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## Ο μεταβαλλόμενος χαρακτήρας της εργασίας στον Αγροτοδιατροφικό Τομέα. Η επίδραση της Γεωργίας Ακριβείας και η αναγκαιότητα απόκτησης νέων δεξιοτήτων μέσω Διά Βίου Μάθησης

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# The evolving nature of work in the Agri-foodstuffs Sector. The impact of Precision Agriculture and the necessity of acquiring new skills through Lifelong Learning

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# Ο μεταβαλλόμενος χαρακτήρας της εργασίας στον Αγροτοδιατροφικό Τομέα. Η επίδραση της Γεωργίας Ακριβείας και η αναγκαιότητα απόκτησης νέων δεξιοτήτων μέσω Διά Βίου Μάθησης

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**ABSTRACT**

The article focuses on the necessity of acquiring a combination of "vertical" and "horizontal" skills, which are of vital importance in the new production management processes and work in the Agri-foodstuffs sector, so as to ensure an efficient relationship between the human resources and the current technological applications. The aim of this paper is to research and pinpoint the opportunities and weaknesses of the required new skills in relation to new technologies in the wider context of the agri-food labour market, and to which extent these skills can feasibly be developed through Lifelong Learning Educational Programmes. The research method of this paper is a qualitative "focus groups" interview method.

**KEY WORDS:** Agri-food, skills, education, new technologies, smart agriculture.

**ΠΕΡΙΛΗΨΗ**

Το άρθρο επικεντρώνεται στην αναγκαιότητα απόκτησης συνδυασμού «κάθετων» και «οριζόντιων» δεξιοτήτων, απαραίτητων για τα θέματα της νέας οργάνωσης παραγωγής και εργασίας στον αγροδιατροφικό κλάδο, ώστε να διασφαλίζεται η επιτυχημένη σύμπραξη του ανθρώπινου δυναμικού με τις εξελισσόμενες νέες τεχνολογικές εφαρμογές. Η εργασία στοχεύει, μέσω της διαδικασίας διεξαγωγής εμπειρικής έρευνας ομάδων εστίασης (focus groups), να εξετάσει και να εντοπίσει τα τις ευκαιρίες και τις αδυναμίες των νέων δεξιοτήτων σε σχέση με τις νέες τεχνολογίες στο ευρύτερο πλαίσιο της αγοράς εργασίας του αγροδιατροφικού κλάδου και κατά πόσο αυτές οι δεξιότητες είναι εφικτό να αναπτυχθούν μέσω προγραμμάτων Δια Βίου Μάθησης.

**ΛΕΞΕΙΣ-ΚΛΕΙΔΙΑ:** Αγροδιατροφή, δεξιότητες, εκπαίδευση, νέες τεχνολογίες, έξυπνη γεωργία.

# 1. Introduction

The continuous evolution of the Information and Communications Technologies (ICTs) is estimated that will induce an intense necessity to create new educational protocols both in formal and non-formal education, with the emphasis placed on the development and further practice of certain "horizontal" and "vertical" skills. At the same time, the imperative of these imminent changes is reinforced not only due to technological reasons, yet also by several demographic and socio-economic factors.

It is evident that the afore mentioned influence directly the already existing managerial models, while they also constitute a significant motive for the creation of new sustainable professional activities (i.e. Precision Agriculture, Telemedicine etc.) for the opening of additional job vacancies. Nevertheless, they might also present serious challenges, since they demand immediate and versatile adaptation from all parties involved (strategy planning agencies, educational organizations, businesses, decision-making stakeholders, citizens etc.). Throughout this procedure, many professions and fields of work will go through a holistic transformation, which some will but others will not survive, thus affecting the quantitative as well as qualitative inflows and outflows of the labour market.

The essential question of the present article, entails the examination and study of the degree to which the acquisition of "vertical" and "horizontal" skills is required by the human resources, particularly with respect to new production management issues and in conjunction to the new and ever-evolving technologies in the everchanging environment of the Agri-foodstuffs labour market, as a result of the 4th Industrial Revolution.

