CHOICE BETWEEN TRADITIONAL AND MODERN MILK SUPPLY CHANNELS BY FARMERS IN PUNJAB, PAKISTAN: A LOGIT REGRESSION APPROACH

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Abstract

Considering the changing milk marketing structure in Pakistan, this study is aimed at investigating the factors influencing the farmers' choice of milk marketing channels in Punjab, Pakistan. The research has been carried by means of survey for data collection from farmers in upper and south Punjab. We interviewed 341 farmers in total, with 165 farmers from Upper Punjab and 156 farmers from South Punjab. The logit model was employed in this study to estimate the factors influencing the dairy farmers' decisions to participate in the modern and tradition milk supply channels. The empirical results indicate that the volume of milk sold, improved cattle breeds, milk prices, distance to milk collection unit and payment methods are significant factors that influence the choice of farmers between two market channels. Quantity of milk sold, and improved cattle breeds are important factors to select modern supply channels. However, milk prices, distance to the milk collection unit and long payment periods discourage farmers' participation in modern channels. The study suggests that provision of advance dairy technology, intuitional support, and investment in infrastructure could enhance farmers' capabilities of managing resources and hence could shift farmers towards commercialization.

Key words: *choice, Logit Regression, milk, supply channels, Punjab, Pakistan*

INTRODUCTION

Food production and its marketing have experienced a revolutionary change all over the world and integrated food supply channels are the fastest growing and prominent market phenomenon [9, 17]. These changes have forced the participants to adopt appropriate strategies to meet the demands of new market challenges. In dairy sector, immense changes are brought in milk marketing, in terms of value addition, product differentiation and market competition [5, 21]. Modern milk supply channels are expanding their business in developing countries since early 1990sand demand for high-value products is increasing [3, 27]. Integrated supply channels provide new opportunities to farmers in terms of price and volume stability [19]. Yet, they also pose new challenges in shape of food safety standards and continuous milk supply [2, 22, 30]. However, with the expansion of modern milk supply channels there are growing

concerns that whether the small-scale fames will be able to reap the advantages of emerging opportunities or not. So, there have been apprehensions about impact of modern milk supply channels on small farmers in developing countries. These new milk supply channels brought considerable changes in milk procurement, processing, and wholesaling. Nevertheless, studies in many developing countries suggested that mainly large-scale farmers benefit from these channels while small scale farmers find it difficult to meet the quality and food safety standards. In addition to this, modern supply channels also face high transaction costs for dealing with millions of small farmers [28].

In Pakistan, from early 2000s, many new players entered processing industry and large-scale dairy farms were built in the country. This resulted in massive investment in milk processing industry and introduced advance marketing strategies. Some milk processing companies introduced modern procurement

systems and contract relationship with farmers to supply dairy inputs and purchase quality milk from farmers. In Pakistan, modern integrated milk supply channels are growing at a pace of 7 to 8 per cent per year. Major players in modern milk supply channels are Nestle and Engro foods with nearly 34% share of each channel [10]. This has developed a competitive structure of milk supply in Pakistan. However, despite all these changes milk marketing structure in Pakistan is largely unorganized and dominated by informal markets. In traditional channels milk is marketed through multi-layered channels. Important player in traditional market channels is milkman/vendor, who purchase milk from small dairy holders in rural areas and sell it to its customers in urban centers. Vendors sell milk directly to consumers or to small, sweet shops, hotels, and restaurants. However, farmers also sell milk directly to consumers in village areas and small tea shops and restaurants. Market players in traditional milk markets purchase milk at farm gate while in case of modern milk supply channels farmers need to travel 1.86 km on average to sell milk. It takes lot of time and increases the transportation costs of farmers too. The other advantages of vendors are quick payments, and no quality control issues in traditional channels.

