

A Regional Approach of the Information Technology Adoption in the Romanian Agricultural Farms

Liliana Mihaela MOGA^{1,2}, Daniela Luminita CONSTANTIN¹, Valentin Marian ANTOHI²

¹Dunarea de Jos University of Galati, Galati, Romania

²Bucharest University of Economic Studies, Bucharest, Romania

liliana.moga@gmail.com,danielaconstantin_2005@yahoo.com,valentin_antohi@yahoo.com

The aim of this paper is to evaluate the stage of Information Technology implementation in the agricultural farms in Romania. At the level of each Romanian development region it was performed a research for identifying the use of Information Technology. In addition, it was conducted a study on the management applied in the agricultural farms, the market of information solutions developed for farms specific needs and of the politics that promote the investments in the Information Technology. The research had as result the identification of the main factors that lead to a reduced Information Technology penetration rate in the Romanian agriculture such as: the reduced number of agricultural farms with legal personality, the decreased investment potential of agricultural farms, the lack of interest of software developer enterprises in providing Farm Management Information Systems and the poor professional skills of farm managers and their employees in the Information Technology field.

Keywords: Farms Management, Information Technology, Farm Management Information Systems, Incentive Factors, Regional Development

1 Introduction

The food sector is one of the most important sectors of the economy, encompassing agriculture, the food industry, retail, and eventually, all members of society as consumers. With its responsibility of serving consumers with food that is safe, readily available, the food sector needs to be efficient, to build on an appropriate organization and control of processes, and to provide assurance on the safety and quality of its products which consumers could trust. Efficiency, process control and consumer communications are all closely related to the use of Information and Communication Technology [1]. In the last decades, Romania is making progresses in developing its electronic services and its acceptance by the users for whom they are designed, in order to face the challenges of our century. The Information and Communication Technology was widely adopted in various economic activities, from industry to services and agriculture. Nowadays, farming is becoming a knowledge intensive industry [2]. In an increasingly turbulent environment, the survival and growth of agricultural production could be supported through the effective use of Information and Communication Technology [3]. Within this context, the Farm Management Information Systems may support the business environment in the agricultural sector, by offering information for a high performance management and for an efficient organization of

agricultural farms activities [4]. The concerns regarding the development of Information Technology solutions designed for meeting the specific informational requirements of farm managers are relatively recent. The agricultural information system is defined as a system in which agricultural information is generated, transformed, consolidated, received, and feedback in order to underpin the knowledge utilization by farms managers and by their employees [5]. The software is the information systems component that mainly reclaims the customization to the specific needs of the farmers.

As a new emerging technology, the Information Technology can deliver many advantages to agribusiness, from cost savings and an improved productivity to higher business intelligence and decision making capabilities [6]. Agricultural farms, and indirectly the rural community, could also get large benefits from the progress of Information Technology, which is closely incorporated in the agricultural education, research and commerce [7], [8]. In contemporary Agriculture management, the agriculture data volume is increasing at a surprising speed. Smooth and efficient streaming and management of data has a key role for the farmer in successful agriculture production [9]. The use of Information Technology is viewed as a mean of agricultural development in poorly developed countries, as well as in the region of SAARC countries

(Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka), a region where small farms prevail [10]. The Farm Management Information Systems should be customized to the farmers' professional level, since there are cases when, as is the case of India, the direct implementation of information systems in the agricultural farms is not feasible [11]. The need for estimating the farmers' informational needs in order to develop the software designed for them is also supported by scholars [12]. Two factors have been frequently mentioned for the low acceptance rate on Information Technology means in the agricultural farms: the absence of collaboration with end users during the information solution development [13], [14], and lack of support and maintenance after the information solution implementation [13], [15].

Farm management information systems have steadily increased in their level of sophistication as they have included new technologies with Internet connectivity being the latest addition. Research conducted at international level propose the introduction of modern Web based approach to the implementation of an Farm Management Information Systems [16]. The analysis of software market in Romania shows that the products developed for the use of managers of the agricultural farms are limited to applications designed for calculating the indicators for European Union funds projects proposals, such as the applications for the Special Accession Programme for Agriculture and Rural Development (SAPARD), websites by means of which online consultancy in agriculture and food industry is provided, portals that make available the contact information for suppliers, distributors etc. from the agricultural and food sectors [17]. The Romanian software developer enterprises' initiatives for the development of software for farms are very limited, but through the facilities provided, it addresses to the large farms, which have low representativeness in the Romanian agricultural sector.

