 1 per kilogram (Table 1 and 2).

Gross product from the culled cow recorded an average of Euro 145 taking into consideration all the eight farms, with a variation coefficient of 10.81 %. The level of this economic indicator ranged between Euro 158/cow/year, the highest value, in case of F6 and Euro 118/cow/year, the lowest value, in case of F3. The value of this economic indicator depended on the cow live weight at the age of culling, which varied between 550 kg and 600 kg and price per kilogram live weight, whose average value was Euro 1.11/kg in average. Also, it depended on the culling rate, whose value varied from a farm

to another between 25 % in case of F1, F6 and F8, 20 % in case of F2, 23 % in case of F4, F5 and F7 and 18 % in case of F3 (Table 1 and 2).

Gross product from manure was in average Euro 282.2, with a variation coefficient very small, just 4.46%, reflecting differences of less importance between farms. Its level was determined by the amount of manure collected from a cow, which varied between 26.4 cubic meters/year, the highest level and 24.2 cubic meters/year, the lowest level and the manure price, whose average value was Euro 11.11/tonne. Its level varied between the maximum level Euro 297/cow/year in case of

F7 and the minimum level, Euro 268/cow/year in case of the farm F1 (Table 1 and 2).

Total Gross product registered in average Euro 2,403.87/cow/year and a variation coefficient of 11.28 %. The maximum gross product per cow and year was registered by the farm F5. Euro 2,863 and the minimum level of this indicator was recorded by the farm F8, Euro 2,038 (Table 1 and 2).

The contribution of various products to gross product/cow/year was the following one: milk 78.79 %, the highest weight, calf 3.43 %, culled cow 6.03 % and manure 11.75 %.

Table 1. Economic indicators achieved by each farm in the year 2013

Farm	Milk yield kg/cow/year	Marketed milk kg/cow/year	Gross product -Euro/cow/year					Variable cost- Euro/cow/year					Gross margin Euro/cow/year
			From milk	From calf	From culled cow	From manure	Total	From replacing heifer	From feed	From own mechanical works	From veterinary service, electricity, water, AI	Total	
F1	5,840	5,673	1,780	82	152	268	2,282	141	516	18	183	858	1,424
F2	5,950	5,576	1,813	80	122	270	2,285	108	479	14	188	789	1,486
F3	6,370	5,670	2,208	80	118	288	2,694	106	480	15	195	796	1,898
F4	6,600	5,940	2,011	83	153	293	2,539	112	504	26	207	849	1,690
F5	6,730	5,922	2,333	84	150	296	2,863	127	488	17	210	942	2,116
F6	5,500	4,950	1,718	86	158	268	2,231	114	466	19	184	783	1,448
F7	5,360	4,770	1,769	82	151	297	2,299	132	490	18	181	821	1,478
F8	5,115	4,501	1,520	85	156	277	2,038	120	465	19	197	801	1,237

Source: Farms book-keeping, Own calculations.

Variable cost for the replacing heifer accounted in average for Euro 120, taking into consideration the culling rate and market price per heifer, whose value varied between Euro 488.88/heifer, the maximum level, in case of F5, and Euro 377.77/heifer, the minimum level in case of F2, F6, F7 and F8. The variation coefficient was 38.91 % reflecting a large difference among farms, between Euro 106/cow/year in case of F3 and Euro 141/cow/year in case of F1 (Table 1 and 2).

Variable cost for cow feeding was in average Euro 487.25/cow/year with a low variation coefficient, 3.71 %. It varied between Euro 465/cow/year, the minimum level in case of F8 and Euro 516/cow/year, the maximum level in case of F1.

The most of forages were produced in the farms and just a few amount was bought from

the market. This contributed to savings of variable cost determined by cow feeding (Table 1 and 2).

Variable cost for own mechanical works varied between the maximum level, Euro 26/cow/year in case of F4 and the minimum level, Euro 14/cow/year in case of F2. Its average level accounted for Euro 18.25/cow/year with a variation coefficient of 19.72 %, reflecting large differences among farms because of the applied technologies and technical endowment in each farm (Table 1 and 2).

Variable cost for veterinary services, electricity, water consumption and artificial insemination registered in average Euro 193.75/cow/year and a variation coefficient of 6.30 %. This variable cost item varied between Euro 215, the maximum level in case

of the farm F5, the farm with the highest milk yield and the minimum level, Euro 181/cow/year in case of F7, where milk yield was 5,360 kg/cow/year, one of the lowest production after F8, which recorded 5,115 kg/cow/year.

This cost item was deeply influenced by the reproduction problems of milking cows,

treatments and medicines cost, energy consumption and its price per kwh, water consumption and its tariff per cubic meter, price by frozen semen dose from high breeding value bulls and tariff per AI service (Table 1 and 2).

Table 2. Averages, standard deviation and the variation coefficients for the economic indicators

Indicator	MU	\bar{X}	S	V%
Milk yield	Kg/cow/year	5,933	593.40	10.00
Marketed milk yield	Kg/cow/year	5,375	548.89	10.21
Gross product from milk	Euro/cow/year	1,894	270.19	14.26
Gross product from sold calf	Euro/cow/year	145	15.68	10.81
Gross product from culled cow	Euro/cow/year	82.6	2.20	2.66
Gross product from manure	Euro/cow/year	282.2	12.60	4.46
Gross Product-Total	Euro/cow/year	2,403.87	271.25	11.28
Cost of replacing heifer	Euro/cow/year	120.00	46.71	38.91
Cost of feeding	Euro/cow/year	487.25	18.11	3.71
Cost of own mechanical works	Euro/cow/year	18.25	3.60	19.72
Cost of veterinary services, electricity, water, artificial insemination	Euro/cow/year	193.75	12.22	6.30
Variable cost-Total	Euro/cow/year	819.25	31.43	3.83
Gross Margin	Euro/cow/year	1,584	259.49	16.37

Source: Own calculations

Total variable cost/cow/year, as a sum of all the item costs mentioned above, accounted for Euro 819.25 for all the 8 farms used in this experiment, with a variation coefficient of 3.83 %. The highest value for this indicator was Euro 858 in case of F1 and Euro 783 in case of F6 (Table 1 and 2).

The contribution of various variable cost items to total variable cost per cow and year was the following one: feeding cost 60 %, replacing heifer 14.64 %, veterinary services, energy and water consumption, and artificial insemination service 23.14 %, and own mechanical works 2.22 %.

Standard gross margin, calculated as a difference between gross product/cow/year and variable cost/cow/year, registered in average Euro 1,584.62 /cow/year with a

variation coefficient of 16.37 %, reflecting differences from a farm to another. Its highest level was Euro 2,006/cow/year in case of the farm F5, the farm with the highest milk yield (6,730 kg/cow/year), and Euro 1,237/cow/year, the lowest level in case of F8, the farm with the lowest milk production average (5,115 kg/cow/year) as shown in Table 1 and 2.

The average values, standard deviation and variation coefficients for each economic indicator taken into consideration in this research work are presented in Table 2.

Coefficients of simple linear correlation are presented in Table 3.

A strong and positive correlation was found between milk yield and marketed yield, also with gross product from milk, and total gross product per cow/year and standard gross

margin as well.

Another substantial and positive correlation was noticed between gross product from calf and total gross product per cow and year and standard gross margin.

A positive correlation was also found between gross product from culled cow and total gross product per cow and year and standard gross margin.

Another positive relationship was noticed between gross product from manure and gross product/cow/year and standard gross margin.

A positive correlation was found between the total variable cost and various variable cost items: heifer cost, feeding cost, own mechanical works cost, veterinary services, energy, water and AI cost as well.

Table 3. Coefficients of simple linear correlation between the economic indicators

	Milk yield	Marketed milk yield	Gross product from milk	Gross product from calf	Gross product from culled cow	Gross product from manure	Variable cost-Total	Standard Gross Margin
Milk yield	-	0.916***	0.923***	-	-	-	-0.637	0.636
Marketed milk yield	0.916***	-	0.920***	-	-	-	-0.503	0.622
Gross product from milk	0.812**	0.789**	-	-	-	-	-	0.724**
Gross product from sold calf	0.806**	-	-	-	-	-	-	0.682
Gross product from culled cow	0.890***	-	-	-	-	-	-	0.740**
Gross product from manure	0.826**	-	-	-	-	-	-	0.815**
Gross Product-Total	0.902***	0.905***	0.887**	0.806**	0.842**	0.825**	-0.551	0.910***
Cost of replacing heifer	-0.393	-	-	-	-0.465	-	0.825**	-0.527
Cost of feeding	-0.448	-	-	-	-	-	0.988***	-0.682
Cost of own mechanical works	-0.316	-	-	-	-	-	0.352	-0.435
Cost of veterinary services, electricity, water, artificial insemination	-0.551	-	-	-	-	-	0.313	-0.529
Variable cost-Total	-0.503	-0.500	-0.478	-0.242	-0.466	-0.269	-	-0.624
Gross Margin	0.636	0.622	0.762**	0.726**	0.726**	0.789**	0.745**	-0.546

Source: Own calculations

A negative correlation was noticed between milk yield and variable cost ($r = -0.503$ and various variable cost items: heifer cost, feeding cost, own mechanical works cost, veterinary services, energy, water and AI cost as well.

Another negative correlation was found between standard gross margin and variable cost ($r = -0.624$) and all the variable cost items as well (Table 3).

Farm classification based on the total number of points received for all the economic indicators taken into consideration in this study is presented in Table 4.

The 1st position was occupied by the farm F5, which recorded 45 points, because this farm came on the 1st position for milk yield, marketed milk yield, gross product from milk, total gross product per cow and year and gross margin/cow/year and on the 7th position for variable costs.

Also, the 1st position was occupied by the farm F3, which recorded the same number of

points, 45, but it came on the 3rd position for milk yield and variable cost, on the 2nd position for gross product from milk, total gross product per cow and year and on the 2nd position for standard gross margin, on the 1st position for heifer cost and own mechanical works as well.

On the 2nd position was situated the farm F4, which got 52 points, as it came on the 2nd position for milk yield and marketed yield, on the 3rd position for gross product from milk, gross product from culled cow, gross product from manure and total gross product per cow and year, and also it came on the 6th position for variable cost and on the 3rd position for standard gross margin.

Also on the 2nd position was placed the farm F2, with the same number of points, 52, like the farm F4, but it was placed on the 4th position for milk yield, for gross product from milk and for standard gross margin, on the 5th position for marketed milk and for total gross product per cow and year, on the 1st position for own mechanical works cost, on the 3rd

position for feeding cost, and on the 2nd position for total variable cost.

On the 3rd position came the farm F6, with 55 points, which was situated on the 6th position for milk yield and marketed milk, on the 1st position for gross product from sold calf, gross product from the culled cow sold in the market and variable cost as well, on the 3rd position for the cost including veterinary services, energy, water, and artificial insemination, and on the 5th position for standard gross margin per cow and year.

On the 4th position came the farm F7, with

62 points. It occupied the 5th position for standard gross margin, but the 1st position for gross product from manure and variable cost including veterinary services, energy, water and artificial insemination.

On the 5th position came the farm F8, as it got 71 points. It was placed on the 8th position for milk yield, marketed milk, gross product from milk and total gross product, and standard gross margin as well, but on the 1st position for feeding cost and the 4th position for total variable cost.

Table 4. Farm classification based on Point Method (Rating Method)

Indicator	Dairy farms							
	F1	F2	F3	F4	F5	F6	F7	F8
Milk yield	5	4	3	2	1	6	7	8
Marketed milk yield	3	5	4	2	1	6	7	8
Gross product from milk	5	4	2	3	1	7	6	8
Gross product from sold calf	4	5	5	4	3	1	4	2
Gross product from culled cow	4	7	8	3	6	1	5	2
Gross product from manure	8	6	4	3	2	7	1	5
Gross Product-Total	6	5	2	3	1	7	4	8
Cost of replacing heifer	8	2	1	3	6	3	7	5
Cost of feeding	8	3	4	7	5	2	6	1
Cost of own mechanical works	4	1	2	6	3	5	4	5
Cost of veterinary services, electricity, water, artificial insemination	2	4	5	7	8	3	1	6
Variable cost-Total	8	2	3	6	7	1	5	4
Gross Margin	7	4	2	3	1	6	5	8
Total points	72	52	45	52	45	55	62	71
Position	6	2	1	2	1	3	4	5

Source: Own calculations

On the 6th position came the farm F1, with 72 points. It occupied the 7th position for standard gross margin and the 8th position for total variable cost, heifer cost, feeding cost and the 5th position for milk yield and the 6th position for total gross product.

Therefore, the best farms were F5 and F3, which were placed on the 1st position for milk yield, 6,730 kg/cow/year (the highest production level) and, respectively 6,370 kg/cow/year (the 3rd position), and also the 1st position for total gross product and the highest standard gross margin (the 1st position) and, respectively on the 2nd position, reflecting the direct connection between milk production and standard gross margin, and also between milk yield, total gross product and standard gross margin.

CONCLUSIONS

The major economic indicators with a deep impact on the financial results, in terms of gross margin are milk production and marketed milk yield. For this reason, they should be placed on the top hierarchy of the factors linked to farms size. The optimization of gross margin or profit is a function of the harmonization between the technical optimum and economic optimum in terms of production cost and milk price.

On the third position it should be positioned milk production cost, which could assure similar positions when standard gross margin/cow and year are taken into consideration.

Feeding cost, replacing heifer cost, the cost of

veterinary services, energy, water and artificial insemination are closely correlated with total variable cost.

In this study it was not taken into account the number of dairy cows, because it was considered without importance in relation to financial results and farm size. The calculations made per cow and year are enough in order to identify the main criteria which should be considered in farm classification according to economic efficiency.

The application of the point method placed two farms on the top position: F5 and F3, each one getting 45 points for the criteria taken into account. However, the farm F5 came on the 1st position for milk yield, marketed milk yield, gross product from milk, total gross product per cow and year and gross margin/cow/year and on the 7th position for variable costs, while the farms F3 came on the 3rd position for milk yield and variable cost, on the 2nd position for gross product from milk, total gross product per cow and year, and standard gross margin, and on the 1st position for heifer cost and own mechanical works as well.

Gross margin is a barometer of economic efficiency in dairy farming, but it is determined by milk yield, which should be considered the major factor of profitability. The highest milk production per cow and year, the higher profitability in dairy farming.

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REFERENCES

- [1] Armstrong, M., 2002, A Handbook of Management Techniques, 3rd Ed., Kogan Page Business Books
- [2] Avila, M., Technical Paper 5: Concepts and Methods for Economic Evaluation of Alley Farming
- [3] Brilman, J., Maire, C., 1990, Manuel d'évaluation des entreprises. Paris, Les Editions d'organisation
- [4] Ceapoiu, N., 1968, Statistical methods applied in agricultural and biological experiments, AgroSilvica Press House, Bucharest
- [5] Chagunda, M. G., Wollny, C., Ngwerume, F., Kamwanja, L. A., Makhambura, T. P. E., Environmental factors affecting milk production of a Holstein Friesian herd in Southern Malawi, <http://www.ilri.org/InfoServ/Webpub>
- [6] Draghici, M., Oancea Margareta, Plesoianu, G., Zahiu Letitia, Screciu Florin, 2004, Text Book of Farm Management, Atlas Press, p.36
- [7] EU Commission, Regulation 1242/2008 establishing the Community typology of agricultural holdings
- [8] EU, Glossary: Standard output (SO), http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:Standard_output
- [9] EU Commission Regulation (EC) 867/2009 amending and correcting Regulation 1242/2008 establishing the Community typology of agricultural holdings
- [10] Food safety starts at farm, The Friesian and AgroConsultancy, The Bilateral Romanian Dutch Project, Quality Control along milk chain in Romania,
- [11] Iosif, G., Stroe Maria, 1987, Optimum dimension of agricultural units-animal farms and holdings, Ceres Press House, Bucharest, p.21-23
- [12] Javed, K., Afzal, M., Sattar, A., Mirza, R. H., 2004, Environmental factors affecting milk yield in Friesian cows in Punjab, Pakistan, Pakistan Vet. J., 24(2): 58-62
- [13] MacDonald James M., O'Donoghue Erik J., McBride William D., Nehring Richard F., Sandretto Carmen L., Mosheim Roberto, Profits, Costs, and the Changing Structure of Dairy Farming, USDA, Economic Research Report Number 47
- [14] Munteanu Liviu, Factor influencing production, <http://www.ojccs.ro>
- [15] Oancea Margareta, 2007, Management, Economic and strategy of agricultural units, Ceres Press House
- [16] Obadina, A.O., Factors Affecting Milk Yield, Dairy Production 342-450, A Milk Yield & Composition, p.1-9, <http://unaab.edu.ng/attachments/Obadina.pdf>
- [17] Pirvutiu, I., Popescu Agatha, 2012, Research concerning Standard Gross Margin depending on Yield in Dairy Farming, Scientific Papers Animal Science and Biotechnologies, Vol.45(2):339-342
- [18] Popescu Agatha, 2009, A comparative study concerning economic efficiency for various levels of milk yield, Scientific Papers Animal Science, Iasi, Vol.52, p.525-530
- [19] Popescu Agatha, 2010, Research concerning the Use of Regression Function in Gross Margin Forecast, Bulletin of UASVM Cluj-Napoca, Romania, Horticulture-Management, Vol.67(2):197-202
- [20] Salfer Jim, 2010, Know the drivers of dairy farm profitability, Dairy Star September 3, 2010
- [21] Sarker Debbarayan, Ghosh Bikash Kumar, 2008, Economics of Milk Production in West Bengal: Evidence from Cooperative and noncooperative Farms, Journal of Economics and Business, Vol. XI – 2008, No 1 & No 2
- [22] Schulte Kristen, Dhuyvetter Kevin, 2010, Factors

Impacting Dairy Profitability:, An Analysis of Kansas
Farm Management Association Dairy Enterprise Data ,
Department of Agricultural Economics, Kansas State
University January 2010

[23]Trebici, V., Iosifescu, M., Moineagu, C., Ursianu
Emiliana, 1985, Small Statistical Encyclopedia,
Scientific and Encyclopedic Publishing House,
Bucharest

RESEARCH ON A SIMPLIFIED MIXED MODEL VERSUS CONTEMPORARY COMPARISON USED IN BREEDING VALUE ESTIMATION AND BULLS CLASSIFICATION FOR MILK PRODUCTION CHARACTERS

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Abstract

The paper goal was to set up a simplified BLUP model in order to estimate the bulls' breeding value for milk production characters and establish their hierarchy. Also, it aimed to compare the bulls' hierarchy set up by means of the simplified BLUP model with their hierarchy established by using the traditional contemporary comparison method. In this purpose, a number of 51 Romanian Friesian bulls were used for evaluating their breeding value for milk production characters: milk yield, fat percentage and fat yield during the 305 days of the 1st lactation of a number of 1,989 daughters in various dairy herds. The simplified BLUP model set up in this research work has demonstrated its high precision of breeding value, which varied between 55 and 92, and more than this it proved that in some cases, the position occupied by bulls could be similar with the one registered by using the contemporary comparison. The higher precision assured by the simplified BLUP model is the guarantee that the bulls' hierarchy in catalogues is a correct one. In this way, farmers could chose the best bulls for improving milk yield in their dairy herds.

Key words: bulls' breeding value estimation, contemporary comparison, milk production characters, simplified mixed model

INTRODUCTION

The use of the highest breeding value bulls in dairy cows populations could assure the growth of milk production as mentioned Draganescu in 1979 [4].

The identification of the best bulls requires to set up the most adequate methods for estimating breeding value for milk production characters [12, 24, 28].

The "contemporary comparison" method, theoretically based by Robertson and Rendel in 1950 [23] and Henderson, Carter and Godfrey in the USA [7], like "herd mate comparison", was very much appreciated for its high efficiency in bulls' breeding value estimation, a reason for which it was largely used in almost all the countries.

Across the time, it was improved in order to increase the precision of the breeding value by eliminating the influence of the mother cows, the differences among dairy herds [21,22], by

correcting the regression coefficient and the deviation of daughters performance from their contemporary cows for age [15,16], calving season and month, lactation duration, herd size [17,18], for the number of daughters and their distribution by herds [14], for the dry period [6,25], for calving interval [13] and for the number of offspring per bull [19].

The contemporary comparison method was later replaced by the new methods based on linear mathematical models, assuring a higher precision in breeding value estimation and being easier used due to the fast computers dynamics.

Mathematical models should be set up in accordance with every country conditions regarding: climate, breed, breeding system, herd size, number of selected bulls, and system of data collection, registration, storage and processing [8, 11, 27].

The most important linear mathematical models largely utilized in breeding value

estimation are (a) selection indices [1,2,6], (b) the least square method [3,6] and (c) the best linear unbiased prediction (B.L.U.P.) [26, 29]. The advantage of BLUP compared to selection indices is that the former assures an unbiased linear prediction with the lowest quadratic error.

Later transformed into "mixed model", BLUP method successfully combined the advantages of the selection indices and the least square method, assuring a minimum variance of the breeding value, this model being much better adapted to the present calculation techniques [2,3,6].

In Romania a series of researched obtained important results regarding the implementation of BLUP method in various variants [4,20].

In this context, the paper presents a simplified mathematical model of BLUP to estimate bulls' breeding value for milk production characters in Romania and makes a comparison between the bulls hierarchy base on the simplified BLUP model and contemporary comparison.

MATERIALS AND METHODS

A number of 51 Romanian Friesian bulls were used for evaluating their breeding value for milk production characters based on two methods: (a) a simplified BLUP model and (b) contemporary comparison method. In this purpose, a number of 1,989 daughters of those bulls were tested for their performance at the 1st 305 days lactation for milk production characters: milk yield, fat percentage and fat. The average number of daughters per bull was 39, ranging between 19 and 198. The daughters were tested in their dairy herds. This was a right decision based on the fact that "20-40 daughters tested in dairy herds assure the same selection precision as 20 daughters tested in stations" as mentioned by Robertson and Rendel (1954) cited by Draganescu, 1979 [4].

Starting from the mixed model established by Henderson (1949), in this paper it was set up an own simplified variant in monofactorial classification, according to the mathematical formula:

$$Y_{ij} = \mu + s_i + e_{ij}, (1)$$

where: Y_{ij} – the performance of the „j” daughter of the „i” bull, μ is a fixed unknown parameter, s_i – the effect of the „i” bull, with the value $s_i = \frac{1}{2} g_i$, where: g_i – the „i” bull's breeding value, e_{ij} – residual effect ($j=1, \dots, n_{ij}$); a and e are uncorrelated variables with the averages equal to zero and variances \sum_s^2 and \sum_e^2 .

Let's consider $\sum(e_{ij}) = 0, \text{cov}(e_{ij}, e_i, j,) = 0$ if

$i \neq i'$, or at least $j \neq j'$ and $\sum_{ij}^2 = \sum_e^2$. The linear model does not suppose that bulls are relatives among them, $\text{cov}(s_i, s_i) = 0, \sum_{si}^2 = \sum_s^2 = 1/4 \sum_A^2$.

Considering that n_i represents the number of daughters of the “i” bull, then the equations of the mixed model are:

$$\begin{bmatrix} n & n_1 & n_2 & \dots \\ n_1 n_1 + \sum_e^2 / \sum_s^2 & 0 & 0 & \dots \\ n_2 & 0 & n_2 + \sum_e^2 / \sum_s^2 & \dots \\ \dots & \dots & \dots & \dots \end{bmatrix} \begin{bmatrix} \mu \\ s_1 \\ s_2 \\ \dots \end{bmatrix} = \begin{bmatrix} y.. \\ y_1 \\ y_2 \\ \dots \end{bmatrix} \quad (2)$$

The breeding value of the “i” bull, s_i , will be:

$$s_i = 2(n_i/n_i + a)(y_i - \mu) \quad (3)$$

where: $s = \sum_e^2 / \sum_s^2$. If we consider $n_i/(n_i + a) = w_i$, then $\bar{\mu} = \sum w_i \bar{y}_i / \sum w_i$.

The precision of the estimated breeding value, R^2 , was calculated using the formula:

$$R^2 = w_i - \frac{w_i}{\sum w_i} \quad (4)$$

When n_i has a high value, then $R^2 = w_i(1 - \frac{1}{\sum w_i})$, unde $\sum w_i$ goes to infinity and $1/\sum w_i$ goes to zero.

This simplified mixed model was utilized for estimating the bulls breeding value and its precision for milk production characters: milk yield, fat % and fat quantity for 305 days of lactation at the 1st lactation.

Based on the obtained breeding value, the

bulls were classified, each of them coming on a certain position from 1 to n. The summation of the positions occupied for pairs of characters allowed to set up a new hierarchy

of the bulls.

Breeding value was also estimated using the contemporary comparison method, based on the formula:

$$\hat{VA} = 2b[(\bar{Y} - \bar{A}_y) - 1/2h^2(\bar{X} - \bar{A}_x) + h^2_A(\bar{A} - \bar{P})] + \bar{P}, \quad (5)$$

where: \bar{A} - herd average, and \bar{P} - breed average, \bar{Y} - mothers average performance, \bar{A}_x - contemporary average performance, and $1/2 h^2$ - mother genetic contribution [10, 21, 22]. h^2 = heritability whose values were 0.25 for milk yield, 0.3 for fat % and 0.25 for fat quantity.

The factor b had the formula:

$$b = \frac{W}{W + \frac{4}{h^2} - 1}, \quad (6)$$

where: $W = \sum_{i=1}^k w_i$ and K – number of herds.

$$w_i = \frac{n_1 \cdot n_2}{n_1 + n_2}, \quad (7)$$

where: n_1 - number of daughters and n_2 - number of contemporaries.

In order to establish the relationship between the bull classification based on the breeding value estimated by the simplified BLUP model and the classification resulted based on the contemporary comparison it was used the rank correlation method established by Spearman [30] based on the formula:

$$r_s = 1 - \frac{6 \sum d^2}{n(n^2 - 1)} \quad (8)$$

The significance of this correlation was tested using Fisher Test for the probabilities $P = 0.05$ and $P = 0.01$, using Fisher tables [30].

RESULTS AND DISCUSSIONS

Bulls' daughters performance in milk yield for 305 days of the 1st lactation

The bulls' daughters registered an average milk yield for 305 days of lactation of 2,789.2 kg, ranging between the minimum of 1,709.5 kg and the maximum of 4,210.4 kg, reflecting an amplitude of 2,500.9 kg.

Bulls' breeding value for milk production characters, estimated based on the simplified mixed model

The 51 bulls recorded positive breeding values varying between +14.2 kg and 986.1 kg, a reason to be considered that they are able to improve milk yield.

Milk fat percentage registered 3.77 % in average, varying between 3.34 %, the minimum level and 4.24 %, the maximum level. A number of 28 % bulls were considered that they are able to improve fat percentage.

The average fat quantity accounted for 105.34 kg with the minimum level of 58.94 kg and the maximum level of 155.58 kg. The breeding value ranged between +29.19 kg and +0.02 kg. Around 44 % bulls were considered able to improve this character (Table 1).

Breeding value precision

The precision of breeding value varied between 55 in case of the bull number 13 and 92 in case of the bull number 8, depending on the number of daughters taken into consideration.

Of the 52 bulls in study, 4 bulls were not able to improve fat quantity and 30 fat percentage. This could be explained by the fact that between milk quantity and fat percentage it is a negative correlation. A number of 4 bulls are not able to improve the both characters.

Bulls' hierarchy based on their breeding value estimated for each milk production character by means of the simplified mixed model

The bull hierarchy for each character is presented in Table 2.

Bulls' hierarchy based on their breeding value estimated for pairs of milk production characters by means of the simplified mixed model

The pair "Milk yield x Fat %"

It was noticed that if we take into consideration the bulls' breeding value for the pair "Milk yield x Fat %" characters, just a number of 28 bulls of the total 52 recorded

positive values, meaning that they could improve the both characters. On the 1st position came the bull number 10, on the 2nd position came the bull number 6 and on the 3rd position came the bull number 17.

Table 1. Bulls' breeding value and its precision for milk production characters

Bull number	Breeding value (+BV)			Precision (R ²)
	Milk yield (kg)	Fat %	Fat quantity (kg)	
1x	986.1	-0.189	29.19	68
2	698.2	0.082	29.03	58
3	654.1	0.085	27.85	87
4	636.7	0.006	24.26	61
5	619.5	0.072	25.47	77
6	601.8	0.102	26.26	58
7x	561.5	-0.035	21.21	80
8	559.2	-0.121	17.06	92
9	545.4	0.058	20.17	63
10	523.2	0.158	23.92	62
11	507.6	0.047	20.04	90
12	500.4	0.065	20.81	86
13	493.0	0.079	19.88	55
14x	489.6	-0.068	16.03	66
15x	475.6	-0.069	15.28	71
16x	465.5	-0.095	14.11	65
17	420.0	0.184	21.47	58
18	370.4	0.039	14.52	83
19x	349.4	-0.102	10.14	79
20x	347.5	-0.036	12.03	62
21	334.1	0.080	12.76	58
22x	324.9	-0.071	10.02	77
23	309.5	0.080	14.44	70
24	301.8	0.267	18.84	72
25x	279.9	-0.058	9.33	63
26	275.0	0.115	14.20	65
27x	274.3	-0.049	8.73	62
28	262.1	0.264	17.82	60
29	249.4	0.000	9.51	74
30	248.2	0.106	12.24	59
31	213.4	0.119	10.87	62
32x	180.5	-0.107	3.17	90
33	178.5	0.090	9.08	62
34x	169.5	-0.029	5.63	55
35	145.3	0.213	11.49	80
36x	137.8	-0.139	1.38	71
37	134.5	0.060	6.08	59
38x	130.1	-0.041	3.94	58
39x	109.0	-0.024	3.01	64
40	102.1	0.057	5.13	59
41xx	94.6	-0.109	-0.27	59
42xx	83.3	-0.123	-0.88	81
43	58.2	0.118	5.25	77
44	50.4	0.093	3.82	63
45	48.8	0.040	3.04	59
46xx	40.9	-0.106	-1.47	59
47	37.6	0.010	2.07	72
48x	29.5	-0.003	0.46	86
49	27.2	0.088	3.08	58
50xx	19.5	-0.052	-0.49	60
51	14.2	0.104	3.03	58

Source: Own calculations

The pair "Milk yield x Fat Yield"

Based on the breeding value registered for these two characters, it was noticed that the first 12 positions were occupied by the first 18

bulls mentioned on the list of the bulls improving each milk production character considered separately.

The pair "Fat % x Fat Yield"

In this case, only 26 bulls registered positive breeding values and their positions are quite different compared with the positions occupied in the previous cases (Table 3).

Table 2. Bulls' classification according to their breeding value for each milk production characters, estimated by means of the simplified mixed model

Bull number	Position occupied for:		
	Milk yield (kg)	Fat %	Fat quantity (kg)
1	1	-	2
2	2	21	1
3	3	20	3
4	4	44	6
5	5	27	5
6	6	15	4
7	7	-	13
8	8	-	16
9	9	30	11
10	10	7	7
11	11	32	12
12	12	28	10
13	13	24	9
14	14	-	17
15	15	-	-
16	16	-	21
17	17	5	8
18	18	35	18
19	19	-	27
20	20	-	24
21	21	-	-
22	22	-	22
23	23	23	19
24	24	2	14
25	25	-	30
26	26	11	20
27	27	-	32
28	28	3	15
29	29	-	29
30	30	13	23
31	31	8	26
32	32	-	39
33	33	18	31
34	34	-	34
35	35	4	25
36	36	-	45
37	37	29	33
38	38	-	37
39	39	-	43
40	40	31	36
41	41	-	-
42	42	-	-
43	43	10	35
44	44	16	38
45	45	34	41
46	46	-	-
47	47	42	44
48	48	-	47
49	49	19	40
50	50	-	-
51	51	14	42

Source: Own calculations

Bulls' hierarchy based on their breeding value estimated for three characters of milk production by means of the simplified mixed model

Table 3. Bulls' classification according to their breeding value for pairs of milk production characters and also for all the three milk production characters, estimated by means of the simplified mixed model

Bull number	Position occupied for:			
	Milk yield x Fat %	Milk yield x Fat yield	Fat % x Fat yield	Milk yield x Fat % x Fat yield
1	-	1	-	-
2	4	1	6	1
3	4	2	7	3
4	13	3	19	9
5	17	3	10	5
6	2	3	5	2
7	-	5	-	-
8	-	8	-	-
9	9	5	15	8
10	1	4	2	1
11	11	7	-	10
12	10	6	14	8
13	8	6	11	7
14	-	10	-	-
15	-	-	-	-
16	-	12	-	-
17	3	9	1	4
18	15	11	20	15
19	-	17	-	-
20	-	16	-	-
21	-	15	-	-
22	-	18	-	-
23	12	14	16	13
24	5	13	3	6
25	-	20	-	-
26	8	17	9	11
27	-	23	-	-
28	6	15	4	7
29	-	22	-	-
30	11	19	13	14
31	10	21	12	14
32	-	28	-	-
33	10	25	18	16
34	-	26	-	-
35	9	24	8	12
36	-	32	-	-
37	18	27	24	19
38	-	29	-	-
39	-	33	-	-
40	20	30	25	20
41	-	-	-	-
42	-	-	-	-
43	15	31	17	17
44	16	33	21	18
45	21	34	26	22
46	-	-	-	-
47	22	36	27	23
48	-	38	-	-
49	19	35	23	21
50	-	-	-	-
51	17	37	22	20

Source: Own calculations

In case of "Milk yield x Fat % x Fat yield", the breeding value allowed 28 bulls to be considered as the best of the all for improving all these three milk production characters at the same time (Table 3).

Comparison regarding bulls' hierarchy based on their breeding value estimated for "Milk yield x Fat yield" by means of the simplified mixed model and by contemporary comparison method

Analyzing the bulls' positions occupied for the couple "Milk yield x Fat yield" characters based on the breeding value calculated by means of the two methods: the simplified BLUP method and the contemporary comparison method, it was noticed that there are substantial differences, because there were used different methods for estimating the breeding value.

But, the bulls number 5,8,16, 23, 28, 35, 38 and 40 occupied almost the same positions, which could be determined by the following factors:

- the genetic differences between bulls which were compensated by calculations;
- many times, the both methods assure almost the same bulls' hierarchy as Henderson (1949) affirmed (Table 4).

Rank correlation

It was noticed that there were significant correlations between the positions occupied by bulls for milk yield and fat yield, proving that a high breeding value bull for one of these characters could also improve the other one. Therefore, it is enough to evaluate the breeding value for milk yield to improve fat yield (Table 5).

The rank correlation among the hierarchy of the bulls assessed by means of the simplified BLUP model and the contemporary comparison method was $r = 0.563$, being substantially significant for the probabilities $P=0.05$ and $P = 0.01$.

This proved that BLUP method modifies in a certain way the positions occupied by bulls established by means of the contemporary comparison method, but not too much. Its superiority is given by its higher precision, unbiased, not influenced, compared to the other method.

Table 4. Bulls' classification according to their breeding value for the pair "Milk yield x Fat yield" determined by means of the simplified mixed model and contemporary comparison method as well

Bull number	Position occupied according to the method used for breeding value estimation	
	Simplified BLUP model	Contemporary comparison
1	1	26
2	1	21
3	2	22
4	3	24
5x	4	6
6	4	10
7	4	31
8x	5	6
9	5	28
10	6	27
11	6	29
12	7	34
13	8	16
14	9	2
15	10	14
16x	11	9
17	12	37
18	13	28
19	14	9
20	15	33
21	15	7
22	16	13
23x	17	18
24	17	3
25	18	25
26	19	25
27	20	8
28x	21	19
29	22	30
30	23	1
31	24	4
32	25	11
33	26	36
34	27	35
35x	28	27
36	29	17
37	30	20
38x	31	32
39	33	15
40x	34	32
41	35	31
42	37	16
43	32	26
44	33	30
45	36	12
46	38	15
47	39	14
48	40	22
49	41	17
50	41	13
51	42	24

Source: Own calculations

Table 5. Rank correlations between the bulls' hierarchy for various characters of milk production

Character	Milk yield	Fat %
Fat %	0,377 ^{xx}	-
Fat yield	0,974 ^{xx}	0,467 ^{xx}

Source: Own calculations

CONCLUSIONS

There are a lot of systematic factors affecting the precision of breeding value estimation. For this reason, the methods used for estimating bulls' breeding value have been improved from contemporary comparison to mixed model.

More than that, the fast evolution of the electronic equipment for data processing allowed as linear mathematical models to be largely used in breeding value assessment in almost all the countries at the world level.

In Romania, contemporary comparison was successfully applied for an important period of time, but the need of higher precision in breeding value estimation imposed to be replaced by BLUP and mixed model.

The simplified BLUP model established and utilized in this research work has demonstrated a high precision of breeding value a reason to consider this model as one of the best for a correct bulls' classification. In this way, farmers could chose the best bulls mentioned in the bulls catalogue for improving milk production characters in the dairy cow population.

Also, the fact that milk yield is closely correlated with milk quantity, it is enough to take into consideration the hierarchy of the bulls established on their breeding value for milk yield.

The comparison regarding the bulls' hierarchy established by the two methods: the simplified BLUP model and contemporary comparison proved that in some cases, it is possible as the bulls' position to be similar.

The use of the BLUP model and mixed model in the current animal breeding is a complex, useful and efficient tool for breeding value estimation with the highest accuracy with a deep impact on the correct hierarchy of the reproductive animals.

In this way, dairy farmers could chose the best bulls from the bulls catalogues according to their breeding value for milk production characters and use their frozen semen in artificial insemination in order to increase milk yield in the cow population.

