Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 19, Issue 2, 2019
PRINT ISSN 2284-7995, E-ISSN 2285-3952

E-TRAINING ON GREEN LOGISTICS IN THE AGRI-FOOD SECTOR

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Abstract

This paper aims to investigate the training requirements of diverse target groups engaged with logistics and supply chain management in the agri-food industry focusing on cereals and rice, and deploy the findings for the development of an e-training program. A field research was conducted with personal interviews to mainly logistics department supervisors of more than 150 firms, in order to detect gaps in their skills and competencies on the application of green practices in the agri-food supply chain. As a result, an e-training program was developed to support trainees to enhance their knowledge and skills in the field, and in turn to increase agri-food supply chain effectiveness and competitiveness. This paper also presents the curriculum content development, which was based on training needs analysis. The utilisation of the Moodle platform for the curriculum content building and the e-training program implementation and delivery, is also discussed.

Key words**:** *e-learning, e-training, green logistics, agri-food supply chains, cereals*

INTRODUCTION

The agricultural and food (agri-food) sector is proved to be a major contributor to EU economy. Current economic crisis has highlighted the need to strengthen agri-food supply chains, which are comprised of a series of operations from 'farm-to-fork' [4]. The application of green practices across the supply chain [12] is critical to the success of the agri-food sector.

For example, Iakovou, *et al*. [3] have proposed a framework for the design of sustainable agri-food supply chains, implementing appropriate green supply chain management and logistics principles.

Tsolakis, *et al.* [15] have identified a list of key issues for the design and management of modern agri-food supply chains that need to be addressed, as follows: selection of farming technologies, financial planning and investment, supply chain partners' relationships, quality management, performance management, risk management, sustainability, transparency, food safety & traceability, harvest planning, logistics operations, waste management & reverse logistics, as well as fleet management, vehicle planning & scheduling.

Many researchers have investigated the skills and competencies that are essential for logistics and supply chain management managers and employees. In particular, Murphy and Poist [9] suggested a widely adopted framework of three skills categories for Logistics and Supply Chain Managers (LSCM): business, logistics and management skills (BLM skills). For each of these three main categories, and especially for the technical logistics skills, other researchers proposed different views. For example, more recent studies focus on technological skills and technical LSCM knowledge [1,13,11,18].

Stakeholders in the agri-food supply chain need to obtain and/or improve appropriate skills and competencies via diverse training methods and techniques, during training programs. Such programs may use face-to-face learning, e-learning or blended learning approach (e.g. Laisi, *et al.* [5], Wu and Huang [17]). More specifically the e-learning approach has been successfully utilised for agricultural training, mainly because it offers remote accessibility, as stated by Leary and

Berge [6]. Moreover, e-learning has been used in the area of logistics (e.g. Laisi, *et al.* [5], Wu and Huang [17]).

Valsamidis, *et al.* [16] have proposed a framework for applying e-learning in agriculture that includes three stages: a) platform development, b) course development and delivery, and c) platform and courses evaluation. This framework can also be applied in agri-food LSCM training.

The work presented in this paper, is related with a project titled "Green Logistics e-Training in Cereal/Rice Sector", (Erasmus+, KA2, Strategic Partnerships for Vocational Education and Training). The project has been completed with the cooperation of four Euro-Mediterranean countries (Greece, Spain, Portugal, Cyprus) in 2018. The scope of the project was to develop and deliver a customized e-learning program to all interested stakeholders in the agri-food supply chain focusing on cereals and rice.

Training requirements surveys charting the current skills & competencies profiles of the logisticians in alignment with the best practices provided by the cereal and rice sector professionals, laid the foundation for the e-training program curriculum and content. In particular, previous work by Marinagi, *et al*, [7] and Trivellas *et al,* [14] presented the results of two field surveys. The first survey was conducted in order to diagnose the training needs on the primary sector of farming (young farmers, short food supply chain). The survey designated the necessity to cultivate skills on marketing, human resource management and strategic networking. The second survey, which was based on all stakeholders along the agri-food supply chain, revealed the gap between realized and desired profiles in skills and competencies related to logistics, business and management.