Sub-questions of this paper, involve the estimation of the extent and of the ways through which the new technologies are applied to Greek agricultural and livestock farming properties; also, the detection of opportunities and threats in the development of new skills around these new technologies through Lifelong Learning Schemes, which the contemporary Greek farmer should possess to be able to implement the latter more effectively, in the wider context of Agri-foodstuffs labour market.

In the last decades, the structure and organization of the food production systems demonstrates a rapid shift of the production paradigm towards fulfilling the requirements and needs of modern consumerist audience (consumer-driven), yet also serving as a combining response to an array of alterations and developments that take place within economy, society, technology and the institutional and legal framework. These developments, particularly in the field of technology, have subsequently incurred favourable conditions for the mitigation of restrictive factors, such as the perishability, sensitiveness and the seasonal nature of products, the huge geographical dispersion as well as the distancing between the points of production and consumption, etc. (HFE, 2013).

Given the fact that the human population is estimated to reach 9.7 billion worldwide by 2050, the current food production is then consequently expected to increase to approximately 60% (Schönfeld et al., 2018). Hence, there is a general trend to design supervision programmes not only for the already existing crops but also for the new artificial cultivations, both in Greece and in the EU (Capital, 2017).

Therefore, the intense use of farmland with the goal to feed the ever-raising global population, has achieved the increase of agricultural productivity over the past decades. Still, in this

task, there is a main ally and that is the Information and Communications Technologies (ICTs) evolution, which has provided the potential of diversified intervention applications with the purpose of production optimization as well as the appropriate use of available rural properties, thus enabling their maximum exploitation depending on the prospects offered (Stafford, 2000).

Since its first applications at the beginning of the '90s, the Precision Agriculture (or Smart Agriculture or Intelligent Agriculture, as it is alternatively called) has been functioning as a modern method of crops management, according to which the input (pesticides, fertilizers, seeds, irrigation water) and the cultivation techniques are both applied on the basis of the requisites of the soil and crop, as those differentiate through space and time (Whelan & McBratney, 2000) while combined to the reduction of environmental footprint at the same time.

In other words, the Precision Agriculture assists the farmer in the decision-making process as well as towards a better administration of the agricultural property (Gemtos et al., 2002) since it provides the ability of accurate, effective and economical agriculture via the respective automations (Schönfeld et al., 2018). Thus, the production maximization is made possible with a simultaneous minimization of the odds of failure due to natural disasters, errors and factors related to crops cultivation, weather conditions and farming equipment (Sung, 2018).

In Greece, the Agri-food sector firmly comprises one of the most important parts in the Greek processing and one of the main driving forces for the Greek economy. As an inextricable component of the Agri-foodstuffs chain it is affected, yet also it strongly affects itself the remaining areas of financial activity (primary and tertiary sector), with respective consequences for the national economy as a whole (HFE, 2013).

Without doubt, the Agri-foodstuffs business area apparently involves high risk that may correspond to external factors, such as geo-climatic conditions (Anastasiadis & Poole, 2015) which, in turn, are deterring for prospective entrepreneurs and new investors in the field. Based on subsidization and offers in "unlabeled" products, the Greek agri-food sector has been developed by less than 1% per annum throughout the previous 25 years representing merely 0,3% of the international production, compared to 0,8% in 1993. What is more, the Greek Agri-foodstuffs sector includes small and fragmented properties (National Bank of Greece, 2015). Indeed, most of agricultural or livestock farming units in Greece are small, predominantly family businesses, often characterized by limited organization. Besides these basic preventing factors, the Greek agri-food sector must also deal with the continuous rise in primary sources costs following the economic crisis and the constant attenuation of the consumers' expenditure, imposing the need to improve the production efficiency.

Additionally, an extremely serious matter, is the fact that up to recently the majority of human resources occupied in the primary sector had incomplete knowledge and was unfamiliar with the new technologies or other specialized innovative ways of production. Born out of the incessant financial crisis, the ability to adjust as demonstrated by the agricultural households, the producers, the agricultural organizations, the communities and local economies is a reflection of the so-called resilience of the farmland territories. The elasticity is evident in that the rural areas are able to absorb the pressure and re-structuring while experiencing the changes, thus maintaining their functionality, organizational features, identity and flexibility of activities (Schouten et al., 2009; Folke et al., 2010).