Many studies have been conducted to identify the factors influencing the participation of farmers in alternative supply chain. Misra et al. (1993) [20] analyze the factors influencing the farmers' choice of milk handlers in USA and find that price of milk is the main factor in choice of marketing channels. Abdulai and Birachi (2009) [1] examine the nature of coordination mechanism and determinants of fresh milk supply chains in Kenya. The study finds that farmers prefer written contracts and distance to markets and gender of operator are main determinants in choice of marketing channels. Staal et al. (2006)[32] address the factors influencing the choice of farmers' participation in alternative milk channels in India and find transaction costs are important determinant in choice of marketing channels. Several other studies focus on the determinants of participation in alternative milk supply chains [4, 15, 18, 30].

In Pakistan very few studies have been conducted to understand the impact of modern milk supply channels on production of farmers. Burki and Khan (2011) [7] and Sadaf and Riaz (2012) [29] studied the impact of modern supply channels on technical efficiency of farmers, [36] analyzed the competitiveness of milk marketing channels and role of government policies, and [25] investigated the profitability of different players in traditional milk marketing channels. However, no studies have been done in Pakistan to understand the factors affecting farmers' choices of milk marketing channels in this changing market structure.

The broad motivation of this study is to identify the factors that influence the farmers' participation in modern and traditional milk supply channels and to assist in formulating policies and programs to improve milk supply system in Pakistan.

The structure of the papers is as follows; reviews the structure of dairy in Pakistan, data and variables, methodology and empirical model, results and discussions, and conclusion and recommendations.

Changing Structure of Dairy in Pakistan

Dairying is an important segment of Pakistan's economy accounting for 12% to the national Gross Domestic Product (GDP) and constitutes 46% of agricultural value added while milk alone accounts for 27% of the agricultural sector [33] and 75% of the total value of livestock products [35]. Livestock sector employs half of the work force, and 35 million people earn approximately 30-40% of their income from livestock [13]. It also serves as a security to famers against crop failure. Pakistan has an annual production of 34 billion liters of milk, out of which 27 billion liters are available for human consumption [26]. Despite having plenty of milk production Pakistan cannot fulfill its growing demand of milk and is net importer of powdered milk and other dairy products.

However, Pakistan has an interesting picture of dairy sector in many ways. First, Pakistan

is the fourth largest producer of milk. Secondly, per capita consumption of milk is highest in Pakistan as compared to rest of the Asian countries (159 kg per person). Third, due to low level of milk processing and high demand of milk and milk products in urban areas several new companies entered in processing of UHT milk to fill the gap after 2000, which include Engro Foods, Shakar Gunj Foods, Noon Dairy Pakistan, Nirala Dairy, Alpha Dairy, Royal Dairy and many other companies started to process milk and milk products [14].

In most of the developing countries of South Asia, Sub-Saharan Africa, and Latin, share of traditional small scale milk markets is above 80% of total milk marketed [24]. In Pakistan more than 90% of the total marketed milk is still supplied through traditional milk supply channels. Out of the total milk available for human consumption in country, nearly 40% is marketed, while the remaining 60% is consumed by rural households [35].

However, there are growing concerns about quality of milk supplied by traditional milk channels, especially, adulteration in milk with water and chemicals and poor milk handling techniques. In addition, urbanization in Pakistan has been growing at 3.1 per cent per year [11]. The demand for milk in Pakistan has been growing at 15 percent per annum [6]. In such situation traditional milk channels are unable to meet the expanding gap between supply and demand. This has created a huge potential for modern market channels to expand their business. Even though milk processing companies including multinational and local are an important component of organized milk markets in Pakistan but milk procurement through these channels is still very low. Furthermore, the distribution of supply channel networks of formal system in terms of volumes of milk handled, marketing infrastructure and installed processing facilities are mostly concentrated in some districts and provinces. Out of 21 milk processing plants in country 19 are in Punjab, 2 are in Sindh while rest of the provinces and territories have no milk processing facility [14].

Consequently, despite being the fourth largest milk producer in the world, Pakistan could not harness the maximum potential of its dairy sector. The government policies towards dairy sector did not remain so encouraging. In the first five-year Plan (1955-60) government chalked a plan to buy milk from specialized dairy farmers and vendors, pasteurize it and sell it to consumer in sealed bottles. It also suggested making cooperatives of milkmen/vendors for transportation of milk to cities. These projects came to operation in two major cities: Karachi (1965) and Lahore (1967). However, these schemes remained unsuccessful due to financial losses and lack of funding from government. The second (1960–1965) and third (1965–1970) five-year plans did not put much emphasis on the development of dairy sector.