In this paper, we investigate the training requirements of the communities engaged with supply chain management in the agri-food sector, which are related with the application of green practices across the supply chain. Then, we present the implementation of a customized e-training program, called "Green Logistics in the agri-food sector". The program aims to support target communities to develop their knowledge and skills in the field, in order to increase their effectiveness and competitiveness.

The rest of the paper is organised as follows: Firstly, the methodology of research is discussed. Then the results of the training requirements analysis are stated and the e-training program curriculum based on these results is described. The e-training platform utilised for building the training content and delivering the e-training program follows. Finally, conclusions are discussed.

MATERIALS AND METHODS

A field research was conducted with personal interviews to supervisors of mainly logistics departments of firms in the agri-food sector, in order to map their training requirements regarding green practices. More than 150 Greek firms participated in the research.

Questionnaire Design

The survey technique consisted face-to-face interviews with key participants of the agriculture supply chain. The structured questionnaire was also available on the web (LimeSurvey), in order to facilitate the process of interviewing the potential participants as well as the process statistical analysis. In addition to face-to-face interviews, a number of self-administered (auto-compiled) questionnaires were gathered. Respondents were asked to rate the importance and the degree of realisation of each skill on a seven-point Likert scale, which provides increased measurement sensitivity and variance extraction. In particular, respondents firstly evaluated the importance of each of the green awareness' item (1: "not at all important" to 7:"very important") and, secondly, the implementation of each item (1: "not implemented at all" to 7:"very high implementation").

The content validity of the questionnaire (instrument) was established through an analytical pre-testing process [19]. During this process, the researchers visited several potential participants (farmers and agriculture

supply chain participants) and relevant academics. In total, ten unstructured interviews were taken. The interviewees were asked to comment on the level of difficulty and/or the lack of clarity of the items of the questionnaire, as well as the instructions provided. After the completion of that procedure, the proposed modifications were fully incorporated. Finally, the modified questionnaire was distributed to a small number of farmers, retailers, manufacturers in the agri-food supply chain, who were also asked to make their remarks.

Sampling

The field research was based on owners, supervisors, or managers in Greek firms along the agri-food supply chain. The research was conducted in 2017 in the regions of Attica and Viotia. Examining demographics, 31% of the respondents work in retailers, 15% work in transportation and logistics companies, 13% work in food processing, and 10% are farmers. The 36% of the sample are females. The 78.1% of the participants hold a managerial/supervisor position (supervisors, directors, managers). The average age of the respondents is almost 42 years with 15 years of work experience.

RESULTS AND DISCUSSIONS

Green Practices Awareness and Adoption

Regarding awareness and adoption (implementation) of green practices, respondents rank higher Eco-friendly behavior in everyday life (mean=5.27), and assessment of personal life footprint (mean=5.10), followed by green practices for physical environment protection (mean=5.06), while the lowest marks are on assessment of environmental impact (e.g. carbon/water footprint) (mean=4.38), awareness /informational initiatives & events for green practices (mean=4.43) and government policy/legislation on green logistics (mean=4.44). Besides, t-test analysis was used to asses the statistical significance of the differences between techniques' awareness and adoption ($p<0.05$). Results summarized in Table 1 indicate that the widest gap appear at assessment of environmental impact (e.g. carbon/water footprint) (15.7%, $p<0.001$), Green practices reducing water consumption (15.4%, $p<0.001$), Green practices for transportation/ logistics (15.3%, $p<0.001$), and Government policy/legislation on green logistics (15.2%, $p<0.001$).