The promotion of Smart Agriculture and of Precision Agriculture is a key target of European politics for the next years. Apart from the Common Agricultural Policy (CAP) forecasts, in April 2019 a partnership agreement for "a smart and sustainable digitalized future for European ag-

riculture and countryside" was signed by 23 EU member-states, thus signifying the systematic efforts which are to be made in this field.

Equal initiatives, at politics level, have also been put to practice in Greece. The most representative examples being the "Three-parties Collaboration Memorandum" for Precision Agriculture among the Greek Ministry of Digital Policy, the Greek Ministry of Rural Development and the University of Thessaly signed in 2018, and the project "Digital Transformation of the Agricultural Sector" still under consultation. Nevertheless, Greece has not taken advantage of the worldwide trend for a more advanced and efficient farming production, such as the optimization of production and quality as well as the endurance to illnesses (Karabini, 2017). Hence, the technological enhancement of the agricultural production is inferior in comparison to other EU countries, basically for two reasons: The agri-food sector consists of small and fragmented properties (National Bank of Greece, 2015) and the majority of the human capital in the primary sector is not equipped with the necessary education-training to use new technologies or other specialized and innovative ways of production.

The impact of the digitalization of agriculture, is expected to affect employability rates as well as the work qualifications of farmers and other professionals involved in agriculture (Walter, 2017). Modern agriculture demands farmers not just to use or accumulate knowledge, yet it rather asks from them to be the experts in agriculture issues. In essence, the farmers should be in the position to manage complex rural eco-systems in a competitive markets environment, while also implementing eco-friendly practices.

Methodologically, the paper aims to investigate, through via a focus groups interview research method, the contribution and value of the new skills in new technologies, through Lifelong Learning Educational Programmes, in the wider context of the agri-food labour market.

The main goal of this empirical study, is to answer questions on the degree and the way that the new technologies have proved useful to the Greek agricultural and livestock farming businesses. At the same time, its purpose is to pinpoint the benefits and hazards related to the subject matter and more importantly to identify: 1) the new skills that the Greek farmer of today has to develop so as to be able to use the new technologies effectively, and 2) to which extent these skills could further be expanded in a feasible manner, through Lifelong Learning Schemes.

# 2. Case study: Acquiring new skills in the agri-foodstuffs sector through lifelong learning in the American School of Agriculture

## *2.1 Research methodology*

The selected method of research is that of focus groups interviews, which is defined by Krueger (1988) as a carefully organized conversation, designed to draw perceptions and convictions on a specified topic of research, within a permitting and non-deterring environment. The focus groups research is not a group interview with an interviewer posing questions to the interviewees; it is a team conversation in which participants are invited to discuss a particular matter with one another through an interactive process, which can either be "vertical", that is researcher-participants interaction but mostly "horizontal" among the members themselves (Wilkinson, 1998). The interaction among members of the team diminishes the influence of the researcher over the procedure and amplifies the gravity of the participants' responses. It is useful to clarify

that the recorded group conversations need not reach general conclusions, opinion convergence, or the formulation of a common interpretation of the shared experience or of others' beliefs, as it often happens when employing the specific technique (Frey & Fontana, 1993).

In the present research, the focus groups per se established the setting for vivid interaction and communication among participants, something which is the basic reason for choosing this specific technique (Kitzinger, 1994). Also, there has been a multidimensional dialectic relationship as many interviewees were asked simultaneously, where beyond the articulation of their own narrative and their interaction with the rest, they also presented the boundaries, limitations and oppositions to an external world, which they do not control or fully shape (Baniou, 2018).

The particular method has been selected because of certain advantages (Morgan, 1997, Krueger, 1988): a) Focus on a specific area, b) formulation of hypotheses emerging from ideas and collective data, c) gathering and assessment of information from various sub-groups of the generic target audience population, d) feedback from previous case studies.

In order to best conduct this study, two separate research tools were put to use, appropriately adjusted to two targeted focus groups, namely the agronomists and the farmers-producers.