Under these circumstances, it may be stated that agricultural farms represent a market share with a high potential for the software developer enterprises in Romania, for which they have not shown a particular interest so far. The identification of the specific needs, requirements and restrictions of agricultural farms management in Romania may contribute both to satisfying the informational needs of small and medium sized farms management and, implicitly, to enhancing their economic and financial results, as well as to

increasing the Romanian software market dimension.

2 Methodology

The research aims to put in evidence a connection between the transformation undergone by the Romanian agriculture starting with 1990, until the European Union accession and the progress of introducing the Information Technology in the agricultural farms management. Scientific literature and empirical studies related to the information systems features and their spread in the agricultural farms were reviewed. Some documents which lay down the politics for introducing the technical and technological progress in agriculture were analyzed in order to evidence the spreading the Information Technology in agricultural farms. The results obtained were correlated with the professional degree of farm managers and the significance of agriculture for the regional economic development. A large part of the study is based on data collected by the Romanian Institute of Statistics within the General Agricultural Census, which was carried out in Romania in 2002, and in 2010 [18]. Also, it is based on data collected within the Structural Investigation in Agriculture, which was performed in two successive stages, in 2005 and in 2007 [19].

3 A Regional Approach of the Romanian Agriculture Evolution

Agriculture is one of the main activities of the Romanian economy. In comparison with other economic activities, agriculture and food industry has one of the greatest growth potential, because Romania is holding a privileged position in terms of natural agricultural resources. The arable land represents 39.5% of the total territory of the country. The Regional Development Project, Today and Perspectives reviews the role of agriculture in the economy of Romanian development regions, highlighting that four of the eight regions ground its economic development on agriculture [20]. The South and South East Regions are traditionally considered as areas with a high agricultural potential. Conversely, the North East Region, known as the poorest development region of Romania, has the highest employment rate of population in agriculture.

One of the changes with major effects, undergone by the Romanian agriculture with the passing of Romania to the market economy in 1990 was the

transfer of agricultural land in private ownership. Until 2000, almost 85% of the agricultural area was already owned by the former owners and their heirs. The process of re-establishing the ownership over the agricultural land had as consequence the rendering of a larger area of the

country's agricultural land in the ownership of a large number of agriculture workers, which led to the setting up of a considerable amount of subsistence farms with the part of providing subsistence, as it can be noticed in Table 1.

Table 1. Agricultural farms using agricultural lands and/or breeding animals, depending on their legal status

Indicators	Year	Unit	Total no. of agricultural farms	Subsistence farms	Farms with legal personality
Agricultural farms	2002	thousands	4,485	4,462	23
	2005	thousands	4,256	4,238	18
	2007	thousands	3,931	3,914	17
	2010	thousands	3,856	3,825	31
Total area	2002	thousands of hectares	15,708	8,454	7,254
	2005	thousands of hectares	15,442	9,886	5,556
	2007	thousands of hectares	15,265	9,591	5,674
	2010	thousands of hectares	15,867	8,488	7,379

Source: National Institute of Statistics

The predominance of the subsistence farms in the Romanian agriculture is the main cause that made the most farms in Romania to be characterized by lack of capital and by an inadequate training of farmers, which explains getting the low incomes and the reduced efficiency of their activity. Large farms, with a poor representation in the Romanian agriculture, manage their resources financial efficiently. Unfortunately, there are a limited number of efficient and competitive farms that get together good economic performance having also both capital and know-how.

Out of the eight development regions of Romania, half of them ground their development on agriculture [20]. Some development regions such as the South West Region and the South Region are considered, by tradition, agricultural focused areas. The economic growth which preceded the financial crisis was mainly supported by the industry from urban areas. The migration of young people from rural to urban areas, together with the rural areas population decay has led to a decline in the available

workforce in rural areas. Thus, it is witnessing the maintenance of the active rural population structure in North East, South East, South West and South development regions, while in the West, North West, Central, and Bucharest development regions, the trend is to shift towards the industry and services sector in urban areas. As a consequence of these changes in the workforce structure, almost half of the Romanian development regions are facing a severe problem regarding the farmers' age structure. Most of these persons has not an agricultural professional education and has a limited competence in the field. Only a few of them have a complete agricultural professional education that includes the following categories of studies: technical education, short term undergraduate or postgraduate studies. The lowest professional education degree is seen at the level of individual agricultural farms managers, farm which are, at the same time, the most numerous and the ones with the weakest economic results, as may be seen from the data synthesized in table 2.