Table 1. Green practices awareness & adoption

Green practices	Awareness	Adoption	Dif. %	Sig.
1. Government policy/legislation on environmental protection	5.14	4.66	10.2%	.05
2. Government policy/legislation on green logistics	5.12	4.44	**15.2%**	.05
3. Firm's Corporate Social Responsibility Strategy	5.35	4.79	11.6%	.05
4. Firm's policy/regulations on green logistics	5.28	4.65	13.5%	.05
5. Assessment of firm's green performance	5.15	4.58	12.5%	.05
6. Green standardization (e.g. ISO 14001, GRI guidelines)	5.21	4.63	12.5%	.05
7. Green practices for transportation/ logistics	5.29	4.59	**15.3%**	.05
8. Green technologies/practices reducing energy consumption	5.37	4.75	13.1%	.05
9. Green practices reducing water consumption	5.60	4.85	**15.4%**	.05
10. Green practices for physical environment protection	5.61	5.06	10.9%	.05
11. Awareness/informational initiatives & events for green practices	5.07	4.43	14.5%	.05
12. Assessment of environmental impact (e.g. carbon/water)	5.07	4.38	**15.7%**	.05
13. Eco-friendly behavior in everyday life	5.77	5.27	9.5%	.05
14. Assessment of personal life footprint	5.74	5.10	12.4%	.05

Source: Own results.

Performance Implications of Green Practices

In order to investigate the association between green practices, and effectiveness at the organisational and supply chain level, Pearson's correlation analysis was conducted. Table 2 presents the results, where all green practices are strongly related to performance at the organizational and supply chain level.

Table 2. Correlation analysis results for green practices

Green practices	Organizational Performance *	Supply Chain Effectiveness *
1. Government policy/legislation on environmental protection	.382	.311
2. Government policy/legislation on green logistics	.361	.286
3. Firm's Corporate Social Responsibility Strategy	.520	.508
4. Firm's policy/regulations on green logistics	.533	.487
5. Assessment of firm's green performance	.488	.449
6. Green standardization (e.g. ISO 14001, GRI guidelines)	.453	.442
7. Green practices for transportation/ logistics	.473	.432
8. Green technologies/practices reducing energy consumption	.448	.411
9. Green practices reducing water consumption	.417	.334
10. Green practices for physical environment protection	.495	.473
11. Awareness/informational initiatives & events for green practices	.473	.410
12. Assessment of environmental impact (e.g. carbon/water footprint)	.494	.378
13. Eco-friendly behavior in everyday life	.456	.447
14. Assessment of personal life footprint	.394	.339

Source: Own results.

Logistics, Business and Management Skills, and Green Performance/ Management

In order to investigate the association between BLM skills [9], and green performance, Pearson's correlation analysis was conducted. Table 3 presents the results, where all groups of skills & competencies are strongly related to green performance/management.

In particular, strategic logistics (logistics skills), and systems thinking skills (management skills), dominate among associations with green performance. Then, logistics information & integration (logistics skills), and warehouse management & ordering (logistics skills) are among the skills that are strongly related to green performance.

Inter-item analysis is used to verify competencies scale for internal consistency or reliability. Specifically, Cronbach's coefficient alpha is calculated for each sub-scale, as recommended by Flynn et al. [2], ranging from 0.74 to 0.89. Thus, all sub-scales exhibited well over the minimum acceptable reliability level of 0.7 [10].

Curriculum Content Development

The results presented above, were combined with previous findings on BLM skills and competencies gaps [7,14], in order to guide the development of the curriculum of the "Green Logistics in the agri-food sector" e-training program, which is provided in four languages (English, Greek, Spanish, and Portuguese).

In particular, wider divergences between realised and required skills were detected in the fields of green logistics, integrated logistics, and logistics information management/logistics software.