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REFERENCES

- [1] Baker, R.J., 1974, Selection indexes without economic weights for animal breeding. Canadian J. An. Sci., 54: 1-8
- [2] Calo, L.L., Mc. Dowel, R.E., Van Vleck, L.D., Miller, P.D., 1973, Simultaneous selection for milk and beef production among Holstein – Friesians, J. Dairy Sci., 56: 1080-1084
- [3] Crettenand, J., 1975, Le testage de taureaux sur la base d'équations linéaires. Thèse pour l'obtenir du Grade de Docteur en Sciences Techniques, Zurich
- [4] Drăgănescu, C., 1979, Animal breeding, Ceres Publishing House, Bucharest, pp.187
- [5] Hazel, I.M., 1943, The genetic basis for constructing selection indices. Genetics. 28: 476
- [6] Henderson, C.R., 1975, Use of all relatives in intraherd production of Breeding values and producing stabilities. J. Dairy Sci., 50 (12): 1910
- [7] Henderson, C. R., Carter, H. W., Godfrey, J. T., 1954, Use of the contemporary herd average in appraising progeny tests of dairy bulls. J. Animal Sci. 13
- [8] Jensen, E.L., 1980, Bull groups and relationships among sires in BLUP sire evaluation models, J. Dairy Sci, 63 (12): 2111-2120
- [9] Johansson, I., 1957, An analysis of data from teh Danish progeny testing stations, Z.Tierz. Zuchtungsbiologie 63(2):105-126
- [10] Johanson, J., 1974, Genetic Aspects of Dairy Cattle Breeding. 1st. Wold Congress on Genetics applied to livestock production, Madrid
- [11] Lee, A., 1979, Mixed model multiple trait evaluation of related sires when all traits are recorded. J. An. Sci., 48 (5)
- [12] Legates, J.E., Lush, I.L., 1954, A selection index for fat production in dairy cattle, J. Dairy Sci., 6
- [13] Louca, A., Legates, J. E., 1986, Production losses in dairy cattle due to days open. J Dairy Sci. 51:573
- [14] Mao, I. L., Henderson, C. R., Miller P. D., 1972, Intrasure regression of daughter on herdmate performance: nature of estimators and trend of estimates. J. Dairy Sci. 55:845
- [15] Miller, R.H., Mc. Daniel, B.T., Plowman, R.D. – Effects of errors in the age adjustment of first lactations. J. Dairy Sci., 51 (3): 378-384, 1968
- [16] Miller, R.H., Mc. Daniel, B.T., Dickinson, F.N., 1969, Regression of Mature Equivalent Production on Age at Calving. J. Dairy Sci., 52
- [17] Miller, R.H., Lentz, W.E., Henderson, C.R., 1970, Joint influence of month and age of calving on milk yield of Holstein cows in the Northeast United States. J. Dairy Sci., 53 (3)
- [18] Neitzel, R.R., Jensen, E.L., Sendelbach, I., Shoor, G.S., 1970, Proposed refinements to the Wisconsin Dairy Herd Improvement culling guide. J. Dairy, Sci., Abstr., 6: 654
- [19] Oltenacu PA, Young CW, 1974, Genetic and financila consoderations of progeny testing programs in an artificial insemination dairy cattloe popuylation, J.Dairy Sci., 57(10)1245-1253
- [20] Popescu Agatha, 1988, Research regarding teh application of BLUP method in bulls' breeding value estimation for milk production. Symposium on „Actualities in Animal Husbandry”, Vol. XIII, Cluj-Napoca, 135-144]
- [21] Robertson, A., 1957, Optimum group size in progeny testing and family selection in dairy cattle. Genetics, 50:21
- [22] Robertson, A., 1957, Optimum group size in progenytesting and family selection, Biometrics 13(4):442-450
- [23] Robertson, A., Rendel, J.M, 1950, The use of progeny testing with artificial insemination in dairy cattle, J.Genetics 50:21
- [24] Ronningen, K., 1974, The utilisation of Selection. Index in Animal Breeding, 1st, Wold Congress on Genetics applied to livestock production, Madrid
- [25] Schaeffer, L.R., 1976, B.L.U.P. Workshop Notes. Aug. 9 to 14, 1976. Department of Animal Breeding, Agricultural College, Uppsala, Sweden
- [26] Schaffer. L. R. and C. R. Henderson. 1972. Effect of days dry and days open on Holstein milk production. J. Dairy Sci. 55:107.
- [27] Searle, S.R., 1964, Review of sire proving methods in New Zealand, Great British and New York State. J. Dairy Sci., 47:402
- [28] Tabler, K.A., Touchberry, R.W., 1959, Selection indices for milk and fat yield of Holstein Friesian dairy cattle. J. Dairy Sci., 1
- [29] Ufford, G.R., Henderson, C.R., Van Vleck, L.D., 1979, An Approximative Procedure for Determining Prediction Error Variance of Sire Evaluation. J.Dairy Sci., 62:621-626
- [30] Progeny testing of Bulls in Finland, The Finish Animal Breeding Association

RESEARCH ON THE BREEDING VALUE ESTIMATION FOR BEEF TRAITS BY A SIMPLIFIED MIXED MODEL

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Abstract

The paper purpose was to apply a simplified mixed model BLUP for estimating bulls' breeding value for meat production in terms of weight daily gain and establish their hierarchy. Also, it aimed to compare the bulls' ranging obtained by a simplified BLUP mixed model with their hierarchy set up by contemporary comparison. A sample of 1,705 half sibs steers, offspring of 106 Friesian bulls were used as biological material. Bulls' breeding value varied between + 244.5 g for the best bull and -204.7 g for the bull with the weakest records. A number of 57 bulls (53.77%) registered positive breeding values. The accuracy of the breeding value estimation varied between 80, the highest precision, in case of the bull number 21 and 53, the lowest precision, in case of the bull number 38. A number of 7 bulls of the total of 57 with a positive breeding value were situated approximately on the same positions at a difference of 0 to 1 points on the both lists established by BLUP and contemporary comparison. As a conclusion, BLUP could be largely and easily applied in bull evaluation for meat production traits in term of weight daily gain, considered the key parameter during the fattening period and its precision is very high, a guarantee that the bulls' hierarchy is a correct one. If a farmer would chose a high breeding value bull from a catalogue, he could be sure of the improvement of beef production by genetic gain.

Key words: breeding value estimation, bulls ranging, meat production traits, simplified mixed model

INTRODUCTION

Selection of the best animals, needed to induce genetic gain, requires to estimate their breeding value, which allows to establish their ranging according to their genetic superiority. The accuracy of the breeding value estimation is the key aspect to which many researchers paid attention. The precision depends on the number of measurements, number of offspring and heritability of the traits. The higher the number of measurements, the number of descendants and heritability, the higher the accuracy of the breeding value [22].

The best modern method considered to assure a correct estimation of the breeding value with the highest precision is BLUP Animal Model and its present variants. The mixed model BLUP was established by [20,21] and later it was improved by other researchers. It is a linear unbiased mathematical model destined to minimize the error of breeding value estimate.

Its advantages consists of: (a) the reduction of time and cost of the data processing, (b) the reduction of the error of breeding value estimate, (c) the increased accuracy of the breeding value estimate, (d) the facilitation of the assessment of breeding value of sires and dams based on the records used for family selection, (e) the facilitation of an increased selection precision due to the use of multi trait genetic and environment correlations between various characters [9,31,32,41,56].

BLUP is widely used to estimate breeding value in various animals species and breeds: in dairy cattle [1,4,6,14,26,33,34,37,45,46,50], in beef cattle [3,7,12,13,16,35,37,39,42,43], in swine [5,25,38], in poultry [27,54], in horses [2,48,57], in sheep and goats [3,10,18,53], in fishes [29,47], in honey bee [8], in dogs [23]. Also, this subject was theoretically approached by many other authors [28,40,44,51]. Due to its advantages, BLUP was also used in the prediction of breeding value and estimation of single nucleotide

polymorphism (SNPs) [1,17, 30], in cross under dominance [24], in small populations with long-term objectives where selection procedures put less emphasis on family information [52], in the field of ecology to estimate the genetic component of phenotypic variation as a tool for ecologists [55].

The use of BLUP was also successfully extended to plant breeding and variety testing [36].

During the last half of century, animal and plant production carried out remarkable records by means of the genetic improvement [15,16,49].

The evolution mathematical models used in breeding value estimation was marked by the substantial contribution given by two researchers: Charles Henderson, who established BLUP mixed models and Robin Thompson, who sustained the Residual Maximum Likelihood (The REML), a method for variance component estimation [15,19,49]. The BLUP implementation was facing difficulties due to the limitations of the computers performance in the period 1972-1995. Later, it has been easily applied due to the performance registered in the field of computing techniques and equipment.

In the field of cattle breeding, BLUP was successfully used for the evaluation of many breeds such as Angus, Hereford, Polled Herford, Shorthorn, Limousin, Red Angus in the USA based on various sire models (1971-1984). After 1984, the BLUP model included the additive maternal effect [7,16]. Later, the RAM models (reduced animal models) were largely used based on birth weight and weaning weight as well as weaning weight and post weaning weight [49].

In this context, the paper approached the topic of breeding value estimation for beef production traits of Friesian bulls using a simplified mathematical model of BLUP in Romania, where contemporary comparison was applied for a long period.

MATERIALS AND METHODS

In order to set up this research work, a sample of 1,705 half sibs steers, offspring of 106

Friesian bulls were used as biological material. The bulls were randomly selected and it was considered that there is no relationship between them.

The sire breeding value estimation was based on the records of their offspring during the fattening period, in term of weight daily gain, considered one of the main selection characters.

The breeding value was assessed using a simplified BLUP mixed model, a linear mathematical model having the form:

$$Y_{ij} = \mu + s_i + e_{ij}, \quad (1)$$

where Y_{ij} = the record of the j offspring of the bull i , μ is a fixed unknown parameter, $s_i = 1/2 g_i$, where: g_i – the „ i ” bull's breeding value ($j=1, \dots, n_{ij}$), e_{ij} = the residual effect, s and e are non correlated variables among them with the averages equal to zero and variances \sum_s^2

and \sum_e^2 .

Considering $\sum(e_{ij}) = 0, \text{cov}(e_{ij}, e_i, j,) = 0$, if i

$\neq i'$, or at least $j \neq j'$ and $\sum_{ij}^2 = \sum_e^2$. The linear model does not suppose that bulls are relatives among them,

$$\text{cov}(s_i, s_i) = 0, \sum_{si}^2 = \sum_s^2 = 1/4 \sum_A^2.$$

Considering that n_i represents the number of decendants of the “ i ” bull, then the equations of the mixed model are:

$$\begin{bmatrix} n & n_1 & n_2 & \dots \\ n_1 n_1 + \sum_e^2 / \sum_s^2 & 0 & \dots \\ n_2 & 0 & n_2 + \sum_e^2 / \sum_s^2 & \dots \\ \dots & \dots & \dots & \dots \end{bmatrix} \begin{bmatrix} \mu \\ s_1 \\ s_2 \\ \dots \end{bmatrix} = \begin{bmatrix} y_{..} \\ y_1 \\ y_2 \\ \dots \end{bmatrix} \quad (2)$$

The breeding value of the “ i ” bull, s_i , will be:

$$s_i = 2(n_i/n_i + a) (y_i - \mu) \quad (3)$$

where: $s = \sum_e^2 / \sum_s^2$. If we consider

$$n_i/(n_i + a) = w_i, \text{ then } \bar{\mu} = \sum w_i \bar{y}_i / \sum w_i.$$

The precision of the estimated breeding value, R^2 , was calculated using the formula:

$$R^2 = w_i - \frac{w_i}{\sum w_i} \quad (4)$$

When n_i has a high value, then

$$R^2 = w_i(1 - \frac{1}{\sum w_i}), \quad \text{unde } \sum w_i \text{ goes to}$$

infinity and $1/\sum w_i$ goes to zero.

This simplified mixed model was utilized for estimating the bulls breeding value and its precision for daily gain.

The estimated breeding value allowed to establish the bulls hierarchy. The results were compared to the bulls' classification based on the contemporary comparison.

The rank correlation between the two classifications of the bulls was calculated according to the formula:

$$r_s = 1 - \frac{6\sum d^2}{n(n^2 - 1)} \quad (5)$$

The correlation significance was tested for the probabilities $P = 0.05$ and $P = 0.01$, using Fisher Test.

RESULTS AND DISCUSSIONS

Bulls' breeding value varied between + 244.5 g for the best bull and -204.7 g for the bull with the weakest records.

Of the total of 106 bulls evaluated in this experiment, 57 bulls (53.77%) registered positive breeding values, being situated over the average of the sample. The best bull for improving meat production in terms of weight daily gain recorded + 244,5 g and the bull situated on the last position as improver + 2.2.g (Table 1).

The accuracy of the breeding value estimation varied between 80, the highest precision, in case of the bull number 21 and 53, the lowest precision, in case of the bull number 38. It deserves to mention that the breeding value of the bull with the number 21 was estimated based on its 30 offspring, while the breeding value estimated in case of the bull number 38 was calculated only based of the records coming from 8 descendants.

The precision values could be explained by the fact that they depended on the offspring

group size per bull, which varied between the optimum limitations, minimum 8-10 descendants per bull.

Table 1. Bulls' breeding value and its precision for meat production trait-weight daily gain- Simplified mixed model BLUP

Bull number	Number of offspring	Breeding Value +BV	Accuracy R^2
1	22	244.5	75
2	28	181.2	79
3x	17	174.5	70
4x	18	168.2	71
5x	13	162.6	64
6x	18	156.3	71
7x	12	150.1	62
8	23	149.3	76
9	14	113.4	66
10	22	112.2	75
11	12	109.5	62
12	11	108.1	60
13	15	98.6	67
14x	20	98.2	73
15	15	93.5	67
16	22	84.0	75
17	13	82.5	64
18	14	81.6	66
19x	15	75.9	67
20	9	74.0	55
21	30	72.9	80
22	16	72	69
23x	12	64.9	62
24	13	64	64
25	12	63.8	62
26	32	61.4	81
27	16	60.6	69
28	17	58.8	70
29	14	54.0	68
30	25	50.2	77
31	21	50	74
32	24	44.6	76
33	23	43	76
34	10	42.2	58
35	16	41.6	69
36	20	40.6	73
37x	16	39.4	69
38	8	37.6	53
39	24	30.5	76
40	17	23.7	70
41	15	21.5	67
42	13	21.4	64
43x	11	21.1	60
44	15	16.3	67
45	11	15.8	60
46	17	14.2	70
47	12	13.0	52
48	21	12.8	74
49	23	11.4	76
50x	12	10.4	62
51	15	8.8	67
52	14	7.1	66
53	16	6.5	69
54	13	4.9	64
55	13	4.0	64
56	15	2.3	67
57	13	2.2	64

Source: Own calculations

Bulls' classification based on the simplified mixed model BLUP and contemporary comparison

Table 2. Comparison between bulls' hierarchy according to their breeding value calculated by the simplified mixed BLUP model and their classification established by contemporary comparison

Bull number	Position occupied according to the method used for breeding value estimation	
	Simplified BLUP mixed model	Contemporary comparison
1	1	19
2	2	20
3xx	3	3
4x	4	5
5	5	2
6	6	10
7x	7	6
8	8	37
9	9	14
10	10	18
11	11	27
12	12	1
13	13	38
14	14	11
15	15	31
16	16	21
17	17	28
18	18	30
19x	19	17
20	20	12
21	21	34
22	22	16
23x	23	22
24	24	15
25	25	53
26	26	44
27	27	35
28	28	32
29	29	4
30	30	46
31	31	9
32	32	47
33	33	50
34	34	24
35	35	43
36	36	51
37x	37	39
38	38	33
39	39	57
40	40	54
41	41	55
42	42	48
43	43	45
44	44	23
45	45	36
46	46	26
47	47	40
48	48	8
49	49	56
50x	50	48
51	51	7
52	52	13
53	53	41
54	54	25
55	55	29
56	56	42
57	57	52

Source: Own calculations

Based on the breeding value estimated by the simplified mixed model BLUP, the bulls were classified in the decreasing order.

Also, their breeding value was calculated by means of the contemporary comparison and again the bulls were classified according to the results obtained by the application of this method.

The comparison between the bulls' classification based on the breeding value calculated by means of the mixed model BLUP and the bulls' hierarchy established based on the contemporary comparison showed that the bulls occupied different positions on the two classification lists because we used two different methods to determine their breeding value.

But, if we look at the first 10 bulls situated on the list established based on the breeding value calculated by the simplified mixed model BLUP, we can select 5 bulls which have almost similar positions on the other list, where their breeding value was calculated by contemporary comparison.

If we take into consideration all the 57 bulls able to improve weigh daly gain, we may notice that 7 bulls are situated aproximately on the same positions on the both classifications at a difference of 0 to 1 positions. It is about the bulls with the number: 3,4,7,19,23,37 and 50. (Table 2).

The rank correlation between the positions occupied by bulls on the two classifications based on the breeding value, calculated by means of two methods: simplified mixed model BLUP and contemporary comparison, was $r = 0.569$, substantially significant for $P=0.05$ and $P=0.01$, meaning that the use of BLUP modifies in a small measure the positions occupied by bulls in the hierarchy established by means of contemporary comparison.

Crettenand (1975) found closer correlations between these positions, but he considered that BLUP has a higher precision which reflects its superiority compared to contemporary comparison [11].

CONCLUSIONS

BLUP could be largely and easily applied in bull evaluation for meat production traits in term of weight daily gain, considered the key parameter during the fattening period.

The method assured a high precision ranging between 53 and 80, depending on the number of offspring per bull.

However, it would be better to proceed to the bull selection based on a multiple trait model where many other characters to be taken into consideration such as: body weight at the age of 180 days, body weight at the age of 365 days, and carcass characters as well. Only in this way, breeding value estimation could be more precisely determined. The more characters considered, the higher accuracy in breeding value estimation.

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REFERENCES

[1]Ahmad Suasana Aziz, 2010, Application of BLUP in prediction of breeding values and estimation of SNP effects in dairy cattle, Ph.D.Thesis, University of Nottingham, www.theses.nottingham.ac.uk
 [2]Arnason, T., Van Vleck L. Dale, 2000, Genetic Improvement of the Horse
 [3]Avendano, S., Villanueva, B., Woolliams, J.A., 2003, Expected increases in genetic merit from using optimized contributions in two livestock populations of beef cattle and sheep, *J. Anim. Sci.*, 81:2964-2975
 [4]Banik, S., Gandhi, R.S., 2006, Animal Model versus Conventional Methods of Sire Evaluation in Sahiwal Cattle, *Asian-Aust. J. Anim. Sci.*, 19(9):1225-1228
 [5]Belonsky, G.M., Kennedy, B.W., 1988, Selection on Individual Phenotype and Best Linear Unbiased Predictor of Breeding value in a closed Swine Herd, *J. Anim. Sci.*, 66:1124-1131
 [6]Ben Gara A., Rekik, B., Boualleque, M., 2006, Genetic parameters and evaluation of the Tunisian dairy cattle population for milk yield by Bayesian and BLUP Analysis, *Livestock Science*, 100(20):142-149
 [7]Benyshek, L.L., 1991, Beef cattle national genetic evaluation programs. *Beef Seedstock Symp.*, South Dakota State University, Brookings

[8]Bienefeld Kaspar, Ehrhardt Klaus, Reinhardt Friederich, 2007, Genetic evaluation in the honey bee considering queen and worker effects-A BLUP - Animal Model Approach, *Apidologie*, 38(1):77-85
 [9]Bondoc Orville, L., 2008, Animal Breeding, Principles and Practice in the Philippine Context, The University of the Philippines Press.
 [10]Clarke, J.N., 1986, Evaluation of industry breeding programs for sheep and goats. Introduction and Overview. 3rd World Congress on Genetics Applied to Livestock Production
 [11]Crettenand, J., 1975, Le testage de taureaux sur la base d'équations linéaires. Thèse pour l'obtenir du Grade de Docteur en Sciences Techniques, Zurich
 [12]Cunha, E.E., Euclides, R.F., Torres, R.A., Carneiro, P.L.S., 2006, Genetic Evaluation of beef cattle herds through simulated data. *Arquivo Brasileiro de Medicina Veterinaria e Zootecnia*, 58(30):381-387
 [13]Eriksson Jan-Ake, Wilton James W., Henningsson Thore, 1979, Evaluating Performance-Tested Beef Bulls for Daily Gain by BLUP, *Acta Agriculturae Scandinavica*, 29(4):393-401
 [14]Estimated Breeding Value for Beef Cattle-Signet, The Signet Guide to Estimated Breeding Values (EBVS), www.signetfbc.co.uk/beefbreeders/estimated-breeding-values-for-beef-cattle.pdf
 [15]Gilmour, A.R., Mixed models in animal breeding: Where to now/
Proc. Assoc. Advmt. Anim. Breed. Genet. 18:394-397
 [16]Golden, B.L., Garrick, D.J., Benyshek, L.L., 2009, Milestones in beef cattle genetic evaluation, *J. Anim. Sci.*, 879140, suppl E3-E10
 [17]Habier, D., Fernando, R.L., Garrick, D.J., 2013, Genomic BLUP decoded: a look into the black box of genomic prediction in Genetics: Early online, published May 2, 2013, www.genetics.org
 [18]Hadfield, J.D., Wilson, A.J., Garant, D., Sheldon, B.C., Krunk, L.E., 2010, The misuse of BLUP in ecology and evolution. *Am. Nat.*, 175(1):116-125
 [19]Henderson, C.R., 1973, Sire evaluation and genetic trends. *Proc. Annu. Breeding Genet. Symp.*, Honor of Dr. J.L. Lush, ASAS and ADSA, Champaign, IL
 [20]Henderson, C.R., 1975, Best linear unbiased estimation and prediction under a selection model. *Biometrics*, 31(2):423-447
 [21]Henderson, C. R., 1984, Applications of Linear Models in Animal Breeding. University of Guelph, Ontario
 [22]Jespersen Charlotte, 2002, Chapter 7. Estimation of indices for breeding value. 04.06.2002, www.ihh.kvl.dk/genetics
 [23]Leighton Eldin A., Booker Jane H., 2003, How to use Estimated Breeding Values to Genetically Improve Dog Guides, Meeting of the "Original Group" Sept.11-12, 2003, Morristown, New Jersey
 [24]Lo, L.L., Fernando R.L., Grossman, M., 1997, Genetic evaluation by BLUP in two-bred terminal crossbreeding systems under dominance. *J. of Animal Sci.*, 75:2877-2884
 [25]Mabry, J.W., See, M.T., 1990, Selection with the

- Animal Model versus Selection within contemporary Groups for Swine, *J. Dairy Sci.*, 73(9):2657-2665
- [26]Muasya, T.K., Ilatsia, E.D., Magothe, T.M., Kahi, A.K., 2007, Heterogeneity of variance and its implications on dairy cattle breeding, *South African Journal of Anim. Sci.*, 37(3):170-175
- [27]Muir William M., Samuel, E., *Poultry Genetics, Breeding and Technology*, p.153
- [28]Nagy Istvan, *Quantitative Genetics*, Chapter 11. BLUP. Kaposvar University, www.tankonyvtar.hu
- [29]Nielsen, H.M., Sonesson, A.K., Meuwissen, T.H.E., 2011, Optimum contribution selection using traditional BLUP and genomic breeding values in aquaculture breeding schemes, *J. Anim. Sci.*, 89(3):630-638
- [30]Nishio Motohide, Satoh Masahiro, 2014, Including Dominance Effects in the Genomic BLUP Method for Genomic Evaluation, published January 08, 2014 in *Plos/One*, www.plosone.org
- [31]Ollivier Louis, 1999, On the use of animal models in the analysis of selection experiments, *Genet. Sel. Evol.* 31:135-148
- [32]Pang, H., Wu, C.X., Zhang, Y., Gong, G.F., Bi YH, 1989, Animal model and multiple trait BLUP applied in poultry genetic evaluation, *Yi Chuan Xue Bao*, 16(4):291-298
- [33]Pantelik, V., Plavsic, M., Trivunovic, S., Aleksic, S., Sretenovic, L.J., Ostojic-Andric, D., Niksic, D., 2011, The evaluation of breeding value of Simmental bulls for milk performance in Serbia. *Biotechnology in Animal Husbandry* 27(2):127-135
- [34]Patry Clotilde, Ducrocq Vincent, 2011, Accounting for genomic pre-selection in national BLUP evaluations in dairy cattle, *Genet. Sel., Evol.*, 43(1):30
- [35]Phocas Florence, Laloe Denis, 2004, Should genetic groups be fitted in BLUP evaluation? Practical answer for the French AI beef sires evaluation, *Genet. Sel. Evol.*, 36:325-345
- [36]Piepho, H.P., Mohring, J., Melchinger, A.E., Buchse, A., 2008, BLUP for phenotypic selection in plant breeding and variety testing, *Euphytica* 161:209-228
- [37] Popescu Agatha, 1988, Research regarding the application of BLUP method in bulls' breeding value estimation for meat production. Symposium on „Actualities in Animal Husbandry”, Vol. XIII, Cluj-Napoca, 153-156
- [38]Popescu Janina, Petroman Cornelia, Balan Ioana., Marin Diana, Heber Loredana, 2009, The individual animal model for many characters in swine, *Scientific Papers, Agricultural Management, Series I*, Vol. XI(2)
- [39]Pullar Duncan, 2001, Genetic Improvement of Beef Cattle-The Scientist, www.bsas.org.uk
- [40]Robinson, G.K., 1991, That BLUP is a Good Thing: The Estimation of Random Effects, *Statistical Science*, 6(10):15-51
- [41] Rosati, A., Tewold, A., Mosconi, C., 2008, *Animal Production and Animal Science Worldwide: WAAP Book of the year 2007*
- [42]Sasaki, Y., 1992, The effectiveness of the best linear unbiased prediction of beef sires using field data collected from small farms. *J. Anim. Sci.*, 70:3317-3321
- [43]Sasaki, Y., Miyake, T., Gaillard, C., Oguni, T., Matsumoto, M., Ito, M., Kurahara, T., Sasae, Y., Fujinake, K., Ohtagaki, S., Dougao, T., 2006, Comparison of genetic gains per year for carcass traits among breeding programs in the Japanese Brown and the Japanese Black Cattle, *J. Anim. Sci.*, 84:317-323
- [44]Schneeberger, M., Barwick, S.A., Crow, G.H., Hammond, K., 2011, Economic indices using breeding values predicted by BLUP, *J. of Anim. Breeding and Genetics*, 109(1-6)
- [45]Searle, S.R., 1982, *Matrix algebra useful for statistics*, Wiley, New York, NY
- [46]Somthep, T., 2002, Genetic improvement in beef and dairy cattle in Thailand: BLUP applications, *Proceedings of the 7th World Congress on Genetics Applied to Livestock Production*, Montpellier, France, August, 2002, Session 25/2002, pp.1-4
- [47]Sonesson Anna K., Gjerde Bjarne, Meuwissen Theo H.E., 2005, Truncation selection for BLUP-EBV and phenotypic values in fish breeding schemes, *Aquaculture*, vol. 243(1-4):61-68
- [48]Tavernier Anne, 1988, Advantages of BLUP animal model for breeding value estimation in horses. *Livestock Production Science*, Vol. 20(2):149-160
- [49]Thompson Robin, 2008, Estimation of quantitative genetic parameters. *Proceedings of the Royal Society Biological Sciences*
- [50]Tumwasorn, S., Katkasame, S., Kuha, K., 2000, BLUP Base for Dairy Cattle Genetic AI improvement in Thailand, *Asian-Aus. J. Anim. Sci.*, 13 Supplement, July 2000B:155-157
- [51]Van der Werf Julius, *Mixed models for Genetic Analysis*, University of New England, Armidale, NSW, Australia, www.vsni.co.uk/products/asreml/user/geneticanalysis.pdf
- [52]Verrier, E., Colleau, J.J., Foulley, J.L., 1993, Long-term effects of selection based on animal model BLUP in a finite population. *Theor. Appl. Genet.* 87:446-454
- [53]Vicovan, P.G., Vicovan, A., Radu, R., Enciu, A., Ida, A., Prediction of breeding value of rams for growth of liveweight by progeny test, evaluated by three methods, *Scientific Papers, Series Animal Science*, Vol. 53, Iasi
- [54]Wezyk, S., Jankowski, J., *Mixed Model Methodology: Meat type Birds*, p.150-154
- [55]Wilson Alastair J., Reale, D., Clements Michelle N., Morrissey Michael M., Postma Erik, Walling Craig A., Kruuk Loeske E.B., Nussey Daniel H., 2010, An ecologist guide to the animal model. *J. of Animal Ecology*, 79:13-26
- [56]Xu-Qing Liu, Jian-Ying Rong, Xiu-Ying Liu, 2008, Best linear unbiased prediction for linear combinations in general mixed linear models. *J. of Multivariate Analysis*, 99(8):1503-1517
- [57]Zurovacova, B., Brno, M.Z.L.U., 2008, Performance of Slovak show jumping horses evaluated using BLUP Animal Model, *J. of Agrobiology*, 25:1-4

RESEARCH ON THE NORMAL DISTRIBUTION OF VARIABLES AS A CONDITION FOR THE CORRECT APPLICATION OF THE STATISTICAL MODELS FOR PROCESSING DATA

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Abstract

The paper aimed to test the normality of the distribution of the variables using Pearson's central moment coefficients. The data were referring to the milk and meat production characters collected from 5,817 individuals, offspring from 106 Frisian bulls under breeding value estimation. The variables were used both in terms of metric characters and logarithmic characters. In case of milk production and reproduction traits, the use of logarithmic characters was useless, and the values of the Beta coefficients showed a distribution relatively closer to the normal one. In case of meat production characters, both the use of metric and logarithmic characters reflected that the distribution of variables was not a normal one, on the contrary it was sharply vaulted. As a conclusion, it is important to check the normality of the variables distribution in order to avoid the errors of calculation by eliminating the extreme values in case of the skewed distribution.

Key words: normal distribution, statistical processing methods, study case, testing

INTRODUCTION

In many research works it is required a large range of data collected from many individuals, which could be an impediment to carry out the experiments or studies. For this reason, it is simpler to use samples of individuals and the conclusions to be extended at the whole population or collectivity.

The sample selection with "n" individuals and X_1, X_2, \dots, X_n variables imposes to study their type of distribution in order as later to choose the most adequate statistical methods for processing data.

A normal distribution of variables looks like Gauss' curve where variables are bell-shaped, and the mean, $\mu = 0$ and standard deviation is $S=1$ and its variance is S^2 .

This is the so called "standard normal distribution" [7,13,15].

Sometimes, the variables are not normally distributed, that is we can discuss about "skewness" as a measure of the asymmetry of the probability distribution of real values around its mean, μ . In case of skewness, the

distribution of variables could be: (a) *skewed to the left*, where the mean is less than the median and (b) *skewed to the right*, where the mean is higher than the median [14].

In a symmetric distribution, the mean is equal to the median and the distribution has zero skewness [9,11].

In case of a sample, the mean, " m_1 " is the sample 1st central moment and the sample variance is " m_2 ", the 2nd central moment.

The sample skewness, g_1 is given by the formula: $g_1 = m_3 / m_2^{3/2}$, where $m_3 =$

$$\frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^3 \text{ and}$$

$$m_2 = \frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2.$$

The common estimator of the population skewness is:

$$G_1 = \frac{K_3}{K_2^{3/2}} = (\sqrt{n(n-1)} / (n-2)) g_1$$

In this case, the variance of the skewness of a sample of size n from a normal distribution is: $\text{var}(G_1) = (6n(n-1)) / ((n-2)(n+1)(n+3))$ [6,12]. Karl Pearson (1895 and later 1920) established two skewness coefficients to simplify

calculations:

-1st skewness coefficient $= (\text{mean} - \text{mode}) / \text{standard deviation}$;

-2nd skewness coefficient $= 3(\text{mean} - \text{median}) / \text{standard deviation}$ [16,17].

At present, Excel and Minitab, SAS, SPSS, Stata, Visual Statistics and other statistical packages facilitate the calculation of the "adjusted Fisher-Pearson standardized moment coefficient" based on the formula:

$$G_1 = \frac{n}{(n-1)(n-2)} \sum_{i=1}^n ((x_i - \bar{x}) / s)^3, \text{ where } n =$$

the sample size and $s =$ standard deviation [16,17].

In order to establish if the distribution of variables is a normal one, one can think that (a) the null hypothesis, H_0 , is that the variables are normally distributed with an unspecified mean, μ , and variance S^2 , and (b) the alternative hypothesis, H_a , is that the variables are not normally distributed.

In this purpose, more than 40 normality tests are at our disposal, among which the most commonly used are: Q-Q plot, P-P plot, Shapiro-Wilk test, normal probability test, D'Agostino's k-squared test, Jarque-Bera test, Pearson's beta coefficients test, Kolmogorov-Smirnov test, Liliefors test, Anderson-Darling test, Sarkady test, Massey test, Chi Squares test [6].

Since 1895, when Karl Pearson started studying the various statistics of skewness, statisticians approached this topic and pointed out its strengths and weaknesses [1,5,6,8,20,22, 23,24].

In this context, the paper aimed to check the distribution of the variables in the field of animal breeding, in a cattle population, using a large sample of individuals, used for breeding value estimation both for milk and meat production traits. Pearson's Beta coefficients were used in order to test the normality of the distribution of variables.

The purpose is demonstrate that from a practical point of view, before starting to process data by statistical mathematical methods, we need to know what kind of distribution the variables have in order to apply the correct mathematical models and

avoid wrong results.

If the variables are not normally distributed, they have to be normalized by eliminating the extreme variables, in general the source of error.

Many times, metric variables are transformed in logarithmic variables or probit, more suitable to be later processed [10].

MATERIALS AND METHODS

This case study was applied on a sample of 5,817 individuals of which 4,112 half daughters and 1,705 half brothers, descendants from 106 Friesian bulls under the estimation of the breeding value both for milk and meat production traits [18,19].

The observed variables regarded the following characters: (a) *for milk production*: milk yield, fat % and fat yield, (b) *for reproduction*: age at the 1st calving, and (c) *for meat production*: body live weight at the age of 180 days, body live weight at the age of 365 days, and weight daily gain during the period of stress fattening.

Pearson's beta coefficients were used in order to test the normality of the variables distribution.

As we mentioned before, Pearson's beta coefficients are based on the central selection moments of the order "k" ($k=2,3,4$) which allow the synthetic presentation of the distribution, identifying some specific features linked to its shape. The distribution of the variables could be normal, skewed to the left, skewed to the right, vaulted or flattened. When the variables is normally distributed, the asymmetry is equal to zero ($B_1=0$), the curve of the frequencies is perfectly symmetrical having the shape of Gauss-Laplace's curve. In case where the variables are not normally distributed around the mean, its about positive asymmetry (B_1 over 0) or negative asymmetry (B_1 lower than 0). The degree of asymmetry on the horizontal of the frequencies polygon versus the normal $N(\bar{X}, S_X^2)$ is reflected therefore by Pearson's asymmetry coefficient, B_1 , calculated as: $B_1 = M_3^2 / M_2^3$, where M_2 and M_3 are the central 2nd and 3rd moments, calculated according

to the formula:

$$M_K = \frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^K$$

The vertical analysis of the frequencies polygon versus the normal allows to establish the value of Pearson's B_2 coefficient, which could reflect either a vaulted distribution or a flattened distribution. In case of a normal distribution, the values distribution is a normal one and $B_2=3$, while in case of a flattened distribution, B_2 is lower than 3, and in case of a vaulted distribution, $B_2>3$.

The B_2 coefficient was calculated with the formula $B_2=M_4/M_3^2$, where M_3 and M_4 are the central selection moments of the 3rd and 4th order.

The normality test was applied both on metric variables and logarithmic variables [21].

In order to validate the conclusions, the null hypothesis was tested and the intervals over the critical values of the skewness and vaultness distribution were established, where significant and very significant differences have appeared. In this purpose, the figures presented in the Statistical Tables for $P=0.05$ were used [2,3,4].

RESULTS AND DISCUSSIONS

Normality test for milk production and reproduction traits

(a) The distribution of variables in terms of metric characters

The calculated values of Pearson's Beta coefficients, based on metric characters, are presented in Table 1.

Milk yield for 305 days of lactation registered almost a normal value of the B_1 coefficient on the horizontal. Making the vertical analysis, we noticed that the B_2 value is a little smaller than 3, indicating a slight flattened curve. However, the difference is not so far away from the normal situation.

The fat percentage registered almost a normal asymmetry coefficient ($B_1=0.12$) on the horizontal, while in case of the vertical analysis $B_2 = 12.68$, reflecting a sharpness of the curve of values for this trait.

The fat yield recorded almost normal values for Pearson's Beta coefficients, $B_1 = 0.11$ and $B_2=2.80$, but with a slight flattened shape.

The age at the 1st calving had a distribution which did not fit to Gauss curve. The value $B_1 = 3.94$ reflect a right skewed distribution of the metric variables, therefore a strong positive skewness, and the value $B_2 = 12.68$ reflected a substantial sharpness on the vertical of the distribution curve.

The affirmations presented above were confirmed by the results obtained by testing the null hypothesis (Table 1).

Table 1. Skewness and vaulting coefficients for the metric characters of milk production and reproduction (N=4,112)

Character	B_1	H_0	B_2	H_0
Milk yield	0.14	No/Yes	2.83	Yes
Fat %	0.12	No/Yes	12.68	No
Fat yield	0.13	No/Yes	2.80	Yes
Age at the 1st calving	3.94	No	2.81	No

Source: Own calculations

(b) The distribution of variables in terms of logarithmic characters

Because it was obtained both a normal and an skewed distribution of the variables in terms of metric characters, it was compulsory to recalculate Pearson's Beta coefficients based on data expressed in logarithmic characters, thinking that in this way the distribution could be normalized. The values of the B_1 and B_2 coefficients values based on logarithmic characters are given in Table 2.

Table 2. Skewness and vaulting coefficients for the logarithmic characters of milk production and reproduction (N=4,112)

Character	B_1	H_0	B_2	H_0
Milk yield	0.19	No/Yes	3.05	Yes
Fat %	14.96	No	72.49	No
Fat yield	0.37	No/Yes	3.98	No
Age at the 1st calving	0.47	No	4.96	No

Source: Own calculations

Milk yield for 305 days of lactation registered higher values of the Beta coefficients than in case when the variables were expressed in terms of metric characters, but these values are closer to a normal distribution.

The fat percentage recorded an expected values for the both coefficients, placed far away outside of the critical values of the skewness and valutness for $P = 0.05$.

The fat yield also achieved higher values for the Beta coefficients than in case when we used metric characters. But, these values do not exceed too much the critical thresholds, reflecting a slight positive skewness and a slight vaulting of the normal distribution as well.

The age at the 1st calving recorded normal values for the both coefficients, existing just a slight right asymmetry and a slight trend of sharpness of the curve.

Therefore, the transformation and use of the primary data as logarithmic characters did not lead to the distribution normalization, on the contrary, it increased the deviation of the Beta coefficients values from the critical thresholds and normal values. We could affirm that the use of logarithmic characters contributed to the omogenization of the variances and imposes to look for other solutions and methods to normalize the distribution of the variables.

Normality test for meat production traits

(a) The distribution of variables in terms of metric characters

The body weight at the age of 180 days registered values which were not normally. The distribution was skewed to the right and a little vaulted, a reason for which the null hypothesis was not accepted for $P = 0.05$.

The body weight at the age of 365 days achieved values closer to a normal distribution, but, also, like in the previous case, the distribution was a little positive ($B_1 = 0.045$), and also slightly flattened ($B_2 = 2.748$).

The weight daily gain recorded values which were normally distributed around the average on the horizontal line, but on the vertical line it was noticed a strong vaulting trend ($B_2 = 4.848$).

Testing the H_0 hypothesis, we noticed various situations from a trait to another and from a coefficient to another.

Because the differences regarding the critical values of the asymmetry and vaulting for

various probability degrees were sometimes un significant, significant and substantial significant, but not too much, it was considered that, in general, this sample of individuals is enough representative, allowing to determine the statistical parameters like average, standard deviation, variance and variability based on the usual statistical models without facing any risk of error (Table 3).

Table 3. Skewness and vaulting coefficients for the metric characters of meat production ($N=1.705$)

Character	B_1	H_0	B_2	H_0
Weight at the age of 180 days	0.170	No/Yes	3.511	No
Weight at the age of 365 days	0.045	Yes	2.748	No/Yes
Weight daily gain	0.006	Yes	4.848	No

Source: Own calculations

(b) The distribution of variables in terms of logarithmic characters

The body weight at the age of 180 days recorded Beta coefficients with values closer to the normal distribution than in case when there were used metric characters.

The body weight at the age of 180 days registered higher values of the Beta coefficients, reflecting a positive skewness and vaulting.

The body daily gain carried out an distribution far away from a normal one, because the values of the Beta coefficients reflect a sharp vaulting curve.

Table 4. Skewness and vaulting coefficients for the logarithmic characters of meat production ($N=1.705$)

Character	B_1	H_0	B_2	H_0
Weight at the age of 180 days	0.95	No/Yes	2.98	Yes
Weight at the age of 365 days	2.73	No	3.91	No/Yes
Weight daily gain	0.25	No/Yes	10.02	No

Source: Own Calculations

Therefore, in case of meat production, the use of the primary data in terms of logarithmic

characters hg as contributed to the normalization of the distribution only for the trait body weight at the age of 180 days.

For the other two traits of fattening, this method did not assure the normalization of the variables distribution in the studied population, on the contrary, it increased the deviation of the Beta coefficients from the normal values.

CONCLUSIONS

Normality test is compulsory in case of the use of samples for statistical populations, even though the volume of the sample is enough high, because we do not know how the variables are distributed.

If the estimated values for the Beta coefficients, based on the metric characters, are close to the normal thresholds of variability, $B_1=0$ and $B_2=3$, and the critical values presented in Tables do not attest significant differences, then we could consider that the distribution of the variables is a normal one, which allows us to use usual statistical methods to process the primary data. If the values of the Beta coefficients substantially exceed the thresholds for a normal variability, we are obliged to eliminate the potential errors proceeding to the normalization of the distribution, either using the logarithmic characters in the calculations or probit and then applying corresponding mathematical methods.