Table 2.Farmsmanagers' classification depending on the education level per categories of farms

No.	Education in the agricultural field	2002		2005		2007	
		Subsistence farms	Farms with legal personality	Subsistence farms	Farms with legal personality	Subsistence farms	Farms with legal personality
1.	Practical agricultural experience	2,720,804	746	2,573,078	424	3,738,504	11,437
2.	Basic agricultural education	1,441,735	3,999	4,088	1,728	139,606	2,563
3.	Complete agricultural education	299,682	11,214	40,759	9,783	35,541	3,699
TOTAL		4,462,221	15,959	2,881,332	12,995	3,913,651	17,699

Source: The National Institute of Statistics

4 Regional Politics and Programs for the Adoption of Information Technology in the Romanian agricultural farms

The support provided by the European Union to the Common Agricultural Policy consumes the greatest part of its budget. The structural reform process of the Romanian economy, initiated in the pre-accession period, was assisted by the European Union by means of various instruments, such as the PHARE, ISPA and Special Accession Programme for Agriculture and Rural Development (SAPARD) financing programs. Starting with 2007, the National Rural Development Programme (NRDP) becomes the instrument of adapting the Romanian agriculture to the European Union requirements, until 2013. Over the last years, the European Union, through its instruments, has supported the introduction of the Information Technology and Communications in enterprises, as a manner of increasing the efficiency of the activities performed. These programs open new financing opportunities for the Romanian companies working in the Information Technology. The Sectoral Operational Programme 'Increase of Economic Competitiveness' is one of the most recent programs, which includes measures that support the introduction of Information Communications and Technology in the economy. Starting with 2011, Axis 3, measures no. 331 and 332 have been launched which were intended for financing the implementation of software systems for microenterprises and small and medium sized enterprises (SME's). Due to the measure no. 311 it is backed up the access to broadband and connected services. Thus, the

measure no. 331 supports the implementation of integrated information systems and other means of information technology in business management, and measure no. 332 sustains the development of electronic commerce systems and other electronic solutions for business. However, the agriculture and the food sector may not benefit from such financing, the funds being intended for applicants from industrial sector, even if they are Small and Medium sized Enterprises.

As concerns the expenses for Information and Communication Technology and for measures aimed at increasing the economic efficiency, the agricultural farms are eligible for financing within the following programs: Regional Operational Programme (ROP) National Rural Development Programme, Sectoral Operational Programme – Human Resources Development, Sectoral Operational Programme Environment, Sectoral Operational Program–Administrative Capacity Development (SOP–ACD), Sectoral Operational Programme Transport, Fishery Operational Programme. It should also be mentioned that only farms having legal personality have access to non-reimbursable financing.

5 Impediments for the Acceptance of Information Technology in the Romanian Agricultural Farms

The evolution of farm incomes depends on the opportunities and risks affecting their activity performance. New programs smooth the investments in agriculture and the macroeconomic stability, along with the

liberalization of the land market, which contribute to the increase of farms size. In this process, an important place having the introduction of Information Technology. On the other hand, the trend of input prices rise and decline of farms purchasing power leads to the decrease of innovation use.

Large farms, with a weak representation in the Romanian agriculture, efficiently manage their resources. A limited number of efficient and competitive farms which obtain good economic performances holds also capital and know-how. They could be confronted with certain adaptation issues with a view to compliance with the European Union standards, or could require additional investments in order to ensure the farm technological endowment. Even the use of personal computers may bring benefits to farmers; however the spreading of personal computers and software in the agricultural farms is limited.

The electronic equipment for mechanization and automation inventories includes Information Technology means for accountancy, equipment

for the genetic records of animals and equipment for micro-climate in greenhouses and animal shelters. As it can be noticed, the greatest weight is held by the Information Technology for the economic administration of agricultural farms. It is also noted the reduced number of agricultural farms which hold in their patrimony means of information technology. Comparing with the typology of agricultural farms, it is observed a directly proportional connection between the farms with legal personality and the number of information technology holders. The subsistence farms remain at the stage of not accepting the technology, whatever is its destination. At the regional level, the highest acceptance rate is found in the Bucharest Ilfov development region, followed by the South East development region. At the opposite side is situated the North East development region. Alarmingly, in 2005 is witnessed a decrease of Information Technology means, expressed in relation to the number of agricultural farms. This information is synthesized in Table 3.

