

Agronomic education and the quest for sustainability: Is there a link?

Chrysanthi Charatsari^a, Afroditi Papadaki-Klavdianou^a, Alex Koutsouris^b, Evangelos D. Lioutas^c

^a Aristotle University of Thessaloniki, School of Agriculture, chcharat@agro.auth.gr; papklavd@agro.auth.gr

^b Agricultural University of Athens, Department of Agricultural Economics and Rural Development, koutsouris@aua.gr

^c Technological Educational Institute of Central Macedonia, Department of Supply Chain Management, evangelos@agro.auth.gr

Abstract: *In this article we present two studies. The first was designed to identify Greek agronomists' levels of sustainability-related competencies and to examine whether gaps in these skills restrict their ability to promote sustainable agriculture (SA) as well as their willingness to engage in SA networks. The second study was conducted to compare the perceived effectiveness of different schemes aimed at enhancing agronomists' competencies on SA. Study 1, following a mixed-methods research design, uncovered that the low levels of agronomists' marketing skills diminish their willingness to participate in SA networks and their self-efficacy in promoting SA, thus generating a sense of anxiety towards sustainable farming. Quantitative results also revealed that levels of knowledge on SA and agronomists' networking competencies affect their involvement in sustainable agricultural management. Interpretative Phenomenological Analysis showed that there is a gap between agronomists' skills/competencies and the reality of practicing agricultural sustainability, whereas it also highlighted the lack of organized knowledge-creating opportunities targeted at SA. Study 2 indicated the importance of weaving together many actors in order to create attractive and effective competence development projects. In parallel, our findings call for a shift from purely didactic approaches to more experiential ways of knowledge construction, and from a focus on technical knowledge to the development of interdisciplinary skills. In sum, this pair of studies emphasizes the need to go beyond traditional schemes of agronomic knowledge transfer to the development of multi-actor learning environments that can serve as mediating hubs in agronomic knowledge, endowing agronomists with key competencies needed to promote SA.*

Keywords: *sustainable agriculture, competencies, knowledge, agronomic education, Interpretative Phenomenological Analysis*

Introduction

Agricultural systems, producing important commodities but also generating environmental externalities (German et al., 2017; Luo et al., 2017; Navarro et al., 2017), are at the center of the discussion on sustainability. Both academic and policy circles express concerns over the ability of current agricultural practices to ensure long-time productivity of farming systems and to sustain ecologically and socially sound development. Therefore, national and international policies constantly strive to find appropriate ways to promote the idea and praxis of sustainable agriculture (SA). Nevertheless, such a shift from conventional to alternative modes of agricultural production is knowledge-intensive (Blay-Palmer et al., 2016; Velten et al., 2014) and requires the opening of new spaces for agricultural knowledge and innovation (Marin et al., 2016; Pogutz and Winn, 2016; Moschitz and Home, 2014). Thus, the development of appropriate knowledge co-evolution schemes among key actors emanates as a top priority for both academia and extension services.

However, supplying farmers with technical knowledge is not sufficient to support transition towards sustainable farming. Agricultural professionals have to use tailor-made approaches (MacRae et al., 1990) that can help farmers increase their knowledge-generating potential

(Valencia et al., 2015). Hence, a crucial question is whether the actors who guide knowledge co-creation processes have the skills and competencies needed to broker sustainable change in agriculture. In this study, using a mixed-methods approach, we aimed at identifying Greek agronomists' gaps in knowledge and skills related to sustainable agriculture, to trace the causes of these gaps, and to evaluate different forms of conventional and innovative lifelong learning approaches aimed at increasing agronomists' sustainability-related knowledge and skills.

Brokering sustainability: Finding the golden mean between theory and praxis

Early discussion on agricultural sustainability emphasized the need to theorize SA and to set up a new framework for research in the field (Gliessman, 1990; Lockeretz, 1988; Lowrance et al., 1986). Simon (1989) was one of the first to note the need to create a threat linking theory with praxis in order to maintain a balance between them. The last two decades, research on both the practice (behavioral norms and routines) and the praxis (the application of knowledge into actual activities) of SA has witnessed tremendous progress. Issues such as climate change, renewable energy, and sustainable rural development have attracted considerable research attention (Hassan et al., 2014), followed by a growth in sustainability-related investments in many countries (Pretty and Bharucha, 2014; Wang, 2014). However it is still questionable whether the sheer and constantly growing volume of research outputs reaches farmers, further enhancing the expansion of SA in rural settings.

In spite of the efforts made to increase farmers' sustainability awareness and knowledge through participatory processes (Wijaya et al., 2018; Pretty and Bharucha, 2015), extension systems seem in the most cases unable to facilitate and guide the change process (Clark et al., 2017; Lioutas et al., 2017). In parallel, several indications confirm that agronomists and extensionists are far from being ready to undertake the role of change agents, supporting thus the transition towards sustainable models of rural development. Recent studies indicate a deficit of competencies and skills related to sustainable agronomic practices (Suvedi et al., 2018; Umar et al., 2017; Yadav et al., 2013) which restricts the efforts to boost adoption of SA by farmers (Rodríguez et al., 2009).

In the dynamic and complex field of SA, effective change occurs when different transition strategies are integrated into scientific thinking (Dentoni et al., 2017). Hence, agronomic education and training should both adopt a holistic perspective, aimed at assisting agronomists develop critical skills and competencies which reflect what Mezirow (1981, p. 9) calls "the realities of practice." This premise generates the need for developing and implementing alternative knowledge production and exchange models that synthesize local and scientific knowledge in order to help farmers adapt themselves and their farm enterprises to the new conditions that transition to sustainability engenders (Altieri, 2004; Pretty, 1995). To address this need, agricultural universities began to develop courses or programs on SA (Clark et al., 2013; Jacobsen et al., 2012) and to design and implement pedagogical practices tailored to the complex nature of agricultural sustainability (Valley et al., 2018; Culhane et al., 2016).

The promising results of such initiatives (Abubakar and Yusuf, 2017; Rodríguez-Solera and Silva-Laya, 2017) indicate that to face the challenges imposed by the quest for sustainability it is important to reorganize both agronomic education and training so as to provide agronomists with new sets of competencies. From an adult education point of view (Queeney, 1995; Argyris, 1993), the diagnosis and classification of learners' needs is an important step towards the design of any efficient program targeted at competence development. In the current research, we aimed at providing a series of insights on the competencies needed by Greek agronomists in order to support transition towards SA. We also propose some new directions for agronomic education and training and we discuss the ways in which lifelong learning approaches can be interwoven to increase their effectiveness.