The research tool for the agronomists' focus group consists of 17 questions which fall into the following categories: a) General (Are you aware of the impact of the 4th Industrial Revolution on the labour market changes in the agri-food sector?). b) Introductory (Do you know which of the smart technologies and software programmes are used in the agricultural and live stock farming properties drawing on your personal experience?). c) Transitional (Which horizontal skills do you think that somebody should possess beforehand, so as to be able to use a smart device or a smart software programme?). d) Key-Questions (In which way do you believe that someone could develop these skills if they haven't done so already?. e) Closing-Questions (From all that has been discussed what is most important to you?).

Respectively, the research tool that has been used in the farmers'-producers' focus group is made up of 15 Questions: a) General (Do you know what Precision Agriculture or Smart Agriculture stands for?). b) Introductory (Have you used smart technologies or smart software programmes in the agricultural processes?). c) Transitional (Do you believe that somebody should know how to use the new technologies in the agri-food sector?). d) Key- Questions (Would you attend a educational programme of long or short duration on these topics?). e) Closing-Questions (From all that has been discussed what is most important to you?).

The procedure adopted in the research, first of all dictated the formation of the two focus groups and the allocation of members. With the assistance of experts from the American School of Agriculture the most experienced agronomists and farmers in issues of Precision Agriculture and Smart Agriculture were selected. Then, different meeting times for each of the teams were assigned.

The first focus group interviews including agronomists, zootechnicians and Adult Education Trainers from the American School of Agriculture with specialization, took place on 23/04/2019 at the premises of the American School of Agriculture, following verbal notification and invitation by the person in charge of the European Adult Education Programmes addressed to the members of the Department.

The second focus group interviews involving vineyard producers of the Cooperative Organization "Krya Vrysi', was conducted on 01/06/2019 in their headquarters, after its president was informed and invited over the telephone by the person in charge of the European Adult Education Programmes. In turn, the president of the Cooperative Organisation notified the rest of members about the research, again over the telephone.

During the implementation of the focus groups research method, the key role was that of the group members, given that the researcher-interviewer was only asking the questions and the interviewees were expressing their own knowledge and experience without any external influence. The research sample comprised of two groups on the basis of their professional identity. In particular, the first group consisted of expert agronomists, zootechnicians and Adult Education Trainers from the American School of Agriculture in Thessaloniki (6 women and 2 men with an average age of 40-45 years old). Regarding the educational level, 67% of the sample is PhD holders, while 33% has postgraduate studies related to agronomy and livestock breeding. As far as their work experience in the Agri-foodstuffs is concerned, 75% of the sample has been working as agronomists or zootechnicians for almost 15-20 years, whereas 25% of the sample has been having a career in the latter positions for the last 2 years.

The second group, includes the vineyard producers of the Cooperative Organisation "Krya Vrysi", who are in partnership with the American School of Agriculture for the past 2 years. More specifically, it is made up of 6 men and 2 women, with an average age of 45-50 years old. 75% of the sample has been in professional occupation in the Greek agriculture for 30-25 years, whereas 25% for the previous 5 years. As for the educational level of the second team, it is obviously lower than that of the first, since 50% of the sample has completed Secondary Education, 33% Primary Education and only 17% are holders of a specialization from Public Vocational Institution.

## *2.2 Research results*

With regards to the focus group of Agronomists and Adult Education Trainers from the American School of Agriculture in Thessaloniki, they point out themselves that they have a theoretical knowledge on the applications and implications of the 4th Industrial Revolution and of the 5th Generation technologies in the Agri-foodstuffs sector. For such kind of issues, they are informed basically through private study and research as well as through several conferences. However, they stressed that practically they are still at a "pre-school" stage of knowledge since the particular subject has been introduced in the Greek reality very recently.

In relation to the question of which technologies they have seen being applied to agricultural and livestock farming properties during their work experience, the participants mentioned the automated process of irrigation, feeding and milking. Also, they referred to the use of smart meteorological systems, highlighting that they have not been practiced as much as needed in the Greek agri-food sector.