Table 3. Correlation analysis results

	mean	S.D.	Cronbach's alpha	Green Performance *
(A) Logistics skills				
L1.Strategic logistics	4.86	1.214	0.839	**0.470**
L2.Logistics information & integration	4.50	1.407	0.850	0.415
L3.Inbound logistics & safety	5.47	0.879	0.760	0.385
L4.Warehouse mgt & ordering	5.54	0.938	0.772	0.407
L5.Distribution management	5.13	1.131	0.753	0.334
(B) Business skills				
B1.Extrovert business network skills	4.52	1.206	0.918	0.332
B2.HR skills	5.20	0.908	0.740	0.309
B3.Strategic skills	5.27	0.986	0.834	0.301
B4.Quantitative skills	4.65	1.292	0.874	0.362
B5.Marketing & communication skills	4.70	1.296	0.821	0.319
(C) Managerial skills				
M1.General managerial abilities	5.12	0.991	0.936	0.371
M2.Emotional intelligence competencies	5.51	0.905	0.876	0.326
M3.Monitor skill	5.57	0.919	0.813	0.399
M4.Systems thinking skills	5.47	0.922	0.812	**0.448**
M5.Extrovert personality skills	5.13	1.071	0.817	0.232
Green performance	4.74	1.398	0.897	

[a] The Kaiser–Meyer–Olkin (KMO) indicator was calculated to assess sample size adequacy. The minimum acceptable level is 0.5. Bartlett's test of sphericity is significant at p<0.001 for all variables.
*All correlation coefficients are statistical significant at p<0.001

Source: Own results

Similarly, examining business competencies in training needs analysis for green agri-food supply chain skills, wider gaps were revealed in e-commerce, quality management and labor relationships. Concerning management skills, competencies promoting innovation and creativity proved to need improvement.

The curriculum is grouped in three distinct categories of skills and competencies, each of which corresponds to a different section: (A) Green logistics and operational skills in agri-food sector; (B) Organisational skills and competencies; and (C) Information and communication technologies. Each of the three sections includes a number of modules. Each module is an autonomous learning unit. The sections (A, B, C) and modules (M1-M13) are the following:

Section A. Green logistics and operational skills in agri-food sector

M1.Rice and cereal sector: an introduction
M2.Transportation and distribution
M3.Storage and warehousing
M4.Sustainable practices and new technologies
M5.Quality management in agri-food supply chain
M6.Vehicle routing

Section B. Organisational skills and competencies

M7.Human resources management
M8.Financial management
M9.Marketing - International trade
M10.Crisis management

Section C. Information and communication technologies

M11.Information and communication technologies in supply chain management:
M12.Electronic commerce
M13.Electronic government

Our research findings guided the curriculum content development. The green practices listed in Tables 1 and 2 have been considered during the creation of the content of all the modules of the e-training program. Furthermore, as demonstrated in Table 3, all groups of BLM skills & competencies are strongly related to green performance.

For example, the module 'M4. Sustainable practices and new technologies' focuses on sustainable development and the new technologies that facilitate it. Green practices for sustainability in the supply chain are included (see Table 1 and 2): Green

technologies/practices reducing energy consumption, Green practices reducing water consumption, Green practices for physical environment protection, Awareness/ informational initiatives & events for green practices, Assessment of environmental impact (e.g. carbon/water footprint), and Eco-friendly behavior in everyday life. Issues such as the reduction of routes and distances and the transport of dangerous goods are also addressed (see in Table 1 and 2: Green practices for transportation/ logistics). The module also includes green practices emerged from a previous survey, which diagnosed the training needs on the primary sector of farming. In particular, the module addresses issues such as the exploitation of by-products for energy consumption, fertilizer, and animal feed, the selection of socially responsible suppliers, the exploitation of precision agriculture and the adoption of supportive indicative technologies.

The content of each module may include various types of training material that support e-training, such as learning objectives, sources, scientific and professional–oriented documents, examples, case studies, exercises, multimedia files, self-assessment tests, examinations, recommendations for further reading etc. These types are considered when deciding the appropriate platform for the implementation of the e-training program.

The E-training Platform

The Moodle Learning Management System (LMS) [8], is an open source web-based platform, which has been employed for the development of the e-training program "Green logistics in the agri-food sector". The URL of the e-training program on Moodle platform is: http://green-logistics.teiste.gr /moodle.