Zooming-in: Agronomists' self-efficacy and transition to SA

Although contemporary literature offers ample evidence that production and co-evolution of sustainability-related knowledge have still wide margins for improvement, little is known on how professionals experience – and deal with – their knowledge shortcomings. From a social psychology perspective, it is well documented that the sense of inadequate competencies reduces individuals' motivation to get involved in tasks and/or situations where these competencies are considered as necessary conditions (Ajzen, 2002; Gecas, 1989). Therefore, to better understand agronomists' attitude towards SA and their ability to promote sustainable transformation, it is important to understand their own beliefs and perceptions on the knowledge and skills they have or need.

To this end, in the current work, we put a particular focus on the issue of self-efficacy. Self-efficacy – a fundamental concept in Bandura's (1986) social cognitive theory – refers to a person's beliefs of her/his capability to successfully cope with specific situations. In other words, self-efficacy represents the sum of one's perceptions on her/his ability to perform a task or a series of specific tasks (Gist and Mitchell, 1992; Bandura, 1989). Importantly, self-efficacy regulates work motivation (Canrinus et al., 2012), given that it affects intentions (Zhao et al., 2005) and future behaviors within professional contexts (Consiglio et al., 2016). In addition, it is more than well-documented that professionals' self-efficacy is positively associated with their job performance (Judge and Bono, 2001), work engagement (Skaalvik and Skaalvik, 2014), and creativity (Ford and Gioia, 2000). As Bandura (1995; 1982) argues, self-efficacy is an important determinant of individuals' willingness to engage in various tasks and to further increase their skills. In this vein, low levels of self-efficacy might reduce agronomists' willingness to participate in SA promoting schemes, since people tend to avoid getting involved in situations they believe that exceed their competencies (Bandura, 1977).

The latter concept, willingness to participate in networks and communities of praxis, is another important factor driving transition towards SA (Hassanein and Kloppenburg, 1995). Participation and collaboration are considered as key elements of any alternative paradigm of rural development (Pretty, 1994). Especially in the case of SA, theorists and researchers converge in the idea that SA can effectively be promoted through networked arrangements, which include farmers, professionals, researchers, and market actors (Moschitz et al., 2016; Niewolny et al., 2016; Klerkx and Jansen, 2010). Nevertheless, as a new line of research indicates, in farm settings participation is largely determined by the levels of stakeholders' felt competencies (Lioutas and Charatsari, 2018; Triste et al., 2018; Charatsari et al., 2017; Zamani et al., 2016; Charatsari et al., 2013). Furthermore, a lack of competencies might raise feelings of task-related anxiety (Bandura, 1988), reducing thus both task performance (Martin and Gill, 1991) and individual's engagement with situations she/he sees as threatened (Meijman and Mulder, 1998), especially when the task includes a high degree of complexity, as in the case of SA.

The present studies

In this pair of studies, instead of simply assessing the levels of agronomists' competencies, we devoted more attention to the factors determining these levels and to the implications the (in)adequacy of such competencies has for the promotion of SA. Moreover, we focused on the ways (university and adult) agronomic education can endow agronomists with key competencies needed to promote SA. An important question that guided our research design concerned the types of competencies which affect agronomists' self-efficacy towards promoting SA, their willingness to participate in SA networks, and their anxiety towards SA. In Study 1, to answer this question, we adopted a mixed-methods approach. In the quantitative strand of the study we assessed four types of competencies which according to the literature are important for the promotion of SA: networking capacities and marketing skills (Grover and Gruver, 2017; Matouš et al., 2013; Teklewold et al., 2013), problem solving competencies (Tomlinson and Rhiney, 2018; Dogliotti et al., 2014), and levels of knowledge on SA (Schut et al., 2016; Meijer et al., 2015). Then, we examined whether these competencies affect key variables of interest. In the qualitative strand we attempted to further

illuminate the findings emerged through these analyses. Study 2, following the results of our first study, sought to evaluate different forms of conventional and innovative lifelong learning approaches aimed at increasing agronomists' sustainability-related knowledge and skills. To meet this purpose we developed and then compared 36 different scenarios.

Study 1

Method

Participants and research design

Data for this study were drawn from a sample of 107 Greek agronomists who worked in the public or private sector. Public sector's agronomists in Greece are charged with various administrative tasks, whereas their work duties also include advisory work in a smaller proportion (Koutsouris, 2014). On the other hand, private agronomists are mainly focused on the selling of agricultural inputs and technology, while advisory work is an extra, cost-free service they offer to their clients (Lioutas et al., 2017). All participants had a tertiary degree (18.7% graduated from agronomic Technological Educational Institutes, 59.8% had a diploma from an agricultural university and 21.5% had a university diploma and a Master's degree) whereas 66.4% of them were men. Their mean age was 40.8 (S.D.=10.7), and their average working experience was 10.1 years (S.D.=7.3).

Participants were first asked to answer a set of questions. In a follow-up phase, 18 of them (16.8%, mean age=41.7, 72.2% men) were selected and interviewed in a rather informal way through sequential semi-structured interviews, in accordance to the principles of Interpretative Phenomenological Analysis (Smith and Osborn, 2015; Larkin et al., 2006). The technique of Interpretative Phenomenological Analysis (IPA) was introduced in the field of psychology during 1990s (Smith, 1996), and bloomed after 2000 before its expansion to other fields (Hefferon and Gil-Rodriguez, 2011). Recently, researchers have used this qualitative approach to collect and analyze data related to rural development processes (Convery et al., 2010) or the ways entrepreneurs learn through experience (Cope, 2011). As a tool, IPA emphasizes the importance of participants' lived experiences and the ways people make sense of them (Larking and Thompson, 2012). Nevertheless, the case-by-case focus of this analysis makes its use difficult in large sample sizes. Eatough and Smith (2017) argue that an appropriate number of participants for an IPA study should not exceed 30 persons, with smaller samples being the common practice.

Measures

To measure agronomists' skills and competencies we used a series of instruments. To assess agronomists' competencies in helping farmers solve their entrepreneurial problems we used three items (e.g., "I am able to provide farmers with various alternatives when they face entrepreneurial dilemmas"). Items were measured on a five-point Likert-type scale, from "completely disagree" to "completely agree." The internal reliability estimate (Cronbach's alpha) for this scale was 0.78. A new variable referred to decision-making autonomy was computed by averaging the three items (M=3.74, S.D.=0.74).