In this study, the use of logarithmic characters for calculating the Beta coefficients did not lead to the normalization of the distribution, on the contrary, the skewness and vaulting have become more evident.

The normalization of the variables distribution offers a certain guarantee that the results which are expected to be obtained in the research work could supply valuable information which could be extended to the whole population of individuals.

In other case, our research work is in danger to lead to random results and the conclusions and recommendations to be under the risk of error.

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REFERENCES

- [1] Arnold, B.C., Groeneveld, R. A., 1995, "Measuring Skewness with Respect to the Mode," *The American Statistician*, 49:34-38
- [2] Craiu, V., 1982, *Statistical hypothesis testing*. Didactical and Pedagogical Press House, Bucharest, 1982
- [3] Craiu, V., Ciucu, G., Stefanescu, A., 1974, *Mathematical statistics and operation research*. Didactical and Pedagogical Press House, Bucharest
- [4] Craiu, V., Mihoc, G., 1976, *Treatise of mathematical statistics*. Romanian Academy Press House, Bucharest
- [5] D'Agostino, R.B. and Stephens, M.A. (1986), *Goodness of Fit Techniques*, Marcel Dekker, Inc., 11-12 and 24-33.
- [6] Doane David P., Seward, Lori E., 2011, *Measuring Skewness: A Forgotten Statistic?* *Journal of Statistics Education*, 19(2)
- [7] Gauss, 1809, *Theoria motus corporum coelestium in sectionibus conicis solem ambientium* (http://en.wikipedia.org/wiki/Normal_distribution)
- [8] Groeneveld, R.A. and Meeden, G. (1984), "Measuring Skewness and Kurtosis," *Journal of the Royal Statistical Society. Series D (The Statistician)*, 33: 391-399
- [9] Hazewinkel Michiel, ed., 2001, *Normal Distribution*, *Encyclopedia of Mathematics*, Springer
- [10] Iosifescu, M., Moineagu, C., Trebici, V., Ursianu Emilian, 1985, *Small encyclopedia of statistics*. Scientific and Encyclopedic Press House, Bucharest
- [11] Jagdish Patel K., Campbell Read B., 1996, *Handbook of the Normal Distribution* (2nd ed.). CRC Press
- [12] Krishnamoorthy Kalimuthu, 2006, *Handbook of Statistical Distributions with Applications*. Chapman & Hall/CRC
- [13] Kruskal William H., Stigler Stephen M., 1997, Spencer, Bruce D., ed. *Normative Terminology: 'Normal' in Statistics and Elsewhere*. *Statistics and Public Policy*. Oxford University Press.
- [14] Mac Gillivray, H.L., 1986, *Skewness and Asymmetry: Measures and Orderings*, *The Annals of Statistics*, 14: 994-1011
- [15] Marsaglia George, 2004, *Evaluating the Normal Distribution*, *Journal of Statistical Software* 11 (4)
- [16] Pearson, K., 1895, *Contributions to the Mathematical Theory of Evolution, II: Skew Variation in Homogeneous Material*, *Transactions of the Royal Philosophical Society, Series A*, 186, 343-414

[17]Pearson Karl, 1920, Notes on the History of Correlation, *Biometrika* 13 (1): 25–45

[18]Popescu Agatha, 1988, Study regarding the normality testing using Pearson's Beta coefficients in a cattle population. The Symposium „Actualities in Animal Science, Vol. XIII:145-152

[19]Popescu Agatha, 2014, Increase of the precision in the breeding value estimation by B.L.U.P.-Best Linear Unbiased Prediction, Eikon Cluj-Napoca, Ed.RawexComs, Bucharest Press Houses, p.74-75, 91-99

[20]Rayner, J.C.W., Best, D.J., and Matthews, K. L. (1995), “Interpreting the Skewness Coefficient,” *Communications in Statistics –Theory and Methods*, 24, 593-600

[21]Rumsiski, L. Z.,1974, Mathematical processing of the experimental data. Technical Press House, Bucharest

[22]Stigler, Stephen M., 1986, The History of Statistics: The Measurement of Uncertainty before 1900. Harvard University Press.

[23]Tabor, J., 2010, Investigating the Investigative Task: Testing for Skewness -An Investigation of Different Test Statistics and their Power to Detect Skewness, *Journal of Statistics Education*, 18, 1-13

[24]Vessereau, B., 1960, Recherche et expérimentation en agriculture. Methode statistique en biologie et en agronomie, Paris, 1960

RESEARCH ON THE MULTITRAIT ASSESSMENT OF THE GENETIC MERIT FOR MILK AND MEAT PRODUCTION IN THE ROMANIAN FRIESIAN USING A BLUP SIMPLIFIED MODEL

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Abstract

*The paper objective was to assess the genetic merit for milk and meat production using a sample of 16 Romanian Friesian bulls and a BLUP simplified model as well as the contemporary comparison method. The bulls' 730 daughters (half-sisters) registered during the 305 days first lactation 3,034.89 kg milk with 22.86 % variation coefficient, 3.79 % fat with 6.06 % variation and 115.72 kg fat with 23.49 % variation. The 249 sons (half-brothers) recorded 138.05 kg at the age of 6 months with 19.31 % variation coefficient, 293.41 kg at the age of 12 months with 4.33 % variation, and 881.97 g/day daily gain with 3.14 % variation. The heritability was 0.505 for milk yield, 0.741 for fat %, 0.567 for milk fat, 0.524 for the weight at 6 months, 0.642 for the weight at 12 months and 0.372 for daily gain. The genotypic correlations have been -0.245 between milk yield and fat % and 0.465 between milk and fat yield, -0.287 between the weight at 6 months and 12 months and 0.850 between the weight at 12 months and daily gain. Breeding value varied from 637.6 and -68.1 for milk yield and between 26.26 and -2.07 for milk fat. The breeding value precision ranged between 92 and 58 in case of milk traits. Breeding value varied between 48.6 and -27.8 for the weight at 12 months and between 168.2 and 2.2 for daily gain. The accuracy of the breeding value for meat traits ranged between 76 and 60. Rank correlations between bull ranking for milk traits were 0.377** between milk fat and fat %, 0.974** between milk yield and fat yield. Rank correlations between bull ranking for meat traits were 0.766** between the weight at 6 months and at 12 months and 0.847** between the weight at 12 months and daily gain. The rank correlation between bull hierarchy by BLUP and contemporary comparison was 0.563 significantly for $P=0.05$ and $P=0.01$. As a conclusion, the high accuracy of BLUP model recommends it to be used for breeding value assessment. The position occupied by bulls in their ranking by BLUP was similar in some cases with the one set up by contemporary comparison. Some Friesian bulls could improve both milk and meat production but most of them have the best impact on the growth of milk yield.*

Key words: BLUP, Friesian breed, multi trait assessment, Romania

INTRODUCTION

Genetic gain in cow populations is assured by selection of dams and sires for milk production characters. Selection pressure by sire is an important tool in breeding experts' hand, as long as the bull is responsible of 70% of genetic gain [14,17].

For this reason, the identification of the best bulls has a major importance and needs corresponding methods for estimating breeding value. Across the time, the methods used in breeding value assessment have been improved from contemporary comparison to BLUP, mixed model, marker-assisted molecular genetics [4,22,24,25,28].

The "contemporary comparison" method, [44]

was largely used in the previous decades but the need of a higher accuracy in breeding value estimation determined the setting up of new methods based on linear mathematical models, deeply supported by the computers development [47, 54].

Selection is usually based on a mixture of traits of major economic importance. In case of milk production, the main characters taken into consideration in the selection schemes are: milk yield, fat percentage, fat yield and protein yield for a 305 days lactation, and in case of meat production: weight at birth, at the age of 6 and 12 months and weight daily gain. [2, 3,8, 13, 27, 35,36, 41, 49]

Heritability show in what measure those traits could be inherited by the future offspring and

the correlations between various characters reflect that the selection of some characters is enough to improve or decline the performance for other characters. [14, 26, 41]

Selection efficiency depends of genetic variability, heritability and correlations exiting between various production traits [33, 34, 35]

Also, the group size of descendants used in bull testing has a deep influence on the precision of breeding value assessment. [44]

The increased precision is closely related to the development of estimation methods for a specific purpose. [50]

The best linear unbiased prediction (B.L.U.P.) and then "mixed model" have been created to assure a minimum variance and a high precision of the breeding value by the successful combination of the advantages of the selection indices and the least square method, and also by largely using the techniques development. [11,18,28,35,46].

At present, the modern molecular and quantitative genetics looks to more and more utilized. [15]. However, marker-assisted selection implemented in practice have proved that its use could lead to bias and high standard errors [31].

Friesian is recognized as a specialized breed for milk production, but also in some countries it is selected both for milk and meat characters taking into account the need to improve the both productions. [1,6,7]

In this context, the paper purpose was to estimate breeding value of Friesian bulls both for milk and meat characters using a simplified mathematical model of BLUP. Also, the contemporary comparison method was used in order to comparatively analyze the effect of these methods on the bulls ranking.

MATERIALS AND METHODS

A number of 127 Friesian bulls grown Romania were used for determining their breeding value for dual purpose based on the specific characters of milk and meat production.

For this purpose, a sample consisting of 5,817 offspring, including a number of 4,112 daughters

(half-sisters) belonging to 98 bulls and 1,705 sons (half-brothers) belonging to 105 bulls was used.

This sample represents 24.94 % of the 425 bulls tested for milk production and 10.33 % of 1,026 bulls tested for meat production during a period of 11 years in Romania.

In order to determine their breeding value, the bulls were tested based on their offspring performance recorded in 221 farms belonging to 35 counties of Romania.

In this study, it was used only a sample of 16 bulls, and their offspring consisting of 730 daughters (half-sisters) and 249 sons (half-brothers) as presented in Table 1.

Table 1. Number of offspring per tested bull, used in this research work

Crt.No.	Bull Code	No. of daughters used for bull testing for milk production characters	No. of sons used for bull testing for meat production characters
1	6841	24	21
2	4083	52	14
3	4094	23	13
4	5338	78	13
5	5329	198	15
6	6014	27	16
7	4837	25	13
8	4076	22	12
9	5435	28	18
10	5184	21	12
11	5347	98	17
12	5105	21	11
13	5650	29	23
14	5349	21	23
15	5204	40	15
16	6499	23	13
	Total	730	249

Source: Selection made by author from the data based used in a research project.

The bull daughters were born at a maximum 60 days interval between them, their age at the 1st parturition varied between 23 and 35 months. The average number of daughters per bull was 39, varying between minimum of 19 and maximum of 198 average daughters, important figures for assuring a high selection precision in dairy herds similar to the one assured by daughters assessed in stations as mentioned Robertson and Rendel (1954) [14]. The daughters were tested for milk production for 305 days of lactation obtained in their herds using the specific characters: milk yield, fat percentage and fat quantity. The data were corrected for birth month, age at the 1st parturition, calving interval, their distribution

among herds. [37,38,39].

The average number of sons per bull was 15, ranging between minimum 9 and maximum 61. The bull sons were evaluated based on their performance for meat production, using the specific characters: weight at the age of 6 months and 12 months and daily weight gain. A correction for birth month of the fattened steers was carried out [40].

For all the characters taken into consideration, both for milk and meat production, there were determined the following statistical parameters: average, standard deviation, variation coefficient and heritability.

The average, Standard Deviation and Variation Coefficient for each production parameter were calculated according to the formulas given below:

$$\text{Average, } \bar{X} = \frac{X_1 + X_2 + \dots + X_n}{n}, \quad \dots (1)$$

where n = number of variables and X = production character

Standard Deviation, S

$$\left(\sqrt{\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{n-1}} \right) \quad \dots (2)$$

$$\text{Variation Coefficient, } V_{\%} = \frac{S}{\bar{X}} \times 100 \quad \dots (3)$$

The heritability for milk and meat production characters, and also the genotypic and phenotypic correlations among milk characters as well as among meat characters were determined using the following formulas:

$$\text{Heritability, } h^2 = \frac{B_V}{P_V} \quad \dots (4)$$

where B_V is breeding value and P_V is phenotypic value.

$$S_{h^2} = \left(h^2 + \frac{4}{n_i} \right) \sqrt{\frac{2}{S}} \quad \dots (5)$$

where h^2 is heritability, S_{h^2} is heritability error.

$$\text{Genotypic correlation, } r_G = \frac{\text{cov}_{GXY}}{\sqrt{S_{G_X}^2 \cdot S_{G_Y}^2}} \dots (6)$$

where: cov_G is genotypic variance, S^2 is variance.

Phenotypic

$$\text{correlation, } r_F = \frac{\text{cov}_{FXY}}{\sqrt{S_{F_X}^2 \cdot S_{F_Y}^2}} \dots (7)$$

where: cov_F is phenotypic variance, and S^2 is variance.

Bull breeding value was estimated using two methods: (a) BLUP - Best Linear Unbiased Prediction in a simplified version and (b) CC - Contemporary Comparison.

The simplified variant in monofactorial classification model, used in this research work, was based on the mixed model established by Henderson in 1949, cited by Popescu Agatha, 2014a. The mathematical formula of this simplified model was:

$$Y_{ij} = \mu + s_i + e_{ij}, \quad \dots (8)$$

where: Y_{ij} - the performance of the „j” daughter of the „i” bull, μ is a fixed unknown parameter, a_i - the effect of the „i” bull, with the value $s_i = \frac{1}{2} g_i$, where: g_i - the „i” bull's breeding value, e_{ij} - residual effect ($j=1, \dots, n_{ij}$); a and e are uncorrelated variables with the averages equal to zero and variances \sum_s^2

and \sum_e^2 .

Considering $\sum(e_{ij}) = 0, \text{cov}(e_{ij}, e_i, j) = 0$ if i

$\neq i'$, or at least $j \neq j'$ and $\sum_{ij}^2 = \sum_e^2$. The linear model did not considered that bulls are relatives among them, $\text{cov}(s_i, s_i) = 0, \sum_{si}^2 = \sum_s^2 = 1/4 \sum_A^2$.

Taking into consideration that n_i represents the number of daughters of the „i” bull, then the equations of the mixed model are:

The breeding value of the „i” bull, s_i , will be:

$$s_i = 2(n_i/n_i + a)(y_i - \mu) \quad \dots (9)$$

where: $s = \sum_e^2 / \sum_s^2$. If we consider

$n_i/(n_i + a) = w_i$, then $\bar{\mu} = \sum w_i \bar{y}_i / \sum w_i$.

The estimated breeding value precision, R^2 ,

was determined based on the formula:

$$R^2 = w_i - \frac{w_i}{\sum w_i} \dots\dots\dots(10)$$

When n_i has a high value, then

$$R^2 = w_i(1 - \frac{1}{\sum w_i}), \text{ where } \sum w_i \text{ goes to}$$

infinity and $1/\sum w_i$ goes to zero.

$$\hat{V}A = 2b[(\bar{Y} - \bar{A}_y) - 1/2h^2(\bar{X} - \bar{A}_x) + h^2_A(\bar{A} - \bar{P})] + \bar{P}, \dots\dots (11)$$

where: \bar{A} - herd average, and \bar{P} - breed average, \bar{Y} - mothers average performance, \bar{A}_x - contemporary average performance, and $1/2 h^2$ - mother genetic contribution.

The factor b had the formula:

$$b = \frac{W}{W + \frac{4}{h^2} - 1}, \dots\dots\dots(12)$$

where: $W = \sum_{i=1}^k w_i$ and K – number of herds.

$$w_i = \frac{n_1 \cdot n_2}{n_1 + n_2}, \dots\dots\dots(13)$$

where: n_1 - number of daughters and n_2 – number of contemporaries.

Points Method was used to classify the bulls according to their breeding value determined by the two methods and for the both production types. Each bull received points from 1 to n, based on its position in the classification. For establishing their final positions for the both productions, the points were summed and then a new bull ranking was required based on Point Methods to identify which bull is the best for dual purpose. Bull ranking was set up in the increasing order of the total number of obtained points. The bull which received the least number of points was situated on the 1st position as the best improving bull.

Spearman's Rank Correlation was used to identify the relationship between the bull classification based on the breeding value assessed by the simplified BLUP model and the classification set up using the contemporary comparison. The formula of rank correlation is given below:

This simplified mixed model was utilized for estimating the bulls breeding value and its precision both for milk and meat production characters.

Contemporary Comparison Method used in this research work was based on the formula:

$$r_s = 1 - \frac{6\sum d^2}{n(n^2 - 1)} \dots\dots\dots(14)$$

Fisher Test was used to evaluate the significance of the rank correlation for the probabilities $P = 0.05$ and $P = 0.01$.

The data were provided by the National Center for Animal Reproduction, Selection and Breeding.

RESULTS AND DISCUSSIONS

Average and variability of milk production characters is presented in Table 2. Milk yield registered 3,034.89 kg per 305 days of lactation with a variability of 22.86 %. Milk yield found in this research is lower than the one found by Freking et al., 1992 (7,803kg) and Rekik, 2009 (3,871 kg). [16, 42] Fat percentage was in average 3.79 with a low variation of 6.06 %. And milk fat recorded an average of 115.72 kg per lactation with a variation coefficient of 23.49 %.

Table 2. Average and variation coefficient for milk production characters (N=2,237)

Character	$\bar{X} \pm s\bar{X}$	V%
Milk yield	3,034.89 ± 14.670	22.86
Fat %	3.79 ± 0.004	6.06
Milk fat	115.72 ± 0.590	23.49

Source: Own calculations.

Average and variability of meat production characters is presented in Table 3.

Bulls weight at the age of 6 months recorded an average of 138.050 kg with a variation coefficient of 19.31 %. At the age of 12 months, the average weight was 293.410 kg with a very low variation coefficient of 4.33 %.

Table 3. Average and variation coefficient for milk production characters (N=1,705)

Character	$\bar{X} \pm s\bar{X}$	V _%
Weight at the age of 6 months	138.050 \pm 6.04	19.31
Weight at the age of 12 months	293.410 \pm 1.04	4.33
Weight daily gain	881.977 \pm 4.24	3.14

Source: Own calculations.

For the weight daily gain, the average was 881.977 g/day also with a low figure for the variation coefficient, 3.14 %.

Heritability for milk production characters is given in Table 4. Heritability for milk production was 0.505, higher compared to the values registered by other authors: 0.21 (Yaeghoobi et al, 2011 in Iranian Holstein), 0.22 (Yousefi-Golverdi et al, 2012 in Iranian Friesian), 0.26 (Hashemi, 2009 in Iranian Holstein, Nixon, 2009 in Canadian Holstein), 0.28 (Dedkova et al., 2001), 0.29 (Chauchan et al., 1991 in Canadian Holstein), 0.37 (Boichard et al, 1987), 0.38 (Hardie et al., 1978 in 0.41 (Rotschild et al., 1979 in American Holstein). [5,10,12,19,21,32,45,53, 54]

However, the heritability determined in this research work was close to other results obtained by other authors: 0.43 (Robertson and Rendel in United Kingdom in 1957, Bradford in the USA in 1964), 0.5 (Muresan in Romania in 1984) [35].

Heritability for fat % was 0.741, which is close to the one obtained by other authors: 0.708 (Nixon, 2009 in Canadian Holstein), 0.81 (Johanson in Denmark in 1954), 0.7 (Stahl in Germany in 1973) [29,35].

Also, it was higher compared to heritability for fat % found by some other authors: 0.53 (Robertson in United Kingdom in 1957), [43], 0.52 (Muresan in Romanian Friesian in 1984), 0.58 (Ujica in Romania in 1974), [29,35] and 0.36 (Hashemi et al, 2009 in Iranian Holstein), 0.23 (Khanzadeh et al, 2013 in Iranian Holstein), 0.28 (Yousefi-Golverdi et al, 2012 in Iranian Holstein). [21,23,54]

Milk fat had 0.567 heritability, a value similar or close to the ones registered by other

authors: 0.56 (Johanson in Denmark, 1954), 0.52 (Muresan, 1984, Negrutiu, 1973, in Romanina Friesian), 0.5 (Temisan in Romania in 1975).[29,35]

Also, the heritability estimated in this study was higher compared to the one found by other authors: 0.38 (Hardie et al., 1978), 0.31 (Chauchan et al., 1991), 0.24 (Hashemi et al, 2009, Yousefi-Golverdi et al, 2012 in Iranian Holstein), 0.086 (Yaeghoobi et al., in Iranian Holstein). [10,19,21,53,54]

Table 4. Heritability for milk production characters

Character	$h^2 \pm S_h^2$
Milk yield	0.505 \pm 0.069
Fat %	0.741 \pm 0.101
Milk fat	0.567 \pm 0.077

Source: Own calculations.

Heritability for meat production characters is given in Table 5. Heritability for the weight at the age of 6 months was 0.524 close to the one obtained by other authors: 0.53 (Blackmore in 1958, Muresan, 1983, Romania), 0.56 (Cundiff, 1971, Langholtz, 1964, Mirita, 1982 in Romania), 0.59 (Linner, 1973, Vlaic, 1979 in Romania). [35].

Heritability for the weight at the age of 12 months was 0.642 while the value for weight daily gain was 0.372, lower compared to the one found by other authors: 0.73 (Langholtz, 1964 in Germany), 0.52 (Trappman, 1972), 0.50 (Averdunk, 1950 in Germany), but close to the one found by a few other authors: 0.44 (Calo, McDowell, 1973, Negrutiu, 1975 in Romania), 0.45 (Langlett, 1967). [35]

The heritability obtained in this research was higher compared to the one found by other authors: 0.17 (Vostry et al., 2012 in Czech Republic). [51]

Table 5. Heritability for meat production characters

Character	$h^2 \pm S_h^2$
Weight at the age of 6 months	0.524 \pm 0.072
Weight at the age of 12 months	0.642 \pm 0.088
Weight daily gain	0.372 \pm 0.051

Source: Own calculations.

Genotypic and phenotypic correlations for milk production characters are shown in

Table 6. The genotypic correlation between milk production and fat % is a negative one, showing that selection for increasing milk yield will lead to a lower fat percentage. In this reserach work, this correlation was -0.245, similar or close to the one mentioned by other authors: -0.27 (Forester, 1971 in Germany), -0.21 (Hartman, 1960 in Germany), -0.22 (Legates, 1957 in the USA), -0.27 (Rendel, 1957 in United Kingdom), -0.20 (Tabler et al., 1959), -0.27 (Alexoiu, 1983 in Romania), -0.20 (Ujica, 1974, Popescu-Vifor, 1978 in Romania), [35] and -0.3 (Wilcox et al, 1971 in Canadian Holstein). [52] But this correlation was lower than the one found by some other authors: -0.43 (Boichard et al, 1987), -0.49 (Chauhan et al., 1991 in Canadian Friesian), -0.98 (Yousefi-Golverdi et al., 2012 in Iranian Holstein) [5,10,54]

The genotypic correlation between milk production and milk fat was 0.465, figure which is smaller compared to the one found by some authors: 0.99 (Yousefi-Golverdi et al., 2012 in Iranian Holstein), [44] 0.93 (Popescu-Vifor, 1978, Ujica, 1974 in Romania), [35] 0.9 (Bergman, 1969 in Switzerland), 0.89 (Harville, Henderson, 1966), 0.88 (Alexoiu, 1983, Negrutiu, 1973 in Romania), [35], 0.743 (Campos et al, 1994), [9], -0.36 (Petre, Negrutiu, 1975 in Romania) [35].

Table 6. Genotypic and phenotypic correlations among milk production traits

Genotypic correlations			Phenotypic correlations		
	Fat %	Milk Fat		Fat %	Milk Fat
Milk yield	-0.245	0.971	Milk yield	-0.181	0.964
Milk Fat	0.465	-	Milk Fat	0.240	-

Source: Own calculations.

Genotypic and phenotypic correlations for meat production characters are shown in Table 7. The genotypic correlation between weight at the age of 6 months and weight at the age of 12 months was a negative one, -0.287 and also the genotypic correlation between the weight at 6 months and weight daily gain, -0.307. This reflects that selection is not so important to be done based on the

trait weight at the age of 6 months because this could have a negative impact on the second trait taken into consideration. But, the correlation between the weight at the age of 12 months and daily gain was very strong, 0.850, showing how important is this trait in bull selection and breeding.

Table 7. Genotypic and phenotypic correlations among meat production traits

Genotypic correlations			Phenotypic correlations		
	Weight at the age of 6 months	Weight at the age of 12 months		Weight at the age of 6 months	Weight at the age of 12 months
Weight at the age of 12 months	-0.287	-	Weight at the age of 12 months	-0.189	-
Weight daily gain	-0.307	0.850	Weight daily gain	-0.726	0.771

Source: Own calculations.

Estimated breeding value (BV) and its precision (R^2) in Friesian Bulls testing for each milk production characters using BLUP simplified model is presented in Table 8. In case of milk production, breeding value varied between 636.7, the maximum value for the bull 6841 and -68.1, the minimum value for the bull 6499. Its precision ranged between 92, the maximum value in case of the bull 5329 and 58, the minimum value in case of the bulls 5184, 5105 and 5349.

Regarding fat %, the estimated breeding value varied between 0.264, the maximum value for the bull 4094 and -0.121, the minimum value for the bull 5329. Its precision ranged between 93, the maximum value in case of the bull 5329 and 62, the minimum value in case of the bulls 5184, 5105 and 5349.

Concerning milk fat, the estimated breeding value varied between 26.26, the maximum value for the bull 5349 and -2.07, the minimum value for the bull 5347. Its precision ranged between 92, the maximum value in case of the bull 5329 and 58, the minimum value in case of the bulls 5184,

5105 and 5349.

From the 16 bulls taken into consideration in this research, a number of 13 bulls had a positive breeding value for milk production and 3 had a negative one. Regarding the fat %, only 14 bulls had a positive breeding value for this character and 2 had a negative one. In case of milk fat, only one bull had a negative breeding value for this trait and all the others had a positive breeding value.

Table 8. Breeding value (BV) and its precision (R^2) determined by BLUP for each milk production traits

Crt No	Bull Code	Milk production (kg)		Fat %		Milk Fat (kg)	
		BV	R^2	BV	R^2	BV	R^2
1	6841	636.7	61	0.006	65	24.26	61
2	4083	619.5	77	0.072	80	25.47	77
3	4094	262.1	60	0.264	64	17.82	60
4	5338	370.2	83	0.039	85	14.52	83
5	5329	559.2	92	-	93	17.06	92
6	6014	58.2	63	0.118	68	5.25	63
7	4837	523.2	62	0.158	66	23.92	62
8	4076	102.1	59	0.057	63	5.13	59
9	5435	-0.4	64	0.023	69	0.36	64
10	5184	420.0	58	0.184	62	21.47	58
11	5347	-37.6	86	0.010	88	-2.07	86
12	5105	130.1	58	-	62	3.94	58
13	5650	275.0	65	0.115	69	14.28	65
14	5349	601.8	58	0.102	62	26.26	58
15	5204	301.8	72	0.267	75	18.84	72
16	6499	-68.1	60	0.122	64	0.02	60

Source: Own calculations.

Estimated breeding value (BV) and its precision (R^2) in Friesian Bulls testing for each meat production characters using BLUP simplified model is presented in Table 9.

For the weight at the age of 6 months, the maximum breeding value was 38.1 registered by the bull 6014 and the minimum breeding value was -36.1.

Its precision varied between 79 recorded by the bulls 5650 and 5349, the maximum value and 65 in case of the bull 5105.

For the weight at the age of 12 months, the maximum breeding value was 48.6 recorded by the bull 6014 and the minimum breeding value was -27.8. Its precision varied between 71 registered by the bulls 5650 and 5349, the

maximum value and 54 in case of the bull 5105.

Regarding the breeding value for daily gain, the maximum value was 168.2 registered by the bull 5435 and the minimum value was 2.2 recorded by the bull 6499. Its precision ranged between 76, the maximum value registered by the bulls 5650 and 5349 and 60, the minimum value recorded by the bull 5105.

Table 9. Breeding value and its precision determined by BLUP for each meat production traits

Crt No	Bull Code	Weight at the age of 6 months (kg)		Weight at the age of 12 months (kg)		Daily gain (g/day)	
		BV	R^2	BV	R^2	BV	R^2
1	6841	-35.7	78	-26.1	69	12.8	74
2	4083	25.3	70	40.3	60	81.6	66
3	4094	6.8	69	24.1	58	82.5	64
4	5338	-15.5	69	-7.9	58	4.0	64
5	5329	-5.0	72	1.5	62	16.3	67
6	6014	38.2	73	48.6	63	60.6	69
7	4837	7.7	69	20.3	58	64.1	64
8	4076	1.0	67	14.3	56	64.9	62
9	5435	-14.4	75	19.8	66	168.2	71
10	5184	29.2	67	39.9	56	63.6	62
11	5347	-12.3	74	-5.2	64	14.2	70
12	5105	3.2	65	9.6	54	15.8	60
13	5650	-36.1	79	-27.8	71	11.4	76
14	5349	0.0	79	31.0	71	149.3	76
15	5204	7.4	72	14.8	62	21.5	67
16	6499	-9.9	69	-3.9	58	2.2	64

Source: Own calculations.

Rank correlations between bulls ranking for various milk traits are shown in Table 10. There were noticed significant correlations for the positions occupied by bulls for milk production and milk fat, showing that a bull improving one of these characters will also have a positive impact on the other trait which will be improved at its offspring. Therefore, it is enough as in bull breeding value estimation based on daughters and bull mothers performance to take into consideration only milk fat or milk production at the first 305 days of lactation, depending on heritability. Weak correlations were found among the bull positions for milk production and for fat percentage as well.

Table 10. Rank correlations between bulls hierarchy for various milk characters

Character	Milk production	Fat %
Fat %	0.377**	-
Milk Fat	0.974**	0.467**

Source: Own calculations

Rank correlations between bulls ranking for various meat traits are shown in Table 11.

Table 11. Rank correlations between bulls hierarchy for various meat characters

Character	Weight at the age of 6 months	Weight at the age of 12 months
Weight at the age of 12 months	0.766**	-
Weight daily gain	0.393**	0.847**

Source: Own calculations

There were found significant correlations between the bull ranking established for the weight at the age of 6 months and the weight at the age of 12 months, but especially between the weight at the age of 12 months and daily gain. This shows that the weight at the age of 12 months and daily gain are the most important characters for the selection for bulls fattening performance. A low correlation was found between the positions occupied by bulls for the traits weight at the age of 6 months and daily gain, proving that the selection based on weight at the age of 6 months does not assure a higher daily gain to the next offspring.

Bulls ranking according to their breeding value calculated for double purpose: milk and meat traits, using BLUP simplified model is shown in Table 12.

Taking into account all the studied characters both for milk and meat production, it was established a new bull ranking. Looking at the figures from the last column of Table 12, one can see that the best bull for dual purpose coming on the 1st position has been the bull 5184. This bull was positioned on the 4th position for milk production characters and on the 3rd position for meat production characters.

On the 2nd position it is situated the bull 4837, which is on the 1st position for milk production traits and on the 14th position for

meat production characters. On the 3rd position is situated the bull 4083, which came on the 5th position for milk characters and on the 11th position for meat traits.

Table 12. Positions occupied by bulls according to their breeding value calculated both for milk and meat characters, by BLUP and Points Methods

Crt.No.	Bull code	Position for		Total points	Position for double traits- milk and meat characters
		Milk traits	Meat traits		
1	6841	10	64	74	18
2	4083	5	11	16	3
3	4094	7	33	40	7
4	5338	14	57	71	17
5	5329	27	38	65	15
6	6014	17	2	19	4
7	4837	1	14	15	2
8	4076	25	2	27	6
9	5435	39	22	61	12
10	5184	4	3	7	1
11	5347	36	47	83	25
12	5105	37	27	64	14
13	5650	10	66	76	19
14	5349	2	21	23	5
15	5204	6	21	27	6
16	6499	30	48	78	21

Source: Own calculations

On the opposite side, there is the bull 5347 situated on the last position for the both characters.

Bulls ranking according to their breeding value calculated for double purpose: milk and meat traits, using Contemporary Comparison Method is shown in Table 13. Using C.C., the traditional method, the bulls registered a different ranking. On the 1st position it is situated the bull 6841, followed by the bulls 4083, 4094, 5338, 5329 and 6014. On the last position came the bull 6499.

The comparison concerning bull position occupied for dual purpose, determined by B.L.U.P. and C.C is presented in Table 14. As one can see, the bull came on different positions in their ranking due to the method used for breeding value estimation. However, a number of three bulls of the total of 16 bulls used in this study occupied almost similar positions, no matter the breeding value estimation method. It is about the bull 4083 coming on the 3rd position by BLUP and on the 2nd position by CC, the bull 6014 situated

on the 4th position by BLUP and on the 5th position by CC and the bull 4076 situated on the 6th position by BLUP and on the 7th position by CC.

Table 13. Positions occupied by bulls according to their breeding value calculated both for milk and meat characters, by Contemporary Comparison Methods and Points Methods

Crt.No.	Bull code	Position for		Total points	Position for double traits- milk and meat characters
		Milk traits	Meat traits		
1	6841	9	10	19	1
2	4083	6	27	33	2
3	4094	7	26	33	2
4	5338	8	28	36	4
5	5329	16	22	38	5
6	6014	32	6	38	5
7	4837	23	16	39	6
8	4076	20	21	41	7
9	5435	39	4	43	8
10	5184	2	45	47	9
11	5347	11	36	47	9
12	5105	17	31	48	10
13	5650	3	48	51	11
14	5349	30	32	62	12
15	5204	27	47	74	13
16	6499	41	44	85	16

Source: Own calculations

Table 14. Bull ranking by BLUP versus CC for dual purpose

Crt.No.	Bull Code	Position for milk and meat production by BLUP	Position for milk and meat production by CC
1	6841	18	1
2	4083	3	2
3	4094	7	2
4	5338	17	4
5	5329	15	5
6	6014	4	5
7	4837	2	6
8	4076	6	7
9	5435	12	8
10	5184	1	9
11	5347	25	9
12	5105	14	10
13	5650	19	11
14	5349	5	12
15	5204	6	13
16	6499	21	14

Source: Own calculations

A large difference was noticed in case of the bull 6841 which came on the 18th position by BLUP, but on the 1st position by CC.

The rank correlation between the bull ranking by BLUP and CC was 0.563, substantially significant for the probabilities $P=0.05$ and $P=0.01$.

Therefore, the use of BLUP simplified model changes the positions occupied by bulls when CC was utilized. BLUP is well appreciated by breeding experts due to its higher precision compared to contemporary comparison method.

CONCLUSIONS

Friesian is well known as a breed specialized for milk production. However, some bulls are very good to improve both milk and meat production.

The contemporary comparison method has been less and less used in breeding value estimation, because the experts were looking to improve the mathematical models in order to get a higher precision.

BLUP is considered one of the best method in its different variants from a country to another. In case of Romania, BLUP was and is successfully used in bull breeding value assessment.

BLUP has become a high efficient tool grace of its the highest accuracy with a deep impact on the correct ranking of the productive animals.

Dairy farmers should be aware that using a high breeding value bull they could get more production gain and higher incomes from marketed products: milk or live animals.