In Figure 1, the homepage is presented, where the main sections of the curriculum appear in four languages. In Figure 2, an example of a module is shown (Storage and warehousing). The screenshot depicts the first part of the webpage of the module's training content. Content developers and trainers of the e-training program utilised Moodle's advanced tools for the creation, organisation and updating of the various types of training content that facilitate the e-training process.

In addition, Moodle enables trainees to access the training material remotely, study in their own schedule, engage in different module activities, assess their progress in each module through self-assessment tests, and participate to the final examination.

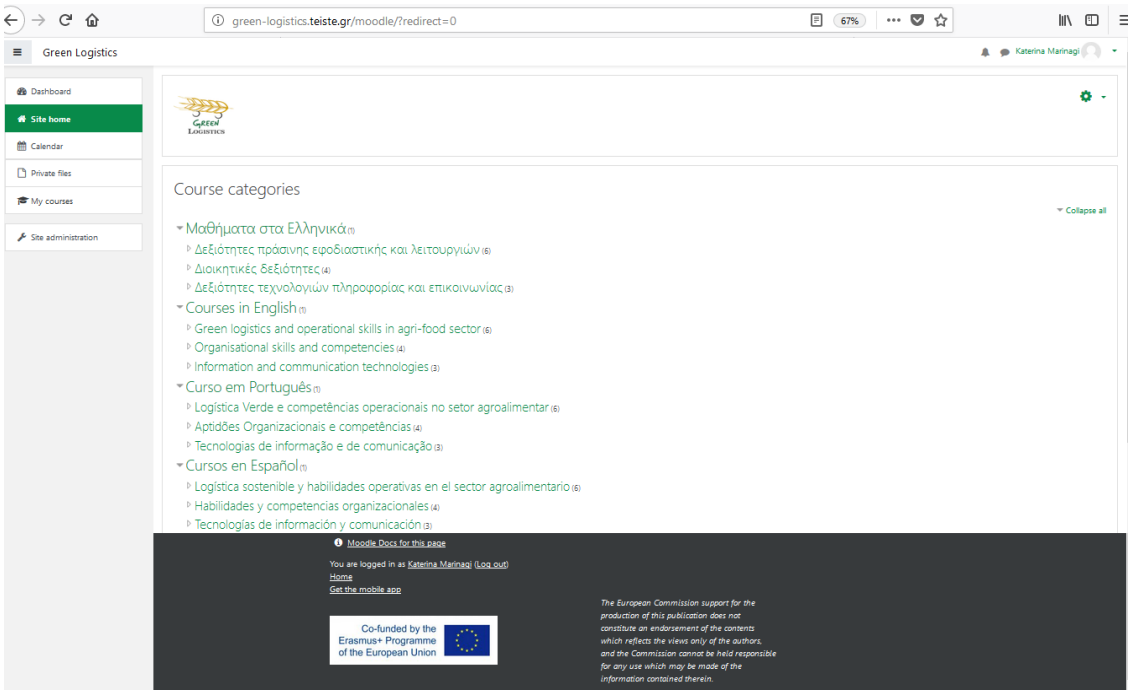

Fig. 1. The homepage of the e-training program
Source: http://green-logistics.teiste.gr/moodle