For measuring participants' skills in facilitating farmers' networking we used six items. An example item was "I am able to help farmers develop alliances with their counterparts." Response options varied from 1 (not at all true) to 5 (very true). A principal axis factoring revealed that items loaded on a single factor (explained variance: 45.9%). An overall variable was computed by averaging scores on these six items (Cronbach's alpha=0.76, M=3.30, S.D.=0.79).

Four items were generated to assess agronomists' knowledge on sustainable farm practices. Subjects rated these items on a five-point scale from 1 (not at all true) to 5 (very true). A principal axis factor analysis yielded a single-factor solution, explaining 46.1% of the total variance. A variable concerning participants' knowledge was computed as the average of the four items (Cronbach's alpha=0.60, M=3.28, S.D.=0.78).

Three more items aimed at measuring marketing related skills were completed by respondents. Principal axis factor analysis revealed that a one-factor solution provided the best fit for the data (explained variance: 69.9%). Cronbach's alpha for this scale was satisfactory (0.73). By calculating the average of the item scores we created a "Marketing skills" variable. The mean score for this variable was 3.19 (S.D.=0.70).

In addition to these measures we used some single-item questions to assess the dependent variables as well as the importance attributed by participants to the issue of sustainability. The latter concept was assessed with the use of a five-point scale anchored by "very low importance" and "very high importance" (M=2.44, S.D.=1.01). Agronomists' self-efficacy in promoting SA was measured by a five-point Likert-type statement. The mean score for the variable was 2.17 (S.D.=0.99). A single item measured on a seven-point scale ranging from "very low" to "very high" assessed participants' willingness to participate in SA networks (M=3.22, S.D.=0.97). Finally, respondents were asked to rate their levels of anxiety when they are asked to deal with SA, by selecting among five answers, ranging from "very low" to "very high" (M=2.11, S.D.=0.91).

Results

Quantitative analysis

To examine the relative influence of the four assessed types of competencies on agronomists' self-efficacy, their willingness to participate in SA networks, and their levels of anxiety towards working on issues pertaining to SA, we followed a hierarchical regression procedure. At step one we entered participants' gender, age, and work experience. In the second step we added perceived importance of sustainability. Then, in the third step, we included the four scales referring to the different types of competencies we assessed.

In the first regression we found that in the final model (Table 1) networking competencies ($\beta=0.38$, $p<0.01$) and levels of marketing skills ($\beta=0.20$, $p<0.05$) predicted agronomists' self-efficacy. The variables entered at Step 1 and Step 2 explained about 2% of the total variance, whereas the scales entered at Step 3 explained 19% of the total variance ($p<0.01$). The second regression revealed that marketing skills ($\beta=0.23$, $p<0.05$) and knowledge on SA practices ($\beta=0.21$, $p<0.05$) were positively associated with subjects' willingness to participate in SA networks. As a group, the four types of competencies and skills explained a significant amount of variance in willingness to participate ($\Delta R^2=0.13$, $p<0.01$). The final regression showed that, again, the final set of predictors accounted for a significant R^2 change ($\Delta R^2=0.15$, $p<0.01$) whereas it was also found that marketing skills ($\beta=-0.30$, $p<0.01$) and knowledge on issues related to the SA ($\beta=-0.21$, $p<0.05$) were significantly and negatively related to the levels of agronomists' anxiety while working on sustainable farms. Interestingly, in the two last regressions age emerged as a significant predictor in Step 1, but its significance decreased after entering the scales referring to agronomists' skills and competencies ($p>0.05$). However, as a set, both demographic variables and the importance attributed to SA were non-significant for predicting willingness ($\Delta R^2=0.06$, $p>0.05$; $\Delta R^2=0.01$, $p>0.05$) or anxiety ($\Delta R^2=0.06$, $p>0.05$; $\Delta R^2=0.01$, $p>0.05$).

Table 1. Final models of the hierarchical regressions

	Self-efficacy in promoting SA	Willingness to participate in SA networks	Anxiety
Gender	0.01	-0.03	-0.01
Age	0.11	0.25	-0.25
Work experience	-0.12	-0.13	0.16
Importance of SA	-0.06	-0.02	0.07
Problem solving skills	-0.05	0.14	-0.04
Networking competencies	0.38	-0.01	-0.02
Knowledge on SA practices	0.05	0.21	-0.21
Marketing skills	0.20	0.23	-0.30

Note: Significant coefficients are in boldface

Interpretative phenomenological analysis

A major focus of our IPA was to uncover the process through which agronomists develop competencies related to SA. To this end, we included in our sample participants who reported different levels of self-efficacy, willingness to participate in SA networks, and anxiety towards the promotion of SA. This procedure leads to a group of participants which had no significant differences from the initial sample in the levels of competencies. Independent sample t-tests revealed that in all cases the differences between the group of IPA participants and the total sample were non-significant ($p > 0.05$).

Our analysis revealed three superordinate themes: fragmented knowledge on SA, limited repertoire of communication and facilitation skills, and lack of interdisciplinary competencies. Table 2 presents these themes, their sub-themes, and some illustrative parts of the transcribed interviews. Our discussions with the 18 agronomists revealed that most interviewees believe that their levels of knowledge on issues pertaining SA are sufficient to support and assist farmers. However, this knowledge is piecemeal and often grounded on inference-based representations. As some participants reported, this knowledge has been developed mainly through a trial-and-error procedure, which was iterated many times during their careers. The lack of opportunities to systematically refresh and advance their knowledge on SA is an obstacle in agronomists' effort to support conversion to SA. As a participant noted, sometimes farmers are aware of the new knowledge developments whereas agronomists lagged behind.