In 1970s and early 1980s government gave incentives to private milk supply channels and encouraged investment by introduction of aseptic packaging material for ultra-high temperature (UHT) treated milk by Tetra Pak Pakistan Limited. The milk processing industry got a massive investment in Pakistan and private sector established 23 milk processing plant. Nevertheless, Pakistan was still facing lack of infrastructure, social taboos in selling milk, and little acceptance of processed milk by consumers. Most of the players could not sustain with higher cost of milk collection and low level of milk processing and sale. In early 2000s many new players entered into milk processing industry and number increased from 2 in 1990s to 21 between 2000 and 2007.

Pakistan did considerable improvement in supply channel networks from 1970s, when selling milk was considered as social taboo and now many in the country are predicting "white revolution." However, milk collection in the country is still facing many major challenges: from serious quality problems with collected milk, to colossal drop in milk production in the summer, and access to proper marketing channels [26].

In this context, the aim of the paper was to understand the determinants of dairy farmers'

participation in formal and informal milk supply channels in Pakistan.

MATERIALS AND METHODS

This study was conducted in Punjab province of Pakistan. Punjab is the largest province of Pakistan with 56% of total population. It is also the highest milk producing province of the country with nearly 64% share in total milk production. It has the world most renowned breeds of buffalo (Neeli Ravi) and cattle (Sahiwal). Buffalo is the major milk producing animal in Punjab having 65 % share of total dairy population and 64% share in total milk production followed by cattle with 49% share of total population and 35% milk share in total milk production [16]. Besides local cattle breeds, cross bred breeds and imported cattle breeds are also gaining importance in dairy farming. In Punjab, crossbred and imported cattle breeds have 17% share in total cattle population in Punjab [12].

Punjab province has two regions based on its cultural division. Upper Punjab has 55% share in total buffalo and cattle population in Punjab and South Punjab has 45% share. In terms of milk processing Plants, Punjab has 19 milk processing plants out of 21 in the country, with 14 in Upper Punjab and 5 in South Punjab [12].

We collected the data through random sampling from 12 districts of Punjab with 6 districts from each region during February-April 2013. We interviewed 341 farmers in total, with 165 farmers from Upper Punjab and 156 farmers from South Punjab. From each district we randomly selected a Union Council (which is a small part of district that has its own local government) and collected the data from one Mauza (which is a part of Union Council that consists of few villages and has its own revenue officer) of each Union Council. Given the importance of changing milk marketing structure we focused on two major marketing channels: modern milk supply channels and traditional channels (vendors, direct sale to consumer and sweet shops). As a basic step in data collected, we

checked the suitability of questionnaire through pilot test. We revised the questionnaire considering the loopholes detected in the pilot survey. During the fieldwork we faced several problems in collecting information. Most common were availability of head of household and in many cases hired labor was doing all dairy related activities and head of household has not appropriate information, like time spent on performing different dairy activities. So, we tried to collect relevant information from relevant persons. We collected the information on socioeconomic characteristics, landownership, cropping pattern, agricultural production, assets ownership, milk production and consumption, milk marketing choices, input output quantities and prices. Nevertheless, there are wide regional, social, lingual, and cultural differences in two regions of Punjab, which might have some effect on the quality of data. After accounting for missing observations from data and unavailability of alternative choices in the village we are left with 307 respondents.

Farmer's participation in marketing channels

Table 1 summarizes the distribution of farmers associated with modern and traditional marketing channels in two channels and two regions. Out of total 307 dairy farmers in data, 83 farmers (26%) sell milk to modern milk supply channels and 224 farmers (84%) sell milk to traditional channels.

Table 1. Household' Distribution: Marketing Channels wise and Region wise

Regions	Formal Supply Channels	Informal Supply Channels	Total
Upper Punjab	32	140	172
South Punjab	51	84	135
Total	83	224	307

Source: Author's Calculations.