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REFERENCES

[1] Alexoiu, A., 1983, Studiul însușirilor fenotipice și genetice ale populației active a raselor de taurine zonate în R.S. România. Teză de doctorat, București

- [2]Arione, A.B., Nogara, P.R., Barbosa, G.B., Weber, T., Kippert, C.J., Andreazza, J., 2005, Heritability and genetics trend for milk and fat yields in Holstein herds raised in the State of Rio Grande do Sul. Brazilian. J. Anim. Sci. 34, 1512-1518
- [3]Averdunk, G., 1974, Progeny testing for beef characteristics, 1st . World Congress on Genetics applied to livestock production, Madrid
- [4]Becker, W.A., 1964, Manual of procedures in quantitative genetics. Washington, St. University
- [5]Boichard, D., Bonaiti, B. (1987). Genetic parameters for first lactation dairy traits in Friesian, Montbéliarde and Normande breeds. Genetic Selection Evolution, 19, 337-350
- [6]Branco Renata Helena, Costa de Oliveira Junior Braz, Zerlotti Mercadante Maria Eugênia, 2012, Genetic parameter estimates for live weight and daily live weight gain obtained for Nellore bulls in a test station using different models, Livestock Science 144:148–156
- [7]Calo, L.L., Mc. Dowel, R.E., Van Vleck, L.D., Miller, P.D., 1973, Simultaneous selection for milk and beef production among Holstein – Friesians, J. Dairy Sci., 56: 1080-1084
- [8]Calus, M.P.L., Carrick, M.J., Veerkamp, R.F., Goddard, M.E., 2005, Estimation of genetic parameters for milk fat depression in dairy cattle. J. Dairy Sci. 88, 1166-1177.
- [9]Campos, M.S., Wilcox, C.J., Becerril, C.M., Diz, A., 1994, Genetic parameters for yield and reproductive traits of Holstein and Jersey cattle in Florida. J. Dairy Sci. 77, 867-873.
- [10]Chauhan, V.P., Hayes, J.F., 1991, Genetic parameters for first milk production and composition traits for Holsteins using Multivariate Restricted Maximum Likelihood. J. Dairy Sci. 74, 603-610.
- [11]Crettenand, J., 1975, Le testage de taureaux sur la base d'équations linéaires. Thèse pour l'obtenir du Grade de Docteur en Sciences Techniques, Zurich
- [12]Dedkova, L., Wolf, J., 2001, Estimation of genetic parameters for milk production traits in Czech dairy cattle populations, Czech. J. Anim. Sci. 46, 292-301
- [13]Dickerson, C.E., Kunzi, N., Cundiff, L.V., Koch, B.M., Arthaud, V.R., Gregory, K.E., 1974, Selection criteria for efficient beef production. J. Anim. Sci., 39(4), 651-673
- [14]Drăgănescu, C., 1979, Animal breeding, Ceres Publishing House, Bucharest, pp.187
- [15]Flint, A.P.F., Woolliams, J.A., 2008, Precision animal breeding, Phil. Trans. R. Soc. BS, Vol. 363(1491): 573-590
- [16]Freking, B.A., Marshall, D.M., 1992, Interrelationships of heifer milk production and other biological traits with production efficiency to weaning. J. Anim. Sci. 70, 646-655.
- [17]Furtunescu, A., 1975, Determinarea valorii de ameliorare a reproducătorilor, Editura Ceres, București
- [18]Guerra José Lúcio Lima, 2004, Statistical models and genetic evaluation of binomial traits, Dissertation, Louisiana State University, p.8-24, 48-53
- [19]Hardie, A.R., Jensen, E.L., Tyler W.J., 1978, Genetic and economic implications of single trait selection for protein and sol-ids-non-fat. J. Dairy Sci. 61, 96-101
- [20]Harville, D.A., Henderson, C.R., 1966, Interrelationships among age, body weight and production traits during first lactation of dairy cattle. J. Dairy Sci., 49: 1254-1261
- [21]Hashemi, A., Bernousi, I., Zadeh, S.R., Ranjbari, M., 2009, Estimates of genetic parameters of productive traits in Holstein-Native Crossbreeds in W. Azerbaijan Province-Iran. J. Anim. Vet. Adv. 8, 917-919
- [22]Henderson, C. R., Carter, H. W., Godfrey, J. T., 1954, Use of the contemporary herd average in appraising progeny tests of dairy bulls. J. Animal Sci. 13
- [23]Khanzadeh Hassan, Hossein-Zadeh Navid Ghavi, Naserani Mohammad, 2013, Estimation of genetic parameters and trends for milk fat and protein percentages in Iranian Holsteins using random regression test day model, Archiv Tierzucht 56:47, p.2
- [24]Jensen, E.L., 1980, Bull groups and relationships among sires in BLUP sire evaluation models, J. Dairy Sci, 63 (12): 2111-2120
- [25]Lee, A., 1979, Mixed model multiple trait evaluation of related sires when all traits are recorded. J. An. Sci., 48 (5)
- [26]Mason, I.L., 1964, Genetic relations between milk and beef characters in dual-purpose, cattle breeds. Anim. Prod., 6: 31
- [27]Mashhadi, M.J., Kashan, N.E.J., Nassiry, M.R., Torshizi R.V., 2008, Predicting breeding value and genetic parameter in Iranian Holstein bulls for milk production traits. Pakistan. J. Biol. Sci. 11, 108-112
- [28]Mrode, R. A., Thompson, R., Linear Models for the Prediction of Animal Breeding Values, at <http://books.google.ro/books?id=bnewaF4Uq2wC&pg=PA337&lpg=PA337&dq=PRECISION+OF+GENETIC+PARAMETERS+IN+BULL++BREEDING+VALUE+ESTIMATION&source=books.google.ro>
- [29]Mureșan, G., 1984, Contribuții la studiul însușirilor morfo-productive ale rasei Friză bălțate cu negru. Teză de doctorat, Cluj-Napoca
- [30]Negrutiu, E., Petre, A., 1975, Ameliorarea animalelor domestice. Editura Didactică și Pedagogică, București, 1975
- [31]Neuer Stefan, Edel Christian, Emmerling Reiner, Thaller Georg, Götz Kay-Uwe, 2009, Precision of genetic parameters and breeding values estimated in marker assisted BLUP genetic evaluation, Genet. Sel. Evol. 2009,41(1): 26
- [32]Nixon, M., Bohmanova, J., Jamrozik, J., Schaeffer, L.R., Hand, K., Miglior, F., 2009, Genetic parameters of milking frequency and milk production traits in Canadian Holsteins milked by an automated milking system. J. Dairy Sci. 92, 3422-3430.
- [33]Oltenacu, P.A., Young, C.W., 1974, Genetic and financial considerations of progeny testing programs in an artificial insemination dairy cattle population,

J.Dairy Sci., 57(10)1245-1253

[34]Pantelic ,V., Petrovic, M.M., Aleksic, S., Ostojic, D., Stretenovic, S., Novakovic , Z., 2008, Genetic correlations of productive and reproductive traits of Simmental cows in Republic of Ser-bia. Archiva Zootechnica. 11, 73-78

[35]Popescu Agatha, 2014a, The precision increase in breeding value estimation by BLUP, Eikon Publishing House,Cluj Napoca, Rawex Coms Publishing House Bucharest

[36]Popescu Agatha, 2014b, Research on meat production parameters in steer fattening and their importance for sires breeding value estimation in Romania, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.14, Issue 1/2014, p.309-316

[37]Popescu Agatha, 2014c, Research on the correlation between the age at the first calving and milk production characters, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.14, Issue 1/2014, p.299-308

[38]Popescu Agatha, 2014d, Research on the influence of the calving interval on milk yield, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.14, Issue 1/2014, p.293-298

[39]Popescu Agatha, 2014e, Research on the milk production differences determined by the calving month of the dairy cows, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.14, Issue 1/2014, p.279-286

[40]Popescu Agatha, 2014f, Research on the meat production differences determined by the birth month of the fattened steers, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.14, Issue 1/2014, p.287-292

[41]Popescu-Vifor, S., 1978, Genetica animală, Editura Ceres, București

[42]Rekik, B., Bouraoui, R., Ben Gara, A., Hammami, H., Hmissi, M., Rouissi, H., 2009, Milk production of imported heifers and Tunisian-Born Holstein cows. American-Eurasian. J. Agr. 2, 36-42

[43]Robertson, A., 1957, Optimum group size in progeny testing and family selection, Biometrics 13(4):442-450

[44]Robertson, A.,Rendel, J.M, 1950, The use of progeny testing with artificial insemination in dairy cattle, J.Genetics 50:21

[45]Rothschild, M.F., Henderson, C.R., 1979, Maximum likeli-hood estimates of parameters of first and second lactation milk. J. Dairy Sci. 62, 990-995

[46]Schaeffer, L.R., 1976, B.L.U.P. Workshop Notes. Aug. 9 to 14, 1976. Department of Animal Breeding, Agricultural College, Uppsala, Sweden

[47]Schaeffer Lawrence R., 2010, Linear Models and Animal Breeding, University of Guelph, Centre for Genetic Improvement of Livestock,

www.aps.uoguelph.ca/~lrs/ABModels/DATA/EuropeNotes.pdf

[48]Searle, S.R., 1964, Review of sire proving methods in New Zealand, Great British and New York State. J. Dairy Sci., 47:402

[49]Stahl, C.W., Rasch, D., Siler, R., Vachal, J., 1974, Genetica populațiilor pentru zootehniști. Editura Ceres, București

[50]Ufford, G.R., Henderson, C.R., Van Vleck, L.D., 1979, An Approximative Procedure for Determining Prediction Error Variance of Sire Evaluation. J.Dairy Sci., 62:621-626

[51]Vostrý Luboš, Veselá Zdeňka, Přibyl Josef, 2012, Genetic parameters for growth of young beef bulls, Archiv Tierzucht 55 (2012) 3, 245-254

[52]Wilcox, C.J., Gaunt, S.N., Farthing, B.R., 1971, Genetic inter-relationships of milk composition and yield. Interregional Publication of North East and South East State Agriculture Experimental Station, Southern Cooperative Series. Bulletin, no. 155.

[53]Yaeghoobi, R, Doosti, A., Noorian, A.M., Bahrami, A.M., 2011, Genetic parameters and trends of milk and fat yield in Holstein's dairy cattle of West Provinces of Iran, International Journal of Dairy Science 6(2):142-149

[54]Yousefi-Golverdi Ali, Hafezian Hasan, Chashnidel Yadolah, Farhadi Ayoub, 2012, Genetic parameters and trends of production traits in Iranian Holstein population, African Journal of Biotechnology Vol. 11(10):2429-2435

SOME CONSIDERATIONS ON THE PROSPECTS OF SORGHUM CROP

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Abstract

The paper purpose was to analyze the sorghum statement at world, EU and Romania level in order to establish the main trends in the future of this crop. Sorghum is an important cereal coming on the 5th position after maize, rice, wheat and barley at world level due to its importance in human nutrition, animal feed, in producing bioethanol and green energy, and due to its good impact on environment. It is cultivated on all the continents, in the tropical, subtropical and temperate areas due to its resistance to drought, production potential, low inputs and production cost. It is an alternative to maize crop being more utilized as substituent in animal diets. The world sorghum production reached 63,811 thousand metric tons in 2014, the main producers being the USA, Mexico, Nigeria, India, Argentina, Ethiopia, Sudan and China. The world consumption of sorghum reached 63,148 thousand metric tons and it is continuously increasing. The sorghum exports accounted for 7,690 thousand metric tons in 2014, of which the USA export represents 4,600 thousand metric tons. Besides the USA, other exporting countries are Argentina, Australia, Ethiopia, India, Nigeria, Uruguay, while the main importing countries are China, Japan, Chile, Colombia, Mexico, the EU, Sudan. In 2014, the EU produced 576 thousand metric tons sorghum, imported 200 thousand metric tons, and consumed 770 thousand metric tons. The main EU producers of sorghum are France, Italy, Romania, Spain and Hungary. In 2012, Romania cultivated 20,000 ha with sorghum crop, 18 times more than in 2007. Also, in 2012, Romania produced 37.5 thousand tons of sorghum grains, by 31 times more than in 2007. The sorghum yield was 1,875 kg/ha by 66% higher in 2012 compared to 2007. Therefore, these figures show the increasing importance of sorghum crop at world level. Because Romania is situated in suitable geographical area for producing sorghum, it could increase production and become a more important supplier for the EU.

Key words: bioethanol, Sorghum crop, efficiency, green energy, food, feed, perspectives

INTRODUCTION

Among cereals crops at world level, Sorghum Sp. comes of the 5th position after maize, rice, wheat and barley [15,19,20,25].

Origin: Sorghum is plant known from the old times. More than 2000 years ago, Sorghum was known in the Roman Empire during Plinius the Elder, a well known naturalist who mentioned this plant in his Naturalis Historia. The first documents regarding Sorghum as a cultivated plant are dated 800 years A.D. attesting that this plant was firstly cultivated in Asiria and India.

However, most of the authors sustain that Sorghum origins are in Africa, where it is still existing as a wild plant on large surfaces. [15]. From the tropical zones of Central Eastern Africa (Sudan, Ethiopia), Sorghum has been extended its area in the hot and

temperate regions from 40-45 degrees North Latitude to 40-45 degrees South Latitude. Nowadays, Sorghum can be found in many arid areas from numerous African countries, in the Central and Southern America and Southern Asia, and also in the Mediterranean countries. [2].

Sorghum types. Sorghum belong to Gramineae Family, Sorghum Genus, including more than 3,000 annual and perennial species of which the most important one is Sorghum bicolor(L), Moench, sin. Sorghum vulgare Pers. This species has the following varieties: (a)Sorghum bicolor var. eusorghum or grain sorghum, (b) Sorghum b.var. technicum or broom sorghum, (c)Sorghum B. VAR. saccharatum or sweet sorghum and (d)Sorghum b. var. sudanese or feed sorghum.

Scientific research has given its contribution

to practical agriculture creating a large variety of hybrids of high production potential. [15]

Sorghum economic importance is given by its large variety of uses.

Sorghum grains are successfully used for human nutrition all over the world, but mainly in the African and Asian countries. Sorghum is considered a gluten less cereal. It is transformed in flour for producing bread in Africa, Central America, Southern Europe and Southern Asia, porridges and side dishes. [3, 14]

Sorghum is used in food industry for producing malted and distilled beverages (beer, low alcohol drinks), and popped grains. Also, sorghum grains are used as animal feed for pigs and cattle fattening as well as for poultry growing. The grains need to be processed by cracking, rolling or grinding, making sorghum nutritive value to be almost similar to the one of maize [3,]

Some varieties of sweet Sorghum have a high productivity in green mass and in sugar production. [14]

Sorghum could be used as green grass during summer season for cattle, sheep and goats, for grazing, also as silage and hay. Sorghum silage is similar to maize silage being rich in sugar and minerals (calcium, phosphorus, caroten). Because when the plants are young, sorghum is dangerous for animals due to its content in a toxic substance called "durrhina", which in the stomach of the animals is transformed in prussic acid, a real poison. Only 1 mg/kg live weight in case of cattle and 0.1 mg/kg live weight in case of sheep is enough to poison these animals. Only the sweet sorghum could be used by animals without any restriction. [5,6].

Sorghum is used as biomass for producing bioenergy and also as raw material for producing biofuel (bioethanol). [11, 12,17]

Sorghum fibers are utilized for producing brooms, washing brushes, knittings, paper, wallboard, fences, biodegradable materials for packaging due to their peculiar resistance. Also, solvents, dried stalks are used for cooking fuel.[2,4, 26]

For the reasons mentioned above, Sorghum is

a crop more and more cultivated in the world and could be considered among the main crops of the future agriculture.

In this context, the paper goal was to point out some considerations on the future of Sorghum crop in the world, in the European Union and in Romania, identifying the main trends regarding the cultivated surface, yield and production.

MATERIALS AND METHODS

The paper is based on a large documentation including the updated publications on Sorghum, also on the main data bases regarding cultivated surface, yield and production at world level in the period 2010-2014, and in the USA, as the main producer and exporting country at world level in the period 2011-2013.

Also, it was analyzed the statement of production, import, domestic consumption and stocks in the EU in the period 201-2014, identifying the main producing and exporting countries.

The main data sources have been USDA Crop Production, 2013, US Grain Council Reports, 2014.

Also, in case of Romania, there were used the statistical data provided by Romania's Statistical Yearbook, 2013 for the period 2007-2012 regarding the Sorghum cultivated area, production and yield.

Taking into consideration the collected information, it was identified the main trend and future of the Sorghum crop and its importance at world level, in the EU and in for Romania as a country with a high potential for cultivating this plant and becoming an important exporter for the EU.

The indices with fixed basis were used to determine the increase/decrease of the cultivated surface, production, consumption, export, import.

RESULTS AND DISCUSSIONS

Advantages of Sorghum crop.

(a)Sorghum has a similar chemical composition to the one of maize, being rich

in starch (73.8 %) and high value protein (12.3%), fats (3.9 %) and ash (1.65 %).

However, its use imposes as the diet to be supplemented with vitamins and minerals.

Table 1. Sorghum chemical composition versus Maize (%)

Sorghum				Maize			
Starch	Protein	Fat	Ash	Starch	Protein	Fat	Ash
73.8	12.3	3.9	1.65	71.5	10.3	4.8	1.44

Source: [2]

Sorghum seeds or caryopsis are rich in calories and protein, a reason to be an important food mainly for the African and Asian people. being an important food. [24]

(b)Sorghum can partially replace maize in the recipes for animal feed. Being a nourishing plant, containing high nutritive constituents, Sorghum could be successful used as a partial substituent in various diets for poultry, sheep, goats, cattle, pigs. This could be very important decision as long as maize price on international markets has substantially increased during the last decades. Because Sorghum has a low content of tannin, it could used just partially in the proportion 50 % maize and 50 % sorghum. This was proved by various experiments like the one carried out in Brasil at Sao Paolo University where a sample of 600 poultry, Cobb 500 Hybrid was divided into three experimental groups as follows: V1(control) fed with a daily diet consisting of 100% maize; V2 (Experimental variant 1) fed with 50% maize and 50% sorghum and V3 (Experimental variant 2) fed with 100 % sorghum poor in tannin. Based on the results regarding live weight, food consumption and carcass weight, it was drawn the conclusion that the poultry fed with 50% sorghum and 50 % maize registered almost a similar performance with the control variant, and the group V3 fed only with sorghum recorded the lowest performance. [16]

Other authors mention that sorghum could be included 20 % in hens diet and 40 % in pigs diet. [9,]

Some other authors mentioned that grain sorghum silage could be used as a supplement for growing steers grazing high quality pastures [1,]

(c)Sorghum is a plant with a well developed root system, with its leaves and its roots

and stalk covered by a wax layer. Growing longer than 1 m, the root explains the increased resistance of this plant to draft and thermic stress, compared to maize. Sorghum roots are disposed in 8 storeys and are covered by other small and thin roots. Also, the wax thin layer covering the leaves and stalk helps the plant to diminish perspiration and better resist to drought. [16]

(d)Sorghum is a highly resistant crop to drought and for this reason it may be cultivated in all the arid zones of the world, being named as the "vegetal camel".[16]. Compared to maize, sorghum can normally grow with just 100 mm rainfalls during the vegetation cycle. Also, its pollen is resistant to temperatures higher than 45-50 degrees, while maize pollen is resistant just up to 35-40 degrees.[9]

(e)Sorghum requirement for soil is very modest. For this reason, Sorghum could be cultivated on low quality and fertility soils where other crops don't. Sorghum can use sandy and salted soils very well, soils with a large pH (4.5-8.5). [16]

(f)Sorghum requires low fertilizer compared to maize or other crops. While maize needs more units of fertilizer, sorghum requires just: 20-60 units phosphorus, 20-60 units of Kalium, but 50-80 units of Nitrogen. [9]

(g)Sorghum requirement for water is less than in case of maize.

Sorghum requirement for water is very low compared to maize or oats. Its water needs for producing 1 g of dray matter is ranging between 158-274 compared to 597 in case of oats. [9]

Other authors mentioned that sorghum requires less than 23 inches of water, compared to maize which needs more water, 30 inches. [20]

Other authors mentioned that sorghum need

200 cubic meters water per ton, that is 50 % less water compared to maize requirement [8]

(h) Sorghum is highly resistant to pests and diseases. Sorghum is not affected by Diabrotica like maize, just a few insects could attack this crop. [9]

(i) Sorghum could be cultivated on all the continents, both in the tropical, subtropical and temperate areas. [8]

(j) Sorghum is a low production cost crop compared to maize. One hectare cultivated with sorghum requires Euro 500, while to cultivate 1 ha of maize a farmer must spend Euro 670. Therefore, sorghum assures Euro 170 savings per ha compared to maize, according to the results obtained within an experiment in France reported by Agricultural Chamber. [9]

(k) Sorghum has an ecological impact on environment. Sorghum, mainly the saccharatum type is able to absorb CO₂. While forests absorb 16t/ha/year and cereals 3-10 t/ha/year, 1 ha of sorghum is able to absorb 50-55 t CO₂. At the same time, it is able to produce huge amounts of oxygen [14]

(l) Sorghum could be used as a green fertilizer or as crop cover due to the positive action its roots able to release some biological active substances. [14]

(m) Sorghum has a high production potential. The average sorghum yield is 15.26 q/ha, but for hybrid sorghum this could exceed 100 q/ha. Normally, sorghum production varies between 50-80 q/ha. In case of broom sorghum, the production is 15-20 q/ha bushels, but also it could reach 40 q/ha. In case of saccharatum sorghum, the production is 40-80 t/ha fresh stalks. From one ton of stalks it could be produced 50-60 l syrup and from the production achieved from 1 ha it could result 3,000 l alcohol. [2, 10]

Sorghum could produce a good amount of biomass and sugar from its succulent stalks. Some varieties could produce in average 20 t/ha, however there are other varieties producing much more: 80 t green mass and 7 t sugar. In the USA, sugar performance could range between 4-17 t/ha. [14]

Large amounts of compost could be obtained from sorghum, the residues being estimated at

15 dt/ha/year. [8]

(j) Sorghum is a raw material for producing bioethanol and green power. Sweet sorghum is suitable and has a high productivity in ethanol production. It has a high productivity, 4,200-6,000 Etoh l/ha. One liter of bioethanol could save 2.2 kg CO₂.

Because of the continuous growth in ethanol at world level, it is expected as sorghum crop to be extended. This assumption is also supported by the fact that sorghum has many advantages compared to sugar cane (lower inputs, lower quality soils, resistant to hot climate) and could produce a similar bioethanol yield/ha like sugar cane. [8]

Sorghum situation at world level: production, consumption and trade.

World sorghum production increased by 4.32 % from 61,167 thousand MT in 2011 to 63,811 thousand MT in 2013. World sorghum consumption registered a higher increase than production, 5.31 %, from 59,660 thousand MT in 2011 to 63,148 thousand MT in 2013. Consumption is a little under production level, the difference reflecting the stocks, however the consumption growth rate is higher than production growth, a incentive for producers to intensify production. (Table 2).

The top ten Sorghum producers in the world are: the USA (9,144 thousand MT), Mexico (7,000 thousand MT), Nigeria (6,500 thousand MT), India (6,000 thousand MT), Argentina (4,800 thousand MT), Ethiopia (4,000 thousand MT), Sudan (3,800 thousand MT), China (2,800 thousand MT), Australia (2,050 thousand MT). [21]

The main countries consuming sorghum are: China, Mexico, Sudan, Ethiopia, Nigeria. [21]

The world sorghum trade increased by 15.83 % from 6,639 thousand MT in 2010/2011 to 7,690 thousand MT in 2014/2013.

The USA is the main exporting country of sorghum in the world with a share of 57.58 % in 2010/2011 and 59.81 % in 2014/2015. Other exporting countries are: Argentina, Australia, Ethiopia, India, Nigeria, Uruguay. (Table 3)

The main importing countries of sorghum are: China, Japan, Chile, Colombia, Mexico, the EU, Sudan. [7]

Table 2. World Sorghum production and consumption (Thousand metric tons)

Specification	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015	2014/2015 2010/2011 %
World production	61,167	57,245	57,933	59,168	63,811	104.32
World consumption	59,960	58,488	57,804	59,144	63,148	105.31

Source: [7] Own calculations.

Table 3. World Sorghum Trade, Oct/Sept, Thousand Metric Tons

Specification	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015	2014/2015 2010/2011 %
World Ty Export	6,639	5,456	7,277	7,635	7,690	115.83
Of which, the USA	3,823	1,549	2,136	5,600	4,600	120.32
The share of the USA in the world export (%)	57.58	28.39	29.35	73.34	59.81	-
World Ty Import	6,639	6,456	7,277	7,635	7,690	115.83
Of which, the USA	1	3	243	2	0	-

Source: [7] Own calculations.

Sorghum situation in the USA- the main sorghum producer in the world: cultivated surface, yield, production and trade.

The surface cultivated with sorghum for all purposes increased by 47.07 % in the period 2011-2013, from 5,481 thousand acres in 2011 to 8,061 thousand acres in 2013.

The surface cultivated with sorghum for grains increased by 66.20 % from 3,929 thousand acres in 2011 to 6,530 thousand acres in 2013, taking into account the importance of grain sorghum.

The share of the cultivated area with grain sorghum increased from 71.68 % in 2011 to 81 % in 2013.

Sorghum yield increased by 9.15 % from 54.6 bushels per acre in 2011 to 59.6 bushels in 2013. this growth is below the surface growth rate, meaning that the extent of the surface is the key factor for increasing production.

The production of sorghum grains increased by 81.42 % from 214,443 thousand bushels in 2011 to 389,046 thousand bushels in 2013.

Therefore, it is expected as the cultivated surface to continue to increase and the production as well. The surface cultivated with sorghum for silage destined to feed the

ruminants increased by 69.64 % from 224 thousand acres in 2011. to 380 thousand acres in 2013.

The silage yield per acre increased by 38.83 % from 10.3 Tons in 2011 to 14.3 Tons in 2013.

The Sorghum silage production increased by 2.35 times in the analyzed period from 2,298 thousand tons in 2011 to 5,420 thousand tons in 2013. (Table 4).

The USA sorghum production increased by 24.21 % from 8,779 thousand MT in 2011 to 10,905 thousand MT in 2013.

The USA production has registered an increased of its share in the world production from 14.35 % in 2011 to 17.08 % in 2013.

The USA sorghum consumption increased by 10.64% from 5,281 thousand MT in 2011 to 5,843 thousand MT in 2013.

The share of the USA sorghum consumption in the world consumption has increased from 8.8 % in 2011 to 9.25 % in 2013. (Table 5).

Sorghum situation in the European Union, EU-28: import, production, domestic consumption, ending stocks.

The EU is a producing but also an importing country of sorghum. The main trend in the EU is to decrease import, production, and

domestic consumption. In the analyzed period, the EU-28 diminished its import of sorghum by 78.31 % from 922 1,000 MT in 2010/2011 to 200 1,000 MT in 2014/2015.

Table 4. Sorghum cultivated area, yield, production at world level in the USA, 2011-2013

Specification	MU	2011	2012	2013	2013/2011 %
Sorghum cultivated surface for all purposes	1,000 acres	5,481	6,244	8,061	147.07
Of which, Grain Sorghum	1,000 acres	3,929	4,955	6,530	166.20
The share of surface cultivated for grains in the total cultivated area	%	71.68	79.35	81.00	-
Yield	Bushels per acre	54.6	49.8	59.6	109.15
Production	1,000 bushels	214,443	246,932	389,046	181.42
Sorghum for silage	1,000 acres	224	363	380	169.64
Silage yield per acre	Tons	10.3	11.4	14.3	138.83
Silage production	1,000 Tons	2,298	4,135	5,420	235.85

4. Source: [18]. Own calculations.

Table 5. The USA Sorghum production and consumption (Thousand metric tons)

Specification	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015	2014/2015 2010/2011 %
The USA production	8,779	5,447	6,272	9,882	10,905	124.21
The share of the USA production in the world production	14.35	9.51	10.82	16.55	17.08	-
The USA consumption	5,281	3,953	4,775	4,293	5,843	110.64
The share of the USA consumption in the world consumption	8.80	6.75	8.26	7.25	9.25	-

Source: [7] Own calculations.

Production also declined, but by only 8.43 % from 629 1,000 MT in 2010/2011 to 576 1,000 MT in 2014/2015.

Domestic consumption of sorghum has been diminished by 50% from 1,535 1,000 MT in 2010/2011 to 770 1,000 MT in 2014/2015.

The main producing countries of sorghum in the EU-28 are: France, which cultivates 50,000 ha and has a sorghum yield of 6.5 tons/ha, Italy comes on the 2nd position with 35,000 ha cultivated area, Romania on the

3rd position, followed by Spain and Hungary.[9]

The new orientation of the EU to biofuels imposed to look for solutions to produce them in an efficient manner. The best crop for coproduction of bioethanol and power is the sweet sorghum. In this respect, researchers from EUBIA, European Biomass Industry Association, provided the following solutions for the EU:

(a) A small Sorghum plantation of minimum 1,000 ha, bioethanol capacity 6,000 m³/year in

microdistillery;

(b) A large Sorghum plantation, on 10,000-50,000 ha, bioethanol capacity 60,000-300,000 m³/year.

These solutions could assure a low production cost of bioethanol, Euro 200/Ton, compared

to the production cost registered in 2005 in the EU, Euro 600/Ton and in other countries: USD 420/Ton in the USA, except Brazil where the ethanol production cost is the lowest one, USD 160/Ton [8]

Table 6. The EU-28 Sorghum import, production, consumption and stocks, Thousand Metric Tons)

Specification	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015	2014/2015 2010/2011 %
Import	922	126	291	200	200	21.69
Production	629	671	495	596	576	91.57
Domestic Consumption	1,535	760	795	795	770	50.16
Ending Stocks	21	14	27	23	24	114.28

Source: [7] Own calculations.

Sorghum situation in Romania: cultivated surface, yield, production.

In Romania, the cultivated area with Sorghum is very small. However, during the period 2007-2012, the cultivated area with this crop increased by 18.18 times from 1.1 thousand ha in 2007 to 20 thousand ha in 2012. This fact

reflects the interest of farmers to cultivate sorghum because the market needs in a continuous increase. The share of Sorghum in the cultivated area with cereals has increased from 0.02 % in 2007 to 0.37 % in 2012.(Table 7).

Table 7. Sorghum cultivated area in Romania, 2007-2012 (Thousand ha)

	2007	2008	2009	2010	2011	2012	2012/2007 %
Cereals cultivated area	5,129.2	5,210.7	5,284.4	5,040.6	5,224.7	5,440.3	106.06
Sorghum cultivated surface	1.1	8.0	6.1	10.3	13.1	20	1,818.18
Maize cultivated area	2,524.7	2,441.5	2,338.8	2,098.4	2,589.7	2,730.2	108.13
Share of sorghum in cereals cultivated area(%)	0.02	0.15	0.12	0.20	0.25	0.37	-

Source: [13] Own calculations.

Sorghum production has recorded a significant growth in Romania, from 1.2 1,000 T in 2007 to 37.5 1,000 T in 2012. This means that it was 31.25 times higher in 2012 compared to the level from 2007. The growth rate was higher compared to the cereals production, which increased by 64%. As a result, the share of sorghum in cereals production increased from 0.01 % in 2007 to 0.29 % in 2012. It is a very small share, but its continuous increasing trend shows that

sorghum has become an important crop among the other cereals in Romania.(Table 8).

The average Sorghum production increased by 66.22 % from 1,128 kg/ha in 2007 to 1,875 kg/ha in 2012. Compared to maize yield, it is a higher growth rate. Looking at the yield level, it is obviously that sorghum performance is lower in comparison with the one of maize.(Table 9).

The increased yield and production is a

consequence of the extended cultivated surface but also of the use of high productive potential hybrids produced by the Research Institute from Fundulea (Fundulea 21,

Fundulea 30, Fundulea 32, hybrids between sorghum and Sudan grass named Sweetleaf and Tudora, with a low content of durrhina and high production.

Table 8. Sorghum production in Romania, 2007-2012 (Thousand tons)

	2007	2008	2009	2010	2011	2012	2012/2007 %
Cereals grains	7,814.8	16,826.4	14,873.0	16,712.9	20,842.2	12,824.1	164.10
Sorghum grains	1.2	20.9	14.4	18.7	39.7	37.5	3125.0
Maize grains	3,853.9	7,849.1	7,973.3	9,042	11,717.6	5,953.4	154.47
Share of sorghum in cereals production(%)	0.01	0.12	0.10	0.11	0.19	0.29	

Source: [13] Own calculations.

Table 9. Sorghum yield in Romania, 2007-2012 (kg/ha)

	2007	2008	2009	2010	2011	2012	2012/2007 %
Maize grains	1,526	3,215	3,409	4,309	4,525	2,180	142.85
Sorghum grains	1,128	2,608	2,359	1,816	3,035	1,875	166.22

Source: [13] Own calculations.

Also, in Romania, there are companies like as Euralis which offers hybrids such as: Arkanciel, Armida, ES Alize, Tramontane and Caussade Semences, which offers other hybrids such as: Balto CS, CSS 29, Fuego CS, Brise CS for grains and Super Sile 20 CS sweet sorghum for silage. [9,14]

The most cultivated areas with sorghum in Romania are the ones suitable for this crop: the plains of South Muntenia, Oltenia, The Banat Plain, the Central Plain of Moldova, in general, the areas where maize is raised.

Sorghum is a profitable crop because of its lower production cost per ha compared to maize. Maize crop need to produce by 10 % more per ha than sorghum to bring the farmer a similar profit like sorghum.

Table 10. Production performance of Sorghum ES Alize Variety compared to maize, 2011-2012 (kg/ha)

Hybrid	2011	2012	Differences 2012-2011
Sorghum ES Alize hybrid	8,280	6,200	-2,080
Maize hybrid	10,441	5,323.6	-5,117.4

Source: [9]

In the areas where the rainfalls are over 250

mm/year, maize is suitable for cropping, leading to yield of 7-8 tons/ha, therefore in these regions maize is more profitable than sorghum.

But, in the areas with 150-250 mm rainfalls, the ES Alize sorghum variety produced by Euralis is more efficient, producing 6 tons/ha while maize is able to produce just 5 tons/ha. Also, in the droughty areas with less than 150 mm rainfalls, sorghum is the most suitable crop producing 5 tons/ha while maize is able to produce only 3 tons/ha. Therefore, sorghum is more efficient to be cultivated in the droughty areas like South, South West and West Romania also for Dobrudja region, where irrigation systems are missing. [9]

The Research and Development Station from Tirgu Mures organized some experiments in order to compare production of ES Alize sorghum hybrid with maize in the period 2011-2012. The chemical composition of the grains of this hybrid is: 11.4 % protein, 4.1 % fat, 66.3 % starch and fibers. [9]

Important experiments were achieved by National Institute for Biology and Animal Nutrition Balotesti (NIBANB) in order to partially replace maize in animal diets. The

obtained results encourages researchers to recommend farmers various recipes based on sorghum. A selection of these recipes is presented in Table 10.[22,23]

These recipes are suitable to the farms where ruminants are grown. They include Sorghum in various forms such as green grass, and silage, but also there are recipes based on Sorghum hay.

The new sweet sorghum varieties F-436 and F-465, created at Fundulea Research Institute, have a high production potential, have a rich sugar content and are suitable for green grass and silage. [22]

Also, it was noticed that the two Sorghum hybrids mentioned above have a nutritive and energetic potential, in terms of nutritive units, close to the one of maize, a reason to replace sorghum. The experiments based on 68/32 sorghum silage/wheat bran have lead to satisfactory results in sheep fattening. [23]

Table 11. Animal recipes where Sorghum partially replaced maize, recommended by NIBANB

Animal category and characteristics	Recipes content
Young cattle, 200 kg live weight, 800 g/day weight daily gain	Sorghum silage 5.15=3 kg, mixed hay 3.59 kg, maize 0.46 kg, soybean cake 0.27 kg, Total 9.45 kg/head/day
Dairy cow, 15 kg milk/day	Sorghum silage 25 kg, alfalfa hay 3.42 kg, alfalfa semisilage 2.64 kg, wheat straw 1.37 kg, sunflower cake 1.25 kg, barley from breweries 6.47 kg, Total 37.09 kg/day
Goat, 55 kg live weight, 3.5 kg milk/day	Green grass sorghum 6.55 kg, maize 0.72 kg, wheat bran 0.43 kg, Total 7.7 kg
Raw, 85 kg live weight	Green grass sorghum 3.79 kg, alfalfa hay 0.71 kg, carrots 1 kg, barley 0.58 kg, peas 0.90 kg, Total 6.98 kg/day
Fattened steers, 400 kg, 1,300 g/day weight daily gain	Green grass sorghum 8.5 kg, alfalfa hay 0.91 kg, barley 4.66 kg, sunflower cake 0.78 kg, Total 14.85 kg/day
Dairy cow, 24 kg milk/day	Green grass sorghum 25 kg, alfalfa hay 5.49 kg, maize 5.51 kg, soybean cake 1.78, Total 37.78 kg/day

Source:[22]

CONCLUSIONS

Sorghum is an important cereal coming on the 5th position after maize, rice, wheat and barley at world level due to its importance in human nutrition, animal feed, in producing bioethanol and green energy, and due to its good impact on environment.

It can be cultivated on all the continents, in the tropical, subtropical and temperate areas due to its resistance to drought, production potential, low inputs and production cost. For this reason, it could be an alternative to maize crop being more utilized as substituent in animal diets.

The world sorghum production reached 63,811 thousand metric tons in 2014, the main producers being the USA, Mexico, Nigeria, India, Argentina, Ethiopia, Sudan and China.

The world consumption of sorghum reached 63,148 thousand metric tons and it is continuously increasing.

The sorghum exports accounted for 7,690 thousand metric tons in 2014, of which the USA export represents 4,600 thousand metric tons.

Besides the USA, other exporting countries are Argentina, Australia, Ethiopia, India, Nigeria, Uruguay, while the main importing countries are China, Japan, Chile, Colombia, Mexico, the EU, Sudan.

In 2014, the EU produced 576 thousand metric tons sorghum, imported 200 thousand metric tons, and consumed 770 thousand metric tons. The main EU producers of sorghum are France, Italy, Romania, Spain and Hungary.

In 2012, Romania cultivated 20,000 ha with sorghum crop, 18 times more than in 2007. Also, in 2012, Romania produced 37.5 thousand tons of sorghum grains, by 31 times more than in 2007. The sorghum yield was 1,875 kg/ha by 66% higher in 2012 compared to 2007. Therefore, these figures show the increasing importance of sorghum crop at world level. Because Romania is situated in suitable geographical area for producing sorghum, it could increase production and become a more important supplier for the

EU.

In Romania, Sorghum could be successfully used for animal feeding, partially replacing maize in the diets for various species and categories: poultry, pigs, sheep, cattle, increasing farmers profit due to the reduced production cost compared to maize and efficiency in animal production is similar like in case of maize.

In this respect, it required as scenarios to be established in order to develop sorghum cropping under the highest economic efficiency, the processing technology being the same.

REFERENCES

- [1]Abdehhadia, L.O., Santinic, F.J., 2006, Corn silage versus grain sorghum silage as a supplement for growing steers grazing high quality pastures: Effects on performance and ruminal fermentation. *Animal Feed Science and Technology*, Vol.127(1-2):33-43
- [2]Bilteanu Gheorghe, BirnaureVictor,1989, *Phytotechnics*, Ceres PublishingHouse, Bucharest, pp.255-268
- [3]Carter, P.R., Hicks, D.R., Oplinger, E.S., Doll, J.D., Bundy, L.G., Schuler, R.T., Holmes, B.J., 1989, *Grain Sorghum (Milo)*, Alternative field crops Manual
- [4]Crop Plant Resources, August 24, 2000, Sorghum: *Sorghum bicolor*
- [5]Cultura sorgului- Sorgul pentru boabe sau zaharat- o planta mult prea rara pe la noi, <http://forum.softpedia.com/topic/641261-cultura-sorgului-sorgul-pt-boabe-sau-zaharat>
- [6]Dragomir Nicolae, 2009, *Sorgul-Sorghum bicolor (L.)Moench*, Tehnologii agricole, April 3, 2009
- [7]Grain, World Markets and Trade, USDA, Sept.2014
- [8]Grassi Giuliano, Low cost production of Bioethanol from Sweet Sorghum, European Biomass Industry Association, <http://www.sseassociation.org/Publications/giulianogradi>
- [9]MihaiAdrian, 2013, Euralis mizeaza pe viitorul stralucit al sorgului, *Profitul agricol*, 8 oct.2013
- [10]Moga Iuliu, Schitea Maria, Mateias Mihail, 1996, *Feed crops*, Ceres Publishing House, pp.283-297
- [11]Pico, D., Pin., ., Vecchiet, A., Balducchi, R., DiNatale, G., Piscioneri, I., Fornasier, F., Mondini, C., Tomat, E., 2011, Sweet Sorghum: Integrated Bioethanol and Biogas production from a high water-use efficient energy crop, *European Biomass Conference and Exhibition Proceedings*, 19th EU BC & EP, 2011
- [12]Pico, D., Pin., Vecchiet, A., Alibardi, L., Sandon, A., Migliardi, D., Biogas production from by-products of the sweet Sorghum bioethanol chain
- [13]Romania's Statistical Yearbook, 2013, www.insse.ro
- [14]Sorg, Caussade Semences, <http://www.caussade-semences.ro/sorg>
- [15]Sorgul, A cincea cereala la nivel mondial, 2012, *Gazeta de Agricultura*, 15 sept.2012, <http://www.gazetadeagricultura.info/plante/cereale/13176-sorgul-a-cincea-cereala-la-nivel-mondial.htm>,
- [16]Sorgul-o alternativa hranitoare si ieftina la nutreturile de porumb, <http://agrintel.ro12680/sorgul-o-alternativa-hranitoare-si-ieftina-la-nutreturile-de-porumb/>
- [17]Sorgul zaharat, <http://biofuels.dbioro.eu/sorg.php>
- [18]Sorghum Area Planted for All Purposes and Harvested for Grain, Yield and Production-States and United States, 2011-2013, USDA Crop Production, 2013, Summary, January 2014, <http://usda01.library.cornell.edu/usda/current/CropProdSu/CropProdSu-01-10-2014.pdf>
- [19]Sorghum, US Grain Council
- [20]Sorghum, http://www.archive.gramene.org/species/sorghum/sorghum_intro.html
- [21]USDA, <http://indexmundi.com/agriculture/commodity/sorghum>
- [22]Voicu, I., Mircea Eugenia, Voicu Dorica, 2013, Recommendations for the use of sweet sorghum in ruminant feeding, *Annals IBNA*, Vol.29:87-95
- [23]Voicu, I., Mircea Eugenia, Voicu Dorica, Vasilachi Andreea, 2013, Evaluation ofthe enrgy andprotein potential of some drought-resistant plant hybrids (ensiled sweet sorghum), *Annals IBNA*, vol.29:23-28
- [24]Waniska, Ralph, D., Structure, Phenolic Compounds, and Antifungal Proteins of Sorghum Caryopses, Microsoft Academic Search, <http://65.54.113.26/Publication/12663278/structure-phenolic-compounds-and-antifungal-proteins-of-sorghum-caryopses>
- [25]Wikipedia, The Free Encyclopedia, Sorghum,<http://en.wikipedia.org/wiki/Sorghum>,
- [26]Wikipedia contributors, 2006, Sorghum, Wikipedia, The Free Wikipedia Encyclopedia, Retrieved May 18, 2006 from <http://en.wikipedia.org/wiki/Sorghum>

ECONOMIC GROWTH OF THE AGRICULTURAL SECTOR OF MOLDOVA COMPARED TO CENTRAL AND EASTERN COUNTRIES OF EUROPE

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Abstract

The main opportunities for the development of the national economy of the Republic of Moldova are closely related to the development of the agricultural sector. The agricultural sector remains a priority for Moldova because 30% out of the population are employed in this area, 75% of the country surface is agricultural land, and agriculture holds 13% of GDP. With these indicators, the agricultural sector can not be neglected. Undoubtedly our main effort should be directed towards the recovery of agriculture and increase the living standards of people from rural areas. It is necessary to review the huge opportunities for agricultural growth and rural areas by using both adequate investments and updating rural development strategies. Agriculture remains one of the most important sectors with huge possibilities and an unjustly neglected sectors.

Key words: agricultural sector, economic growth, economic development, GDP growth

INTRODUCTION

Any economic change, moreover in the agricultural sector, has as a purpose the development of the national economy, in other words the economic growth. Market economy gives priority to business enterprises, regardless of the branch of the economy it belongs to. The results obtained show positive or negative sides of the national economy, the national economy is viable if it can stimulate the organization and development of profitable business.