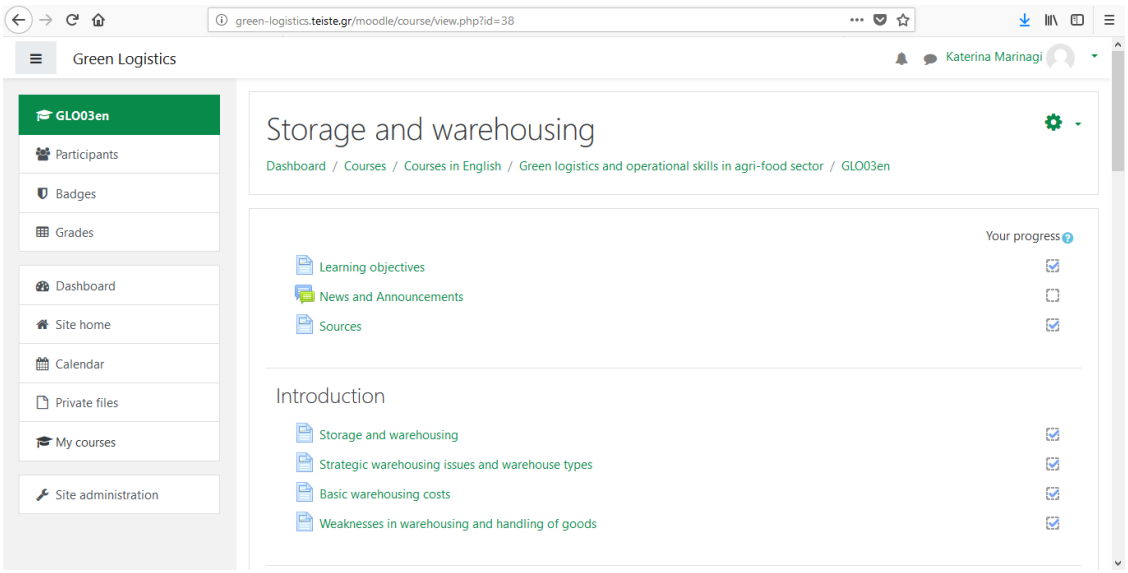

Fig. 2. A screenshot of the module "Storage and warehousing"
Source: http://green-logistics.teiste.gr/moodle/course/view.php?id=38

In Figure 2, the tick box to the right of each activity informs the trainee if it is completed or not. Moodle tools also facilitate the issue of an official certificate per trainee, only if they pass the final examination.

We have also utilised Moodle's collaborative tools such as discussion forums, chats, and e-mails to enable both trainee-to-trainee and trainee-to-trainer interaction.

Besides the provision of the tools mentioned above, Moodle LMS has been chosen because it is SCORM compliant, it is accessible across different web browsers and devices, it safeguards data security and user privacy, and provides documentation and user forums in multiple languages.

CONCLUSIONS

This paper presented a field survey that was conducted in order to investigate the training requirements of the target groups on the application of green practices across agri-food supply chains. The wider gaps between realised and required skills and competencies were detected in: assessment of environmental impact (e.g. carbon/water), green practices reducing water consumption, green practices for transportation/ logistics, and government policy/legislation on green logistics.

Statistical analysis investigating the association between green practices, and effectiveness at the organisational and supply chain level, revealed that all green practices are strongly related to performance at the organizational and supply chain level.

Similarly, examining the association between BLM skills [9], and green performance, revealed that all groups of skills & competencies are strongly related to green performance.

The synthesis these results with previous findings on BLM skills and competencies gaps of stakeholders in agri-food supply chains [7,14], guided the development of the curriculum content of the e-training program "Green Logistics in the agri-food sector".

Moreover, the utilisation of the Moodle LMS platform for the curriculum content creation and the e-training program implementation and delivery was discussed.

Future work includes focusing on green supply chains of other agricultural products, such as olive oil.

ACKNOWLEDGEMENTS

This research work was financed from Erasmus+ Programme, KA2, No. 2015-1-EL01-KA202-014015.