Table 2. Superordinate themes, subordinate themes, and illustrative narratives

Superordinate theme	Sub-theme	Illustrative comment
Fragmented knowledge on SA	Trial and error learning	<i>"You are trying, you fail, you learn; I'm okay with that. It's just part of the work. However, you can't convince a farmer to do the same, for them every mistake counts."</i>
	Lack of opportunities to gain knowledge on SA	<i>"Where can anyone learn anything on SA? You just type in Google a question, hoping to be lucky. Most of the times you aren't."</i>
Limited repertoire of communication and facilitation skills	Difficulties in communicating messages to farmers	<i>"You must use different language in every case. It seems easy but it is not, since every farmer has his own language. So, you are trying to guess: What kind of guy is this one?"</i>
	Handling group dynamics	<i>"What can you do when your group is in conflict? You just improvise, obviously."</i>
Lack of interdisciplinary competencies	Lack of problem-solving competencies	<i>"Organic farmers always ask me: How to do this? How to do that? An endless series of 'how' questions. I'm trying to figure out an answer but... You know, problems in real life are always more complex than those described in the textbooks we were reading as students. That's why I prefer to work with conventional farmers. Fewer questions, easy answers, less stress."</i>
	Lack of farm planning competencies	<i>"When you are working with 'sustainable' farmers the most demanding part of the job is to help them sell their products. For conventional farmers it's easy. There are many opportunities; they have just to choose one. In SA the thing is different."</i>

Moreover, the majority of interviewees agreed that they lack facilitation skills, a phenomenon that seems to increase in younger and entry-level professionals. Consequently, they confront difficulties in group projects. A major concern for most agronomists is their inability to handle group dynamics and in-group conflicts. In addition, most of the participants mentioned that – especially during their early career stages – they met difficulties in the process of communicating with farmers. An important antecedent of these shortcomings lies in the

nature of higher agronomic education in Greece: the current context of agronomic education in the country focuses almost exclusively on the acquisition of technical knowledge, whereas the development of interpersonal skills and competencies receives limited attention. In fact, only three out of the thirteen higher education institutes that offer a bachelor in agronomy include courses of agricultural extension in their programs. As some interviewees noted, university curricula in the country are mainly devoted to producing technically skilled and highly specialized professionals. Such an orientation leads to a considerable imbalance between the levels of technical knowledge and facilitation competencies that young agronomists possess. Consequently, after their graduation, agronomists have deep expertise – that usually remains untapped – in particular domains (e.g., entomology, pest control, irrigation systems) whereas they are in short of necessary skills to effectively communicate with farmers.

Furthermore, it was evident from the data that agronomists need more interdisciplinary competencies. Some participants focused on agronomic competencies, whereas others talked about skills pertaining to the economic and social aspects of sustainability. Although the analysis suggested that work experience increases such skills, participants described a high level of difficulty in dealing with complex situations, which, in turn, eliminates their self-confidence in solving complex problems associated with SA. Importantly, in all the three main themes emerged from the analysis, a common denominator is the inability of agronomic education to supply agronomists with key skills needed to support transition towards SA.

Study 2

Method

The second study was based on data from a sample of 68 agronomists (mean age=41.6, S.D.=11.5; 64.7% men). Among the participants 57 (83.8%) had a university diploma in agronomy and 11 (16.2%) graduated from agronomic Technological Educational Institutes. The average work experience for the total sample was 8.9 years (S.D.=6.9). Subjects were asked to evaluate the effectiveness of 36 different scenarios related to agronomists' competence development by using a one to seven scale, with the higher values indicating greater perceived effectiveness. These scenarios differ in their aims and foci, the degree of public-private mix in the designing of competence development projects (CDPs), and the strategies proposed to construct knowledge (Appendix). This way we attempted to concentrate our analysis on the main elements determining the quality and effectiveness of CDPs (Avis, 2014; Mulder, 2012; Lans et al., 2011). Participants had the opportunity to read an analytical description of each scenario before rating its effectiveness. Methods of knowledge construction were divided into three general categories: one including purely didactic approaches, one comprising from experiential techniques, and one consisting of a mix of didactic and experiential strategies. Moreover, although in all cases the general target was to increase agronomists' sustainability-related competencies, in each scenario the focus of CDP was on a group of technical agronomic competencies (referred to hereinafter as "agronomy") or on a set of interpersonal and interdisciplinary competencies (referred to as "interdisciplinary issues").

Results

Among the 36 examined scenarios, lowest ratings were observed for those involving only the public sector or only private companies. The average rating of all scenarios referred to publicly designed CDPs was 2.68 (S.D.=0.89), whereas the corresponding average for privately developed CDPs was 3.08 (S.D.=1.09). Interestingly, paired sample t-test revealed that the difference between the two sets of scenarios was statistically significant ($t=-4.19$, $p<0.01$). The twelve scenarios concerned CDPs developed through the collaboration of public and private sectors received the highest evaluation. For CDPs designed jointly by universities, private companies and public organizations the mean score was 4.74

(S.D.=0.96) while the possibility of collaboration between private bodies and public universities also received high ratings (M=3.74, S.D.=1.31).

The highest mean score among the examined scenarios was observed for the Scenario S16 (M=5.65, S.D.=1.14) which concerns CDPs jointly developed and implemented by public organizations, universities and private agencies, offering a mix of instructional and experiential techniques aimed at improving a wide range of agronomists' competencies (Table 3). High ratings were also noted for the Scenarios S22 (M=5.59, S.D.=1.45), S18 (M=5.44, S.D.=1.23), and S21 (M=5.15, S.D.=1.17). Between the scenarios S16, S22 and S18 the differences were not statistically significant. On the contrary, these three scenarios had significant differences in their mean scores with all the remaining 33 scenarios.

An interesting finding is that, as a set, scenarios that were based on the integration of both didactic and experiential methods received significantly higher ratings than these in which the proposed methods were purely didactic ($t=-7.02$, $p<0.01$) or fully experiential ($t=-11.02$, $p<0.01$). However, it is noteworthy that, as a group, scenarios which predicted the use of didactic approaches did not show significantly lower mean scores than those based only on experiential practices ($t=-1.61$, $p>0.05$). Finally, as we expected, CDPs focused exclusively on agronomic knowledge had significantly lower mean scores than those concerned a wider array of competencies ($t=-2.93$, $p<0.05$).

Table 3. Key features of the four highly rated scenarios

Organizer(s)	Key aspects		
	Methodology	Focus	Scenario
Public actors, private actors and Universities	Didactic and Experiential	Interdisciplinary issues	S16
Private actors and Universities	Didactic and Experiential	Interdisciplinary issues	S22
Public actors, private actors and Universities	Experiential	Interdisciplinary issues	S18
Private actors and Universities	Didactic and Experiential	Agronomy	S21

Discussion and conclusion

The Gulliver effect

Our qualitative analysis confirmed that the system of agronomic education in Greece is unable to endue agronomists with practice-oriented knowledge and soft skills (Koutsouris and Papadopoulos, 2000), thus reducing their capacity to deal with sustainability related issues (Österle et al., 2016). However, at the other end of the spectrum, this skills deficiency oftentimes leads agronomists to face a difficult situation: they must handle a complex array of tasks and duties, without having the necessary proficiency. This holds true especially for young, entry-level professionals who experience feelings of mis-fit when they have to cope with complex sustainability challenges, a situation leading to a particular "Gulliver effect" (from Jonathan Swift's novel "Gulliver's travel"). In other words, agronomists' specialized knowledge and expertise makes them "too skilled" for conventional production systems but not skilled enough to confront with problems related with SA. As we found in Study 1, the lack of competencies necessary to promote SA not only confines their performance in supporting farmers who follow sustainable production models, but it also produces a decrease in self-efficacy and high levels of stress, therefore diminishing agronomists' willingness and perceived ability to facilitate the transition towards SA.