Economic growth, living standards increase, new investments, export promotion have become subjects of primary interest for the agricultural sector of Moldova, due to the country's agrarian character.

MATERIALS AND METHODS

As informative sources in the present process of investigation some information from Ministry of Agriculture and Food Industry, Intervention Agency and Payments of Agriculture, Financial Ministry, financial reports of National Bank and other economical-financial structures from the country and abroad were used. The basic methods of research used are analysis and synthesis, economical

comparison and statistic method.

RESULTS AND DISCUSSIONS

Reorganization implemented last decade in the agricultural sector is tough and progresses heavily. The results received are positive and negative, meanwhile the tasks are huge, taking into consideration challenges caused by European Union adherence.

Moldova is rich in natural resources necessary for agriculture, with fertile soils in most districts of the country. Although being a small country, Moldova is an agricultural giant compared to many European countries.

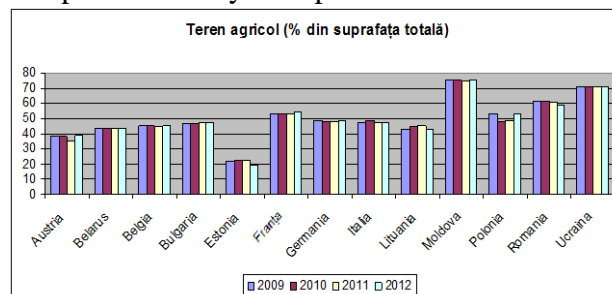


Fig.1. The area of agricultural land out of the total area of the state

Source: Data provided by <http://data.worldbank.org> and <http://en.worldstat.info>

According to National Bureau of Statistics (NBS), after the first General Agricultural

Census in 2011, Moldova with over 2,2 million hectares of agricultural lands just 1,9 mln. ha (87%), are used as agricultural land. Reporting the utilized agricultural area to the total area of the state we can say that Moldova has significant agricultural resources in Central and Eastern Europe with strong agricultural neighbours such as Romania and the Ukraine. Utilised agricultural area of Romania decreased by 4.5% between 2003 and 2010 and is 13.3 million hectares (61.8%). Italy with 12.88 million hectares is behind Romania. France is farther than Romania (27 mln.), Spain (23.7 mln.), Germany (16.7 mln.) and Poland (14.38 million.).

The number of farms in Moldova is 32% higher than in Germany (299,100 farms) 56% more than in France (514,800), while in Bulgaria the number of farms is 371.000 and 577.000 in Hungary. Romania, the country with the highest number of farms in the European Union (EU) in 2010 had 3.86 million agricultural holdings, which represented one third of the total at Community level. The number of farms in Romania decreased by 14% between 2003 and 2010, while in EU the decline was about 20% or around 12.05 million, according to Eurostat. The average area of one farm in the Republic of Moldova is 2.2 ha, including individual farms - 247.9 ha, and those without- 0.8 ha. This average is well below the average of farms in EU-25, which is about 16.0 ha.

Although agriculture is still important the number of employees in this sector states a decline. Since 2009, the number of people employed in agriculture has remained the same approximately 320-350.000 people and the main reason that caused people to remain in the sector was increasing the prices to agricultural products and recently improved trades conditions.

The labour employment rate in agriculture shows a down tendency in Central and Eastern Europe. According to the survey conducted by Eurostat in agricultural sector of EU 11.3 million employed people are over 15 years old which constitutes 5.2% of the total number of employees. Although employment in the Romanian agriculture is still one of the largest in Europe, the number of labour people in

agriculture area is decreasing slowly from 42% in 2000 to 28% in 2012 (2,42 million people). Other European countries with the greatest agricultural working potential are Poland (19.1% out of total EU-28) decreased by 7% between 2000-2012, Latvia (7%), Bulgaria (7%) Slovakia (-4%).

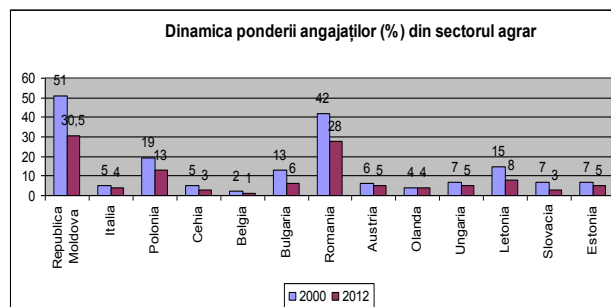


Fig. 2. Share of employees agricultural sector, % of the population (2012)

Source: Prepared by author based on data from the World Bank <http://data.worldbank.org/indicator/>

The agricultural sector has been and continues to be the cornerstone of the national economy representing over 50% of the national economy. The contribution of agriculture in GDP creation in the last five years is about 12% and overall industry processing agricultural raw materials, contributes over 25% to GDP and creates approximately 40% of total exports. The period between 2000 and 2011 has shown an average annual growth of 5% of GDP. The most significant influence on GDP growth had the value added in goods -4.5 % in agriculture out of total 5.5 %

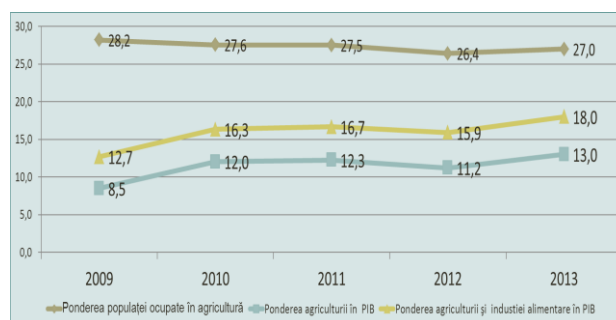


Fig. 3. Share of agriculture in GDP

Source: It's elaborated by the author on the basis of information from National Bureau of Statistics

GDP in 2013 consisted 100.311 billion lei (\$7.687 billion USA), increasing to 8.9% in 2012 (comparative prices). The percentage of

agricultural businesses in the Republic of Moldova is much higher than the share of agriculture in the global economy, which is somewhere in the 3 to 3.5% of world GDP.

In spite of considerable weight, the agriculture Moldova offered a limited support to economical growth in the last five years. The influence of the weather conditions severely limited the contribution of GDP in Moldova.

The role of agriculture in GDP declined in all Eastern European countries with an average of 10% in the last decade. This is not caused by the abridgment of business in agriculture, but it was caused by a slower growth than in other economical domains.

In the European Union (EU), according to the data provided by World Bank in 2012, the best in GDP was Bulgaria (6.4%), followed by Romania (6%), Croatia (5%), Latvia (4.4%). Moldovan agriculture demonstrates unstable growth which is much slower than in other sectors of the economy. One of the main reasons is the dependence of agriculture on natural conditions - drought has recently become a common destructive factor. Crop production is highly vulnerable to climate conditions: drought years 2007, 2009 and 2012, had a fatal effect on most crops.

Agricultural production incertitude is due to high risks in agriculture and underdeveloped tools for limiting them, dependence on climate conditions, irrigation system poor developed, low application of modern agricultural technologies and lack of new inventions in agriculture, such as index-based insurance programs for weather risks. Another reason that leads to agricultural production lagging is linked to the economic crisis, high prices of fertilizers, fuels, technologies and agricultural machines. This created difficult conditions for farmers and the development of agriculture as a whole.

Nevertheless in 2013 agriculture achieved an economical growth of 8%, in this way providing more than half of the total rise. The influence agriculture on economic growth in 2013 was 38%. The agricultural sector is the main area in Moldova, for the role it has in the national economy and the social role of it. Agriculture contributes significantly to the GDP

respectively, reduces gross value added in agriculture is critical for GDP growth.

Between 2008 and 2011 a slight increase in GVA was kept created by agriculture. In 2012 the gross value added in the goods sector declined by 10.7% compared with 2011, due to significant reduction in gross value added in agriculture and fishing, 23.3%, which is 10.9% of GDP. In 2013 a significant increase in agriculture was recorded, hunting and forestry; fishing to 41.0% compared to 2012. Gross value added in agriculture, hunting, forestry which was over 52.2% achieved in 2012 and GDP increased with 12.9%.

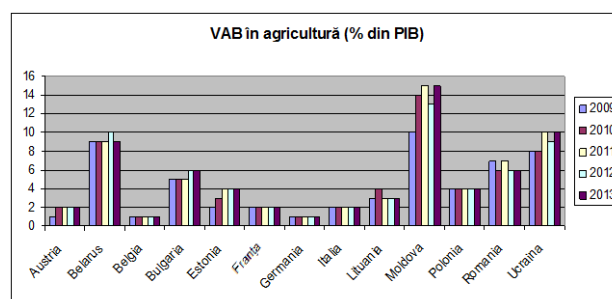


Fig. 4. Gross value added in agriculture
Source: Data provided by <http://data.worldbank.org>

We can see that the Moldovan agriculture has the largest share of national GVA compared to the countries of Central and Eastern Europe, despite the low level of productivity in the field. This is due to the high share of agriculture in the national GDP and high employment share in this sector.

The agricultural sector continues to have a substantial growth potential, yet underestimated, agricultural restructuring and revitalization of the rural economy represent major trends of economic development of the country.

According to a study of INSEE the French agriculture although highly developed lost about 5.4 of GVA growth and decreased from 7.9% in 1970 to 1.8% in 2013.

The same tendency is seen in Romania, where in early 2000s, the contribution of agriculture, forestry and fisheries GVA compared to the total gross value added was about 12%. Currently its development is decreasing, firstly dropping below 10% in 2005 and reaching the minimum levels of 6.5% in 2007 and 6% in

2013.

Value added in Romanian agriculture is half of EU -15, which leads to total agricultural production of about 1400-1500 euro / ha in Romania, comparing with 2400 to 2600 euro / ha in the EU-15.

Official statistics shows that Belgium is the country with the highest rate of added value per farm worker, \$ 10,904/farm worker in 2013 compared to 2009, followed by France with \$ 7,982, Italy with \$ 5,869 and Austria with \$ 5,130. In Moldova, the GVA is \$ 1,031 / farm worker for the same period.

According to the analyzed data the contribution of agricultural sector to GVA in accounted 15.52% in 2013, recording an increase of 2.32 times compared to 2008, or 232.68%.

This contribution is due to the steady increase in the value of agricultural production, besides 2012 which was highly unfavorable for agriculture.

Table 1. Changes in the value of agricultural output in GDP

Indicators	2009	2010	2011	2012	2013	Average annual growth
GDP, mln. lei	60430	71885	82349	88228	100311	7976,2
% from the previous	94,0	107	106,8	99,3	108	2,8
The value of industrial production, mln. Lei	22643	28140	34194	36362	38066	2402,9
% from the previous	78,9	109,3	109,5	98,1	106,8	5,58
The value of agricultural production, mln. Lei	13300	19873	22619	19922	24472	2234,4
% from the previous	90,4	107,9	105	77,7	138,3	9,58

Source: It's elaborated by author on the basis of information of National Bureau of Statistics

Value of agricultural production rise in GDP between 2009 and 2013 was averaged 9.58% annually. In 2013 it increased by 47.9%.

In 2013 the share of crop production in total agricultural production increased by 10% compared to 2012 which is 72% out of of the grain and vegetables - 29.0% (11.0% more than in 2012), technical culture - 17.6% (14.5% in 2012), potatoes, vegetables and melons - 8.0% (0.7% decrease from 2012), fruit, nuts and berries - 5.4% (6 7% in 2012), grapes - 9.1% (1,3% less than in 2012).

Analysis of the global crop evolution in all household categories in Moldova, agricultural production decrease is seen in 2012 compared with the previous year with 2,356 million lei, and in 2006 the increase amounted 6520 million lei.

Table 2. Evolutionary aspects of global crop production in all categories of households of Moldova

Indicators	Years					
	2007	2008	2009	2010	2011	2012
Agricultural production mil. lei	12825	16503	1330	19873	22619	20263
Including:						
Plant production mil. lei	7941	10600	7861	13616	15751	11346
Livestock production mil. lei	4509	5519	4987	5786	6347	8417
Absolute deviation of crop production, mil. lei	-1138	2659	452	471	521	500
Index (+,-) plant production, %	87	133	74	173	116	72
% of crop production in agricultural production	61,92	64,23	59,11	68,52	69,64	55,99
% of livestock production in crop production	35,16	33,44	37,5	29,11	28,06	41,54

Source: It's elaborated by author on the basis of information of National Bureau of Statistics

As a result the crop production was reduced with 4405 million lei in 2012 compared to 2011, but there is an increase in 2006 with 2267 million lei (24,97%) and animal raising decreased in 2012 compared with 2011 with 32.61%, whilst being doubled with 4139 million lei (2006).

In most analysed periods fluctuation in crop production is underlined in current prices, the effect on these critical fluctuations are caused by the drought. The highest rate of global growth production occurred in 2008 compared to 2007 with 28.68% where the crop production in current prices increased by 2659 million lei or 33.48%, but in 2009 a reduction in global production is seen in 2008 compared to 19.40% where global crop production at current prices decreased by 2739 million lei or 25.83%, also a reduction occurred in 2012 compared to 2011 by 10,42%, where global crop production at current prices decreased by 4405 million lei or 27.97%. Consequently there is crop production and reducing weight in the composition of agricultural production in 2007, 2009 and 2012. However comparisons vegetable output in current prices do not reflect

the actual volume change because it does not take into account the inflation.

Crop production in 2013 over the previous year was due to the increase of the average crops. Thus, the average products per hectare of maize increased by 2.5 times, soy - 1.9 times, sunflower and sugar beet - 1.8 times of each, wheat - 1.7 times, barley - 1.6 times, potatoes - 1.3 times.

So, in 2013 the share of production of agricultural enterprises was 44% (in 2012-35% in 2011 to 32%). Agriculture in Central and Eastern European countries is primarily a family activity (approximately 77.8% of workers). For example, in Poland, family farming is 97.02% out of the work done in agriculture, in France (51.58%), Hungary (90.45%) and Romania (97.04%). In Germany, individual and proper farms have 94.3% out of the total number of farms and covers 68.9% of the agricultural area. Approximately 4.0% of the farms are organized as partnerships.

Sales analysis of agricultural products is essential for assessing the role of the agriculture in the national economy and its market position. The table below reflects the progress achieved in sales between 2005-2013

Table 3. The evolution of sales revenue in the agricultural sector (mln. lei)

	2006	2007	2008	2009	2010	2011	2012	2013	a.2013 in % / a.2006
Total sales	117	149	175	146	178	190	212	232	+197,3
Agricultural sales	4,1	4,2	5,6	4,8	7,0	7,4	7,2	8,9	+215,46
%, of total sales	3,53	2,81	3,22	3,28	3,95	3,93	3,42	3,85	+0,32 p. p

Source: It's elaborated by the author on the basis of information of National Bureau of Statistics

According to the data presented in Table 3 we can conclude that the growth rate of sales revenue in the agricultural sector is almost always twice lower than the average in our country. As a result, the share of these overall total national income remains virtually unchanged, showing slight growth + 0,32 pp during the last 8 years. Also, in this period, for example, the revenue from sales of commercial enterprises (both wholesale and retail) increased from 42.5% in 2,007 representing 63,045.1 million to 82101.3 million lei or 46.3% in 2013. Annual growth rate of sales

revenue as the national economy in general and the agricultural sector in particular, is reflected in the figure below.

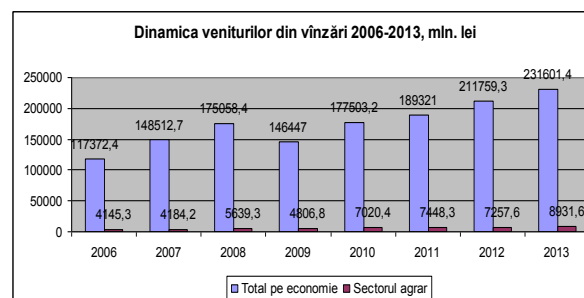


Fig. 5. Dynamics of income from selling agricultural products, 2006-2013

Source: Prepared by the author based on NBS

About 40 percent of these sales is sales revenue for their agricultural products. The largest increases in income have registered SMEs specializing in agriculture - 6.1 million lei in 2013, up from 1.2 million the previous year.

Table 4. Dynamics profit from sale of plant and animal agricultural enterprises in Moldova during 2005-2013

	No. agric. enterprises	No. profitable agric. firms	% profit agric. f	Profit of sale of agricult. products, thd lei		The growth rate of profit to one firm	
				total	for 1 enterprise	a fixed base	a mobile base
2005	1524	785	51,6	464178	304	100	-
2006	1522	765	50,1	436355	286,7	94,3	94
2007	1528	894	58,5	455741	298,3	98,1	104
2008	1527	1021	66,8	864025	565,8	186,1	189
2009	1575	736	46,7	270137	171,5	56,4	30,3
2010	1580	1149	72,7	985088	623,47	205	363
2011	1536	1110	72,3	132394	861,94	283,5	138
2012	1486	692	46,6	- 57832	- 38,91	- 12,8	- 4,5

Source: It's elaborated by the author on the basis of information of Statistical Yearbook

Analyzing the data we mention that throughout the period analyzed there is a slight upward trend in the number of profitable enterprises (except 2009 and 2012, years of crisis) until 2009. From 2010 till 2011, there is a 20% increase in the number of profitable enterprises than in 2005. This is explained by the increased productivity of cereals (wheat) per hectare and Moldovan agricultural production has become more competitive in international markets. Also, in this period the growth rate of exports exceeded imports of agricultural production. Another moment that had positive impact on profits of the agricultural enterprises was the creation of Payment and Intervention Agency in Agriculture in 2010, Ministry of Agriculture

and Food, which performs the administration and management of the funds for farmers. Agricultural income in Central and Eastern Europe experienced recently both positive and negative changes. The latest changes between 2011 and 2012 show that the index of agricultural income per unit of output rose by more than a quarter (27.8%) in Belgium, but decreased a lot in Romania (-27.1%), Croatia, Slovenia and Poland (from -10% to -14%).

Agriculture's contribution to value creation and GDP respectively, a function of two important factors: the number of workers and labor productivity.

As lowers employment in agriculture, productivity increases. In our view, given that the potential for land expansion will soon be exhausted, continuing agricultural growth will have to come from increased productivity.

In most cases, the differences between the national average and productivity in agriculture are based on structural causes.

In general, however, the contribution of agriculture to total gross value added in the economy is apparently lower due subsistence and employment and consumption patterns in the various countries. The background to reduce the number of employees, the main sources of growth remain productive capital and total factor productivity, both improved slightly in recent years.

CONCLUSIONS

Undoubtedly our main effort must be directed to the recovery of agriculture and raising the living standards of people living in the rural areas. It is necessary that all opportunities for agriculture growth and rural areas to be reviewed and used both by adequate investments and the development or updating of integrated rural development strategies. Moldovan agriculture remains one of the sectors with the most significant growth potential and one of the unjustly neglected sectors. Thus, knowledge of the mechanisms of intervention in the agricultural sector policy development and effective use of agricultural practices of the developed countries is a necessary prerequisite to build a proper market economy.

REFERENCES

- [1] Statistical Yearbook, 2005-2013
- [2] National Bureau of Statistics, www.statistica.md
- [3] <http://data.worldbank.org>
- [4] <http://en.worldstat.info>
- [5] <http://data.worldbank.org/indicator/>
- [6] www.aipa.md
- [7] www.maia.gov.md

SYSTEMS OF SOCIAL PROTECTION IN THE ROMANIAN RURAL AREA

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Abstract

The system of social protection represents the set of actions, decisions and measures enterprised in society for the prevention, diminution or the removal of the consequences of some events considered as social risks. At present, the actions for social protection are conceived for ensuring a basic living standard for all people, regardless the means of which they dispose and has in view the social living conditions. The paper employs a quantitative and a qualitative analysis, using the data from governmental and non-governmental sources. The results reveal one of the lowest levels of expenses for social protection in the rural area, and the social assistance services in the rural area are also affected by the socio-economic context and by the general poverty both of the local budgets and of the State budget.

Key words: rural area, social assistance, social aid

INTRODUCTION

The concept of social protection is defining the policy of protecting the less-favoured population categories, by measures following the alignment of these categories at a decent life standard.

In conformity with the standards of the international bodies (UN, UNESCO) in establishing the living standard there are measured the following parameters: the material living conditions (employment, incomes, the working conditions, the dwelling, clothing etc) and the social conditions (health, education, culture etc).

According to the EUROSTAT methodology, the expenses for the social protection must cover risks as: health insurances, disabilities, old age, family/children, unemployment, dwellings, and social exclusion. The impact of the social programs is assessed on basis of three dimensions: the target of the allocation or the share of funds for social assistance of which the poor population benefitted; effectiveness or share of allocations in the mean of poor population's consumption and the degree of the covering or the share of the poor population receiving the respective allocation.

Social assistance is working following another principle than the social security: based only on funds coming from the state budget or from donations of volunteers and of international institutions. The assistance does not presuppose a previous financial contribution on behalf of the person assisted socially, it has at its basis the principle of solidarity and presupposes the assessment of the assisted person's needs.

MATERIALS AND METHODS

The whole information volume in this article was obtained through specific methods for the selective research, respecting all its stages from the methodological point of view: identification of the researched issue, research framework delimitation, information collection, data processing, analysis and interpretation drawing up the conclusions.

The office research also played an important role in the article, which consisted, on one hand, in the identification of other studies and articles on the same subject, and in the processing of some statistical data, on the other hand. Hence, the information sources used can be classified into governmental sources (statistical, ministerial and from research institutes), and into non-governmental sources (independent publications).

RESULTS AND DISCUSSIONS

The process of land restitution has placed the agricultural land in the ownership of the small sized households. A big part of those receiving land through the restitution process are lacking the education necessary, are lacking the experience, money means and even the physical capacity to practice a commercial agriculture.

With all these, the farm income (both in cash and in kind) is the most important income source for the rural households, after which there come the salary gains, the governmental transfers mainly pensions) and the performing of the social assistance (family allowances, aids and indemnities).

Because of the high degree of employment on own account in agriculture, the official nominal rate of unemployment in the rural area is much lower than amidst the urban population. Unemployment on long term is firstly an urban problem, while in the rural area the major issue is the underemployment combined with the low productivity of the present farming jobs [3].

The activity of social assistance at the level of the communes in the rural environment is reduced, many times, only to the work of the *social worker employed in the Town hall*. The work of the social workers is as more important, as the other forms of support offered by the community or the NGO sector, as are quasi-non-existent in most of the rural areas.

Beside the services offered by the representatives of the local authorities and those of the nongovernmental sector, the most important role in supporting the persons under difficulty comes to the *family* and, in a significantly smaller measure, to the *cult institutions*.

The support offered by the family in the social cases is very important but it is neither very important or sufficient and specialized, most of the times, being necessary alternative forms, as the services supplied by the institutions with attributions in the field, to permit an efficient support of the persons under difficulty.

Neither the religious (cult) institutions with a role in the delivering of social services at community level, although increasingly, can cover the lack of the institutionalized forms of support as those offered through the state bodies or of the nongovernmental organizations. This, as much more, as the activities of the cult organisms in the social field are far from the standards developed by organisms as *The Catholic Church in Italy*, for example [1].

Implication of the *nongovernmental organizations* in the social sector in *the development of projects and programs in the rural environment* is sporadic, even if, in the last years, together with the starting of European financings through the Operational Sectoral Program Human Resources Development it grew the number of such types of organizations, which are developing activities in the rural communities.

Also, we cannot speak yet about the existence of an important social role, which the NGO-s have systematically at the level of rural communities. The steps made in this respect until now are not enough and there remained many rural areas with deficient social services.

Development of the nongovernmental sector, represent, in this respect, the only viable modality through which it could be covered the void represented by the need for social services specialized, at the level of the rural communities. The barriers of such expanding can be identified both at the level of the rural communities, and at that of public policies in the field and of the access to finance.

The problems of infrastructure and the relationship with the local authorities are the main obstacles met at the communities' level, but these seem easily surmountable in comparison with the major problems in regard with the insurance with the necessary of finance for the projects' development.

The actions of the NGO-s with activity in the social sector in the rural environment are addressed to some specific target groups (unemployment, persons employed in the subsistence agriculture, roma population,

young people, and disabled persons) and are made of actions as:

- Support and counselling according supply for the integration on the labour market;
- The delivering of courses for professional formation free of charge to the persons coming from vulnerable groups;
- Organizing campaigns for media and information at the level of communities and of the public opinion;
- The foundation of some entities of social economy and the support for their activities ;
- The realization of studies and elaboration of strategies regarding the situation of the vulnerable groups and the ways to intervene at the level of the communities;
- Social services supply.

Implication of the nongovernmental organizations into the rural communities has in its centre:

- Supply of services of information and counselling for the beneficiaries coming from the groups socially disadvantaged;
- The services supply for professional orientation and for professional formation of the unemployed and the persons being in the search for a job.

Thus, the actions of the NGO-s with social activity in the rural are developing, generally, in a small area of activities, speaking about a niche specific for them. The increase of the NGO-s involvement can be realized only through the development of the schemes for financing which should support their activities or through the creation of organizations inside the community, to develop activities mainly within it.

Referring to the social services which can be offered to the old persons under difficulty, the aspects of interest are of the existence and functioning of the social canteens, 'economat' shops, the services for care at the domicile or in specialized institutions.

The presence of the social canteens in the rural is a sporadic one; only in 24.1% of the counties under research existing such suppliers in the rural, and 'economat' shops localized in communes are to be found only in two counties (Ilfov and Vâlcea). The explanation we can consider to be that in the

rural, the local people are procuring their food from their own household, which it should not justify, the foundation of such units in the villages. Nevertheless, there are food products processed, which anyhow the villagers 'import' from the urban, and their presence at accessible prices (the 'economat' shops) or even for free from the social canteen, would be in support of the old persons.

At the level of the communities in the rural, within the Town halls, the activity object of the social *protection activity* is made of the ensemble of measures, programs, professional activities, specialized services for the persons' protection, of the families, groups and communities with special problems, under difficulty and under a high degree of social risk, who do not have the possibility to realize through means and efforts of their own a normal and decent way of life.

The development of the villages depends on the economic progress of the whole society that is why any sectoral approach must take into account the larger frame represented by the general economic context. We cannot speak about the reduction of subsistence agriculture practicing, for example, in lack of the development of the lucrative opportunities in the other sectors of activity, which could increase the demand for labour. From this perspective, the overcoming of the economic problems at societal level represents the only viable way through which it can be produced the transformation of the economic profile of the villages. All the other measures coming in support of the development of the human capital, including through increase of the professional training of individuals, represent only secondary measures, which, in lack of the increase of the labour demand, cannot prove their efficiency.

The rural strategies dedicated to the sustainable systems for social protection comprise measures, actions realized in order to answer the individual, family, or group social needs in view of preventing and overcoming of some difficulty, vulnerability or addiction situations, for the prevention of marginalization or social exclusion in the goal of increasing the life quality.

The strategic orientations of the rural space, which, through the effects of the implementation, convergent and integrant, are based on the improvement of the conditions of the rural employment, on the reduction of economic and social fragility, specific for the unemployed population [2]:

- creation of a rural society based on the social inclusion by taking into consideration to the rural solidarity between generations and the ensuring of the increase of the rural life quality as a condition of the sustainable individual welfare;
- the formation of the rural labour market, adjusted to the requirements of the ratio demand-supply;
- the promotion of the access of the young people to the labour market and the consolidation of the status of professional formation, of the stages and apprenticeships;
- the accelerated modernization of the education systems and professional formation of the rural population.

CONCLUSIONS

In the last decades, the world of the Romanian village was in a continuous process of transformation which leads to the modification of both the specific of the rural localities, and of the demographic, occupational and value coordinates of the population. An important part of the employed population has insecure jobs, seasonal ones or even occasional, from which they obtain small incomes (mostly in kind), uncovered by the system of social security, health and unemployment relief.

Social assistance must ensure the respecting of the persons' rights as they are regulated in the treaties and in international conventions which Romania ratified and through which it engaged itself to promote, either directly, or by cooperation with the nongovernmental organizations, measures adequate, destined to persons (young, old or with problems) in order to permit them to remain full members of the society, to dispose of sufficient resources for a decent existence, to be able to actively participate on the public, social and cultural life, to decide upon their own life, to

live an independent existence, as long as possible, in the usual environment; to have the necessary services for care, in function of the individual needs, and for the persons under institutionalized regime, a proper existence to be ensured.

In this framework, social assistance, component of the social protection system, has in view the ensemble of institutions and measures through which the State, the public authorities of the local public administration and the civil society ensure the prevention, limitation, or the outgiving of the temporary or permanent effects of some situations which could generate the marginalization or social exclusion of some persons. It has as main objective the protection of the persons, who, due to some reasons of economic, physical, psychic or social nature, do not have the possibility to ensure the social needs, to develop their own capacities or competences for the social integration.

To the social need with an economic aetiology it can be answered only by interventions, in which the social benefits are covering the necessary wished for a minimum standard of living. The services in the field of social assistance are specific for the needs provoked by personal incapacity or addiction. When between the social assistance and social change it is not established a tight relationship, there can emerge serious problems coming from the users, from those offering a support, from the practice people, from the managers and the organizations-suppliers of social services.

REFERENCES

- [1]Mihalache, F., Croitoru, A., 2011, Mediul rural românesc: evoluții și involuții. Schimbare socială și antreprenoriat, Editura Expert, București.
- [2]Oțiman, P.I. (coord.), 2011, Alternativele economiei rurale a României: dezvoltarea agriculturii sau insecuritate alimentară și deșertificare rurală severă, Editura Academiei Române, București.
- [3]Steriu, V., Oțiman P.I. (coord.), 2013, Cadrul național strategic pentru dezvoltarea durabilă a sectorului agroalimentar și a spațiului rural în perioada 2014-2020-2030. Cadrul național strategic rural, Editura Academiei Române, București.

GREEN PRICES – A REFLECTION OF ENVIRONMENTAL PROTECTION

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Abstract

The price is generally a very important factor in taking the purchase decision; it will influence the acceptance or rejection of organic products. For those who believe market forces represent a path to sustainability, it is vital to include eco-costs in the product costs and, further, in their prices. Otherwise, consumption growth will result in a continuous degradation of ecosystems, taking into consideration that environmental costs are not reflected in the price. To what extent a company is considering the ecological policy will be reflected in its cost structure. Organic products, most of the times, will incur additional costs generated by preservation and improvement expenses for environmental. These expenses will be reflected in costs, the price will reflect the value of the main benefits required by the consumer.

Key words: cost, ecosystem, environment, price

INTRODUCTION

Paul Hawken emphasized the idea that "consumers are offered incomplete information because the business environment does not support the true costs of the product sold. When they will receive the correct information, not only about the price but also the cost, people will make smart and accurate decisions in order to improve their own lives, but also that of those around them"[4] This incomplete information refers to underestimation or exclusion of eco-costs (costs associated with environmental protection) from the unit cost structure, leading to the establishment of unrealistic prices.

MATERIALS AND METHODS

Based on the price role as an element of the marketing mix in order to provide an indicator of the transaction amount and additionally to reflect the sale terms through quantitative reductions, allowances, etc., we can sense its importance in shaping an environmental behaviour. Through price an offer from the seller to the buyer is being realized, which he can accept or reject.

The price is generally a very important factor in taking the purchase decision; it will

influence the acceptance or rejection of organic products. For those who believe market forces represent a path to sustainability, it is vital to include eco-costs in the product costs and, further, in their prices.[7]

Otherwise, consumption growth will result in continuous degradation of ecosystems, taking into consideration that environmental costs are not reflected in the price.

RESULTS AND DISCUSSIONS

To what extent a company is considering the ecological policy will be reflected in its cost structure. Organic products, most of the times, will incur additional costs generated by preservation and improvement expenses for environmental conditions (for e.g., only the firms in the EU spent annually approx. £ 30 billion for environmental protection and safety). [7]

These expenses will be reflected in costs, the price will reflect the value of the main benefits required by the consumer, all costs involved by classic marketing, all those costs that would confer environmental attributes (increased costs due to the introduction of eco-compatible materials, investments for the greening of processes and technologies investment (170 billion dollars was only the

amount needed by the U.S. to eliminate chlorofluorocarbons), additional costs required for complying with new environmental regulations (for e.g. expenses with the introduction of catalytic converters, reserves for additional costs for remediation, necessary in the situation where environmental disasters occur, costs associated with environmental taxes).

However, there are a number of savings connected to conferring environmental attributes generated by reducing the quantities of raw materials, materials, energy required to manufacture the product, the "dematerialization" of packaging, switching to cheaper fuel in achieving transport within the firm (for e.g. the use of unleaded petrol).

Prices for green products may be higher as a result of awards or compensation awarded to producers for their environmental efforts. For example, for every litre of organic milk taken by the English state from the farmers such an award shall be granted. It is granted if the cows are fed organic, feed produced without the use of chemical fertilizers, fertilizers, insecticides. [5]

Although, in general, there are higher prices for organic products, however this kind of products can lead to significant savings during use (for e.g. economic bulbs, besides the fact that they have a much lower energy consumption, they have a much longer life - seven times higher than ordinary bulbs).

In making decisions regarding "green" prices, three key issues are required to be taken into account: the structure of unit costs, consumer perception, products and competitors' prices.

Unit costs play a crucial role in pricing, they: quantify the expected unit cost per volume, set the lower limit of the price, represent one of the two factors involved in determining profit. Profit is a key criteria of the economic activity, setting unrealistic costs or setting them incorrectly (by not performing and not including eco-costs), generates false signals about what is profitable and what is not.

Most of the times the prices of organic products are higher, due to the inclusion of environmental costs.

In this context, Ken Peattie makes a

significant statement which changes the view on the problem. He says: "The idea that organic products are somehow unusually expensive is probably an illusion. The reality is that "grey" products (traditional, ordinary) are unrealistically cheaper. Costs associated with environmental degradation in the case of "grey" products are not reflected in their prices, so that the environment provides a subsidy".[7]

The ratio beneficial fauna/pest fauna indicates the equilibrium or non equilibrium state in the researched corn field and imposes applying the measures of amelioration that are adequate for a lasting economic development in the benefit and for the welfare of the entire community. [1]

Therefore, the issues to be considered and resolved are: identifying the numerous sources of eco-costs and developing ways in which they are allocated to products responsible for them. In order to solve the second problem it is necessary to reflect specific accounting, record them separately and not together with other expenses, in order to be considered in making decisions about the products that will be achieved, technologies and materials that will be used. Further more, regulations pressure, public opinion, organization commitments towards community make this separate and distinct efforts evidence necessary for the protection of the ecosystems. [2]

As pointed out by Philip Kotler, "ultimately the consumer will decide if the product price is right." He believes the value consumer perception as the key to pricing. It has the essential role and not the seller's costs. Pricing oriented to the consumer means knowing the value it assigns to benefits obtained through the consumption or use of the product. [6]

The value perceived is given by the relationship between the perception of primary and secondary benefits and monetary sacrifice. [3]

Consumers make the buying decision based on the perceived benefits. Usually, the environmental benefits take the form of intangible promises on further improving the quality of life, they are usually secondary

benefits and consumers are not concerned in particular. They are rated favourably if any, but not vital if they don't exist.

In addition, consumers may not have the necessary know-how about the environmental attributes or not to inquire about them and then we can not speak of any association between perceived value and perceived environmental attributes and the number of those who would pay more for organic products is small. However, experts agree that increasing the level of education, of knowledge regarding environmental issues; environmental attributes are transformed into purchase decision making factors, when price and quality are perceived as equal for more alternatives. [7]

Another important element to be considered when setting up prices are competitors decisions, prices and costs. Organic products and their prices will be competitive with conventional ones, so they will have to deal with strong competition. With similar products perceived as having the same quality and the same price, the environmental attributes can become elements that are considered in the purchase decision, becoming a competitive advantage. The consumer can then say to himself that he did the right thing by choosing organic products without having to pay a higher price and without compromising the primary benefits.

But also based on the price charged by the seller, organic products can compete, so is the case of the supermarkets in Great Britain. [8]

In the UK, supermarkets are widely criticized as they practice for organic products higher prices than those charged by small retailers. At Tesco, the largest supermarket chain, organic foods are up to 63% more expensive, at Sainsbury's by 59%, at Waitrose's by 38% (Eurofood, 2002). Obviously these higher prices can estrange consumers from organic products, and the number of clients served by supermarkets is higher compared to the clients represented by small specialized retailers.

CONCLUSIONS

To what extent a company is considering the ecological policy will be reflected in its cost

structure.

In making decisions regarding "green" prices, three key issues are required to be taken into account: the structure of unit costs, consumer perception, products and competitors' prices. Another important element to be considered when setting up prices are competitors decisions, prices and costs. Organic products and their prices will be competitive with conventional ones, so they will have to deal with strong competition. With similar products perceived as having the same quality and the same price, the environmental attributes can become elements that are considered in the purchase decision, becoming a competitive advantage. The consumer can then say to himself that he did the right thing by choosing organic products without having to pay a higher price and without compromising the primary benefits.

REFERENCES

- [1]Antonie Iuliana, 2012, The economic importance of the epigeal fauna in the corn agricultural ecosystem in Ocna Sibiului in 2012, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development Vol. 13
- [2]Ditz Daryl, Ranganathan Janet, Banks Darryl, 1995, Environmental Accounting, in Green Ladgers: Case Studies in Corporate Environmental Accounting, Baltimore, MD: World Resources Institute
- [3]Fuller, D., 1999, Sustainable Marketing. Managerial-Ecological Issues, Sage Publications, California
- [4]Hawken Paul,1993, The Ecology of Commerce: A Declaration of Sustainability, New York, Harper Collins
- [5]Iosif, G., Bran, F., Manole, V., Iosif, S., Stoian, M., 1999, Ecomarketingul societăților comerciale, Editor Tribuna economică, București
- [6]Kotler Philip, Saunders, J., Armstrong, G., Wong, V., 1999, 2013, Principiile Marketingului, Ed. Teora, București,
- [7]Peattie Ken, 1995, Environmental Marketing Management, Pitman, London
- [8]http://articles.findarticles.com/p/articles/mi_m0DQA/is_2002_Jan_31/ai_82737486http://articles.findarticles.com/p/articles/mi_m0DQA/is_2002_Jan_31/ai_82737486

STUDY ON NOISE LEVEL GENERATED BY HUMAN ACTIVITIES IN SIBIU CITY, ROMANIA

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Abstract

In this paper I have proposed an analysis and monitoring of the noise sources in the open spaces of air traffic, rail and car in Sibiu. From centralizing data obtained from the analysis of the measurements performed with equipment noise levels, we concluded that the noise and vibration produced by means of Transportation (air, road, rail) can affect human health if they exceed limits. Noise is present and part of our lives and always a source of pollution as any of modern man is not conscious.

Key words: air traffic, car traffic, noise level, rail traffic

INTRODUCTION

The purpose of this study is to determine the impact of noise in Sibiu, air traffic noise, rail and car. Measurements were performed in noise levels inside the Sibiu International Airport on takeoff and landing runways passenger aircraft. Noise levels within the airport can adversely affect comfort and health status of the population in the area of its site. As a result of expansion and modernization works Sibiu International Airport, air traffic held him known changes to increase the number of air flights and increasing transmission capacity aircraft that serve.

We can also say that the noise produced by road traffic in Sibiu have the same environmental impacts as those produced by air traffic ie direct effects on health, eg auditory system disorders, but also indirect effects such as psychophysiological stress, chronic heart disease, sleep disturbance and impact on morbidity and mortality. Car traffic was monitored in several busy intersections in the city of Sibiu.

Rail traffic is 10% of total transport emissions noise in Sibiu. The noise comes from the engines (especially diesel), the friction of the wheels on the rails, and whistle blowing. In addition, when the train is moving at high speed, noise is more important than

areoacoustic other sources. Depending on the aerodynamic train noise emissions are 50-80 times the logarithm of train speed and become significant at speeds greater than 200 km/hour[1]

Dose-effect and Schultz equation provides a statistical picture of population severely affected by traffic noise from above. This parameter includes seven classes of noise assessment [2,4].