Table 3. Agricultural farms which used electronic equipment for mechanization and automation, in the ownership of agricultural farms, per development regions

No.	Development Region/ Electronic equipment for mechanization and automation	No. of farms which own electronic equipment	Total no. of farms	No. of farms which own electronic equipment	Total no. of farms
		2002		2005	
1.	North West Development Region	225	591,536	50	579,235
	Information Technology for Accountancy	174	–	–	–
2.	Central Development Region	224	427,026	97	412,358
	Information Technology for Accountancy	186	–	–	–
3.	North East Development Region	233	736,657	29	801,822
	Information Technology for Accountancy	207	–	–	–
4.	South East Development Region	331	470,187	79	481,092
	Information Technology for Accountancy	307	–	–	–
5.	South Muntenia Development Region	382	822,597	104	795,902
	Information Technology for Accountancy	344	–	–	–

No.	Development Region/ Electronic equipment for mechanization and automation	No. of farms which own electronic equipment	Total no. of farms	No. of farms which own electronic equipment	Total no. of farms
		2002		2005	
6.	Bucharest Ilfov Development Region	79	66,518	18	55,666
	Information Technology for Accountancy	66	–	–	–
7.	South West Oltenia Development Region	124	589,808	22	579,269
	Information Technology for Accountancy	101	–	–	–
8.	West Development Region	177	327,383	62	305,818
	Information Technology for Accountancy	158	–	–	–
Total		1,775	4,484,893	461	4,256,152
Total of Information Technology for Accountancy		1,442	–	–	–

Source: The National Institute of Statistics

The analysis of information resulted from the research leads to one of the motivations, namely the negative attitude of agricultural farms managers and employees towards the use of information technology. It is an attitude that results from the ignorance generated by the weak level of professional education, the impossibility of adapting to the modernity and innovation, due to old age or simply due to the lack of trust in the results generated by information processing using the means of the Information Technology. The development of human capital, and technological innovation processes could be influenced by the university's involvement in the local community, including for the agriculture[21]. By analyzing the current level of agriculture in Romania, may also be identified the second reason. Thus, the presence in extraordinarily high number of the subsistence farms accounts for the weak representation of investments for farm modernization or for the education of human resources, even if there are certain programs for their financing from European funds.

The lack of education in Information Technology means is supplemented by the absence of information solutions to meet the requirements of agricultural farms, but mainly the software with a friendly interface. A factor with a special impact on the adoption of a new technology is the cost, which becomes even more important in case of

agricultural farms, which have limited investment resources.

6 Conclusions

Even though it is recognized that for the farms management, farmers need to collect and process financial, climatic, and technical information, the level of the implementation of information technology in Romanian agricultural sector still remains very low. The efforts to promote programs financed by the European Union, with the purpose of purchasing information technology means and software, have no visible effects in Romania. One of the reasons may be the reduced number of agricultural farms with legal personality which can apply for financing within these programs. For the moment, the agricultural farms represent a well outlined share on the Romanian software market, in terms of the specific requirements. The low investment potential of agricultural farms supports the lack of interest of software developer enterprises in executing software customized for agricultural farms informational needs, which is provided at affordable prices.

Another factor that led to the situation described above is the negative attitude of the farm managers towards the use of Information and Communications Technology. Their behavior is resulted from ignorance, generated by the low training degrees, impossibility of adapting to the

new technologies due to their advanced age, or simply the lack of confidence in the results generated by information processed using the personal computers. Lack of training for the use of information technologies is augmented by the absence of programs adequate to farm needs, but mainly of any programs accessible to people that have less computer training. A factor with a particular impact in adopting a new technology is the cost, which becomes more important in the agri-business, where the investments are limited. The endeavors to promote European Union funded programs meant for purchasing computers and software have no visible effects in Romania. One of the reasons may be the small number of agricultural farms with legal personality that may apply for funds provided through these programs.

Agricultural farms represent a well-defined segment of the Romanian software market in terms of specific requirements. The low investment potential of the agricultural farms sustains the lack of interest of software developers in developing customized products designed for agricultural farms, at competitive prices. The agricultural farm restructuring, which could follow the specialization and concentration of agricultural activities in certain regions of Romania, with high agricultural potential, along with the continuation of the European Union policy for supporting the investment in information technology, could motivate the software developers to mobilize resources in order to create products that meet the demands of this market sector.

The restructuring of agricultural farms, which could follow the specialization and concentration of agricultural activities in certain regions of the country with high agricultural potential, together with the continuation of the European Union politics to support investments in Information Technology, could motivate the software developer enterprises from Romania to mobilize resources in order to create products intended for satisfying the specific requirements of this market sector.

Acknowledgments

This work was co-financed from the European Social Fund through the Sectoral Operational Program Human Resources Development 2007–2013, project number POSDRU/89/1.5/S/59184 “Performance and excellence in postdoctoral research in Romanian economics science domain”.