With respect to the positive effect that the application of the new technologies has on the rural sector, they stated their opinion that "most benefits occur during the productive process". In particular, as positive aspects were recorded the cost-effectiveness and error mitigation thanks to the automated procedures, the profitable production, the exact facts and figures of farm properties and animal breeds, the reduction of the required working hours, the higher levels of euphoria and the contribution to the protection of the environment, thanks to the controlled portions of fertilizers and pesticides. At the same time, they also stressed that the most serious threat embedded in the adoption of smart applications in the agri-food sector lies in the incorrect interpretation of the smart software programmes data by the farmers.

As for the factors that prevent the implementation of smart technologies in their own agricultural and livestock farming properties, there was a reference to unawareness and lack of knowledge on the part of the farmers in relation to the most effective use and application, the

high cost for purchasing and installing the appropriate equipment as well as the skeptical or even negative attitude demonstrated by farmers when meeting something innovative.

Finally, on a know-how basis, they pointed out themselves that "farmers should acquire new skills including the knowledge of using computers and (smart) mobile phones, smart machines and smart software programmes". Also, they stated that these specific skills can only be developed through special training and optimally via a combination of curriculum education to further education (i.e. long-term educational programmes and continuous professional education).

Moreover, as far as the focus group of farmers is concerned, it has been shown that they have partial knowledge of the matter both theoretically and technically, whereas they have already made the first steps by installing smart meteorological systems and ground sensors as well as devices for automatic irrigation, crop-dusting and fertilization. However, their knowledge about Precision Agriculture in a more general sense is incomplete, since they stated themselves that they are unaware of other applications of the new technologies or software programmes which they could use.

Throughout the discussion, many of the positive aspects of the Precision Agriculture applications on their own farmland were mentioned, such as: full knowledge of their rural properties facts and figures, cost and errors attenuation during the production procedure, increase of revenues via the rise in the quality of goods which the automated processes ensure, reduction of the working hours and decrease in the consumption of pesticides and fertilizers, which incur lesser cost production yet a more positive environmental footprint.

Thus, it is worthy to note that the participants in both focus groups were in many respects aware of the Precision Agriculture content, more on a theoretical and partly on a hands-on level. In particular, the focus group of the farmers obtained this theoretical knowledge via the practical application of the Precision Agriculture technologies.

Technically, both teams have used some of the Precision Agriculture applications and technologies like the meteorological stations, the chartering of rural properties via underground sensors and the automated activities of irrigation and fertilization. Nevertheless, there are other applications that have not been put to use yet, such as robotics and robot vehicles, either because of neglecting their existence or due to their high cost, also even out of one's own reservations.

Furthermore, both team members identified as positive impact of the precision agriculture applications the complete and valid information concerning the rural properties, the more economical and profitable production, the cost and errors attenuation during the production process and the environmentally friendlier agriculture, all of which are compatible with the referenced bibliography. In addition, the farmers' focus group members argued that the reduction of working hours is a significant positive aspect of the precision agriculture applications. However, this comes in contrast to data from secondary sources, since scientists and researchers believe that this particular trend is expected to cause serious damage to the labour sector, because it will instigate the replacement of human activity by automated machinery activity.

Concerning the difficulties which they faced during the implementation of the new technologies in their rural properties, members of both focus groups, agreed that the most important difficulty arises from the lack of expertise, training and subsequently from the high cost to purchase and install the new equipment, a fact which is confirmed by the bibliography.

Particularly, regarding the education and professional skills area, it is worthy to note that the survey participants identified as the necessary qualifications the advanced digital skills, the data interpretation ability and the know-how in use of the new farming machines. However, according

to the works cited, the contemporary farmer has to develop a wide range of skills, such as the decision-making ability, the problem-solving ability and the social skills, in order to be able to execute effectively the tasks required by the implementation of the Precision Agriculture applications.

For the acquisition of those skills, all participant members agreed that the role of the continuous and targeted education is crucial. More specifically, they find ideal the combination of curricular education to Continuous Professional Occupation Training. Throughout the discussion, the necessity to re-structure the syllabus not only of the fundamental, but also of the continuous professional occupation training was brought to light, since the Precision Agriculture and the new technologies have not been included in both so far. Also, they proposed that the educational programmes should emphasize mainly on the hands-on experience and less on the theoretical background. Moreover, the need to provide long-term educational programmes on Precision Agriculture issues was also expressed, given that it is a recently evolved field. Finally, as far as the role of "self-learning" is concerned, it is useful to point out that the focus group of the farmers thinks of the latter as unachievable due to the perplexed nature of the precision agriculture applications, something which is in contradiction to the agronomists' team, where part of their theoretical knowledge was obtained though private study and research.