Important characteristics of households in two regions of Punjab are presented in Table 2. It shows that average age, experience, education, household size and herd size are

higher in South Punjab while milk output per day (liters), quantity of milk sold per day (liters) and percentage of crossbred and imported cows in herd are higher in North Punjab. The price of milk per liter in modern milk supply chains and traditional supply chains is higher in North Punjab.

Table 2. Household's Characteristics (Mean) in Two Regions of Punjab

Variables	Upper Punjab	South Punjab	Total
Age of HH head (years)	44.2	46.1	45
Experience of HH head (years)	16.1	16.5	16.3
Education level of HH head	1.89	2.42	2.
Household Size (number)	8.68	8.94	8.8
Herd Size	16.93	20.35	18.44
Milk Herd	5.01	5.38	5.17
Buffalo	11	8.86	10.05
Local Cattle	2.17	3.80	2.89
Crossbred	2.17	4.63	3.26
Imported Cattle	1.58	3.04	2.22
Crossbred and Imported Cattle	3.75	7.68	5.49
Percentage of Cross and Imported Cattle	19	36.26	26.6
Cow percentage in herd	33.16	56.30	43.38
Price of milk in traditional channels (Rs/ltr)	46.47	41.5	44.60
Price of milk in modern channels (Rs/ltr)	41.12	39.4	40.09

Source: Author's Calculations.

Table 3 describes the socioeconomic and farm related characteristics of farmers in formal and informal markets and an independent sample t-test is conducted to test the difference between characteristics of two marketing channels. It shows that the age of farmers in modern market channels is less, and experience is more than the farmers in traditional channels. However, age and experience of head of household does not vary significantly among different market channels. Educational level of farmers in modern market channels is significantly higher which may suggest farmers' tendency towards early adaptation of new marketing channels with higher education levels. The average family size in traditional channels (9) is statistically higher than modern market channels (8.24). Table 3 further shows that the herd size in modern milk channels (21.65) is higher than traditional channels (17.25) and is statistically different. It may suggest that large farmers tend to sell milk to modern supply channels. Number of buffalo and local cow in herd does not significantly different in both market channels. However, farmers in modern marketing channels have more crossbred and imported cattle (8.54) than farmers in traditional channels and it is statistically different.

Table 3. Household Characteristics of Farmers of based on Participation in Two Different Milk Supply Channels in Punjab with mean and standard deviation in (parenthesis)

Variables	Modern Channels	Traditional Channels
Modern Channels = 1, Traditional Channels = 0, Mean = 0.26, SD = 0.44		
Age of head of household (years)	44.84 (10.84)	45.15 (11.28)
Experience of head of HH (years)	17.13 (8.49)	16.07 (8.93)
Education level of head of HH	2.32 (1.43)	2.05 (1.38)
Household size (number)	8.24 (3.39)	9.00 (3.30)
Herd size	21.65 (12.90)	17.25 (11.48)
Milch herd	5.65 (3.39)	5.00 (3.99)
Buffalo	10.46 (8.87)	9.90 (7.94)
Local cattle	2.63 (4.73)	2.99 (5.72)
Crossbred	6.19 (8.60)	2.18 (3.68)
Imported cattle	2.34 (4.74)	2.18 (4.91)
Crossbred and imported cattle	8.54 (9.06)	4.36 (6.38)
% of Cross and imported cattle	37.11 (30.63)	22.76 (26.31)
% of cows in herd	52.27 (31.61)	40.10 (28.77)
Milk output (liter/day)	54.14 (42.03)	39.45 (29.17)
Milk sold (liter/day)	45.20 (40.68)	31.21 (28.31)
Sold milk percentage	77.12 (13.85)	70.57 (17.73)
Price of milk (Rupees/liter)	40 (4.94)	44.6 (7.75)
Distance to city (km)	7.40 (2.80)	7.04 (2.78)
Distance to milk collection unit (km)	1.86 (0.93)	2.92 (1.06)
Distance to metalled Road (km)	0.35 (0.48)	0.46 (0.62)
Dairy farming land (acres)	3.30 (1.99)	2.90 (1.83)

Source: Author's Calculations.