Although one could argue that the lack of such competencies can be compensated by the skills an agronomist gradually develops within the job setting, several indications confirm that when persons feel incompetent to deal with a work indicate a tendency to avoid involvement

with it (Kong, 2013). On the contrary, individuals who experience a sense of competence are characterized by higher levels of work engagement (Bakker, 2011) and job satisfaction (Ha and Choi, 2010), increased motivation (Gagné and Deci, 2005), and higher rates of self-esteem (Deci et al., 2001). In this vein, it is expected that the facilitation of competence development through participation in CDPs –especially during the early career stages – can lead to a greater level of self-efficacy and, consequently, to the formation of positive attitudes towards the promotion of SA. However, before implementing any intervention aimed at enhancing such competencies it is important to identify central objectives and key-priorities in order to customize CDPs to target professionals' real needs and expectations. Although our second study offered several related findings, only future research can settle this question.

From technical knowledge to interdisciplinarity

Our both studies demonstrated that pure technical knowledge cannot set a solid ground for fostering the promotion of SA. Interpersonal skills, market penetration competencies and group guidance skills were found on the one hand to affect agronomists' attitudes towards working on SA (Study 1) and on the other hand to be considered as important determinants of the effectiveness they attribute in projects targeted at their competence development (Study 2). Since institutes of agronomic education in Greece have not yet embraced the idea of interdisciplinarity, the best route to achieve this goal is through the development of collaborative networks between university and industry (Kruss, 2006).

Indeed, our findings lend support to the argument that community-university and public-private partnerships can enhance the potential of sustainability education (Ashton et al., 2017; Niewolny et al., 2016), whereas also substantiate the need for hybridizing professionals' knowledge by adopting interdisciplinary approaches (Pearce et al., 2018; Tejedor et al., 2018; Annan-Diab and Molinari, 2017) and strategies leading to the co-evolution of solution-oriented knowledge (Gredig and Sommerfeld, 2008). As an interesting new stream of research has showed, such "hybrid learning configurations" can provide a novel setting for the development of transboundary and creative knowledge (Cremers et al., 2017; 2016). Nevertheless, further research is needed on the ways the public-private and intersectoral collaboration can be fostered so as to open-up new spaces for agronomic knowledge and competence.

Concluding remarks

This work represents one more step in the research of factors that induce or confine the further expansion of SA. This set of studies indicated that, to face the challenges imposed by the quest for sustainability, it is important to reorganize both agronomic education and training in order to provide agronomists with new sets of competencies. Drawing on concepts used in social psychology, and employing a wide range of methods spanning from interpretative phenomenological analysis to scenario analysis and regression models, the present studies disclosed that current forms of agronomic education and training in Greece are unable to supply agronomists with the broad array of competencies required to promote and support sustainable rural development. Moreover, our findings unveiled the need to create alternative learning schemes, aimed at facilitating the production, exchange, and communication of current and practice-oriented knowledge among individuals, organizations, and academia.

Acknowledgment

This research was financially supported by IKY fellowships of excellence for postgraduate studies in Greece – SIEMENS PROGRAM. The authors wish to acknowledge this support.

References

- Abubakar, K.H. and M.A. Yusuf (2017) Relevance of experiential learning in the training of extension agents in Nigeria: A proposal. *British Journal of Education* 5(13): 69-77.
- Ajzen, I. (2002) Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. *Journal of Applied Social Psychology* 32(4): 665-683.
- Altieri, M.A. (2004) Linking ecologists and traditional farmers in the search for sustainable agriculture. *Frontiers in Ecology and the Environment* 2(1): 35-42.
- Annan-Diab, F. and C. Molinari (2017) Interdisciplinarity: Practical approach to advancing education for sustainability and for the Sustainable Development Goals. *The International Journal of Management Education* 15(2): 73-83.
- Argyris, C. (1993) *Knowledge for action*. San Francisco: Jossey-Bass.
- Ashton, W.S., M. Hurtado-Martin, N.M. Anid, N.R. Khalili, M.A. Panero and S. McPherson (2017) Pathways to cleaner production in the Americas I: bridging industry-academia gaps in the transition to sustainability. *Journal of Cleaner Production* 142: 432-444.
- Avis, J. (2014) Workplace learning, VET and vocational pedagogy: The transformation of practice. *Research in Post-Compulsory Education* 19(1): 45-53.
- Bakker, A.B. (2011) An evidence-based model of work engagement. *Current Directions in Psychological Science* 20(4): 265-269.
- Bandura, A. (1977) Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review* 84(2): 191-215.
- Bandura, A. (1982) Self-efficacy mechanism in human agency. *American Psychologist* 37(2): 122-147.
- Bandura, A. (1986) *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ, US: Prentice-Hall, Inc.
- Bandura, A. (1988) Self-efficacy conception of anxiety. *Anxiety Research* 1(2): 77-98.
- Bandura, A. (1989) Human agency in social cognitive theory. *American Psychologist* 44(9): 1175-1184.
- Bandura, A. (1995) *Self-efficacy in changing societies*. New York: Cambridge University Press.
- Blay-Palmer, A., R. Sonnino and J. Custot (2016) A food politics of the possible? Growing sustainable food systems through networks of knowledge. *Agriculture and Human Values* 33(1): 27-43.
- Canrinus, E.T., M. Helms-Lorenz, D. Beijaard, J. Buitink and A. Hofman (2012) Self-efficacy, job satisfaction, motivation and commitment: Exploring the relationships between indicators of teachers' professional identity. *European Journal of Psychology of Education* 27(1): 115-132.
- Charatsari, C., E.D. Lioutas and A. Koutsouris (2017) Farmers' motivational orientation toward participation in competence development projects: A self-determination theory perspective. *The Journal of Agricultural Education and Extension* 23(2): 105-120.
- Charatsari, C., M. Černič Istenič and E.D. Lioutas (2013) "I'd like to participate, but...": Women farmers' scepticism towards agricultural extension/education programmes. *Development in Practice* 23(4), 511-525.
- Clark, J.K., M. Bean, S. Raja, S. Loveridge, J. Freedgood and K. Hodgson (2017) Cooperative extension and food system change: Goals, strategies and resources. *Agriculture and Human Values* 34(2): 301-316.
- Clark, S., C. Byker, K. Niewolny, and J. Helms (2013) Framing an undergraduate minor through the civic agriculture and food systems curriculum. *NACTA Journal* 57(2): 56-67.
- Consiglio, C., L. Borgogni, C. Di Tecco and W.B. Schaufeli (2016) What makes employees engaged with their work? The role of self-efficacy and employee's perceptions of social context over time. *Career Development International* 21(2): 125-143.
- Convery, I., I. Soane, T. Dutson and H. Shaw (2010) Mainstreaming LEADER delivery of the RDR in Cumbria: an interpretative phenomenological analysis. *Sociologia Ruralis* 50(4): 370-391.
- Cope, J. (2011) Entrepreneurial learning from failure: An interpretative phenomenological analysis. *Journal of Business Venturing* 26(6): 604-623.
- Cremers, P.H., A.E. Wals, R. Wesselink and M. Mulder (2016) Design principles for hybrid learning configurations at the interface between school and workplace. *Learning Environments Research* 19(3): 309-334.