Scientific evidence shows that the discomfort caused by noise from transport sources is different depending on the mode of transport. Usually at an equal level equivalent continuous sound pressure and noise of an airplane is more annoying than road noise, especially at medium to high levels[5]. .

So that we can get an idea of all that is noise pollution caused by human activity in Sibiu, I proposed in this study to monitor noise from outdoor concerts organized by the City of Sibiu, and fireworks in Venue Theatre Festival.

The values obtained in this study come from an average of measurements performed during the hours of monitoring of each event.

MATERIALS AND METHODS

In order to monitor noise sources in spaces open site of Sibiu, I used a Digital level (**Fig.**



1) meter equipment profile GLX-exploration (Fig.2) unit that was attached to sensor measurement noise. To get a more complete picture of the sources and noise from Sibiu, we collected samples from various locations and areas of the city, we

performed measurements of noise from road, rail and air. Measurements were inside International Sibiu Aeroport, railway train station and various intersections with heavy car traffic, all from Sibiu. Other events were monitored and outdoor concerts unhold Great Square in Sibiu, fireworks and cultural events at the Festival Theatre.

The device used for measurement noise levels, is fitted Engineering and Environmental Laboratory in Agriculture and I used it at work practical discipline of environmental pollution sources (Table 1). Digital sound level meter is a digital device for measuring the level of sound waves in decibels (dB).

The sound level meter is used for measuring the sound source intensity of 40-130 dB. It is a device for checking the sound sources or simple measurements of ambient noise.



Fig. 2. GLX-explorer

RESULTS AND DISCUSSIONS

The purpose of this study is to determine the impact of noise inside the Sibiu International Airport on takeoff and landing runways passenger aircraft. Noise levels within the airport can adversely affect comfort and health status of the population in the area of its site. As a result of expansion and

modernization works Sibiu International Airport, air traffic held him known changes to increase the number of air flights and increasing transmission capacity aircraft that serve (Table 2).

Table 1. Sibiu – Stuttgart BluAir, Aircraft B737 class 300, Race 329, 16.03.2013/time 09:05-09:15

Locatione	Measured values (dB)				Measurement conditions / Sources of noise	Terms Weather
	LEQ	SPL	MIN	MAX		
Sibiu airport runway - distance 5m wing aircraft	70	64,3	75	85,7	Noise	17° C, , partly cloudy, light wind
	84,4	68	88,9	96,2	Off	
	90	69,7	94,1	106	Off	
	91	63,7	95	108	noise	

Table 2. Disturbance index takeoff aircraft

Locatione	Leq measured (dB)	Index disruption R	Appreciation class noise
Sibiu airport runway -at different distances from the aircraft wing	70	4,77	very noisy
	84,4	5,9	traumatic
	90	6,70	very traumatic
	91	6,79	very traumatic

We can say that road traffic noise have the same environmental impacts as those produced by air traffic ie direct effects on health, eg auditory system disorders, but also indirect effects such as psychophysiological stress, chronic heart disease, disorder sleep and impact on morbidity and mortality (Fig. 3, Table 3).

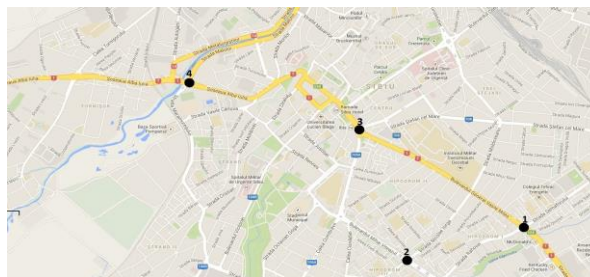


Fig. 3. Map intersections monitored

1-Intersection Semaforului Street with V.Milea Avenue,
2-Intersection M.Viteazu Avenue with N.Iorga Street,
3-Intersection Piata Unirii,
4-Intersection Alba Iulia Street with Malului Street and Maramuresului Street.

Table 3. Noise monitoring in various intersections in Sibiu

Locatione	Measured values (dB)		
	Day		
Intersection Semaforului Streed with V.Milea Av	LEQ	1. IN	2. AX
	80,2	79,1	89,4
	79,3	76,8	85,3
	70,2	69,5	75,6
Intersection M.Viteazu Av with N.Iorga Streed	LEQ	MIN	MAX
	84,4	77,2	84,1
	90	75,3	81,3
	91	67,3	71,4
Intersection Piata Unirii	LEQ	MIN	MAX
	89,4	79,6	91,3
	85,3	75,5	87,2
	75,6	70	77,2
Intersection Alba Iulia Streed with Malului Streed and Maramuresului Streed	LEQ	MIN	MAX
	85,3	80	92
	83,7	78,6	89,4
	80,7	71	79,2
Evening			
Intersection Semaforului Streed with V.Milea Av	LEQ	MIN	MAX
	82,1	78,2	85,3
	76,7	75,6	83,7
	79,6	74,8	80,7
Intersection M.Viteazu Av with N.Iorga Streed	LEQ	MIN	MAX
	79	74,3	82,3
	77	72,4	80,5
	75,3	70	76,3
Intersection Piata Unirii	LEQ	MIN	MAX
	74,4	77,2	87,3
	70	75,3	85,3
	66,6	67,3	82,5
Week-end			
Intersection Semaforului Streed with V.Milea Av	LEQ	MIN	MAX
	78,2	74,4	88,3
	82,4	70	87
	64,8	66,6	78
Intersection M.Viteazu Av with N.Iorga Streed	LEQ	MIN	MAX
	85,3	74,6	85,3
	83,7	71	84,2
	80,7	67,6	75
Intersection Piata Unirii	LEQ	MIN	MAX
	77,2	78,4	89,2
	75,3	74,3	88,1
	67,3	70,2	79,3
Intersection Semaforului Streed with V.Milea Av	LEQ	MIN	MAX
	79,6	79,6	93
	75,5	76,2	90,2
	70	71,1	82,1

Noise Impact largest rail operations are in urban areas, where most functions are performed transshipment. In addition, rail terminals are often located in areas with high density inner cities (Table 4).

A recent study shows that 35% of children aged 7-18 years have loss of hearing ability. This is due, in most cases, musical performances in an orchestra, wearing headphones or participation in noisy concerts.

A big threat is the ear and stereo music stations, whether at home, at a concert or a disco.

Table 4. Noise monitoring of the train station in Sibiu

Pct. determining	Location	Measured values (dB)			Measurement conditions / Sources of noise
		LEQ	MIN	MAX	
23.04.2014/ora 14:35-14:45					
1.	Mare Station Sibiu	80,7	82	95	Train-Săgeata Albastră
		71,7	69,7	74	Stay train
		93,1	89,3	103,6	train Staff
		76,1	77,4	83,5	Stay train

Dangerous hearing explosions tires are cars or trucks, and fireworks.

So that we can get an idea of all that is noise pollution caused by human activity, I proposed in this study to monitor noise from outdoor concerts organized by the City of Sibiu, and fireworks during the festival International Theatre.

Values obtained in the table below come from an average of measurements performed during monitoring hours of each event (Table 5).

Table 5. Monitoring of other noise sources in urban

Pct. determining	Location	Measured values (dB)			Measurement conditions / Sources of noise
		LEQ	MIN	MAX	
27.05.2014/ora 21:35-23:45 (concert), 6.06.2014, ora 24:00-24:10 (foc de artificii)					
1.	Sibiu city	101	111,3	118,5	Concert
		98,7	99,4	106	background noise
		115	117,5	119,3	Concert
		93,4	98,3	108	background noise
		97	92	101,1	fireworks
		80,1	78,1	98,3	background noise
		95	98	104,9	fireworks
		82,5	84,2	96,5	background noise

CONCLUSIONS

As a result of this study, the following conclusions can be drawn:

- Noise from aircraft monitoring was higher during takeoff and lowest during landing. According to measurements made noise levels, Sibiu International Airport runway, values equivalent continuous noise from aircraft landing stood around 90-106 dB (A)

values for the discomfort index R is in the class of appreciation "traumatic and very traumatic. "Under Government legislation 674/2007 on "Evaluation and management of ambient noise" results from measurements are above the limits, so we refer to noise[5, 7].

-The values of noise levels have been taken from Mare in Sibiu Station can compare noise and train train Blue Arrow Personnel 19102. According samples 19102 Personal train noise is greater than the product of Blue Arrow, so it is recommended to train more frequently use Blue Arrow.

-The analysis of data collected and processed in the field can see that traffic is very busy in Sibiu, the number of vehicles is high strength, noise level is above the allowed limit (of measurements was sometimes exceeded 100 dB) less especially during peak hours. Noise highest occurred in intersections monitored day between 7.30 to 8.30 am in the morning, afternoon and in the days between the hours of 15.30 to 17.30 free weekend.

-Other sources of noise pollution were monitored artifice fires and outdoor concerts. The data collected and analyzed, we could see that the values have deposit limits, sometimes skipping threshold 100dB and why we consider such events as noise pollution[6].

To protect the inner ear and auditory system, by monitoring challenging noise sources can make the following recommendations:

- Avoiding consecutive noisy activities.
- Using station stereo music listening at normal limit without becoming annoying. Offering ears a break.
- Protecting your ears with earplugs or headphones when special equipment and powerful machines are operated. Measuring the intensity noise of a band or musical group and protecting ears when they are too high.

By including education classes in the school of information about the dangers posed to the hearing due to noise. If a child has been exposed to loud noise, hearing should be tested immediately.

It is recommended that each family member to have made at least one hearing test. In children it is recommended that this test be done before the start of school. People at risk

of losing their hearing test should go to this every year[3]. These include those working in loud noises long term newborns with family history linked to hearing loss, infants and children with ear infections that have lasted more than three months, and anyone over 40 years.

REFERENCES

- [1]Ciobotariu, V., Socolescu Ana Maria, 2008, Poluarea și protecția mediului, Editura Economică București.
- [2]Dorobont, A., Costin A., 1982, Poluarea sonoră și civilizația contemporană. Editura Tehnică, Bucuresti.
- [3]Iorga, I. , Ciodaru, M., 1983, Măsurarea zgomotelor și vibrațiilor în tehnică. Editura Tehnică București.
- [4]Rojansch, V., 2002, Protecția și ingineria mediului, Managementul mediului, Editura Economică Bucuresti.
- [5]Ursoniu, C. , Dumitrescu, C.,1976, Poluarea sonoră și consecințele ei, Editura Făclia.
- [6]Văiteanu, D., Darabont, Al., Iana, M., Munteanu, M., Costescu M., 1983, Circulația și poluarea sonoră a mediului urban, Editura Tehnică București.
- [7]Vișan, S., Angelescu, A., Alpopi, C., 2000, Mediul înconjurător-poluare și protecție. Editura Economică București

DIVERSITY AND THE MAIN ECOLOGICAL REQUIREMENTS OF THE EPIGEIC SPECIES OF FOREST ECOSYSTEMS IN THE SIBIU COUNTY, IN THE YEARS 2013-2014

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Abstract

Epigeous insects in the “Dumbrava Sibiului” oak forest were captured between 2013-2014. From April to September in each year. 12 traps were installed in a circle 147 individuals collected belonged to 28 species and 6 families: Carabidae – 14 species (50.0%), 187 individuals (77.37 %), Staphylinidae – 7 species (25.0 %), 15 individuals (6.17 %), Silphidae – 3 species (10.72 %), 29 individuals (11.93 %), Elateridae – 1 species (3.51 %), 1 individual (0.41 %), Scarabaeidae – 2 species (7.14 %), 8 individuals (3.29 %), Forficulidae – 1 species (3.51 %), 2 individuals (0.82 %)). Also, we presented in tables the ecological requirements of the species of Carabidae collected, the variation of their relative abundance and the structure of dominance Composition of species corresponded to communities from drier forms of irregularly flooded the floodplain forests with decreased level of ground water, known from Central Europe.

Key words: abundance, dominance, ecological requirements, entomofauna, Forest “Dumbrava Sibiului”

INTRODUCTION

The faunistic and zoogeographic direction is represented by a plenty of earlier works. Some of these also include the biological characteristics of species [1, 9, 10, 11, 12, 13, 14-16, 18-21]. The second direction of research is oriented of structure of *Carabid* communities in a wide scale of natural and artificial ecosystems.

Some papers on carabids from mixed forests in Moldova (Romania) were published by Solomon L., Varvara M., (1986) [17] and also Varvara (2004, 2005) [19, 20]; while those in beech forests and in coniferous forests and besides it some collaborators published many papers on structure of the carabid communities in the field of potatoes, sugar beet, wheat, maize, sunflower, clover and in apple orchards in Moldova. The observations on the taxonomic composition and ecological structure of populations of *Carabidae* in the same forest ecosystems are published in the other papers [17,18,19,20,21,22].

The carabids in Romania were studied in two basic directions, one purely faunistic

(zoogeographic) and the other one ecologic and coenotic.

The aim of the present paper is the faunistic and ecologic evaluation of the epigeic insects collected in the “Dumbrava Sibiului” oak forest.

MATERIALS AND METHODS

The insects were collected in the Dumbrava Sibiului oak forest (Fig. 1) situated in the Municipality Sibiu, in Sibiu County, at the contact between the Cindrel Mountains and the sediments of the piemontan plaine and hills in the S of the city Sibiu. „Dumbrava Sibiului” (GPS: 45°44'35''N, 24°05'51''E) has a surface of 978 ha and it is distributed in four forests (Fig.2).

The traps were set in a circle of 12.5 m diameter. The traps were put in the first decade of April, 2011, 2012 till September and were emptied twenty times.

The species dominance is characterized by the following scale: eudominant > 10 %, dominant species 5-10%, subdominant 2 - 5%, recedent 1 -2 % and subrecedent < 1 %. They were

installed 12 pitfalls having the capture possibilities of 29.37% from the circle circumference [5,15].

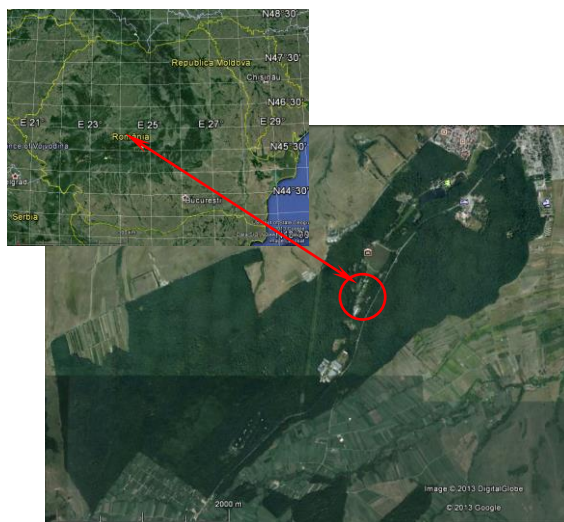


Fig. 1. The satellite map of the "Dumbrava Sibiului" oak forest, the circle mark the study plot (after <http://maps.google.ro>)

The species dominance is characterized by the following scale: eudominant > 10 %, dominant species 5-10%, subdominant 2 - 5%, recedent 1 -2 % and subrecedent < 1 %. They were installed 12 pitfalls having the capture possibilities of 29.37% from the circle circumference [15].

In order to attract the insects inside the trap, at the aperture of every collector bottle a funnel made of a thin of a sheet of PVC, dark colored.



Fig. 2. Interior of the study plot in the oak forest

RESULTS AND DISCUSSIONS

In the "Dumbrava Sibiului" oak forest, Carabid were represented by 188 individuals (77.37%) belonging to 14 species (50% of species collected). Four species were eudominant (*Pterostichus oblongopunctatus*,

Platynus assimilis, *Pterostichus niger* and *P. melanarius*) whose number of individuals ranged from 29 (13.89%) (*Pterostichus melanarius*) to, 60 (31.91%) (*Pterostichus oblongopunctatus*). Four species were subdominant (*Carabus violaceus*, *C. ullrichi*, *C. gigas* and *Harpalus latus*) and the remaining six species were recedent (Table 3). Table 2 the main ecological requirements of the species of Carabidae. Five species (35.71%) are spring breeders and three species (28.57%) are autumn breeders. In the spring 2012, the spring breeding *Pterostichus oblongopunctatus*, *Platynus assimilis* were captured in the period from 1 to 6 April.

According to the variation of moisture preferences, *Loricera pilicornis* is an eurytopic mesohygropilous species, particularly typical for initial stages of succession of vegetation cover. *Carabus scheidleri* is mesohygropholius, preferably forests species, but it is able to survive succesfully in open landscape. *Carabus ullrichi*, *Carabus coriaceus*, *Carabus gigas*, *Pterostichus oblongopunctatus* are mesohyrophilous forests species, *Carabus violaceus* and *Pterostichus melanarius* are moderately hydrophilous. *Carabus violaceus* is primarily a forest species, but at higher altitudes it is able to colonize high stands of grasses. *Pterostichus melanarius* is a eurytopic species abundant in floodplain forests, in fields and in to certain degree also in moutain forests. *Platynus assimilis* and *Pterostichus niger* are hygrophilous species typical for floodplaun forests and one. *Harpalus latus* and *Anisodactylus binotatus* are open landscape species. *Harpalus latus* is mesohydrophilous, while *Ansisodactylus binotatus* prefers increased humidity and heavy soils.

In total, during 2013-2014 there were collected 147 individuals of 28 species of epigeic insects of the "Dumbrava Sibiului" oak forest belonging to two orders (*Coleoptera*, five families *Dermaptera*, one family), (Table 1), among them 28 species. The families of *Carabidae* and *Staphylinidae* were represented by 75% and 203 individuals (83.54%). The other families (*Silphidae*,

Elateridae, *Scarabaeidae* and *Forficulidae*) were represented by 7 species (25 %) and 40 individuals (16.47%).

Most of species are zoofagous 78.57%. *Harpalus latus* and *Anisodactylus binotatus* are pantofagous. Most species are palaearctic in the “Dumbrava Sibiului” oak forest.

Table 1. The taxonomic structure of the epigeic insects collected from the Dumbrava Sibiului oak forest during 2013-2014

Families	Species	%	Individuals	%
<i>Carabidae</i>	14	50.0	92	77.37
<i>Staphylinidae</i>	7	25.0	15	6.17
<i>Silphidae</i>	3	10.71	29	11.93
<i>Elateridae</i>	1	3.57	1	0.41
<i>Scarabaeidae</i>	2	7.14	8	3.29
<i>Forficulidae</i>	1	3.57	2	0.82
Total	28	99.99	147	99.99

Table 2. Ecological and zoogeographic characteristics of Carabid collected in the Dumbrava Sibiului oak forest

Species	Reproduction	Hum.	Habit.	Food	Distribution
<i>C. gigas</i>		M	F	Z	
<i>C. coriaceus</i>	A	M.	F	Z	Eur.
<i>C. violaceus</i>	A	M	F, St.	Z	West Pal.
<i>C. ullrichi</i>	S	M	F	Z	Transpal.
<i>C. scheidleri</i>		M	F	Z	
<i>C. nemoralis</i>		M	F	Z	
<i>H. latus</i>	A	M.	F, St.	P	Transpal.
<i>P. niger</i>	plastic	M	E	Z	Transpal.
<i>P. melanarius</i>	Plastic	M	F	Z	West pal.
<i>P. oblongopunctatus</i>	S	M	F	Z	Transpal.
<i>P. assimilis</i>	S	H	F	Z	Transpal.
<i>Agonum</i> sp.					
<i>A. binotatus</i>	S	M	O	P	Westpal.
<i>L. pilicornis</i>	S	M	F	Z	Holarct.

Legend : Reproduction type: A = Autumn, S=Spring, P= Plastic; Humidity preference: M= Mesophilous, X=Xerophilous, H=Hygrophilous; Habitat preference: F= Forest, E= Eurytopic, O=landscape; Z = Zoophagous, P=Pantophagous; E= Europe, W = Westpalaearctic, T=Transpalaearctic; H= Holarctic.

Table 3. The dominance structure of the species of Carabidae in the Dumbrava Sibiului oak forest, Sibiu County

Dominance degree	Species	%	Individuals	%
Eudominant	4	28.57	150	79.79
Dominant	0	0	0	0
Subdominant	4	28.57	21	11.17
Recedent species	6	42.86	17	9.04
Subrecedent species	0	0	0	0
Total	14	100.0	188	100

CONCLUSIONS

Within an oak tree forest, the conditions of humidity are lower than within a beech tree

ecosystem. Comparing our results, as concerns the family of Carabidae, (species, percentages of individuals) with those of [2,3,4] in a forests of pedunculate oak (*Quercus pedunculatus*) sessile oak (*Quercus petraea*) in Republic of Moldova [2] collected 21 species of Carabidae, while we only 14 . Among them six species were common for these two forests, viz *Platynus assimilis*, *Pterostichus niger*, *P. melanarius* , *Carabus ullrichi*, *Harpalus latus* and *Carabus coriaceus*. Eight species (57.14 % of total species) were captured only in the Dumbrava Sibiului forest, while 15 species (71.42 %) only in the forest studied by [3].

The community composition reflects the position of the sampling site close to the margin of the forests and neighbouring fields, but the forest and eurytopic species predominate over the open landscapes species represented by *Harpalus latus* [48]. Presence of *Silphids* and *Scarabaeids* in the material results from the attractivity of the caught material in the traps for these necrophagous or coprophagous species.

The variation of percentages of the common species dominance in the two sites reflect more adequately the reality of locale conditions. Thus, The ”Dumbrava Sibiului”forest has better conditions of humidity for the forest is located in the Sibiu Depression with mountain influences in comparison with the “Plaiul Fagului” Reserve, located closer to Eastern steppe[2].

Pterostichus oblongopunctatus has a percentage of 31.43% in the “Dumbrava Sibiului”while in the “PlaiulFagului”it was not collected at all. The species *Carabus ullrichi* had a percentage of 10.95%, in the “Plaiul Fagului” and only 2.66 % in the “Dumbrava Sibiului”. Percentage differences are due to variation of the humidity in the two forests.

The following species of carabids, *Carabus coriaceus*, *Carabus violaceus*, *Carabus ullrichi*, *Pterostichus niger*, *P. melanarius*, *Harpalus* sp. were collected from crops near the forest, too, but in fewer individuals.

The species composition characterized by a high dominance of *Prerostichus niger*,

Pterostichus melanarius, *Platynus assimilis*, *Carabus ullrichi* and *Staphylinus erythropterus* is typical of dry types of floodplain forests in Central Europe (*Quercus Fraxineta*, *Ulmi Fraxineta carpineae*), [5,15,21,22]. In comparison with carabid communities in many other localities in lowlands and highlands number of species and individuals is extremely low and corresponds to the highly degraded communities [17] and corresponds to the urban parks with preserved seminatural vegetation and fauna, but isolated in the city. The collecting and analysing of 147 individuals during 2013-2014 in the "Dumbrava Sibiului" oak forest revealed that the epigeic entomofauna poor as in number of individuals as in number of species. The epigeic fauna of insects is composed of 96.42% Ord. *Coleoptera* and 3.57% Ord. *Dermoptera*.

Five *Carabid* species are springbreeders, and 4 species autumn breeders. The majority of species were forest species, mesophilic, zoophagous, Palaearctic.

The *Carabids* were represented by 14 species, 184 individuals, *Staphylinids* 7 species, 15 individuals, and *Silphids* by 3 species, 29 individuals, *Elateridae* 1 specie, 1 individual, *Scarabaeidae* 2 species, 8 individuals and *Forficulidae* 1 specie, 2 individuals.

The eudominant species of *Carabidae* were: *Pterostichus oblongopunctatus* *Platynus assimilis*, *Pterostichus niger*, *P. melanarius*. The percentage of individuals of eudominant species ranged from 29 (15.43 % *Pterostichus melanarius*) to 60 (31.43 % *Pterostichus oblongopunctatus*). 6 species were recedent.

REFERENCES

- [1]Arion, G., Panin, S., 1928, Prodromul faunei entomologice din România. *Coleoptera*. Buletin Agronomic. 5. Bucharest 6: 1-66.
- [2]Botnariuc, N., 1976, Concepția și metoda sistematică în biologia generală. Academiei RSR. Bucharest: 1-229.
- [3]Botnariuc, N., Vădineanu, A., 1982, Ecologie. Didactică și Pedagogică, Bucharest: 1-439.
- [4]Ciocchia, V., Stancă Moise, C., 2000, Contribuții la studiul structurii și activității entomofaunei epigeice într-o pădure de stejar Dumbrava Sibiului. Proceedings of 5th National Conference on Environmental Protection in Biological and Biotechnical Methods and Means and the 2nd National Conference Ecosanogeneză, 26-27 May 2000, Brașov, pp. 320-328.
- [5]Ciocchia, V., Stancă Moise, C., 2002, Contributions to the knowledge of the Macrolepidoptera from Natural Complex "Dumbrava Sibiului". Scientific session dedicated to celebrating 75 years since the establishment of Marine Biological Station "Prof. Dr. Ioan Borcea" Agigea-Constanta. 19-20 october 2001. Analele Științifice ale Universității „Alexandru Ioan Cuza” Iași. seria. Biologie Animală, 48: 29-43.
- [6]Fleck, E., 1904, Die Coleopteren Roumăniens. Buletinul Societății de Științe din București. 13(3/4): 308-346.
- [7]Fleck, E., 1905, Die Coleopteren Roumăniens. Buletinul Societății de Științe din București. 14(5): 491-570.
- [10]Hurmuzachi, C., 1901, Catalogul coleopterelor culese din România în anii 1899 și 1900 de membrii Societății Naturaliștilor. Publicațiile Societății Naturaliștilor din România. 2: 3-13.
- [11]Knechtek, W., Panin, S. A., 1944, Oekologisch-zoogeographisches studium an *Coleopteren* des rumänischen Faunengebietes. Académie Romaine, Études et recherches, 15: 1-219.
- [12]Panin, S., 1952, Familia *Cicindelidae*. Fauna R.P.R. Insecta, Academiei RPR. București. 10(1): 1-56.
- [13]Panin, S., 1955(1), Familia *Carabidae* (g. *Cychrus* F. și g. *Carabus* L.). Fauna R.P.R. Insecta, Academiei RPR. București. 10(2): 1-148.
- [14]Panin, S., 1955(2), Familia *Scarabaeidae* (*Coleoptera*). Fauna R.P.R. Insecta. 10(4), Academiei RPR. București. 68-70: 104-113.
- [15]Stancă Moise, C., 2006, The influence of grassland on the structure and the activity of *Carabidae* captured in the year 2005 in the natural rezervation Dumbrava Sibiului, Universității Lucian Blaga din Sibiu. Acta Universitatis Cibiniensis, Seria Științe Agricole, vol. 1, nr. 1(6): 132-140.
- [16]Teodorescu, I., Vădineanu, A., 1999, Controlul populațiilor de insecte, Editura Universității Bucharest, 18-34
- [17]Vădineanu, A., Teodorescu, I., 1987, Controlul pe baze ecologice ale populațiilor de insecte din agroecosisteme. Ocrotirea Naturii și a Mediului Inconjurător. 3(1): 25-31.
- [18]Varvara, M., Andriescu, I., 1986, Die Konstanz und Abundanz der Carabidae in der Zuckerrübenkultur der Moldau (Osten Rumăniens). Analele Științifice ale Universității "Al. I. Cuza", Iași. Biologie. Supliment. 32: 109-113.
- [19]Varvara, M., 2004, Variation of the species diversity of *Carabidae* (*Coleoptera*, *Carabidae*) in two vegetal associations in the Bârnova forest. Iași (East of Romania). Analele Universității "Alexandru Ioan Cuza", Iași. seria Biologie animală. Tom L: 117-139.
- [20]Varvara, M., 2005, Diversity and the main ecological requirements of the epigeic species of *Carabidae* (*Coleoptera*, *Carabidae*) from two types of forest ecosystems in the Suceava County (Moldavia). Entomologica Romanica Cluj, (10):81-88.
- [21]Varvara, M., 2008, Diversity and Main Ecological Requirements of the Epigeic species of *Carabidae* (*Coleoptera*, *Carabidae*) in the Ecosystem crop of sugar beet from Moldavia, 1981-2001. Lucrările Simpozionului "Entomofagii și rolul lor în păstrarea echilibrului natural", Universitatea "Al. I. Cuza", Iași: 175-192.
- [22]Worell, E., 1951, Contribuții la cunoașterea faunei coleopterelor și lepidoptrelor din Transilvania mai ales din împrejurimile orașului Sibiu. Buletinul Științific. Secțiunea de Științe Biologice. Agronomice. Geologice și Geografice, Bucharest: 3(3): 533-543.

PROMOTION AND MARKETING OF BUCHAREST - PRAGUE TOURS

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Abstract

This paper has as its theme the marketing and promotion of tourism circuit between Bucharest and Prague, unique area in the world because there is a harmonious combination of potential natural and cultural values and historical tourism which attracts many tourists. Also due to the geographical potential tourists coming to Prague can practice sports activities both winter and summer. Both natural resources and the human touch are important sights to attract more tourists in the area, and in Prague, the potential exists.

Key words: cultural tourism, marketing, potential, promotion, tourism circuit.

INTRODUCTION

To attract more tourists are practiced forms of tourism such as rural, cultural and environmental tourism.

Rural tourism has become slowly but consistently especially tourist markets in economically development of some countries. It is not a new phenomenon, with a long tradition in some European countries such as Switzerland, Austria, Sweden, where the link between rural households and travel the world, has always been pronounced. In Romania, unlike other developed European countries, the village has retained much of authenticity remains a well-integrated organization, based on many traditions and shared experiences in which every individual feels about the community to which it belongs [1].

Eco-tourism has its beginnings in North America in the mid-1980s as a result of tourism development wildlife lovers, in the most fragile and withdrawn the planet. National Tourism Authority of Romania has a concrete program of eco-tourism development, protection and conservation of natural and human tourism resources who is done in European programs aimed integrating in this way in the structure of the European Community [2].

Cultural tourism is currently part of an extraordinary development and diversification, both at European and international level as a result of political and economic opening of Central and Eastern European countries on the one hand and, on the other hand, due to competition between countries associated with ancient traditions in the form of tourism. Being specific countries with large tourist predispositions: natural and man makes can be found in our country. This is one of the reasons we chose for this circuit, the main form of tourism to *cultural tourism*.

MATERIALS AND METHODS

- ITINERARY: Bucharest - Pitesti - Arad - Budapest - Szentendre - Bratislava - Brno - Prague - Dresden - Karlovy Vary - Vienna - Budapest - Arad - Sibiu - Pitesti - Bucharest
- Price: from 275 euros per person
Duration: 7 DAYS
- Departures: 26.04, 7.06, 12.07, 2.08, 16.08, 30/08/2014.
- Total distance traveled: 3304 km

Almost forgotten during the communist period, Prague has become a major tourist attraction, since 1989, for travelers keen to discover the Gothic beauties. Old Town and the New One are merged into a unified

beauty, dominated by the Charles Bridge, Prague Castle and the red roofs, unmistakable [12].

RESULTS AND DISCUSSIONS

Price Analysis

175 Euros + 100 Euros (payable mandatory agency in Romania) for cruises Vltava (Prague) and Danube (Budapest) + trips (without tickets) to: Danube Bend, Karlova Vary, Dresden Castle Konopiste.

Notes - people who register themselves and the agency cannot find a partner will not pay the *single* difference.

Services included

- Romanian guide services
- 6 Bed and Breakfast in Hotels 3 *
- Transportation by air-conditioned bus 2 *, street and parking fees.

Services not included

- Tickets for sightseeing (museums, places of worship, etc.) and any guides for them.

Tours and transfers:

- *Venice Prague* - Cruise for 45 minutes. Prague channels: 12 Euro / person;
- Cruise on the River Vltava, 1.5 hours: 17 Euro / person;
- Prague Panorama - city -tour by bus, 2 hours: 18 Euros / person;
- City Tour Hop on- hop off ticket valid for two days (one hour cruise on the Vltava included): 25 Euro / person;
- Fountain Křižík - access to the spectacle included: 26 Euro / person;
- Grand City Tour - bus tour (3 hours): 28 Euro / person;
- Cruise on the River Vltava, with lunch (2.5 hours): 28 Euro / person;
- Cruise on the River Vltava, with dinner (3hours): 33 Euro / person;
- Grand City Tour of Prague Castle and the Vltava cruise: 36 Euro / person;
- Bohemian Glass Factory: 38 Euro / person;
- Prague by night, coach and cruise tour (4 hours): 49 Euro / person;
- Trip to Karlovy Vary (9.5 hours): 61 Euro / person.

Total approximate price: 427 EURO

To qualify for discounts, trip must be paid in

full upon registration [9].

Overview itinerary

DAY 1 - Sunday, 06.15 pm, presentation for embarking to the marketplace in Bucharest North Station. 6.30 Time - travel route Pitesti - Sibiu - Arad. Accommodation in Budapest - Szentendre. 851 Kilometers driven.

DAY 2 (breakfast). Trip to the Danube Bend: Szentendre (touristic town), Visegrad (Castle outside - the former residence of King Matthias, panorama - Danube Bend) , Esztergom (Cathedral - coronation place of the kings of Hungary and millennial center of Catholicism, view on Valley Danube and Slovakia - town Storovo). Travel to Bratislava - visiting Coronation Church of Maria Theresa and the Danube promenade. Stop (30 min.) in Brno. Accommodation in Prague. 549 Kilometers driven.

DAY 3 (breakfast). Praga- tour by bus, traveling to Prague Castle, and pedestrian promenade: Sts. Vit, Loreta Monastery , Golden Lane, Mala Strana neighborhood , crossing the Charles Bridge, Old Town Square (City Hall clock Saints) neighborhood and Hebrew Wenceslas Namestie (luxury shopping area). Leisure. Cruise on Vltava. Optional (€ 35 - if paid the agency in Romania at least 21 days prior to departure or € 45 - if paid in the trip); evening Prague with dinner (with drinks) and artistic shows. Accommodation in Prague. 54 Kilometers driven.

DAY 4 (breakfast). Travel (150 kilometers) in Dresden. Stop (2 hours) to visit the Zwinger Castle and the city center then moving (178 km from Dresden) in Karlovy Vary (stop 2 hours) - Czech pearl stations. Accommodation in Prague. 458 Kilometers driven.

DAY 5 (breakfast). Trip (40 km from Prague) for visiting Konopiste Castle (castle tour 45 minutes). Go to Vienna - bus tour route: Big Wheel in the Prater (stop), UN Headquarters, Danube Tower, crossing the Danube and Vienna ring (Opera, Art Museum, Maria Theresa Square, Parliament, City Hall, University Burgtheatre). Pedestrian floor Vienna Heroes Square, Hofburg Palace, St. Stephen Kärtnerstrasse and shopping streets Graben, Plague Column. At 21.30- departure

by bus to the hotel. Accommodation in Vienna. 331 Kilometers driven.

DAY 6 (breakfast). Visit the Schonbrunn Palace, or, for tourists who don't visit the palace, walk in the park and palace gardens. Free time in Vienna. Visit at the choice: Hofburg museums, Museum of Art, Museum of Natural Sciences, Capuchin Crypt [3]. At 14:00, traveling at Budapest - it through to landing in a short coach tour (can be seen): Danube, Castle, Fisherman's Bastion, Chain Bridge, Parliament, Elisabeth Bridge. After the tour, cruise (includes boat, local guide and one glass of champagne) on the Danube by night (optional 18 € - payment on the trip, gala dinner buffet with drinks and music). Accommodation in Budapest. 243 Kilometers driven.

DAY 7 - Saturday (breakfast). Continue on Route Hungary - Arad - Deva - Sibiu - Pitesti Olt Valley. Check (in normal conditions: weather, traffic, customs formalities, etc.), about 23 o'clock in Bucharest - Northern marketplace Station (Route Griviței - subway grate - Museum CFR). 818 Kilometers driven [5].

Main Attractions

1. Budapest-Szentendre

On the route between Budapest and Szentendre we operate the large size riverboat MS Hunyadi. The MS Hunyadi has two decks for maximum 600 passengers. On the main deck we operate a buffet. In the low seasons and in case of low water level we operate medium sized riverboat(s) with buffet and two decks for maximum 250 passengers.

Szentendre is a small baroque town at the gate of the Danube Bend, at the meeting place of the river Danube and the Pilis hills, in a beautiful natural setting [11].

2. *Bratislava* is the capital of Slovakia and, with a population of about 500,000, the country's largest city. Bratislava is in southwestern Slovakia, occupying both banks of the Danube River and the left bank of the Morava River. Bordering Austria and Hungary, it is the only national capital that borders two independent countries.

Bratislava is the political, cultural, and economic center of Slovakia. It is the seat of

the Slovak president, the parliament, and the Slovak Executive. It is home to several universities, museums, theatres, galleries and other important cultural and educational institutions.

The history of the city has been strongly influenced by people of different nations and religions, namely by Austrians, Czechs, Germans, Hungarians, Jews, Serbs and Slovaks (in alphabetical order, not by significance). The city was the capital of the Kingdom of Hungary, a part of the larger Habsburg Monarchy territories, from 1536 to 1783 and has been home to many Slovak, Hungarian, and German historical figures [7].

3. *Vienna* is the capital and largest city of Austria, and one of the nine states of Austria. Vienna is Austria's primary city, with a population of about 1.757 million (2.4 million within the metropolitan area, more than 20% of Austria's population), and its cultural, economic, and political center. It is the 7th-largest city by population within city limits in the European Union. Until the beginning of the 20th century it was the largest German-speaking city in the world, and before the splitting of the Austro-Hungarian Empire in World War I the city had 2 million inhabitants. Today it is the second only after Berlin by German speakers. The city lies in the east of Austria and is close to the borders of the Czech Republic, Slovakia, and Hungary. These regions work together in a European Center border region. Along with nearby Bratislava, Vienna forms a metropolitan region with 3 million inhabitants. Apart from being regarded as the City of Music because of its musical legacy, Vienna is also said to be "The City of Dreams" because it was home to the world's first psycho-analyst – Sigmund Freud. The city's roots lie in early Celtic and Roman settlements that transformed into a Medieval and Baroque city, the capital of the Austro-Hungarian Empire. It is well known for having played an essential role as a leading European music center, from the great age of Viennese Classicism through the early part of the 20th century. The historic center of Vienna is rich in architectural ensembles,

including Baroque castles and gardens, and the late-19th-century *Ringstrasse* lined with grand buildings, monuments and parks.

The city was ranked 1st globally for its culture of innovation in 2007 and 2008 and fifth globally (out of 256 cities) in the 2011 Innovation Cities Index, which analyzed 162 indicators in covering three areas: culture, infrastructure, and markets. Vienna regularly hosts urban planning conferences and is often used as a case study by urban planners. It attracts about five million tourists a year [8].

4. *Prague* is the capital and the largest city of the Czech Republic. It is the fourteenth-largest city in the European Union. It is also the historical capital of Bohemia. Situated in the north-west of the country on the Vltava River, the city is home to about 1.24 million people, while its larger urban zone is estimated to have a population of nearly 2 million [10].

Prague has been a political, cultural, and economic center of central Europe with waxing and waning fortunes during its 1,100-year existence. Founded during the Romanesque and flourishing by the Gothic and Renaissance eras, Prague was not only the capital of the Czech state, but also the seat of two Holy Roman Emperors and thus also the capital of the Holy Roman Empire. It was an important city to the Habsburg Monarchy and its Austro-Hungarian Empire and after World War I became the capital of Czechoslovakia. Prague is home to a number of famous cultural attractions, many of which survived the violence and destruction of 20th-century Europe. Main attractions include the Prague Castle, the Charles Bridge, the Old Town Square, the Jewish Quarter, the Lennon Wall and Petřín hill. The city boasts more than ten major museums, along with numerous theatres, galleries, cinemas, and other historical exhibits. Its rich history makes it a popular tourist destination, and the city receives more than 4.4 million international visitors annually, as of 2011 [4].