Modern milk supply channels promote high yielding crossbred and imported cow to reduce seasonal variations in milk production which happens quite often in buffalo milk production system [30].

Moreover, dairy herd of farmers in modern milk supply consists of 52 per cent of cows while in traditional channels cows share in herd is 40 per cent.

Average milk production of farmers in modern supply channels (54.1 liters/day) is higher than traditional market channels (39.4 liters/day). Market surplus of farmers participating in modern milk supply channel is also higher. Nearly 77 percent of the total milk produced is marketed by farmers in modern channels while 70 per cent is marketed in traditional channels. Price offered by modern supply channels (Rs40) is significantly lower than traditional channels (Rs44.6).

Average distance to milk collect unit is statistically different and higher in case of traditional marketing channel (2.92 km) than modern channels (1.86 km). Distance to metaled road is found statistically lower in modern marketing channels (0.35 km) than traditional marketing channels (0.46 km). Land use for dairy farming is lower in case of farmers participating in modern milk channels (2.46) than traditional ones (2.90 acres). It could portray better use of resources by farmers participating in modern supply channels.

Econometric Model

The logit model developed by Cox (1958)[8] and Walker and Duncan (1967)[34] is used in this study to estimate the factors influencing the dairy farmers' decisions to participate in the modern and tradition milk supply channels. In binary logit model the dependent variable (milk marketing channel) is a dichotomous variable (yes=1; no=0) and independent variables are qualitative and quantitative, the probability of adoption can be expressed as follows:

Probability of adoption

$$P_{(y=1)} = \frac{e^{\beta_o + \beta_1 X_i}}{1 + e^{\beta_o + \beta_1 X_i}} \quad \text{equation (1)}$$

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The logit transformation of the probability of adoption P(y=1) can be expressed as follows:

$$ln\left[\frac{p_{(y=1)}}{(1 - p_{(y=1)})}\right] = \beta_o + \beta_1 X_i \quad \text{equation (2)}$$

where: p represents the probability of farmers participating in modern milk supply channels and β_{is} are the regression coefficients estimated by maximum likelihood method. Equation (2) represents the logarithm of the odds of choice of milk marketing channels conditional on the independent variables that are included in the model.

The interpretation of logit regression coefficients is less straightforward than ordinary least square model. The coefficients of logit regression represent the likelihood of an outcome depending on the increase or decrease in independent variables. A positive coefficient of independent variables increases the probability and vice versa. However, the marginal effects of independent variables on the probabilities are not equal to the coefficients. The marginal effects of each variable are computed by using following equation:

$$\frac{\delta p(Y)}{\delta X_i} = \frac{\beta X_i * \exp[Z]}{[1 + \exp(z)]^2} \quad \text{equation (3)}$$

where Z is the sum of coefficients, multiplied by the means of respective variables plus the constant term. The binary logit model does not assume the linearity between explanatory and explained variables. It does not require homoskedasticity assumption and does not assume normally distributed variables.

Since the logit regression is non-linear model, the normal R^2 measure for the goodness of fit is not valid. To measure the percentage of correct predictions, the predicted probability of adoption is calculated for each farm and is compared to the actual adoption decisions. The predicted probabilities of logit model lie between 0 and 1. The model predicts adoption if the predicted probability is higher than 0.5 and assumes non-adoption otherwise. The binary logit model used in this study is specified as follows:

$Y_i = f(\beta; \chi_i) = f$ (milk sold, cross and imported cattle, dairy farmland, milk price, distance, payment, education, region)

where:

Yi is dichotomous variable (modern channels = 1, traditional channels = 0) and X_i are the independent variables.

Here, milk sold (liters) is the quantity of milk sold per day, cross and imported cattle are the number of these cattle in herd, dairy farm land (acres) is the total land used for cultivation and shed, milk price is price of milk per liter in Rupees paid by different channels, distance is the distance in km from milk collection unit, payment is the payment period (fortnight or less = 1, more = 0), education is the levels of education (no education = 0, primary = 1, middle = 2, higher secondary = 3, bachelor = 4, master of higher = 5) and region is based on the political and cultural division of Punjab (North Punjab = 1, South Punjab = 0).