- Cremers, P.H., A.E. Wals, R. Wesselink and M. Mulder (2017) Utilization of design principles for hybrid learning configurations by interprofessional design teams. *Instructional Science* 45(2): 289-309.
- Culhane, J.H., K. Niewolny, S. Clark, K. McConnell and C. Friedel, (2016) Learning through collaborative and interdisciplinary teaching: A case study of faculty work as learning in sustainable agriculture education. *NACTA Journal* 60(2): 219-226.
- Deci, E.L., R.M. Ryan, M. Gagné, D.R. Leone, J. Usunov and B.P. Kornazheva (2001) Need satisfaction, motivation, and well-being in the work organizations of a former eastern bloc country: A cross-cultural study of self-determination. *Personality and Social Psychology Bulletin* 27(8): 930-942.
- Dentoni, D., S. Waddell and S. Waddock (2017) Pathways of transformation in global food and agricultural systems: Implications from a large systems change theory perspective. *Current Opinion in Environmental Sustainability* 29: 8-13.
- Dogliotti, S., M.C. García, S. Peluffo, J.P. Dieste, A.J. Pedemonte, G.F. Bacigalupe, M. Scarlato, F. Alliaume, J. Alvarez, M. Chiappe and W.A.H. Rossing (2014) Co-innovation of family farm systems: A systems approach to sustainable agriculture. *Agricultural Systems* 126: 76-86.
- Eatough, V. and J.A. Smith (2017) Interpretative phenomenological analysis. In: Wiling C. and W.S. Rogers (eds.) *The SAGE handbook of qualitative research in psychology*. London: Sage, pp. 193-211.
- Ford, C.M. and D.A. Gioia (2000) Factors influencing creativity in the domain of managerial decision making. *Journal of Management* 26(4): 705-732.
- Gagné, M. and E.L. Deci (2005) Self-determination theory and work motivation. *Journal of Organizational Behavior* 26(4): 331-362.
- Gecas, V. (1989) The social psychology of self-efficacy. *Annual Review of Sociology* 15(1): 291-316.
- German, R.N., C.E. Thompson, T.G. Benton (2017). Relationships among multiple aspects of agriculture's environmental impact and productivity: A meta-analysis to guide sustainable agriculture. *Biological Reviews* 92(2): 716-738.
- Gist, M.E., and T.R. Mitchell (1992) Self-efficacy: A theoretical analysis of its determinants and malleability. *Academy of Management Review* 17(2): 183-211.
- Gliessman, S.R. (1990) Agroecology: Researching the ecological basis for sustainable agriculture. In: S.R. Gliessman (ed.) *Agroecology: Researching the ecological basis for sustainable agriculture*. New York, NY: Springer, pp. 3-10.
- Gredig, D. and P. Sommerfeld (2008) New proposals for generating and exploiting solution-oriented knowledge. *Research on Social Work Practice* 18(4): 292-300.
- Grover, S. and J. Gruver (2017) 'Slow to change': Farmers' perceptions of place-based barriers to sustainable agriculture. *Renewable Agriculture and Food Systems* 32(6): 511-523.
- Ha, N.S. and J. Choi (2010). An analysis of nursing competency affecting on job satisfaction and nursing performance among clinical nurses. *Journal of Korean Academy of Nursing Administration* 16(3): 286-294.
- Hassan, S.U., P. Haddawy and J. Zhu (2014) A bibliometric study of the world's research activity in sustainable development and its sub-areas using scientific literature. *Scientometrics* 99(2): 549-579.
- Hassanein, N. and J.R. Kloppenburg (1995) Where the grass grows again: Knowledge exchange in the sustainable agriculture movement. *Rural Sociology* 60(4): 721-740.
- Hefferon, K. and E. Gil-Rodriguez (2011) Interpretative phenomenological analysis. *The Psychologist* 24(10): 756-759.
- Jacobsen, K.L., K.L. Niewolny, M.S. Schroeder-Moreno, M. Van Horn, A.H. Harmon, Y.H. Chen Fanslow, M.A. Williams and D. Parr (2012) Sustainable agriculture undergraduate degree programs: A land-grant university mission. *Journal of Agriculture, Food Systems, and Community Development* 2(3): 13-26.
- Judge, T.A. and J.E. Bono (2001) Relationship of core self-evaluations traits-self-esteem, generalized self-efficacy, locus of control, and emotional stability-with job satisfaction and job performance: A meta-analysis. *Journal of Applied Psychology* 86(1): 80-92.
- Klerkx, L. and J. Jansen (2010) Building knowledge systems for sustainable agriculture: Supporting private advisors to adequately address sustainable farm management in regular service contacts. *International Journal of Agricultural Sustainability* 8(3): 148-163.