Taking into account all of the above, there is an imperative to pave the way for alternations and improvements both in the format and in the content of the Lifelong Learning Schemes. More specifically, in relation to the content of each educational programme there is an urgent need to incorporate the acknowledgement of current developments in the Precision Agriculture, the trainees' familiarization with the implementation of innovative technological systems, while at the same time to constantly develop and upgrade the digital skills. Regarding the training in Precision Agriculture issues, the interconnection of fundamental to continuous occupational education is required to enable the follow-up with recent trends. In any case, each of the provided educational schemes, in order to instill essential knowledge, should theoretically concentrate on issues around the Precision Agriculture, yet also be organized in such a way that would permit a hands-on experience of the new knowledge.

## 3. Conclusions

Following the concise presentation of the theoretical aspects on the transformation of the wider labour market environment for the agri-food sector in conjunction with the results from the focus groups survey analyzed, certain conclusions are drawn below.

Within the correct farming practices and sustainable development framework, it is made easy for the Greek farmers to apply the Precision Agriculture for the sake of themselves as well as for the benefit of national agriculture, successfully employing the equipment and applications of the latest technology; thus, not only further increasing their income, but also contributing to the country's financial profile (Hedley, 2015). Therefore, the adoption of smart agriculture and precision agriculture applications by the Greek farmers might on the one hand be limited, still rather dynamic so as to create a productive and long-term sustainable sector. In order for that to be realized, it is necessary to stimulate all the interested bodies and to intensify the efforts towards enlightening the farmers and designating the appropriate cultivations which could take better advantage of the smart agriculture technologies.

Nonetheless, an acceptable presupposition for the successful transformation of the wider labour market context of the Agri-foodstuffs sector is the ultimate shaping of the single digital market, particularly at a moment when lack of basic digital skills is acknowledged, especially in the context of immensely increased requirements. Since the advanced technological systems are likely to form special and ever-updatable skills, Lifelong Learning and Training is admittedly vital for employees. Thus, besides the usually high cost to implement new technologies in individual properties, restricted knowledge and skills may, in fact, prove serious obstacles, especially in the developing countries. In order to reinforce the offer of the required skills, it is important to promote occupational training schemes and lifelong learning. At the same time, the demand for a wide variety of specializations and expertise throughout the value chain spectrum is evident, ranging from the operational structure via system design, the visualization and managerial processing of production functions to human interaction. In this environment, the transformation of the curricular education for the Agri-foodstuffs sector and the enrichment of the programme syllabus with innovative elements, which lead to the acquisition of up-to-date skills and information, are imperative.

In any case, for the human resources to conform with the Precision Agriculture guidelines in the agri-food sector, it must be considered that there is a set of other interfering parameters which are linked to the socio-demographic profile of the farmers (Barnes et al., 2019). Pierpaoli et al. (2013) have shown, through empirical studies, that the key factors involved in the adoption of these applications by the farmers are the level of education, the age and the degree of familiarization with computer use.

More particularly, farmers with a high educational background or those who have attained a type of agriculture training or specialization, tend to better recipients of the new technologies, especially since education acts positively for the acquisition of technological and business skills (Barnes et al., 2019). Also, Kutter et al. (2011) state that skills in computer literacy and relevant applications have a great influence on the intention to adopt smart agriculture systems, since the weak ability of handling the data [otherwise] constitutes the main source of reluctance.

Taking into consideration the above limitations, it would be recommendable for the future research to be oriented towards the further examination of the parameters which affect the integration of smart agriculture and precision agriculture practices in Greece, by sampling a greater population both in numbers and in geographical terms. Last but not least, the subject of any future research should be the examination of the role of other interested legal bodies, such as research institutions, public organizations, educational institutions, collaborative farming businesses etc. in the promotion of smart agriculture practices and in the adjustment of the domestic human resources to its requirements.

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## Biographical Notes

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