RESULTS AND DISCUSSIONS

Traditional market channel is considered as base category in logit model. The results of logit regression are presented in Table 4. It shows that the volume of milk sold, number of cross and imported cows in the herd and regional dummy has significant positive effect on the farmers' likelihood to participate in the modern supply channels. Volume of milk sold increases the likelihood of farmers' participation in modern milk supply channels by 0.2%. This may suggest that farmers with large quantities of milk are inclined towards modern milk supply channels for smooth supply of milk and modern milk supply channels have less price fluctuations in peak season. Moreover, modern milk supply channels also offer relatively higher prices to large farmers too. These findings are also consistent with the study of [31] who find that the farmers who sale large volumes of milk prefer to participate in modern channels which can absorb the huge amounts of milk.

Farmers having higher share of cross and imported cattle are more likely to sell milk to modern milk supply channels that could explain that they are technologically more advance and try to avoid seasonal drop of milk which happens in case of buffalos' production. Another possible explanation could be that the farmers who are largely cow milk producers are also more likely to join modern milk supply channels because of less preference of cow milk by consumers due to low fat contents. However, the marginal effect of cross and imported cattle on farmers' participation in modern milk supply channel is quite small (0.6%).

Regional dummy has also significant positive effect on likelihood of participation of farmers in modern supply channels. The rationale here is that the modern milk supply channels are more concentrated in North Punjab and farmers have better access to modern supply channels and competition among different supply channels ensures better prices and incentives to farmers to participate in modern supply channels. Marginal effect of regional dummy is high which show that farmers in Upper Punjab are 12% more likely to participate in modern supply channels.

Negative coefficient of price of milk implies that increase in milk price reduces the likelihood of participation of farmers in modern milk supply channels. The possible interpretation of this is price is basic driving force in selection of marketing channels by small and medium farmers. Lower prices of milk offered by modern marketing channels in comparison to vendors and consumers, reduces the likelihood of farmers towards modern milk supply channels.

However, its marginal effect on non-participation of farmers in modern supply channel is quite low (0. 9%). It could also elucidate that the farmers with higher volumes of milk are more likely to sell milk to modern supply channels to ensure smooth delivery of milk. However, these findings are inconsistent with the study of [30] who suggests that farmers are more likely towards modern milk supply channels irrespective of lower prices offered by these channels. They find that modern channels have price stability as compared to traditional ones that increases the likelihood of farmers towards these channels.

Table 4. Logit model estimates of milk marketing channels

Independent Variables	Regression coefficients		Marginal effects	
	Coefficients	Standard Error	Coefficients	Standard Error
Constant	4.636***	1.33	-	-
Milk sold (ltrs)	0.017**	0.00	0.002**	0.00
Cross and imported cow	0.048**	0.02	0.006**	0.00
Dairy farmland	-0.263**	0.13	-0.032**	0.01
Milk price (Rs/ltr)	-0.074***	0.02	-0.009***	0.00
Distance to MCU (km)	-1.009***	0.19	-0.126***	0.01
Payment method	-2.097***	0.38	-0.262***	0.03
Education	0.158	0.11	0.019	0.01
Region	1.032***	0.40	0.129***	0.04
Number of observations	307			
Log likelihood	-120.58			
Pseudo R^2	0.32			

Source: Author's Calculations.

Distance to milk collection unit lowers the likelihood for the choice of modern supply channels. It has higher negative marginal effect (12%) on the participation of farmers in modern supply channels. This suggests that with increase in distance, small and medium farmers do not supply milk to modern market channels because of increasing transport costs and time required to transport milk. However, large farmers may find it difficult to transport large quantity of milk at greater distance and it increases their transportation cost too. So, increase in distance discourages both small and large farmers to participate in modern supply channels. These results are consistent with the findings of [30] and [23] who find that the channels associated with long distance have higher transport costs and are not preferred as these reduces farmers' gross margins.