- Kong, H. (2013) Relationships among work-family supportive supervisors, career competencies, and job involvement. *International Journal of Hospitality Management* 33: 304-309.
- Koutsouris, A. (2014). *AKIS and advisory services in Greece: Report for the AKIS inventory (WP3) of the PRO AKIS project*. Athens: PROAKIS.
- Koutsouris, A. and D. Papadopoulos (2000) Sustainability: Implications for agricultural extension, education and training-The Greek case. In: Doppler W. and J. Calatrava (eds.) *Proceedings of the 2nd European IFSA Symposium, Granada, Spain*. Weikersheim: Margraf Verlag. pp. 353-357.
- Kruss, G. (2006). Higher education and contemporary challenges: Investigating industry partnerships and networks. In: Kruss, G. (ed.) *Working partnerships in higher education, industry and innovation*. Cape Town: HSRC Press. pp. 1-13.
- Lans, T., J. Verstegen and M. Mulder (2011) Analysing, pursuing and networking: Towards a validated three-factor framework for entrepreneurial competence from a small firm perspective. *International Small Business Journal* 29(6): 695-713.
- Larkin, M. and A.R. Thompson (2012) Interpretative phenomenological analysis in mental health and psychotherapy research. In: D. Harper and A.R. Thomson (eds.) *Qualitative research methods in mental health and psychotherapy: A guide for students and practitioners*. Chichester, England: Wiley, pp. 101-116.
- Larkin, M., S. Watts and E. Clifton (2006) Giving voice and making sense in interpretative phenomenological analysis. *Qualitative Research in Psychology* 3(2): 102-120.
- Lioutas, E.D. and C. Charatsari (2018) Green Innovativeness in farm enterprises: What makes farmers think green? *Sustainable Development* in press. DOI: 10.1002/sd.1709.
- Lioutas, E.D., C. Charatsari, M. Čerňič Istenič, M. De Rosa, and G. La Rocca (2017) Evaluating extension systems using a systems approach: A comparative study in Greece, Italy and Slovenia. 23rd European Seminar on Extension Education, 4-7 July 2017, Chania-Greece.
- Lockeretz, W. (1988) Open questions in sustainable agriculture. *American Journal of Alternative Agriculture* 3(4): 174-181.
- Lowrance, R., P.F. Hendrix and E.P. Odum (1986) A hierarchical approach to sustainable agriculture. *American Journal of Alternative Agriculture* 1(4): 169-173.
- Luo, Y., X. Long, C. Wu, J. Zhang (2017) Decoupling CO₂ emissions from economic growth in agricultural sector across 30 Chinese provinces from 1997 to 2014. *Journal of Cleaner Production* 159: 220-228.
- MacRae, R.J., S.B. Hill, G.R. Mehuys, J. Henning (1990) Farm-scale agronomic and economic conversion from conventional to sustainable agriculture. *Advances in Agronomy* 43: 155-198.
- Marin, A., A. Ely and P. Van Zwanenberg (2016) Co-design with aligned and non-aligned knowledge partners: implications for research and coproduction of sustainable food systems. *Current Opinion in Environmental Sustainability* 20: 93-98.
- Martin, J.J., and D.L. Gill (1991) The relationships among competitive orientation, sport-confidence, self-efficacy, anxiety, and performance. *Journal of Sport and Exercise Psychology* 13(2): 149-159.
- Matouš, P., Y. Todo and D. Mojo (2013) Roles of extension and ethno-religious networks in acceptance of resource-conserving agriculture among Ethiopian farmers. *International Journal of Agricultural Sustainability* 11(4): 301-316.
- Meijer, S.S., D. Catacutan, O.C. Ajayi, G.W. Sileshi and M. Nieuwenhuis (2015) The role of knowledge, attitudes and perceptions in the uptake of agricultural and agroforestry innovations among smallholder farmers in sub-Saharan Africa. *International Journal of Agricultural Sustainability* 13(1): 40-54.
- Meijman, T.F. and G. Mulder (1998) Psychological aspects of workload. In: P.J.D. Drenth and H. Thierry (eds.). *Handbook of work and organizational psychology*. Volume 2: Work psychology, Hove: Psychology Press, pp. 5-33.
- Mezirow, J. (1981) A critical theory of adult learning and education. *Adult Education* 32(1): 3-24.
- Moschitz, H. and R. Home (2014) The challenges of innovation for sustainable agriculture and rural development: Integrating local actions into European policies with the Reflective Learning Methodology. *Action Research* 12(4): 392-409.

- Moschitz, H., D. Roep, G. Brunori and T. Tisenkopfs (2015) Learning and innovation networks for sustainable agriculture: Processes of co-evolution, joint reflection and facilitation. *The Journal of Agricultural Education and Extension* 21(1): 1-11.
- Mulder, M. (2012) Competence-based education and training. *The Journal of Agricultural Education and Extension* 18(3): 305-314.
- Navarro, A., R. Puig, E. Kılıç, S. Penavayre, P. Fullana-i-Palmer (2017) Eco-innovation and benchmarking of carbon footprint data for vineyards and wineries in Spain and France. *Journal of Cleaner Production* 142: 1661-1671.
- Niewolny, K.L., J.M. Grossman, C.J. Byker, J.L. Helms, S.F. Clark, J.A. Cotton, and K.L. Jacobsen (2016) Sustainable agriculture education and civic engagement: The significance of community-university partnerships in the new agricultural paradigm. *Journal of Agriculture, Food Systems, and Community Development* 2(3): 27-42.
- Österle, N., A. Koutsouris, Y. Livieratos and E. Kabourakis (2016). Extension for organic agriculture: A comparative study between Baden-Württemberg, Germany and Crete, Greece. *The Journal of Agricultural Education and Extension* 22(4): 345-362.
- Pearce, A.R., S.A. Smith, M. Saxton and A. De Soto (2018) Sustainability boot camp: Bridging disciplines to create a sustainable future. *International Journal of Construction Education and Research* 14(1): 59-73.
- Pogutz, S. and M.I. Winn (2016) Cultivating ecological knowledge for corporate sustainability: Barilla's innovative approach to sustainable farming. *Business Strategy and the Environment* 25(6): 435-448.
- Pretty, J. and Z.P. Bharucha (2014) Sustainable intensification in agricultural systems. *Annals of Botany* 114(8): 1571-1596.
- Pretty, J. and Z.P. Bharucha (2015) Integrated pest management for sustainable intensification of agriculture in Asia and Africa. *Insects* 6(1): 152-182.
- Pretty, J.N. (1994) Alternative systems of inquiry for a sustainable agriculture. *IDS Bulletin* 25(2): 37-49.
- Pretty, J.N. (1995) Participatory learning for sustainable agriculture. *World Development* 23(8): 1247-1263.
- Queeney, D.S. (1995) *Assessing needs in continuing education: An essential tool for quality improvement*. San Francisco: Jossey-Bass.
- Rodriguez, J.M., J.J. Molnar, R.A. Fazio, E. Sydnor and M.J. Lowe (2009) Barriers to adoption of sustainable agriculture practices: Change agent perspectives. *Renewable Agriculture and Food Systems* 24(1): 60-71.
- Rodríguez-Solera, C.R. and M. Silva-Laya (2017) Higher education for sustainable development at EARTH University. *International Journal of Sustainability in Higher Education* 18(3): 278-293.
- Schut, M., P. van Asten, C. Okafor, C. Hicintuka, S. Mapatano, N.L. Nabahungu,... and M. Sartas (2016) Sustainable intensification of agricultural systems in the Central African Highlands: The need for institutional innovation. *Agricultural Systems* 145: 165-176.
- Simon, D. (1989) Sustainable development: Theoretical construct or attainable goal? *Environmental Conservation* 16(1): 41-48.
- Skaalvik, E.M. and S. Skaalvik (2014) Teacher self-efficacy and perceived autonomy: Relations with teacher engagement, job satisfaction, and emotional exhaustion. *Psychological Reports* 114(1): 68-77.
- Smith, J.A. (1996) Beyond the divide between cognition and discourse: Using interpretative phenomenological analysis in health psychology. *Psychology and Health* 11(2): 261-271.
- Smith, J.A. and M. Osborn (2015) Interpretative phenomenological analysis. In: J.A. Smith (ed.) *Qualitative psychology: A practical guide to research methods*, 3rd Edition. London: Sage. pp. 25-52.
- Suvedi, M., R. Ghimire and T. Channa (2018) Examination of core competencies of agricultural development professionals in Cambodia. *Evaluation and Program Planning* 67: 89-96.
- Tejedor, G., J. Segalàs and M. Rosas-Casals (2018) Transdisciplinarity in higher education for sustainability: how discourses are approached in engineering education. *Journal of Cleaner Production* 175: 29-37.