CONCLUSIONS

For tourists being attracted to spend their holidays in the mountains or the sea, in the

country or outside, have available to them a range of travel services to travel agencies. So we can say that the tourism product is considered to be the result of associations, interdependencies between activities of an area (resources) and facilities (services) offered to the buyer.

A company should always know what are the tourists' requirements to constitute an offer of products and services suited to the tourist market. So either way planned trip or just weekend or long term or tourist circuit, as in our case, travelers should have as much information about offers and locations to which their attention.

Promote our situation was made particularly advertising campaigns aimed at informing tourists of actual and potential existence of different products and services and increased demand for the company's offer [6]. Institutional advertising is a form of promotion that aims to support, among targeted segments of tourists travel firm, mainly highlighting its purpose and values promoted in close connection with the desires and needs of consumers aiming to eventually create and develop a positive image company. The circuit made this theme envisages attracting more tourists through bids and services.

REFERENCES

- [1] Cretu, R., 2012, "Legislation in catering and tourism "CERES Publishing, 2012
- [2] Niculaie, A., Foris, T., Cretu, R., 2002, "Tourism Management. Ecotourism-part of modern tourism", Psihomedica Publishing, Sibiu, 2002
- [3] arhitectonic.blogspot.com
- [4] <http://www.ghiduri-turistice.info>
- [5] <http://www.globetravel.ro/-2014/circuit-Prague>
- [6] <https://www.google.ro>
- [7] <http://ro.wikipedia.org/>
- [8] jurnaldecălătoriei.net
- [9] ofertelelastminute.wordpress.com
- [10] www.infotour.ro
- [11] www.travelontop.ro
- [12] www.travelwiz.ro

QUANTITATIVE RESEARCH ON CONSUMER BEHAVIOR BY OPTICAL RED WINE MARKETING

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Abstract

Study exhaustive wine area is a frequently researched topic since the beginning of 2000 when it comes to legislative bases for wine and wine products. Among the considerations that led to its choice of study include: Romania considerable resources in terms of agricultural area, and especially the wine (mention here the existence of eight wine regions, vineyards and a hundred thirty seven) support and attention given to the legislative branch of Romanian wine (by law 244/2002-Legea vineyard and wine), and the European and not least history as a wine producing country with Spain, Italy and France. The paper aims to determine whether or not a situation determinant of marketing in red wine consumption by analyzing questionnaire responses developed.

Key words: marketing, red wine consumption, vineyard, wine products

INTRODUCTION

Food consumption is most often proportional to the average size of the family as they are often members of different consumer needs. This is why, addressing in particular to the law 61/1991, wine consumption is clearly segmented among different age categories.

In the situation described above, an important role plays marketing through its policies of product, price, placement, promotion and marketing-mix obviously, but its resources are limited because the products have a shelf low price can be too high because the supply chain vendors and the intervention of intermediaries participating in the same effect. Therefore, most often only task is to promote full marketing specialists that consumers can be persuaded to buy products.

Regarding family or individual consumption of wine is necessary to mention that in Romania, under a deep segmentation of the market, buying the food may be a planned decision, usually seen in people who have a culture of consumption (if quality wine buyers, and those who consume table wine, the desire to serve the meal an alcoholic beverage) or impulsive decision due impulses

created by marketing techniques (promotions, tastings, etc.).

Demand for food products including wine is greatly influenced by demographic, social, and economic. In this direction, influence factors such as reduced family size, increasing the number of women active diversification recreational activities, healthy nutrition intense concerns, including food security and safety can have a strong impact on the demand for wine. However, combative attitude on alcohol consumption at European level can contribute to significant changes in the consumption of wine.

The demand on the Romanian wine market is mainly driven by the consumption needs of individual preference and purchasing power. It also quantifies demand and export value in different markets.

In general, data on wine consumption in Romania shows that a Romanian citizen consumes 22 to 24 l wine [1], which represents more than half of the countries with a developed economy consumption amounting to 50 l/consumer/year. Consumption causes of this discrepancy can be considered the purchase price, its share in the budget for consumer food basket and

speculatively without education wine consumption.

MATERIALS AND METHODS

The behavior of the individual consumer is influenced by a number of factors with an increased or weak action, on the nature of the need for human [2].

In Romania, wine consumption ranks second after beer consumption, with an annual value of 21.1 liters in 2011, up 14% from 2010 [3], but beer consumption surpassed, equaled from 79.5% in 2011.

Based on this statistic and specialist information promoted on the role of wine for consumption as food first and then the alcoholic beverage [4], we propose to investigate the role of marketing and existing strategies, but also the new strategies to increase consumption wine quality Romanian market [6].

In order to obtain an answer to this problem, we opted for a questionnaire of 24 questions, discovering opinion and consumer behavior impact marketing and its tools in sizing consumption.

RESULTS AND DISCUSSIONS

Methodological framework on the organization of the market [5] includes steps such as: defining the problem and research purpose; formulation of objectives; the modality of data collection; sample composition by choosing participants; conducting interviews and work quality control of data collection and interpretation.

The study involved a questionnaire with 24 questions arranged in four chapters, each chapter being paired by a P in the 4 P's of marketing. In preparing the questions we used an extensive bibliography including marketing concepts [7], statistical data provided by the National Institute of Statistics, Ministry of Agriculture and Rural Development ONIV, WEPA, PNVV, OIV and online publications in the field of wine and www.vinul.ro, www.hrbexpert.ro or www.adar.ro.

Before distributing the questionnaires to completing steps deemed necessary to establish research and outlining its schedule. The steps follow in conducting the research were:

- 1) Establish objectives and types of questions;
- 2) Develop questionnaire;
- 3) Dissemination of the questionnaire;
- 4) The collection and processing;
- 5) Final Report.

The number of people whom I considered to be relevant in obtaining results consistent with reality is 200 people with higher education and those aged 20 years in Bucharest, Galati, Braila and Bacau to check if there is uniformity in the way to answer questions. The findings show that research has shown to be an interesting experience in terms of divergent opinions I had the opportunity to know, and consuming resources from both the researcher by the insistence by the respondents to complete answers to questions and for that repondeti received document during the work week and were willing to spend on average 5 minutes to complete it.

When asked about the importance of criteria such as variety, type, color, price, packaging and vineyard in the purchase of wine to use a scale of importance from very important, important and unimportant. Thus, there were obtained the following percentages:

- Variety is important for 51,50% of respondents, followed by 37% who consider it unimportant to purchase unlike 11.50% who think this is very important;
- The type of wine is very important for most respondents, with a percentage of 63.50%;
- Responses to the importance of the color of wine are relatively homogeneous, so that 33.5% consider it very important, 25% important and unimportant 41.5%;
- In terms of price, the majority of 68% consider this important issue;
- The packaging is particularly important because 81% of the results considered unimportant this issue. Speculating this percentage, we could say that the mind of the consumer is already embedded the idea that wine packaging is glass, and her appearance is irrelevant because the consumer does not

purchase the reuse of this container several times;

- Vineyard is a criterion which is not given importance, considering the large number of respondents, namely 188 for which there are

major differences between the vineyards where the wine is produced and this could translate into a lack of culture viticulture.

Table 1 Important criteria in purchasing wine

How important are the following criteria in the decision to buy wine ?				
	Very important	Important	Not important	TOTAL
<i>Variety</i>	23	103	74	
Percentage(%)	11,50	51,50	37,00	100
<i>Type</i>	127	51	22	
Percentage (%)	63,50	25,50	11,00	100
<i>Colour</i>	67	50	83	
Percentage (%)	33,50%	25,00%	41,50	100
<i>Price</i>	35	136	29	
Percentage (%)	17,50	68,00	14,50	100
<i>Package</i>	15	23	162	
Percentage (%)	7,50	11,50	81,00	100
<i>Vineyard</i>	2	10	188	
Percentage (%)	1,00	5,00	94,00	100
TOTAL	200	200	200	

Source: survey data

In terms of income each distribution is dominated by respondents who have an income included £ 1500 and 2000, which corresponds to 46% or 92 persoane. Acest research result is favorable because the issue is sensitive across income à-vis consumption change and the fact that most participants have an income above the average income is an indicator of availability of its allocation for the acquisition of medium to high quality.

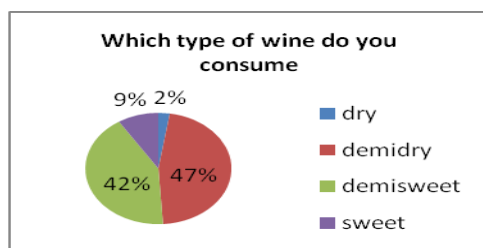


Fig. 1. Types of consumed wines

From the processed data shows that Romanians prefer to drink wine "moderate" in terms of the concentration of sugars and alcohol default because semidry and semisweet wines have a frequency response of 42% for sweet wines and 46.5% for the semidry . This preference demonstrates that most consumers have a penchant for wine

more "moderate" avoiding extremes and too sweet or too dry.

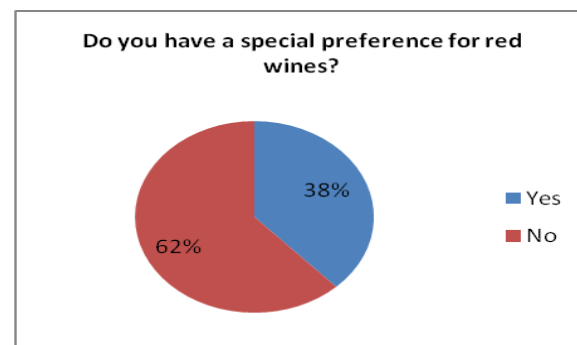


Fig. 2. Wine preference depending on wine color

When asked about their preference for red wines, 50% and 62% answered that they prefer red wines in particular.

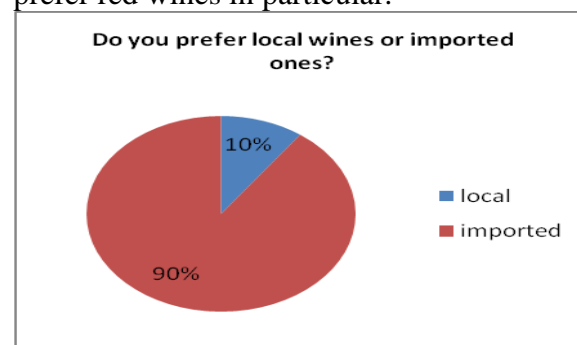


Fig. 3 Wine preference depending of its origin

This response is a reiteration of the study conducted by WEPA Wine Market Overview confirming that red wine is preferred by 68.6% of the total Romanian consumers, while red wines have a preference share only 31.4%.

As shown in the diagram 4, 90% of respondents prefer wines made in Romania, while only 10% of its purchasing imported wines.

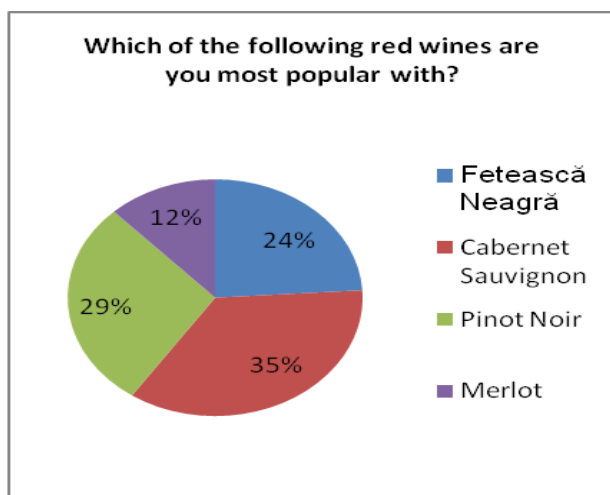


Fig. 4. Red wine preference based on wine variety

No chart answers the question. 5 on resonance in the minds of consumers of certain types of red wine, reveals that the most famous red wine is Cabernet Sauvignon respondents with a percentage of 35.5% option, followed by Pinot Noir deaproepe 28.5% and Black Fetească 24%. The look is interesting because most prefer local wine, but are more receptive to imported wine types.

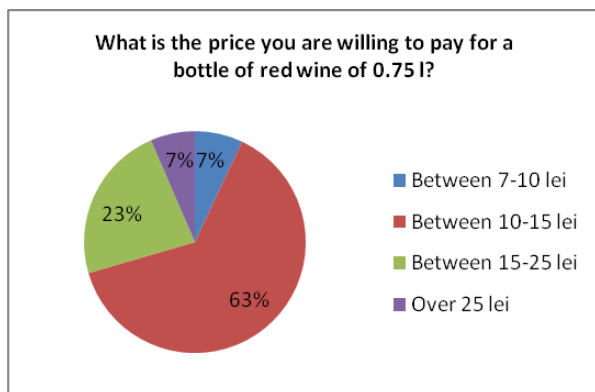


Fig. 5. Consumer preference for wine price

In terms of price they are willing to allocate the purchase of a bottle of red wine, the most

frequent answer was between 10-15 lei, with a percentage of 63.5%, followed by an availability of 23% for price from 15 to 25 lei. Although 23% of respondents are willing to pay £ 15 for a bottle of wine, considered average, they think the price is a barrier to purchase a bottle of red wine.

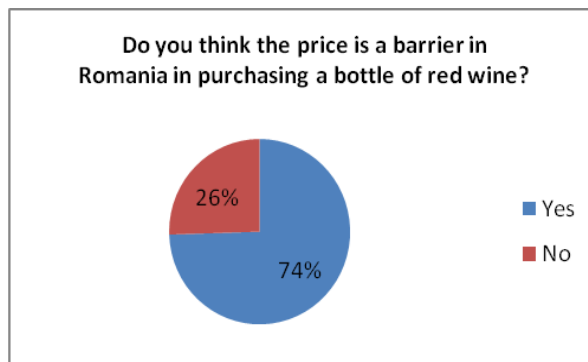


Fig. 6. Consumer opinion on wine price as a purchase barrier

Of the total number of people surveyed on the share of income monthly allocated, an overwhelming percentage allocated less than 1% of his income.

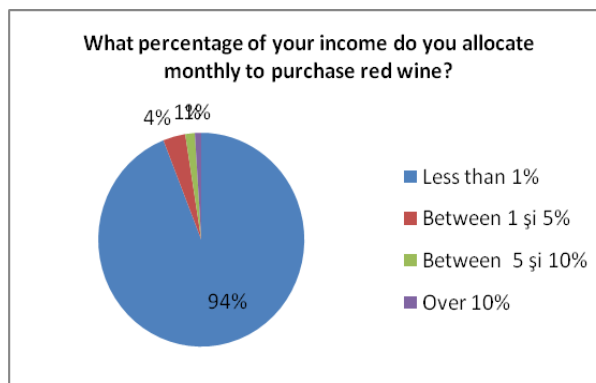


Fig. 7. Monthly income percentage spent by consumer for red wine

This means that for an income from 1500 to 2000 lei/, 1% is 15 to 20 lei. In fact, this means a bottle of wine per month.

Regarding the sensitivity increasing share allocated to purchase red wine, 135 of repondeți appreciated if income growth increases, which means a percentage of 67.5% of the total.

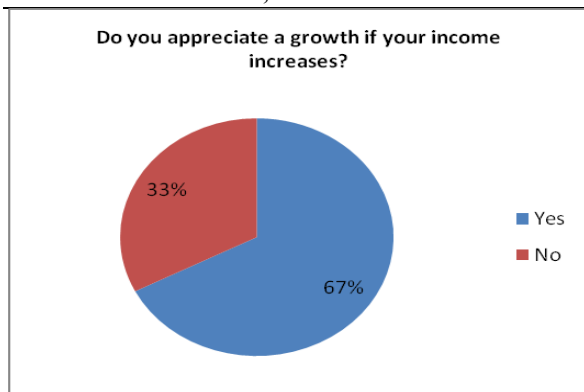


Fig. 8. Price-income cross

Also, most responded that a possible increase in income would prefer red wine to buy better quality, as opposed to the 11.5% that would consume more red wine. There is also an intermediate category option that both the quality and the quantity.

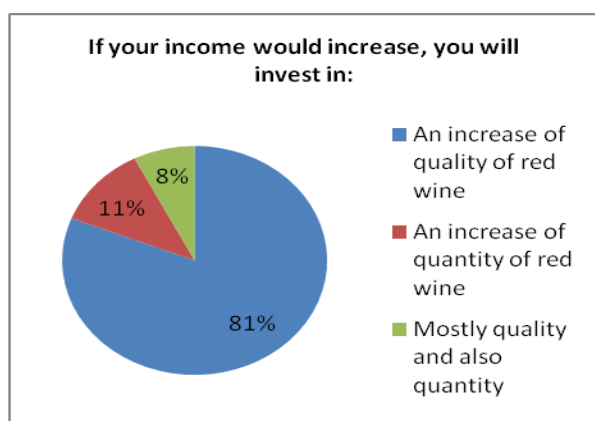


Fig. 9. Invest preference for a higher income

The place where you frequently purchase red wine is mainly supermarket or hypermarket in 89%, followed by 5% boutiques and specialist shops then 3.5%.

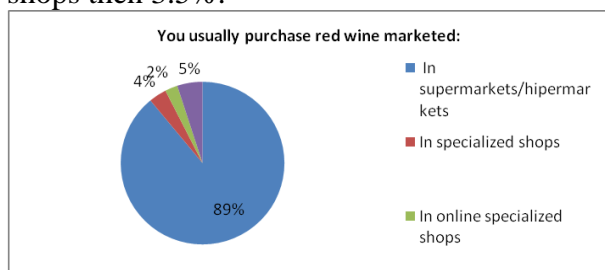


Fig. 10. Purchase place where red wine is marketed

Regarding the supply of local red wines, most of respectively 89.5% believe in supermarkets /hypermarkets offers a wide range of products.

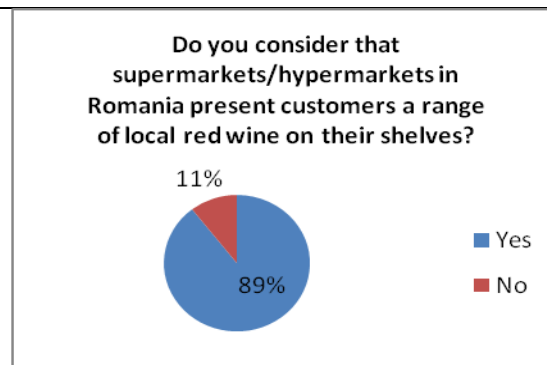


Fig. 11. Range of red wines

Regarding the promotion of marketing strategies and online trading, 72% of respondents were reluctant to this phenomenon, opting for a negative response aimed at knowing how storage products. This demonstrates that most conservative and prefer to buy food from places where they are already known and tangible.

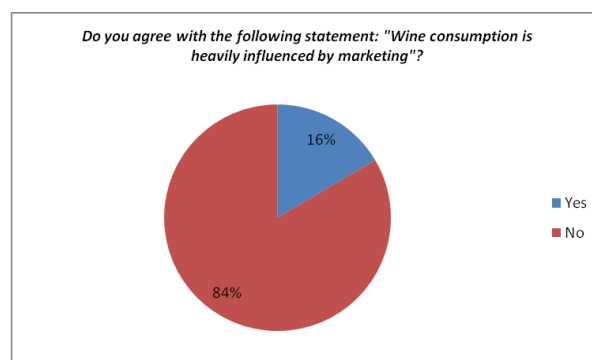


Fig. 12. The marketing influence

Regarding the opinion about how marketing is to influence consumer buying wine, 83% believe that there is such influence, while 16.5% agreed with the statement "Wine consumption is heavily influenced by marketing".

To the question about the impact it might have on marketing wine consumption growth, the highest frequency was for "No", 71%, or 142 people.

Answers to the question of diagram nr. 4.20 shows that increasing the consumption of red wine in certain periods of the year due to a simple habit of consumption as 53% said so, while only 36.5% believe it allocates a larger grocery budget which part is for and purchase wine.

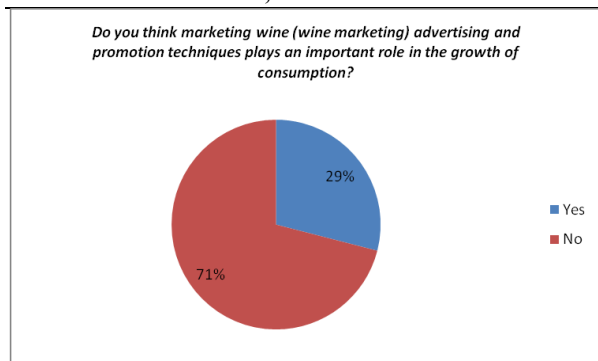


Fig. 13. Red wine consumption growth

For those surveyed, tasting sessions held regularly not contribute to increased consumption of red wine as the frequency of responses to this question is 107 people out of 200 who responded negatively.

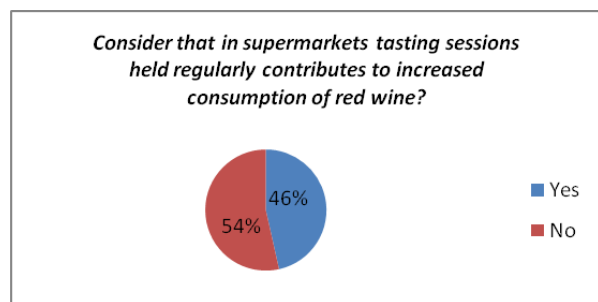


Fig. 14. Wine tasting sessions

Regarding respondents available to consume more red wine during meals, 51.5% believe that would do this if they have a daily menu rich, followed at a rate of 39.5% for those who want more time for meals.

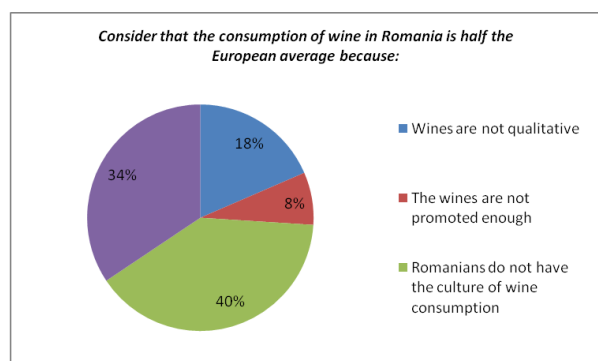


Fig. 15. European consumption vs. local one

Opinion of those who responded to the questionnaire about the low level of wine consumption in Romania to the European average showed a 53% response by choosing "Romanians have money to eat constantly coming", followed by those who think

"Romanians do not have the culture of wine consumption." Thus, we can say that the main causes of low consumption: lack of financial resources and lack or loss of consumer tradition.

Considering a marketing strategy, promotion red wines awarded among ordinary consumers, this paper aims to identify whether this instrument could influence consumption to increase. This question more than 80% of respondents stated that this strategy has no impact because Romanian consumers are receptive to these messages.

Following the analysis performed, we can say that marketing has an important role in increasing the consumption of wine, but red wine segment consumers are more reluctant, and strategies must be adopted so as not to be aggressive because the result can be rejection of consumer.

The research was useful to discover whether lack of financial resources or marketing strategies inhomogeneous low consumption causes a wine, finding that the problem still persists revenue budget allocated a percentage distribution of food and wine to purchase.

Also surprising was the attitude of the respondents vis-à-vis the wine as a food or alcoholic beverage, the proportion of over 85% consider wine an alcoholic beverage, which means that a useful tool for increasing consumption is thought to overthrow the balance those interested in sizing consumption.

CONCLUSIONS

Reality Romanian wine sector can now define succinctly by: vineyards and nurseries 1.45% of the total agricultural area, average annual per capita consumption of 21.1 liters [8], equivalent to 50% of the EU average activity dynamic market disputed between four main actors Murfatlar Jidvei Cotnari Vincon whose turnovers are in the same position for years, low yields and producers exploiting natural capital by foreign funds.

In this landscape, the activities of production and consumption, apparently the results are measured around a market of 350-400 million,

according to the experts, but the average consumer still reject assimilation as a food wine, not as an alcoholic beverage, as the French paradox, being only an abstract notion. Although Romania is still in the top ten of the world of wine, the analyzes tend to believe that only a small segment into participating in this ranking, and risk of foreign origin have consumed products is very high. I noticed also that there is a mismatch of data provided by institutions in the area that sometimes delayed consistency.

Regarding marketing and the effects it creates, it seems to point in Romania, it is only an illusion and can not quantify the contribution that has consumption growth equation.

Therefore, we believe that the results will be visible when winemarketingului will focus on correlation with a healthy diet, when the economic and regulatory environment will restrict promote non-values, you will develop strategies to educate the moderate consumption and beneficial.

We believe that this paper has achieved its goal, demonstrating on a scale that marketing tools are free of materiality as long as the socio-economic context did not permit them than sequentially, and where wine consumption is needed such scaffolding as far "Consumers are more brand loyal than price" [9].

In conclusion, to ensure premises domestic wine consumption growth, both at home and abroad, we need strategies to obtain a quality wine and producer repromovare Romania as the "new world".

Limits of work that have hampered the research was the lack of updating data for 2012, the delay in returning questionnaires or loss, and lack of interest of respondents in answering.

AKNOWLEDGEMENTS

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research in Romanian economics science domain”

REFERENCES

- [1]Strategia pentru dezvoltarea sectorului agroalimentar pe termen mediu și lung orizont 2020-2030 =draft=, Ministerul Agriculturii și Dezvoltării Rurale, București, 2014, p. 7
- [2]Boboc, D., 2006, „Elemente pentru politica de marketing a vinului”, revista Tribuna economică, v. 17, nr. 50, p. 75, 78
- [3]Constantin, M., 1997, Marketingul producției agroalimentare, Editura Didactică și Pedagogică, București
- [4]Jackson, R., 2000, „Wine Laws, Authentication, and Geography”, Wine Science (Second Edition) Principles, Practice, Perception, 2000, P. 482–543, <http://www.sciencedirect.com/science/article/pii/B9780123790620500111>
- [5]Manole, V., 2006, „Reglementări specifice organizării comune de piață a vinului”, revista Tribuna economică, v.17, nr. 16, p. 25-26
- [6]Otopeleanu, D., 2010, „Piața vinului în România”, revista Tribuna economică, v.21, nr. 20, p.67-69
- [7]Singly, F., Blanchet, A., Gotman, Anne, Kaufmann, J., 1998, Ancheta și metodele ei: chestionarul, interviul de producere a datelor, interviul comprehensiv, Editura Polirom
- [8]Puiu, G., coord., 2012, Direcția de Statistică Agricolă, Bilanțuri alimentare, INSSE, București, p. 36
- [9]Stoian, Viorel, 2011, Marea carte a degustării vinurilor, Ediția a 3-a, București

MOLDOVAN AGRI-FOOD TRADE UNDER THE INFLUENCE OF INTEGRATION PROCESSES

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Abstract

The paper aims at the assessment of the main effects of signing the Association Agreement on the Moldovan agricultural sector, while examining its reaction, if the Republic of Moldova would have opted for its integration in the Customs Union - Russian Federation, Belarus, and Kazakhstan. During the period 2010-2013, Republic of Moldova launched a number of trade policy development initiatives in order to ensure a more facilitating legal framework for the economic and trade relations with the key external partners. An agreement on the establishment of a free trade area in the CIS was signed in this period. Similarly, Republic of Moldova started negotiating the Association Agreement with the European Union, which was signed in June this year and has as component part the Deep and Comprehensive Free Trade Agreement (DCFTA). The paper reveals that the signing of the Association Agreement with the EU could serve as instrument to stimulate the agricultural sector, but the DCFTA establishment will present some challenges, which are to be properly addressed, in order to exclude their turning into risks.

Key words: agri-food trade, customs union, export, free trade agreement, import

INTRODUCTION

The negotiation, initialing and preparation for signing the Association Agreement (AA) has increased the concerns for the agricultural sector, particularly the way in which it will meet the challenges of symmetric liberalization of foreign trade with European Union countries and Turkey [1]. The significance of these measures is more important than trade relations facilitation, which aim at speeding up the structural reforms and overcoming the transition stage of the national economy. At the same time, AA is as important for the national economy, as much responsibility is required on behalf of the national authorities and the entire civil society for its proper implementation. Along with the intensification of the liberalization process, many sectors of the economy will face a number of challenges to increase the competitiveness and ensure resistance to foreign competition. One of the most threatened sectors, which was granted special importance in the negotiations is agriculture, which continues to play an important role in the national economy.

The Customs Union (CU) implies a higher

level of integration compared to FTA. Besides the maximal elimination of tariff and non-tariff barriers to trade, the participants to the agreement that usually are geographically adjacent countries, shall adopt a common customs tariff, reaching a consensus on the degree of protection of all sectors. Therefore, the negotiation and implementation of a CU involves increased efforts in terms of time, financial resources and political concessions. By adhering to CU, a state loses a large part of its autonomy to develop its trade policy [2]. The Republic of Moldova was included in the EU list of countries benefiting from preferences since the mid-90s, and since 2008, it benefits from autonomous trade preferences. However, the opportunities offered by this system are not fully exploited to the existing potential and the rates offered for a large part of agri-food products remain unrealized, except for some tariff headings, such as: corn, wheat, barley, wines. Moreover, some products such as those of animal origin cannot be exported to this market [3].

MATERIALS AND METHODS

The objective of this study is to assess the main effects of signing the Association

Agreement over the Moldovan agricultural sector, while examining its reaction, if the Republic of Moldova would have opted for integration into the Customs Union - Russian Federation, Belarus, and Kazakhstan. During the investigations, the following study methods were used: statistical method, which involved researching a larger number of observations, analysis of growth rates of the economic indicators; theoretical synthesis, formulation of judgments. The information was gathered from sources of the World Bank, World Trade Organization UNCTAD, WITS, and National Bureau of Statistics of the Republic of Moldova.

RESULTS AND DISCUSSIONS

The agri-food sector traditionally plays an important role in negotiating the preferential trade agreements. This can be explained by the food security concerns of the public authorities of the country, welfare of the rural population, and in particular, in developed countries, the impact of imports of certain agri-food products could have on consumer safety.

In the Republic of Moldova, the situation is quite challenging. Compared to other countries in the region, the contribution of agricultural sector to GDP growth is significant. According to the National Bureau of Statistics, in 2011⁸, the share of agricultural sector (added value) in GDP exceeded the level of 12% of GDP, and food and beverages industry - constituted about 4.5% of GDP and more than a quarter of the added value created by the industry. The value added in industry was lower than in the agricultural sector, about 11.4% of GDP (Fig.1).

The contribution of agriculture to GDP growth in the Republic of Moldova is significant, although decreasing in recent years. Similarly, despite the high share in GDP, compared to the Central and Eastern Europe countries, the added value created in the sector reported per capita in the Republic

of Moldova is much lower.

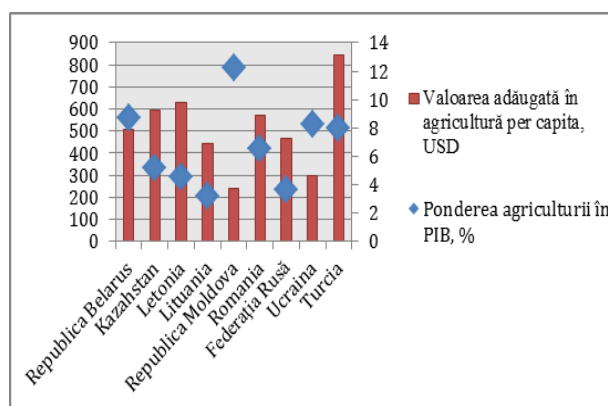


Fig.1. Share of agriculture in GDP and added value created in the sector per capita, 2011

Source: According to UNCTAD data

According to the World Bank data, in regional aspect, the Republic of Moldova is among the countries with the lowest level of labor productivity (Table 1). Quantified as the ratio of value added per worker, expressed in USD in 2005 prices, the labor productivity in the sector amounted to USD 1,884.3, much smaller than in the countries from the region, let alone the European average.

Table 1. Labor Productivity in Agriculture

	EU	Romania	Turkey	RM	Russia	Kazakhstan	Belarus
Labor Productivity, USD (2005=100%)	18380,4	8067,8	6597,8	1884,3	5968,6	3532,5	7845,5

Source: According to the World Bank data.

Low productivity can be explained by several reasons:

- Farm structure, concentrated mainly in small households. According to 2012 data, about 50.8% of agricultural production was obtained in population households;
- Weak farm endowment with technical equipment, the agricultural machinery owned by farmers being most often morally and physically obsolete.
- Low level of education of the population employed in the sector, which adversely affects the structural transformation process and technological progress.
- Poorly diversified structure of the sown areas etc.

⁸ The last year for which annual data regarding GDP resources is available and the agricultural sector was not affected by natural disasters was taken into account.

Balance of the risks and integration options opportunities of the Republic of Moldova for the agricultural sector

In November last year, the Republic of Moldova initialed the Association Agreement with the European Union, which directly provides for the creation of a Deep and Comprehensive Free Trade Area (DCFTA) between the parties, and will try to continue the assessment of the main risks and opportunities for the local agri-food sector. Also in this context, the potential effects shall be appreciated that may bring a deeper economic integration in the CIS - joining the Customs Union - Russia, Belarus, and Kazakhstan.

Impact of the DCFTA with the European Union

Currently, the foreign trade between the Republic of Moldova and the European Union takes place within the asymmetric preferential trade regime, meaning "0" tariff for agri-food products exported to these destination, with some exceptions:

- products of animal origin, cereals, white sugar and grape wine that are allowed to be exported within the established tariff quotas;
- fruits and vegetables exempted of VAT payment at import. At the same time, many of these products are subject to a minimum price of entry at import [4].

Several previous studies indicate that even in these conditions, the local exporters cannot fully benefit from the existing preferential regime. The biggest constraint in this regard is their low capacity to adjust to the European quality standards. Although for many years, the Republic of Moldova has started upgrading the quality infrastructure; this process is costly and time consuming.

Including due to this reason, the agri-food industry has been given a special role in negotiating the agreement, both regarding the import in the Republic of Moldova and in the EU. Thus, according to the Association Agreement, Title V - dedicated to the trade and trade-related areas and annexes aimed at this title, by signing this Agreement, the parties will grant each other free market access for products originating in the

Republic of Moldova and the EU, with some exceptions.

The European Union will maintain certain tariff and non-tariff barriers for certain products:

- a) tariff rates - tomatoes, garlic, grapes, apples, plums, grape juice;
- b) customs duty without VAT - artichokes, cucumbers, zucchini, oranges, clementine, mandarins, pears, apricots, cherries, nectarines, peaches, grape etc.

The Republic of Moldova will reserve the right to gradually liberalize the import of products according to some predefined schemes, in different terms, depending on the sensitivity of the sector.

In this way, some instruments can be distinguished in this respect:

1. reducing tariffs in three annual steps, starting from 1 January of the year following the entry into force of the Agreement – melted cheeses, other than grated or powdered like;
2. reducing tariffs in 5 annual steps, starting from 1 January of the year following immediately after the entry into force of the Agreement - fresh cheese (including whey cheese) unfermented and curd, tomatoes, onions, zucchini, carrots, cucumbers, sweet peppers, nectarines, strawberries, effervescent wine and grape must, etc.;
3. reduction of tariffs in 10 annual steps, starting from 1 January of the year following the entry into force of the Agreement - milk and milk cream, concentrated or with added sugar or other sweetening matter, cherries, canning and meat products, offal of turkeys, uncooked beef and others;
4. reducing tariffs, starting from 1 January of the fifth year after the entry into force of the Agreement – fresh, refrigerated or frozen eatable pork offal, grapes, apples, peaches, plums (Association Agreement between the European Union and the European Atomic Energy Community and their Member States, of the one part, and the Republic of Moldova, of the other part).

In addition to these particular issues, based on this Agreement, "Parties shall commit themselves to enhance the cooperation and good neighborly relations, including cooperation in the development of projects of mutual interest, in particular those aimed at preventing and combating corruption and criminal activities. These commitments are a key factor in the development of relations and cooperation between the Parties and contribute to the regional stability and peace.

In fact, this agreement represents a complex reform agenda for the Republic of Moldova in key areas to ensure the functioning of the economy according to the principles of market economy. The document will compel the local authorities to promote the necessary reforms in several areas: justice, public administration, competition, consumer protection, statistics, public finance management, industrial policy, corporate governance, energy infrastructure, transportation, quality, social policy, etc.

If these reforms are not be promoted by the public authorities, business environment and society as a whole, the agreement could have a profound negative impact on the agri-food sector, which will produce chain effects on other areas - employment, standards of living of the population, public finance, etc.

Liberalization of imports of agri-food products in the European Union and Turkey would mean the elimination of import customs tariffs, which would correspond to a reduction in the price of imported goods by about 10 % within maximum 10 years. According to the WTO data, in 2012, the simple average of MFN tariff in the Republic of Moldova for this product category was of 10.5%. Based on separate categories, the simple average tariff was of: 14.7% for animal products, 12.8 % - fruits and vegetables, 10.2 % - cereals and cereal products, 13 % - beverages and tobacco. In particular for wines, for one liter of imported wine, a duty of 0.5 euro is levied etc.;

Although competitive pressure will bring benefits to the local consumers, this might also influence their income levels, given the high level of employment of the population in

agriculture. Removal of any protection tools for this sector without increasing its immunity could cause higher unemployment and relatively low qualifications and reduced training of the workers could create problems in their reorientation towards other sectors.

At the same time, the correct and responsible promotion of the reform program could generate multiple opportunities for the sector:

1. Creating an equitable business environment and a functioning market with fair competition rules;
2. Increased foreign investment in the sector and its modernization;
3. Reducing the technical barriers and diversification of the range of products exported to this market;
4. Increasing export activity of the local entrepreneurs, enhanced by a regulatory framework of the long-term predictable trade relations;
5. Development of the entrepreneurial culture following the intensification of trade relations with economic partners at a more advanced stage of development.

Impact of a potential membership in the Customs Union

As an alternative to creating a DCFTA with the European Union, we considered appropriate the assessment of the effects that could be generated by the accession of the Republic of Moldova to the Customs Union - Russia, Kazakhstan, and Belarus. Or even now, this issue is one that causes many discussions.

The trade regime with the current members of the Customs Union enjoyed a preferential treatment within the CIS, even since the country's independence. Since 2013, the trade relations with these countries are conducted within the multilateral agreement on the creation of a Free Trade Zone in the CIS, which was signed in 2011.

This agreement replaced the multitude of bilateral free trade agreements between the countries, establishing a single regulatory trade framework for all Member States. This ensures, to a great extent, the elimination of any kind of mutual trade barriers, although even within this, some tariff barriers have

been preserved, the most relevant in this respect being the export customs duties.

Unlike the commercial relations with the Western partners, the preferential trade regime with the member countries of the Customs Union is symmetrical, which implies free access to mutual markets.

In this context, according to the existing empirical evidence, it is unlikely that the adherence of the Republic of Moldova to this structure could create new trade flows in the mutual trade - a term defined in the literature as trade creation effect.

Indeed, the Republic of Moldova has a relatively higher specialization in the agricultural sector compared to the Eastern partners than the Western partners, but those advantages that could be provided by a preferential trade regime for enhancing the bilateral trade flows most likely have been used by now.

Table 2. Comparative aspects on MFN tariff rate in the regional profile, %

Country	All products	Agri-industrial products	Industrial, non-agricultural products
Republic of Moldova	4,6%	10,5%	3,7%
Belarus	9,7%	13,4%	9,1%
Kazakhstan	9,5%	13,4%	8,8%
Russian Federation	10,0%	13,3%	9,4%
European Union	5,5%	13,2%	4,2%

Source: According to World Trade Organization data.

About 38 % of agri-food products traded outside the Republic of Moldova is exported to the Customs Union market. This is an exclusive market for the sale of some plant and meat products. And joining the Customs Union involving immediate abolition of controls at the internal borders, could contribute to the facilitation of trade in these product categories. Similarly, elimination of export duties of the member countries for various fuels, especially for the Russian natural gas, could reduce the costs for farmers.