Payment procedure reduces the likelihood of participation of farmers in modern supply channels. It has strong negative marginal effect (26%) on the modern milk supply channels. Farmers are less likely to participate in the modern supply channels because they make payments monthly and through banks. This creates difficulty for small and medium farmers in meeting their day-to-day expenses. Farmers are also not so familiar with banks and are usually hesitant to deal with banks. Moreover, monthly income from milk sale is not so high that they keep it in banks. However, vendors and consumers make them weekly payments and give them early payments in case of emergency. For small and medium farmers, it is easy to sell milk to traditional milk supply channels. These findings are consistent with study of [31] who find that the farmers prefer to sell milk to market channels who make them immediate cash payments as it is necessary to fulfill farmers' daily financial needs. However, these findings are inconsistent with the study of [32] who find that the farmers are less likely to sell milk to those channels who make cash payments.

Size of land used for dairy farming, reduces the likelihood of farmers' participation in modern milk supply channel by 3.2%. This needs a careful interpretation. The possible rationale behind is that the farmers who use more land for cultivation of fodder and dairy activities are relatively less efficient in use of resources and are traditional ones. Besides this, farmers with large share of buffalos who have more fodder requirements than cows might use more land for cultivation.

To the best of our knowledge, farmers having buffalos are more inclined towards traditional channels because of high demand of fresh milk of buffalo due to its high fat contents. Such farmers have less likelihood for participation in modern milk supply channels. Table 5 shows that the logit model correctly predicts 86% of the overall observed values, with 63% correct predictions for participation in modern supply channels and 95% correct predictions for traditional market channels.

Table 5. Classification of predicted outcomes of logit model

Predicted			
Classified	Modern = 1	Traditional = 0	Total
Modern = 1	52	12	83
Traditional = 0	31	214	224
Total	83	224	307
Percentage correctly predicted	62.6%	94.6%	85.8%

Source: Author's Calculations.

CONCLUSIONS

Although modern milk supply channels are expanding their base, but traditional milk markets still have major share in milk markets in Pakistan. Major hurdles in modern supply channels are small and scattered milk producers that increase the milk collection costs of modern milk channels. Traditional milk markets are effective in terms of access to small farmers and urban consumers. However, growing concerns in consumers about quality of milk and hygiene related issues with traditional milk channels are increasing the demand for processed milk. Urbanization has been growing in Pakistan with huge pace that has increased the demand for fresh milk in urban centers and traditional channels are unable to fill the gap. These factors have created enormous space for modern milk supply channels in Pakistan.

In this study we analyze the factor influencing the choice between modern and traditional milk marketing channels by using the survey data of dairy farmers in Punjab, Pakistan. We have found significant difference in terms of herd size, cross and imported cattle in herd, milk sale volume, milk output volume, price, and educational levels of farmers in modern and traditional milk channels. Volume of milk sold and high-quality breeds in herd have significant effect on farmers' participation in modern supply channel. This shows that technologically advance and large farmers opt for modern supply channels. Furthermore, with the commercialization of dairy sector and increasing demand of quality milk the participation in modern supply chains will increase.

However, milk prices, distance to milk collection unit and payment procedure, negatively affect the farmers' participation in modern supply channels. This suggests that farmers with small quantity of milk sale are inclined towards those market channels that offer higher prices and collect milk at farm gate that reduces their transport cost. Furthermore, traditional milk supply channels make early payments and sometimes make advance payments that encourage farmers to sell milk to these channels. The growth of modern milk supply channels by and large depends on the development of milk collection infrastructure, competitive prices and rapid system of payments.

Considering the findings of this study, if farmers are provided with advance dairy technology and are given intuitional support, it could enhance milk production and farmers' capabilities of managing resources and hence could shift farmers towards commercialization. Easy access to market by improved market infrastructure needs investment in infrastructure and is necessary step for enhancing milk supply. Moreover, milk prices and payment methods are important factors in choice of market channels and selling milk and hence can be used as a policy instrument in enhancing farmers' level of commercialization.

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