- Teklewold, H., M. Kassie and B. Shiferaw (2013) Adoption of multiple sustainable agricultural practices in rural Ethiopia. *Journal of Agricultural Economics* 64(3): 597-623.
- Tomlinson, J. and K. Rhiney (2017) Assessing the role of farmer field schools in promoting pro-adaptive behavior and attitude toward climate change in Jamaica. *Journal of Environmental Studies and Sciences* 8(1): 86-98.
- Triste, L., J. Vandenabeele, F. Van Winsen, L. Debruyne, L. Lauwers and F. Marchand (2018) Exploring participation in a sustainable farming initiative with self-determination theory. *International Journal of Agricultural Sustainability*. In press. doi: 10.1080/14735903.2018.1424305.
- Umar, S., N. Man, N.M. Nawi, I.A. Latif and B.A. Samah (2017) Core competency requirements among extension workers in peninsular Malaysia: Use of Borich's needs assessment model. *Evaluation and Program Planning* 62: 9-14.
- Valencia, V., P. West, E.J. Sterling, L. García-Barríos, S. Naeem (2015). The use of farmers' knowledge in coffee agroforestry management: Implications for the conservation of tree biodiversity. *Ecosphere* 6(7): 1-17.
- Valley, W., H. Wittman, N. Jordan, S. Ahmed, and R. Galt (2018) An emerging signature pedagogy for sustainable food systems education. *Renewable Agriculture and Food Systems*. In press. doi: 10.1017/S1742170517000199.
- Velten, S., J. Leventon, N. Jager and J. Newig (2015) What is sustainable agriculture? A systematic review. *Sustainability* 7(6): 7833-7865.
- Wang, S.L. (2014) Cooperative extension system: Trends and economic impacts on US agriculture. *Choices* 29(1): 1-8.
- Wijaya, A., P. Glasbergen, P. Leroy and A. Darmastuti (2018) Governance challenges of cocoa partnership projects in Indonesia: Seeking synergy in multi-stakeholder arrangements for sustainable agriculture. *Environment, Development and Sustainability* 20(1): 129-153.
- Yadav, D.S., P. Sood, S.K. Thakur and A.K. Choudhary (2013) Assessing the training needs of agricultural extension workers about organic farming in the North-Western Himalayas. *Journal of Organic Systems* 8(1): 17-27.
- Zamani, N., P. Ataei and R. Bates (2016) The use of the Persian translation of the Learning Transfer System Inventory in the context of agricultural sustainability learning in Iran. *International Journal of Training and Development* 20(1): 92-104.
- Zhao, H., S.E. Seibert, and G.E. Hills (2005) The mediating role of self-efficacy in the development of entrepreneurial intentions. *Journal of Applied Psychology* 90(6): 1265-1272.

Appendix

Key features of the scenarios used in Study 2

Key aspects			
Organizer(s)	Methodology	Focus	Scenario
Public organizations	Didactic	Agronomy	S1
		Interdisciplinary issues	S2
	Didactic and Experiential	Agronomy	S3
		Interdisciplinary issues	S4
	Experiential	Agronomy	S5
		Interdisciplinary issues	S6
Public organizations and Agricultural Universities	Didactic	Agronomy	S7
		Interdisciplinary issues	S8
	Didactic and Experiential	Agronomy	S9
		Interdisciplinary issues	S10
	Experiential	Agronomy	S11
		Interdisciplinary issues	S12
Public organizations and Agricultural Universities with the support of private companies	Didactic	Agronomy	S13
		Interdisciplinary issues	S14
	Didactic and Experiential	Agronomy	S15
		Interdisciplinary issues	S16
	Experiential	Agronomy	S17
		Interdisciplinary issues	S18
Private companies and Agricultural Universities	Didactic	Agronomy	S19
		Interdisciplinary issues	S20
	Didactic and Experiential	Agronomy	S21
		Interdisciplinary issues	S22
	Experiential	Agronomy	S23
		Interdisciplinary issues	S24
Private companies and public organizations	Didactic	Agronomy	S25
		Interdisciplinary issues	S26
	Didactic and Experiential	Agronomy	S27
		Interdisciplinary issues	S28
	Experiential	Agronomy	S29
		Interdisciplinary issues	S30
Private companies	Didactic	Agronomy	S31
		Interdisciplinary issues	S32
	Didactic and Experiential	Agronomy	S33
		Interdisciplinary issues	S34
	Experiential	Agronomy	S35
		Interdisciplinary issues	S36