However, if the Republic of Moldova accedes

to the Customs Union, certain costs that would result from this process should be taken into account.

-First of all, considering that joining the Customs Union would mean a common customs tariff and trade regime, the CU membership is incompatible with DCFTA, which the Republic of Moldova intends to sign with the European Union. Similarly, it could most likely have the effect of non-renewal of autonomous trade preferences granted by this, which would significantly affect exports of agricultural products on the western market. In this way, if currently, with certain exceptions, within the autonomous trade preferences, the exports of agri-food products enjoy free access to the EU market, then the cancelation of the trade preferences would mean imposing on Moldovan products entering the EU market an average tariff of about 13.2 % (Table 2);

-Exports of agri-food products in CU reflect a high degree of geographical concentration, this increasing the volatility of exports, and sector activity to various external shocks. And as shown by the experience of 2006, such shocks can sometimes have fatal consequences on some sub-sectors of agriculture and food industry;

-The reduction of productivity in the sector, as a result of the increase in customs tariffs for industrial products, including capital imported from the third countries, so necessary for the technical endowment of the branch. It's about weak entrepreneurial culture and production organization as well as technical endowment of agricultural enterprises and farms that are reflected in the low productivity obtained; Risk of delaying the promotion of some reforms necessary for the business development in general. fragmented.

CONCLUSIONS

The dilemma between East and West for the Republic of Moldova is a topic that has seen many debates in recent years. Currently, the Republic of Moldova is on the eve of signing a Deep and Comprehensive Free Trade Agreement with the European Union that will

put on an equal footing two important economic partners, being able to exploit the opportunities offered by the preferential trade arrangements and close cooperation with both.

At the same time, we have addressed this issue in the context of agri-food sector development prospects, considering it as still being an important one, or neglecting it could have adverse effects on the branch if the potential risks are not acknowledged.

Agriculture is one of the sectors that still provide a major contribution to ensuring the growth of the national economy. At the same time, in recent years, its evolution indicates a relatively high volatility, which also causes large oscillations in economic growth rates.

For this reason, but also due to the importance of this sector to ensure development of rural areas and the country's food security, the agricultural development must have a special place in the economic policy of the state.

Regeneration of the sector and increase in its competitiveness abroad requires some radical measures that would produce changes in its structure. The signing of the Association Agreement with the EU could serve as instrument to stimulate this process, but the DCFTA establishment will present some challenges for the sector, which are to be properly addressed, for this not to turn into risks.

REFERENCES

- [1] Association Agreement between the European Union and the European Atomic Energy Community and their Member States, of the one part, and the Republic of Moldova, of the other part (http://eeas.europa.eu/moldova/assoagreement/assoagreement-2013_en.htm)
- [2] Chauffour, J.P., Maur, J.C., 2011, Preferential Trade Agreement Policies for Development. Washington, p.111-112. ISBN: 978-0-8213-8643-9
- [3] Chistruga, M., Clipa, V., Fala, A., 2010, Analiza performanțelor exporturilor Republicii Moldova prin prisma regimurilor preferentiale de comerț. Chișinău: Institutul de Economie Finanțe și Statistică, 44 p.
- [4] Council Regulation (EC) No 55/2008 of 21 January 2008 introducing autonomous trade preferences for the Republic of Moldova and amending Regulation (EC) No 980/2005 and Commission Decision 2005/924/EC

VULNERABILITIES IN ACHIEVING AGRICULTURAL POTENTIAL OF ROMANIA

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Abstract

The land fund of Romania represents a huge potential for agriculture. The potential has proved difficult to achieve, and among the main vulnerabilities researched lately, we have identified the decline in consumption of vegetable crops, fruit and meat, determined by the declining purchasing power in Romania and the European Union's common market. Therefore the degree of achievement of the agricultural potential is directly influenced by economic developments in Romania and EU Member States. The technical endowment of Romanian farmers is an old and still unresolved problem. Even though Romania has benefited from EU pre-accession funds and still benefits from it, they proved to be a poor solution for Romanian farmers with farm machinery equipment. Indicator analysis of the evolution of the number of tractors in Romania in the post-accession period, reveals that the actual number of tractors in the period under review increased overall, but even if the total number of tractors in Romania increased from 2007 until 2012, UAA (ha) per a tractor is almost constant.

Key words: agriculture, consumption, economics, agricultural machinery

INTRODUCTION

Analyzing the land of Romania, we will find that Romania's agricultural potential is huge. Still achieving, or obtaining it at an optimum level is far from being achieved. The total area of Romania is 23,839,071 ha in 2012. From which agricultural area is 14,615,057 hectares, arable land is 9,392,262 ha, areas occupied by the passion represent 3.27061 million hectares, areas occupied by meadows represent 1,544,957 ha, and areas occupied by vineyards and nurseries 210.475 ha. The area occupied by agricultural land is 9,224,014 ha. Romania has land surfaces from the first category of fertility class, considered the most valuable and suitable for any uses articles up to the 5th grade of fertility ultimately not providing conditions for plant growth. A crucial aspect of our country's is its agricultural potential. The utilized agricultural area represents 61.8% of the total area of Romania, with 39% arable land. In terms of size of population, agricultural area is 0.65 ha /capita arable land and 0.41 ha / capita (Istudor Nicolae, Compiled profile of economic organizations in Romania meet the

health food, veterinary and environmental of the European Union, 2008). [4]This positions take us at seven European Union countries. Given these issues, it is obvious that Romania has large areas with high fertility, which represents favorable conditions for obtaining a agriculture performance. But nevertheless, aspects "wealth" natural capital is not all the conditions for obtaining a competitive agriculture. During the research I highlighted two aspects that are vulnerabilities in terms of achieving Romania's agricultural potential. On the one hand food market consumption trends lately (negative influences related to Romania's economic downturn). And on the other side I will treat the issue of poor technical equipment of farm machinery agriculture in Romania. The evolution of consumption in Romania vegetable crops, fruit and meat in 2012. In the attempt to identify and analyze the main underlying vulnerabilities which load the road to achieve Romania's agricultural potential, we surprised, among other things, the economic developments of our country.

MATERIALS AND METHODS

In this paper, have been used data from National Institute of Statistics regarding utilized agricultural surface and the number of machinery used in agriculture by regions using a time series from 2007 – 2012. In order to quantify the endowment in the Romanian agriculture, it has been calculated the utilized agricultural surface for one tractor, as main indicator that shows the competitiveness of the sector. As well, in this paper has been analyzed the evolution of the agro-food products consumption in order to illustrate the socio-economical effects of the financial crisis in Romania and upon the agriculture.

RESULTS AND DISCUSSIONS

Influences of the financial crisis upon the consumption of agricultural products

Romania passed through a period of economic downturn caused by the financial crisis, with major impact in the European Union and beyond. Therefore it is considered determinant the consumption of crops, fruits and meat, to analyze the evolution of Romania's agricultural sector. The analysis shows a decrease in the average annual consumption of vegetable products per capita in Romania. The research analyzes the evolution of the main consumption crops, fruits and meat products. Wheat consumption in 2012 decreased by 8.4 kg (Availabilities of population consumption in 2012, National Institute of Statistics, 2013) compared to 2011. [1] Annual average consumption of fruit and fruit products decreased in 2012 by 3.6 kg (Feed balance in 2012, National Institute of Statistics, 2013). [7] The consumption of apples has decreased by 1.9 kg (Feed balance in 2012, National Institute of Statistics, 2013). At peaches and nectarines, cherries and sour cherries, it was a decrease of 0.6 kg. Rice consumption in 2012 over the previous year decreased by 1.3 kg (Supply balances sheet for major food products in 2013, National Institute of Statistics, 2014). In conclusion, we can say that very few products have maintained an ascending "trend" in terms of

consumption. Meat has registered a decrease in the average consumption in most meat products. Analysing these declining indicators we can say that the development of consumption is not influenced either by a weak agricultural year (which in most times would increase prices and hence a decrease in market demand or consumption), either low productivity or yield per hectare. The main cause is marked by changes in purchasing power export and domestic market. For example, in 2012 the export of apples was 49.6% lower than the years with the highest increases(2007-2008). Domestic consumption of apples in 2012-2013 decreased by 8.7% (Feed balance in 2012, National Institute of Statistics, 2013) over the previous year. [6]Pears to a decrease in consumption of 1.8% (Feed balance in 2012, National Institute of Statistics, 2013) in 2012-2013 over the previous year. These decreases are registered on most consumer food products. Small increases in consumption occurred on potato market. For example, imports of potatoes in 2012-2013 increased by 26.4% (Romanian Ministry of Agriculture and Rural Development, 2014) over the previous year, but exports fell by 29.1% (Romanian Ministry of Agriculture and Rural Development, 2014) over the previous year. [5]Analyzing overall from 2007 to 2013, the consumption of potatoes has increased. The effect is determined by the price, which made agricultural products more affordable to maintain a constant level of consumption or even increased slightly. These indicators examined show that the purchasing power of the Romans has been declining. The main reason is the economic contraction that has experienced a European Union as a whole, with a smaller or larger impact from a Member State or another. The financial crisis has affected our country, Romania recorded an economic contraction in GDP of around 6%, comparing the 2008 level by 2012. In Romania, only the level of GDP reached in 2013 slightly above GDP reached year 2008. Such an agricultural potential is directly influenced by economic developments in Romania and the Member States (especially

the economic development of countries with which we have developed significant economic relations). In the same vein, vulnerability or gap in competitiveness of agriculture in Romania to Europe Union agriculture are generated by the poor technical equipment of the Romanian farmers. [2]

Endowment of Romanian farmers -one of the main problems of competitiveness

Endowment of domestic farm is an old problem. Since 1990 Romania is confronted with poor technical equipment of machines.

Table 1.Number of tractors by regions in the period 2007 - 2012

Regions	Year 2007	Year 2008	Year 2009
	Number		
TOTAL	174003	174790	176841
NORD-VEST	27739	27972	29368
CENTRU	22616	22471	22657
NORD-EST	18912	19191	19622
SUD-EST	21339	21169	21323
SUD-MUNTENIA	32325	32493	32080
BUCURESTI – ILFOV	1275	1404	1301
SUD-VEST OLTEA	22055	21956	22611
VEST	27742	28134	27879

Regions	Year 2010	Year 2011	Year 2012
	Number		
TOTAL	180433	183064	184446
NORD-VEST	31694	32163	32482
CENTRU	23390	24053	24414
NORD-EST	19944	20319	20594
SUD-EST	20532	20700	20765
SUD-MUNTENIA	32402	32155	32742
BUCURESTI – ILFOV	1273	1294	1295
SUD-VEST OLTEA	23307	23625	23537
VEST	27891	28755	28617

Source: data processing, INS, TEMPO ONLINE

Which meant that in this time period so far, to see an unwanted "brake" in the development of Romanian agriculture. This finding has motivated my research orientation to analyze the degree of Romanian agriculture machinery equipment. We considered the indicator on the evolution of the number of tractors in

Romania in the post-accession period (2007-2012) as a reference, because most agricultural activities used tractor. Although the analysis may include other complementary machines, the equipment we extruded research on farm with essential equipment, without which a farmer can operate effectively. In this research we studied utilized agricultural area and the number of tractors in Romania in the period 2007-2012. In order to analyze the evolution of the number of tractors in Romania and found differences that occurred in various parts of the country, we appeal to this segment research development regions of Romania.

From Table. 1, we can see that the actual number of tractors in the period under review increased overall from 174 003 tractors in 2007-184446 units in 2012. However in the case of developing regions it can be noticed a decrease in the number of tractors. For example for the southeast region development is a decrease from 2007 to 2012 from 21,339 tractors in 2007 to 21.169 in 2008 to 21.323 in 2009 to 20.532 in 2010 to 20.700 in 2011 and 20.765 tractors in 2012. In the South-East and West was a decrease in the number of tractors from 23 625 in 2011-23537 in 2012 and from 28 755 tractors in 2011-28617 2012. Bucharest-Ilfov development region is in the same harmful evolution with an increase of only one tractor, from 1,294 in 2011-1295 in 2012.

However for Bucharest-Ilfov development region, analysis is not relevant because this region is predominantly urban and less rural and agricultural default.

In table 2, there is a total increasing of utilized agricultural area of Romania in the period 2007-2012, with a few exceptions. A variable evolution was recorded in Central Development Region, where the utilized agricultural area in 2007 was 550 077 ha, with a decrease in 2008-529973 ha, followed by an increase in 2009-556248 ha loss 2010-522903 ha, increasing 2011-563956 ha and a decrease in the utilized agricultural area 2012-552180 ha. Basically Bucharest-Ilfov region recorded the largest losses occupied with agricultural areas from 75 977 ha in 2007-56184 ha in

2012. Vast majority of these areas have been used either to develop residential and industrial areas. What can generalize but it is a drop in agricultural areas of analysis used the last two years.

Table 2.Utilised agricultural surface in the period 2007 – 2012

Region	Year 2007	Year 2008	Year 2009
TOTAL	7777174	7798075	7884101
NORD-VEST	841230	735411	712111
CENTRU	550077	529973	556248
NORD-EST	1190291	1146317	1155451
SUD-EST	1585102	1707790	1736042
SUD-MUNTENIA	1787495	1802225	1855086
BUCURESTI – ILFOV	75977	54727	55592
SUD-VEST OLTENIA	981675	1031765	1033718
VEST	765327	789867	779853
Region	Year 2010	Year 2011	Year 2012
TOTAL	7807379	8081613	8058329
NORD-VEST	722597	725261	700984
CENTRU	522903	563956	552180
NORD-EST	1130502	1166806	1252490
SUD-EST	1766107	1799198	1736558
SUD-MUNTENIA	1815491	1877798	1884369
BUCURESTI – ILFOV	64781	55808	56184
SUD-VEST OLTENIA	1023571	1050067	1038754
VEST	761427	842719	836810

Source: data processing, INS, TEMPO ONLINE

Thus, only the north-east and Muntenia region recorded increases in agricultural land used by the 1,166,806 ha ha 2011-1252490 in 2012 and 1,877,798 ha 2011-1884369 2012. Besides analyzing agricultural area used whole region in 2012 to the year 2011 there is an alarming drop from 8,081,613 ha to 8,058,329 ha.

In table 3 we processed the data in Table 1 and Table. 2 and obtained UAA incumbent a tractor on each development region of Romania.

From the analysis we can see that in most developing regions of Romania is a decrease

of the utilized agricultural area which lies a tractor.

Table 3.Utilised agricultural surface for one tractor by regions, period 2007 - 2012

Regions	Year 2007	Year 2008	Year 2009	Year 2010	Year 2011	Year 2012
	ha/tractor					
TOTAL	44.70	44.61	44.58	43.27	44.15	43.69
NORD-VEST	30.33	26.29	24.25	22.80	22.55	21.58
CENTRU	24.32	23.58	24.55	22.36	23.45	22.62
NORD-EST	62.94	59.73	58.89	56.68	57.42	60.82
SUD-EST	74.28	80.67	81.42	86.02	86.92	83.63
SUD-MUNTENIA	55.30	55.47	57.83	56.03	58.40	57.55
BUCURESTI - ILFOV	59.59	38.98	42.73	50.89	43.13	43.39
SUD-VEST OLTENIA	44.51	46.99	45.72	43.92	44.45	44.13
VEST	27.59	28.08	27.97	27.30	29.31	29.24

Source: data processing, INS, TEMPO ONLINE

Thus, in the north-west in 2007 to 30.33 ha was for a tractor. In the same region there is a decrease each year covered up to the value of 21.58 ha incumbent on a tractor in 2012. Similar decline occurring in the Central region, northeast region, the Bucharest-Ilfov. Exceptions are southeast and west region, both registering growth of 74.28 ha which lies a Trace year 2007 to 83.63 ha incumbent on a tractor in 2012 and from 27.59 ha what it returns a tractor in 2007 to 29.24 ha incumbent of a tractor in 2012. South-west region, Oltenia maintains constant UAA incumbent a tractor from 44.51 ha in 2007 to 44.13 ha in 2012. South-Muntenia Region has a utilized agricultural area that lies an equal tractor in 2009 with 2012 (57.83 ha / tractor versus 57.55 / tractor).

Although vulnerabilities in achieving agricultural potential of Romania are numerous, they require extensive and detailed research; These two analyzes made in the research: the evolution of consumption in Romania vegetable crops, fruits and meats in 2012, and the endowment of Romanian farmers-one of the main problems of competitiveness, is an analysis to highlight and address the main vulnerabilities of agriculture in Romania . In the first part of the analysis there is a decrease in consumption in major crops, fruits and meats in 2012. Primary

cause is marked by changes in purchasing power export and domestic market. Achieving agricultural potential is directly influenced by economic developments of the Member States (especially the economic development of countries with which we have developed significant economic relations).

CONCLUSIONS

Reviewed the progress indicator on the number of tractors in Romania in the post-accession period (2007-2012) reveals that the actual number of tractors in the period under review increased overall from 174 003 tractors in 2007-184446 units in 2012. However reality shows that one region decreases in the number of tractors registered since 2007 until 2012, and in three regions decreases the number of tractors in 2012 compared to 2011. In comparison with other EU countries, in 2009 the are notable differences (Eurostat, 2010): Germany 681,200 tractors, Lithuania 118,041 tractors tractors, Luxembourg 6,527 tractors, Poland 1.57729 million, Spain 1,320,599 tractors, Romania 176,841 tractors)

Even if the total number of tractors in Romania increased from 2007 until 2012, the utilized agricultural area (ha) per a tractor is almost constant. Situation found can be worrying, because after five years the European Union in 2012 did not record almost any progress in terms of utilized agricultural surface in Romania. Even though our country has received funding through the SAPARD Programme in the pre-accession period and still receive funds for the purchase of machinery patterning by Measure 121, it still have a low endowment in agriculture.

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REFERENCES

- [1] Availabilities of population consumption in 2012, the National Institute of Statistics, 2013
- [2] Eurostat, 2010, www.epp.eurostat.ec.europa.eu
- [3] Feed balance in 2012, the National Institute of Statistics, 2013
- [4] Istudor Nicolae, 2008, Compatibilization profile economic organizations in Romania meet the health food, veterinary and environmental of the European Union, Edited by Academy of Economic Studies, Bucharest.
- [5] Ministry of Agriculture and Rural Development www.madr.ro
- [6] National Institute of Statistics, www.ins.ro
- [7] Supply balances sheet for major food products in 2013, National Institute of Statistics, 2014

ONLINE PLATFORM AND TRAINING METHODOLOGY IN MOBIVET 2.0: THE OPTIMUM TOOL FOR SELF- DIRECTED LEARNERS AND TRAINERS IN VOCATIONAL EDUCATION AND TRAINING

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Abstract

The paper presents a summary of the activities and the results with an impact in vocational education and training from the implementation of the MOBIVET 2.0 project. The project envisaged that the future of teaching would rapidly vacate the classroom and become heavily involved in distance-learning using Multimedia/Internet. The revolution from the classroom lecturer's "talk and chalk" to independent Mobile E-Learning requires a completely new and different didactical approach. Education process gets more focused on the availability and mobility needs of the students and more adapted to the changes in technology, as mobile devices become more versatile, software changes every few months and the wireless transfer rates increase. This process requires new teaching methodologies, training of trainers to keep them updated and validation of the best practices in the educational field. An online Learning Management System was implemented, a wide range of devices were used, ranging from desktop computers, to laptops, tablets and smartphones (with different Operating Systems, browsers and screen sizes and resolutions) to develop and test a number of seven courses in different study areas. Teachers and students from vocational education and training (VET) were assisted in the process and this led to the development of a "VET Teachers manual in using Mobile Web 2.0 tools and applications in online training and tutoring", an "online training and tutoring methodology" and a "self-evaluation methodology", with step-by-step guidance for users. The technical testing and the piloting activities in the project revealed that by using mobile technologies in teaching, the availability of information increases and thus educational activities better serve their purpose for the students. Also, the use of laptops, smartphones and tablets was preferred by the participants over the desktop computers in a ratio of 3:1, thus emphasizing the need for mobility and information availability.

Key words: e-Learning, mobile learning, mobile devices, interactive mobile learning environment, distance learning in VET

INTRODUCTION

Many EU citizens constantly seek ways to improve their professional development to remain competitive on the ever-changing labour market. As a result the number of self-directed learners, seeking for long-term development of knowledge and skills, grows rapidly. The dynamics of this process transforms the formal and informal learning

into lifelong learning. But the self-directed learners set new requirements to lifelong learning: to be better, faster, cheaper and easily accessible.

They also need an immediate effective support and back up from online tutors when they need help to successfully continue their online self-guided training.

Today there is a critical need for new improved and more efficient teaching/training

methodologies and techniques that will shrink the gap between all participants in lifelong learning and will provide teachers and trainers with new knowledge and skills helping them to design and manage up-to-date online training and tutoring processes.

As the technologies of communication (exponential increase in mobile Internet bandwidth with 3G, 4G, 4G+ and the future 5G transfer technologies, increase in storage space, processing power), the devices (new mobile devices such as tablets and smartphones, with new sensors and new technologies for user interaction) and software technologies are changing at a very fast rate, educational institutions at European level are more and more interested in developing and expanding the currently available technologies in e-Learning field. New innovative training materials also require new training methodologies, as well as new ways to deliver the educational content to the target groups, considering the growing need of mobility, availability, information aggregation and very fast response times among both students and adults in the labour market.

The Digital Agenda for Europe (DAE) aims to reboot Europe's economy and help Europe's citizens and businesses to get the most out of digital technologies. [3,4] It is the first of seven flagships initiatives under Europe 2020, the EU's strategy to deliver smart sustainable and inclusive growth. Among the 7 key areas for further efforts to stimulate the conditions to create growth and jobs in Europe, the third key area focuses on improving the digital skills and jobs. [4]

DAE stated that Europe is suffering from a growing professional ICT skills shortage and a digital literacy deficit. Only one of the nine ICT applications companies present in the Financial Times Global 500 list is European; only four of the top 54 websites visited across Europe are of European origin. The international Web Sites, Wikipedia (San Diego, USA), Facebook (Harvard University, USA), Google (Stanford University, USA), Twitter (St. Louis, USA), Yahoo (Sunnyvale, USA), Moodle (Perth, Australia) and internet shopping sites, EBay (San Jose, USA),

Amazon (Seattle USA) are examples of interoperable applications which are all based on WEB2.0 Technologies.

In this context, 7 organisations (2 universities, 2 training centres and 3 learning innovations oriented SMEs) from 7 countries (Bulgaria, Germany, Greece, Malta, Romania, Slovakia and Spain) joined efforts in implementing the project called "Mobile Web 2.0 e-Training for Vocational Education Trainers - MOBIVET 2.0" (LLP/LDV/MT/ TOI/02/2012). This project aims at filling the online training gap between the self-directed learners and VET trainers by developing mobile e-learning 2.0 knowledge and skills of the trainers, thus turning them from in-class trainers to skilled online tutors (e-tutors). In this way the project offers a strong support for current and further development of innovative Web 2.0-based tutoring methodologies, pedagogy approaches and practices, thus improving lifelong learning in EU. [7]

The findings and the conclusions of the Fourth report on vocational training research in Europe: modernizing vocational education and training (CEDEFOP) [2] include the following facts:

- 42% of the EU population indicated participation in lifelong learning activities;
- one fifth of the population of the EU refers to computer-based training when engaging in lifelong learning;
- only 4.5% of the population attended formal education/training courses;
- informal workplace self-learning is a key element for Continuous Professional Development (CPD);
- only a fifth of companies trained more than half their employees using e-learning;
- there is an unsatisfactory supply of e-learning materials adapted to the specific needs of organizations, and a general preference for more informal training tools.

MATERIALS AND METHODS

MOBIVET 2.0 project is using e-Learning materials and innovative methods as effective tools to broaden the e-skills and competencies of European VET practitioners (teachers,

trainers and tutors) and helps to develop adequate online training practices for effective distance tutoring of lifelong self-learning activities at the workplace and while being mobile, without time and distance barriers.

The first step was to create the educational framework based on the innovative results from four other successfully implemented projects: DeInTRA (reports, guidelines and toolkits for overcoming barriers and gaps for the implementation of innovative training methodologies) [1], CareIn (a learning environment based on Web 2.0 technologies used to teach health and care assistance workers) [5], MENUET (4 interactive e-books compatible with tablets and smartphones in fields of Web-Design, Open Distance Learning, Environment Protection and e-Commerce; one authoring tool for developing learning materials using Web 2.0 technologies; one toolkit to publish online and manage course assessments; one Learning Management System (LMS) platform; one guide on how to use e-books/e-textbooks effectively in teaching and learning) [10] and RESNET (methodologies and reports on developing and testing practices for effectively conducting and managing distance learning activities) [9].

Due to the advances in digital technologies, it is now possible to integrate multiple media into single educational applications. Multimedia applications on CD-ROMs and websites may incorporate text, pictures, audio, graphics, animations, simulations, full-motion

videos and links to other software or websites, thus greatly enriching the learning experience. In order to overcome the fact that a significant portion of learning is taking place outside of formal training providers - schools, colleges and universities, mobile devices are used to deliver content to learners.

New multimedia learning materials formats and new hardware devices require the development of new skills and methodologies of teaching and targeting trainers. An integrated method to overcome difficulties in the training of trainers was used in a course on how to develop interactive materials for their students by using actual mobile devices while attending the course. Another key important factor was to split the whole course into smaller modules and deliver them one by one, introducing each technology, followed by examples, in a constructive manner.

Another issue considered consisted in developing a common format in order to ensure a cross-platform compatibility with browsers and devices. Two important technologies were used to this purpose: HTML 5 and Adobe Flash, each with its advantages and disadvantages. The next step was to test the content developed by using each of these two technologies on multiple browsers (Internet Explorer, Firefox, Safari, Chrome, Opera). During the technical testing phase, there were assessed the interactivity with objects, the correct display of information on the screens, the ergonomics and portability aspects.



Fig. 1. Platform content delivery mechanisms depending on the web and mobile web (tablets and smart phones) browsers [6]

The e-learning content was tested on both desktop and laptop web browsers running on Linux and Windows Operating Systems, with LCD screen resolutions ranging from 1280 x 720 to 1366 x 768, as well as on mobile devices (both tablets and smartphones) from 4.5' to 10.1', running Android and IOS Operating Systems.

Regarding the creation of the content, the following work-flow was used: Analysis of the written course, creation of the learning material scenario (script), design and creation of the visual materials, content development and programming, integration of the content into the platform, technical evaluation of the functionalities of the multimedia objects, scientific evaluation of the content and publishing the content online.

As regarding the LMS (Learning Management System) used, Moodle was the solution chosen as the best fit, following a technical market survey and considering the series of advantages: simplicity in use for teachers and students, compatibility with a large number of learning content formats and devices, good scalability and because it is open-source, free to use and the most popular open-source e-Learning environment with over a million users in 2010 [8,11].

There are also activities in the project focusing on evaluating teaching methods by using mobile devices from both the teachers' and the students' perspectives. To this purpose, test beds were organized in partners' countries with piloting activities for 7 courses developed in the project: "e-learning practices in VET", "Applying social media in VET", "Web 2.0-based Mobile Technology in VET", "Emotional Intelligence in the Workplace", "The Green Office", "Intercultural Skills", and "Leadership Skills".

In Romania, the evaluation survey was carried out online, during a period of two months. For the students' evaluation, there were 210 registered participants, with a gender distribution of 52% male and 48% female students and with 86% of the students over 18 years old. For the teachers' evaluation, there were 100 registered participants, with a gender distribution of 66% male and 33%

female teachers and with a majority of 67% of the students over 40 years old.

RESULTS AND DISCUSSIONS

Courses content format

The results of evaluating the best fit new technologies for content development indicated HTML 5 (a markup language for structuring and presenting content for the World Wide Web and a core technology of the Internet) with CSS 3 (Cascading Style Sheets - a style sheet language used for describing the presentation semantics (the look and formatting) of a document written in a markup language) and JQUERY (a multi-browser JavaScript library designed to simplify the client-side scripting of HTML).

For the eBooks format of the courses, a very nice instrument that was used and was very well received and appreciated by both teachers and students, is called *PageFlip*.

The Learning Management System platform

The flexible layout elements offered by the Moodle platform helped to organize the learning content depending on the course/teachers/ students needs. Also it offered the advantage of interface responsiveness (adapt the displayed contents depending on the screen size and resolution of the device used to access the platform, without having to publish the learning content multiple times). Other useful modules, available since version 2.x that were used, include:

People: This block contains a link to the list of participants enrolled in the course.

Activities: Lists and allows navigation between the different activities available in your course (e.g., Forums, Quizzes, and Assignments).

Recent Activities: Shows participants updates since they last accessed the course.

Search Forums: Allows the user to search the course's forums for a specific word or phrase.

Navigation Block: It appears on every page of the site. It contains an expanding tree menu which includes My Home, Site Pages, My Profile and Courses.

Latest News: Displays recent posts made to the News Forum.

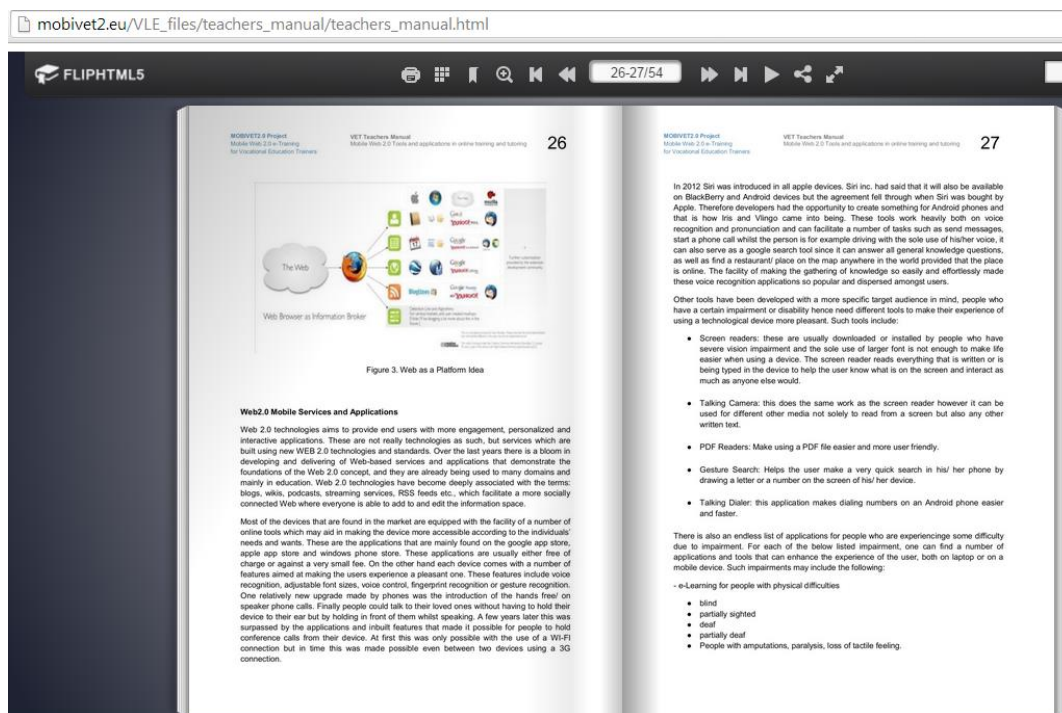


Fig. 2. Using PageFlip instrument in HTML 5 to view the contents of an e-book

Upcoming Events: Displays upcoming events in the course, particularly ending dates associated with assignments and quizzes.

Content Area: The area where course resources and activities are placed students.

Settings Block: The settings block provides context-sensitive links to settings pages. The *Switch role to* link has also been moved to the Settings block.

Browsers

The results from testing the compatibility and the response times of different browsers indicated Chrome as the best browser for laptops and desktop computers and Safari for tablets running on IOS Operating System (v.6.1.x and newer).

Statistical analysis of the Evaluation Form about student attendants' perception regarding the MobiVET training courses revealed the fact that students have studied the course materials in proportion of 67% from their residences revealing the tendency towards self-learning, one of the main objectives of the project. The remaining percent of 33% of students studied the courses at school, one of

the reasons being the fact that MobiVET training courses offered students the possibility to receive guidance from their teachers. Even so, more than 90% of the students that studied from school indicated the fact that that they needed partial or no guidance from their teachers, contrariwise the small proportion of students that needed full guidance.

The perception of the students regarding the content of the courses revealed the following aspects: 71% of the students indicated that the content of the courses were clear enough to be understood, meanwhile 29% considered that the courses were very specific and easy to understand and none of the students found the courses difficult to understand.

As seen in the pie chart, 45% of the teachers are teaching in upper secondary education - theoretical profile high-schools, followed by a percent of 33% that are teaching in upper secondary education - technology profile high-schools.

In order to complete the information about students' perception over the MobiVET courses that they have studied, in the final part

of the Evaluation Form, the students were asked to give additional feedback and further

suggestions in order to improve future training courses.

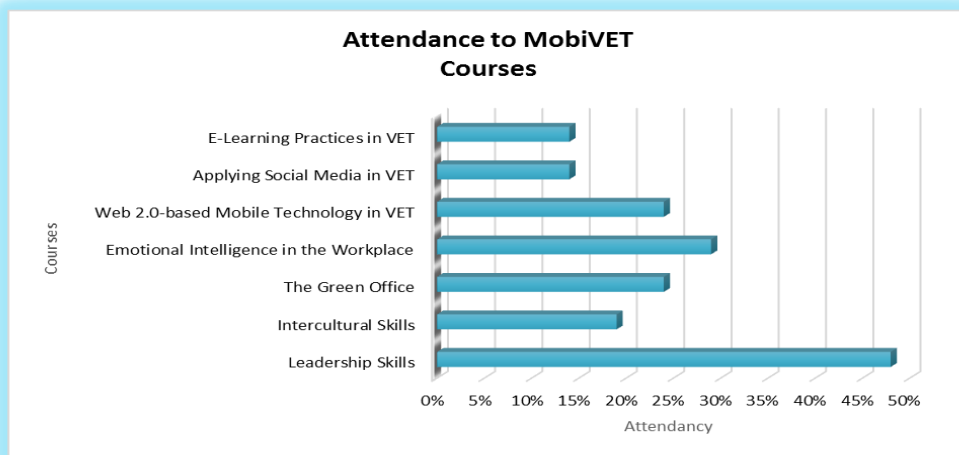


Fig. 3. Participants' (students) attendance to MobiVET Courses
1.

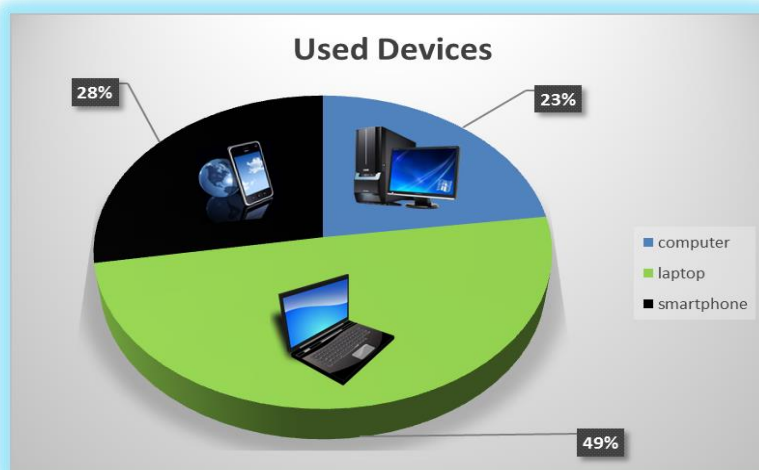


Fig. 4. Devices used to access courses by the students

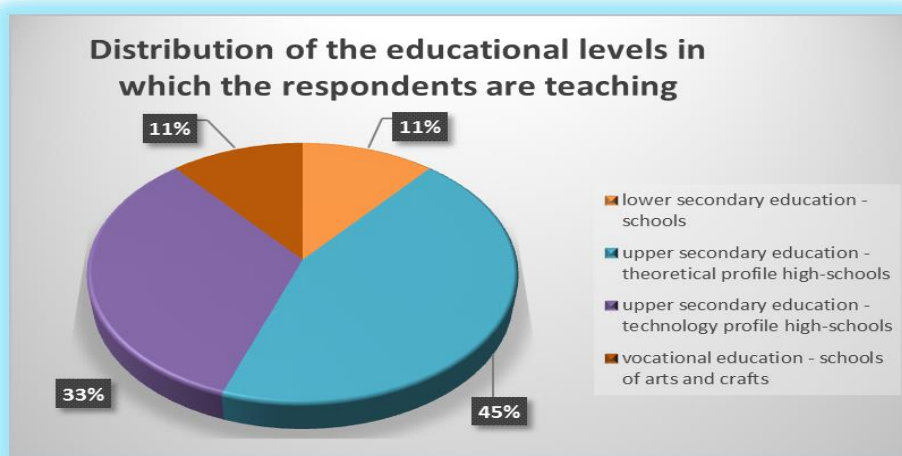


Fig. 5. Distribution of the educational levels in which the respondents (teachers) are teaching

With a majority of 52%, students declared that future courses should continue being structured and contented in the same way the ones that they have studied did, meanwhile the other 48% suggested the extension of the courses with further information and additional materials and none of the respondents indicated that the courses should reduce their size.

The information contained by the e-Handbook: "Guide to Using Web 2.0 Technologies in Training" was totally or fully unknown by teachers and helped them to become more familiar with mobile training technologies.

CONCLUSIONS

The Future will be led by Multimedia E-Books, which will seamlessly include all the functionalities currently offered by MOODLE, enabling Independent Mobile Learning for the pursuit of knowledge.

With totally automatic assessment, marking and grading, these interactive e-Books will be used by more and more people all over the world.

By using mobile technologies in teaching, the availability of information increases and thus educational activities better serve their purpose for the students.

Implementing such systems at a greater scale may encounter a small amount of resistance at first, associated with situational inertia and educational conservatism. But, if it is correctly correlated with the continuous advances in technology in the sense of adding educational value with the new interactive content, these issues can be easily overcome by stimulating the enthusiasm of new things and the expectations met by the utility of these new learning materials and methods.

In order to be able to keep up with the new technologies and trends, constant training programs must be developed and applied to trainers, who must continuously reinvent themselves.

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REFERENCES

- [1] Ciuca, V., Lincaru, C., Grecu, L., 2009, Innovative Methodologies in Lifelong Learning, DeInTRA Project "Cooperation for Innovative Training Methodologies Deployment in the European Labour Market". International Conference on Education and New Learning Technologies, July, 6-8, 2009 Barcelona, Spain and <http://www.deintra.eu>
- [2] Descy, P., Tessaring, M., 2008, (eds). Modernising vocational education and training: fourth report on vocational training research in Europe: background report, volume 3. Luxembourg: Publications Office, (Cedefop Reference series). http://www.cedefop.europa.eu/etv/Upload/Information_resources/Bookshop/567/3050_3_en.pdf
- [3] Digital Agenda for Europe, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Brussels, May 2010, http://ec.europa.eu/information_society/digital-agenda/documents/digital-agenda-communication-en.pdf
- [4] Digital Agenda for Europe <http://ec.europa.eu/digital-agenda/digital-agenda-europe>
- [5] Emotional Intelligence care in health and social assistance, <http://www.carein.eu>
- [6] Luminosity Studio – eLearning Authoring Solution, Collaborative and rapid eLearning authoring solution in HTML5 <http://www.cm-group.co.uk/products>
- [7] Mobile Web 2.0 e-Training for Vocational Education Trainers <http://www.mobivet2.eu>
- [8] Open-source Learning platform. Moodle.org, <http://moodle.org/>
- [9] RESNET 2008-2009, Project № 2008-1-SK1-LEO05-00227, Slovak University of Agriculture, <http://www.resnet-project.org>
- [10] The MENUET Project, Mobile E-Novative Use of E-learning Technologies (MENUET) <http://141.85.252.215/menuet>
- [11] The MENUET E-Book: "ODL techniques", <http://menuet.etcenter.ro>, 2010