REFERENCES

[1]Flöthmann, C., Hoberg, K., Wieland, A., 2018, Competency requirements of supply chain planners &

analysts and personal preferences of hiring managers. Supply Chain Management: An International Journal, 23(6):480-499.
[2]Flynn, B.B., Sakakibara, S., Schroeder, R., Bates, K., Flynn, J., 1990, Empirical research methods in operations management, Journal of Operations Management, Vol. 9(2): 250-84.
[3]Iakovou, E., Vlachos, D., Achillas, Ch., Anastasiadis, F., 2014, Design of sustainable supply chains for the agri-food sector: a holistic research framework. Agricultural Engineering International: CIGR Journal Special issue 2014: Agri-food and biomass supply chains, 1-10. http://www.cigrjournal.org, Accessed on November 5, 2018.
[4]Jaffee, S., Siegel P., Andrews, C., 2010, Rapid agricultural supply chain risk assessment: a conceptual framework, Agriculture and Rural Development, Discussion Paper 47, The World Bank.
[5]Laisi, M., Hilmola, O-P., Korovyakovskiy, E., Simushkov, A., 2011, Utilising e-learning in Russian transport logistics sector. International Journal of Shipping and Transport Logistics, 3(2):210-226.
[6]Leary, J., Berge, Z.L., 2006, Trends and challenges of eLearning in national and international agricultural development. International Journal of Education and Development using Information and Communication Technology (IJEDICT), 2(2):51-59.
[7]Marinagi, C., Kofakis, P., Trivellas, P., Reklitis, P., 2018, Designing an e-training program on green logistics in rice and cereal sector. Proceedings of the 10th Annual International Conference on Education and new Learning Technologies (EDULEARN18*)*, 2-4 July, Palma Mallorca, Spain, 8094-8103, IATED Publications, https://library.iated.org/publications/ EDULEARN18/start/1200, Accessed on Dec.10, 2018.
[8]Moodle, 2018, Learning Management System. https://moodle.org/, Accessed on April 10, 2018.
[9]Murphy, P.R., Poist, R.F., 1991, Skill Requirements of Senior-level Logisticians: Practitioner Perspectives. International Journal of Physical Distribution & Logistics Management, 21(3): 3-14.
[10]Nunnally, J.C., Bernstein, I.H., 1994, Psychometric Theory, 3rd ed., McGraw-Hill, New York, NY.
[11]Sangka, K.B., 2017, A Competency Model for Operations Managers in Indonesia Third-Party Logistics (3PL) Providers. PhD Thesis, Business IT and Logistics, RMIT University, Melbourne, Australia.
[12]Srivastava, S.K., 2007, Green supply-chain management: a state-of-the-art literature review. International Journal of Management Reviews, 9(1): 53–80.
[13]Suttiwatnaruput, K., Pornchaiviseskul, P., Archiwaranguprok, S., 2014, Supply chain manager competencies and their impact on supply chain integration. European Journal of Logistics, Purchasing and Supply Chain Management, 2(1), 71-89.
[14]Trivellas, P., Reklitis, P., Marinagi, C., Tsoulfas, G., 2018, Examining Gaps in Business and Logistics Skills and Their Performance Implications in the Agrifood supply Chain in Greece, International Conference on Strategic Innovative Marketing and Tourism - ICSIMAT 2018, Voula, Greece, 17-20 October 2018.
[15]Tsolakis, N., Keramydas, C., Toka, A., Aidonis, D., Iakovou, E., 2012, Agri-food supply chain management: A comprehensive hierarchical decision-making framework and a critical taxonomy. The 2nd International Conference on Supply Chains (ICSC 2012), 5-6 Oct., Katerini, Greece.
[16]Valsamidis, S., Kazanidis, I., Petasakis, I., Karakos, A., 2011, A Framework for E-Learning in Agricultural Education, in M. Salampasis, A. Matopoulos (eds.): International Conference on Information and Communication Technologies for Sustainable Agri-production and Environment (HAICTA 2011), Skiathos, 8-11 September, 2011.
[17]Wu, Y.C., Huang, S.K., 2013, Making on-line logistics training sustainable through e-learning. Computers in Human Behavior, 29, 323–328.
[18]Young, L., 1998, Human element, Materials Management and Distribution, December, p. 27.
[19]Zikmund, W.G., 2003, Business Research Methods, Thomson/South-Western, Mason, OH.