References

- [1] R.J. Lehmann, R. Reiche and G. Schiefer, “Future internet and the agri-food sector: State of the art in literature and research,” *Computers and Electronics in Agriculture*, Vol. 89, 2012, pp. 158–174.
- [2] D. Just and D. Zilberman [1st of June, 2012]. *Information Systems in Agriculture. Giannini Foundation of Agricultural Economics*. [Online]. Available: http://giannini.ucop.edu/media/are-update/files/articles/v6n1_2.pdf.
- [3] A.B. Tekin, “Information and communication technology: an assessment of Turkish agriculture,” *Outlook on Agriculture*, vol. 40, no. 2, 2011, pp. 147–156.
- [4] E. Cofas, *The efficiency of the information systems in the analysis of the economic return of agricultural farms*. ArsAcademica Publishing House, Bucharest, 2009.
- [5] N.G. Röling, *Extension science: information system in agricultural development*, Cambridge University Press, Cambridge, 1988.
- [6] A. Tencate, *Information Technology and Industrial Automation Trends in Agriculture, Mathematical and Control Applications in Agriculture and Horticulture*, Pergamon Press, Oxford, 1991.
- [7] X. Zheng, C. Wu, W. Mu and X. Zhang, “Incentive and barriers of information technology adoption in agribusiness, Sichuan Province, China,” *Journal of Food, Agriculture & Environment*, vol. 7, no. 3&4, 2009, pp. 522–525.
- [8] A. Zugravu, “The fishery and aquaculture component of rural development,” *The Annals of Dunarea de Jos University. Fascicle I. Economics and Applied Informatics*, no. 1, 2006, pp. 154–161.
- [9] Y.E. Duan, “Design of agriculture information integration and sharing platform based on cloud computing,” in *Proceedings of IEEE International Conference on Cyber Technology in Automation, Control, and Intelligent Systems, CYBER 2012, Bangkok, 2012*, pp. 353–358.
- [10] S. Soho, “Information and Communication Technology initiative of SAARC Agriculture Centre in the SAARC Region,” in *Proceedings of the International*

- Conference on Computer Science and Information Technology, 2008, Dhaka, pp. 923–929.
- [11] V. Sreenivasulu and H.B. Nandwana, “Networking of Agricultural Information Systems and Services in India,” *INSPEL*, vol. 35, no. 4, 2001, pp. 226–235.
- [12] J. Steffe, “Estimation of farmers’ management needs: toward multi-function software title,” in Proceedings First European Conference for Information technology in Agriculture, Copenhagen, 1997.
- [13] R.M. Crassweller, J.W. Travis, P.H. Heinemann and E.G. Rajotte, “The future use and development of expert system technology in horticulture,” *HortTechnology*, vol. 3, 1993, pp. 203–205.
- [14] G.L. Parham and J.K. Poley, “Creation and maintenance: the split personality of software development,” *AI Applications*, vol. 7, no. 2/3, 1993, pp. 42–44.
- [15] J.R. Lambert, “Continuous improvement of software support processes,” *AI Applications*, vol. 7, no. 2/3, 1993, pp. 45–48.
- [16] R. Nikkila, I. Seilonen and K. Koskinen, “Software architecture for farm management information systems in precision agriculture,” *Computers and Electronics in Agriculture*, Vol. 70, No. 2, 2010, pp. 328–336.
- [17] S.R. Patarlageanu, “The efficiency of the information technology in agri-business,” *Agriculture – Science and practice*, vol. 1–2, no. 61–62, 2007.
- [18] General Agricultural Census (2002, 2010). Issued by Romanian Institute of Statistics.
- [19] Structural Investigation in Agriculture (2005, 2007). Issued by Romanian Institute of Statistics.
- [20] Project for Regional Development - Present and Perspectives (2007). Issued by National Commission for Prognosis.
- [21] A.I. Popescu, “Challenges for the Knowledge Society,” *Management & Marketing*, vol. 7, no. 3, 2012, pp. 493–512.



Liliana Mihaela MOGA is associate professor of Financial Information Systems and Economic Analysis at Dunarea de Jos University of Galati. She is postdoctoral fellow in Regional Science field at the Bucharest University of Economic Studies. Her research activity is focused on Knowledge Management, Management Information Systems, Information Technologies for Quality Safety Traceability, and on Information Technology adoption in banks, enterprises and agricultural farms.



Daniela Luminita CONSTANTIN is professor of Regional Economics and Policy and the Director of the Research Centre for Macroeconomic and Regional Forecasting at the Bucharest University of Economic Studies. She is the President of the Romanian Regional Science Association and member of the Council of European Regional Science Association.



Valentin Marian ANTOHI is lecturer of Economic Analysis and Public Finance at Dunarea de Jos University of Galati. He got his Ph.D. title with a thesis focused on the effects of social and economic integration of the Romanian agriculture in the European Union. His research interest is in fields of finance, quality management in agriculture, economic analysis, and social policy.