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Towards Agricultural Digitalization: Does Higher Agricultural Education Supply Students with Relevant Competencies? †

Chrysanthi Charatsari [1,*], Anastasios Michailidis [1], Evagelos D. Lioutas [2], Thomas Bournaris [1], Efstratios Loizou [3], Aikaterini Paltaki [1] and Dimitra Lazaridou [4]

1 Department of Agricultural Economics, School of Agriculture, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece; tassosm@auth.gr (A.M.); tbournar@agro.auth.gr (T.B.); apaltaki@agro.auth.gr (A.P.)
2 Department of Supply Chain Management, International Hellenic University, 60100 Katerini, Greece; evagelos@agro.auth.gr
3 Department of Regional and Cross Border Development, University of Western Macedonia, 50100 Kozani, Greece; lstratos@agro.auth.gr
4 Department of Forestry and Natural Environment Management, Agricultural University of Athens, 36100 Karpenisi, Greece; dimitral@for.auth.gr
* Correspondence: chcharat@agro.auth.gr
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Abstract: Agricultural digitalization is gaining momentum, urging a transition from process-driven to technology-enhanced and data-driven agriculture. To support such a transition and help farmers derive benefits from digital technologies, also avoiding the potential threats associated with digitalization, future advisors need a variety of competencies, ranging from pure technocentric skills to more complex capabilities, such as impact forecasting and transition facilitation. Do Greek students who study to become advisors have these competencies? In this study, we attempted to answer this question following a quantitative approach. The results indicate that participants possess low levels in all the examined sets of competencies and, as a result, have limited overall competency in dealing with digital agriculture. These findings suggest the need for agricultural universities to reset competence-related targets and design strategies to supply future farm advisors with the competencies needed to act as facilitators of agricultural digitalization.

Keywords: agricultural digitalization; advisors; students; competencies; competence development; smart farming; precision agriculture; skills; advisory services; farming

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1. Introduction

Digitalization of agriculture refers to the introduction of technologies belonging to the so-called fourth industrial revolution to the agricultural sector. These tools are expected to have a positive transformative potential for farming and the wider agrifood sector [1], without, however, being free from negative impacts [2,3]. To unfold their potential and bring about the desired outcomes, digital technologies depend on the adopters' aptitude to exploit them [4]. Since farmers do not always possess the skills needed to autonomously use these technologies [5] and cope with the new complexities that digitalization creates [6], advisors are called to undertake the role of digital transition facilitators, helping adopters extract value from these technologies [7–9].

Such a role is demanding, requiring a broad array of competencies. Research indicates that advisors working in the field develop digitalization-related competencies through their participatory engagement in the digital transition process [8]. However, to date, there is no evidence of the extent to which agricultural universities supply students who, after graduating, will act as advisors with the competencies needed to deal with digitalization.

Our study aims to offer some preliminary insights into this topic by examining the levels of Greek agronomy students' competencies in nine different areas, including competencies related to the interactions between human actors and technology, involving both advisor–technology interaction and the mediation of the farmer–technology relationship; understanding the use and potential of technologies; integrating technologies into farms; effectively and responsibly exploiting technologies; anticipating the impacts of digitalization; and managing digitalization-related risks. We also focused on competencies associated with the abilities of future advisors to guide the digital transition of farms, namely adaptation to the new conditions that digitalization creates, facilitation of the transition process, empathy towards adopters, and the ability to orient the self toward the future. As a set, these competencies allow the future advisors to adapt themselves to external changes, paving the way for the transition process, understanding the adopters' needs and difficulties, and developing and attaining goals for the future.

2. Methods

Our analysis draws on data from a sample of 108 students (55.6% women; mean age = 23.5 years; S.D. = 4.1) who study agronomy at a large Greek university. To measure students' competencies, we developed nine scales referring to basic technology understanding (example item: "Understanding the potential of technologies"), technology integration competencies (example item: "Solving problems associated with newly introduced technologies on the farms"), technology exploitation skills (example item: "Transforming technologies to productive resources"), impact forecasting competencies (example item: "Predicting how technologies will transform farming systems"), risk reduction competencies (example item: "Minimizing the social risks associated with technologies"), adaptation competencies (example item: "Adapting to profound change when innovative technologies emerge"), transition facilitation competencies (example item: "Facilitating through my collaboration with farmers the technology-enabled transition of farm enterprises"), empathy (example item: "Understanding how farmers feel about technologies and resolving potential conflicts"), and future orientation (example item: "Anticipating the potential futures that technologies create"). To generate items for the first four scales, we lean upon conceptual and empirical literature on the technology-related competencies of farm advisors [8,10–12]. For the remaining scales, we formulated items based on social science research that refers to farmer–advisor interaction during the digitalization process [8,13–16].

For all the items, students were instructed to indicate their competency level on a scale ranging from 1 (not at all) to 5 (very much). Principal axis factor analyses confirmed that items loaded on the theoretically expected factors. Cronbach's alpha values were satisfactory for all the scales, ranging from 0.80 to 0.94.

To assess students' overall digital agriculture-related competency, we used a single item measured on a ten-point scale, where higher values correspond to a higher level of competency.

To analyze data, beyond descriptive statistics, we built a simultaneous regression model to examine what types of competencies are associated with participants' overall level of competency in dealing with digital agriculture.

3. Results

The summary statistics of the variables are presented in Table 1. Interestingly, students' overall digital agriculture-related competency was low (M = 4.12; S.D. = 1.94). However, it is worth mentioning that considerable differences exist between participants, given that the overall competency scores ranged from 1 to 8. The mean scores for the nine sets of competencies were moderate, ranging from 2.92 to 3.53. Notably, only three competency sets yielded mean scores higher than the baseline level of 3.0; two involving a high degree of self-direction (future orientation and empathy) and the capacity to understand technologies.

Table 1. Summary statistics of the study variables.

Variable	Mean Score	Standard Deviation
Basic technology understanding competencies	3.22	1.05
Technology integration competencies	2.99	1.00
Technology exploitation competencies	2.92	0.98
Impact forecasting competencies	2.98	0.93
Risk reduction competencies	2.85	1.03
Adaptation competencies	3.10	0.90
Transition facilitation competency	2.93	0.92
Empathy competency	3.31	1.00
Future orientation competencies	3.53	0.86
Overall competency	4.13	1.94

When all the sets of competencies were entered in a simultaneous regression model (R^2 = 0.20, F = 2.76, p = 0.006), only the technology integration capacity (β = 0.54, p = 0.021) and transition facilitation competencies (β = 0.46, p = 0.048) received significant beta coefficients. In both cases, higher scores led to an increase in the future advisors' overall competency.

4. Discussion and Conclusions

The present study uncovered that future advisors in Greece have low levels of agricultural digitalization-related competencies. Some of the examined sets, like future orientation and empathy, had higher—yet questionably sufficient—scores. Our regression analysis revealed the pivotal role of technology integration and transition facilitation competencies in shaping the overall competency. Since both these variables had scores below the baseline level, it is not surprising that the overall competency in dealing with digital agriculture was also low.

These results point out the need to rethink the ability of the offered curricula to supply students with the competencies needed to cope with the challenges posed by digitalization in the agrifood sector. Modern approaches and a redefinition of the priorities set by their designers can help future farm advisors effectively support the transition to digital agriculture.

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