CHALLENGES OF AGROECOLOGY KNOWLEDGE TRANSFER IN THE HIGHER EDUCATION TRAINING PROGRAMS IN HUNGARY

APOLKA **UJJ**[1] - ISTVÁN **FEHÉR**[2]

[1]Szent István University, Faculty of Agricultural and Environmental Sciences, Institute of Nature Conservation and Landscape Management, Department of Organic Farming and Agri-environmental Planning, 2100 Gödöllő, Hungary
[2]Szent István University, Faculty of Economics and Social Sciences, Institute of Business Sciences 2100 Gödöllő, Hungary

Corresponding author: Apolka Ujj, email: ujj.apolka@mkk.szie.hu; tel.:+36 28 522000/2264

ABSTRACT

The agroecology education due to its complexity and its characteristics of transdisciplinarity presents a challenge for educators. Preparing students for a comprehensive understanding of sustainability requires new teaching strategy and approach in education. In SAGITER project, we focus on the promotion of agroecological knowledge transfer, by combining science-based approach with informal knowledge resulting from everyday experiences. Eleven institutions from seven European countries decided to work together in order to create training module and teaching tools for trainers. In Hungary, selecting the best transfer method depends on the basic knowledge of the target group (students), therefore a thorough real user need assessment was carried out. BSc and MSc students studying agriculture and economics participated in the survey in order to explore their opinion and knowledge level about agroecology. The survey focused on three main issues: sustainable agricultural structure, environmental views and ecological farming. Results of the survey proved that there are serious differences in knowledge level related to agroecology by gender, by age and by place of education. Nevertheless the most significant factor that influences students' knowledge is their previous experiences acquired by practice. Therefore the summary of the survey suggests a complex approach based on experimental learning inspired by reflecting experiences on farms that can be also applied at universities. This complex teaching strategy should involve not only environmental, but biophysical, economical, transparency, and even social sensitivity aspects.

keywords: agroecology, sustainability, knowledge transfer, education, ecological farming, transdisciplinarity

INTRODUCTION

Over the past decades, the international literature just as numerous Hungarian authors define the concept of sustainability in various ways. Different definitions originate from one common root, in which everyone agrees: sustainability is a global strategy in order to preserve the world including the conscious use of resources that can satisfy the current generation's needs, in a way that does not diminish the next generation's chances" (Douglass 1984; Harnos 1993; Glickman 1996; Ujj 2006). This definition also implies that in the course of agricultural production, reasonable management of natural resources is needed while balancing the economic sustainability with the environmental one. Furthermore, the preservation of the environmental quality has to be considered while producing healthy foods for the modern, conscious society (Rovira 1995; Fehér 2009). In conclusion, sustainable development stands on three pillars: economy, society and environment, which are inter-related and have mutual impacts on each other (OECD 2008; Lisányi Beke –Fehér 2013a,b).

In general it can be also stated that the primary user and converter of the natural landscape is the agriculture itself, therefore, the protection of nature should be harmonized with agricultural activities (OECD 2008). Conversely it is also true: The success of agricultural activity, especially its efficiency is determined by the natural conditions, the existence and the condition of natural resources (Günal et al. 2015). With this knowledge in mind, it can be stated, that the compliance with the basic objectives of sustainability does not seem to be complicated, even though it is not easy to judge which production systems and methods are 'appropriate'.

Traditional agricultural systems, such as those identified

as Globally Important Agricultural Heritage Systems (GIAHS), offer a wealth of knowledge, principles, practises and biodiversity that cannot be replaced by modern science (UNEP 2005; FAO 2003). Several approaches, including integrated pest management, polyculture farming system, conservation agriculture and agroecology combine traditional agriculture practises with modern science (FAO 2003).

As a 'definition', the science of agroecology can be determined as the application of ecological concepts and principles to the design and management of sustainable agroecosystems, providing a framework to assess the complexity of agroecosystems (Altieri 1987). Agroecosystems are communities of plants and animals interacting with their physical and chemical environments that have been modified by human in order to produce food, fibre, fuel and other products for human consumption and processing. Agroecology is the holistic approach of agroecosystems, including not only the environmental but also the human elements. According to Tomich et al. (2011) agroecology is an integrative science that deals with key challenges of mitigating environmental impacts of agriculture while dramatically increasing global food production, improving livelihoods, and thereby reducing chronic hunger and malnutrition. In this spirit, instead of focusing on one particular component of the agroecosystems, agroecology emphasized the interrelatedness of all agrosystem components and the complex dynamics of ecological processes (Vandermeer 1995). But why is this necessary? Dover and Talbot (1978) defines and describes an ecological approach to agriculture that differs from the industrial approach that has dominated agricultural research and development for decades. Francis et al. (2012) also emphasizes that much of education in agriculture has moved from practical, hand-on field activities and internship to focus on theory in formal learning settings (mainly in classrooms). The growing need for a productive and sustainable agriculture calls for a new view of agricultural development that builds upon the risk-reducing, resource conserving aspects of traditional farming, and draws on the advances of modern biology and technology. In the suggested strategy of Dover and Talbot, to attain a sustainable agriculture, the importance of the research and education must be highlighted. In order that the development of ecological agriculture could strike root, scientists need to train a whole new generation. Therefore, multidisciplinary comprehensive ecological-agricultural trainings are needed in agricultural education (secondary schools, universities) that develop a new generation of agroecologist capable of dealing with whole systems and provide agroecological knowledge for future policy makers (SARE 2010; Francis et al. 2013).

On this basis, the SAGITER project (2013-2016 Project title: Agro ecological Knowledge and Ingenuity of terroirs) focuses on the progress toward a sustainable agriculture education that can be achieved by combining both scientific and non-specialised knowledge. Our project aim is to rebalance the asymmetric vision of the world in which the scientific knowledge is regarded as rational and therefore *"right"* and the popular knowledge as irrational therefore *"wrong"*. Scientific approach needs to be combined with vernacular knowledge. The question is how the transmission of layman knowledge can operate in a corpus designed for science and which methodologies need to be adapted for the transmission toward the concerned audience. It is also a question how the people who use the agroecological knowledge were able to acquire it and how we can transfer the everyday knowledge through trainings.

In SAGITER project, we participate in the promoting/upgrading process of the agroecological knowledge, and the ingenious systems that are implemented from time to time on the territories with the following project objectives:

- Participation in the evolution toward a productive and sustainable agriculture by creating a training module for trainers. This module will incorporate pedagogical approaches adapted to the consideration, the promotion, the learning and the implementation of agroecological knowledge.
- Exchange on the approaches about the concept of agroecology, the notion of agroecological knowledge, the different pedagogical experiences undertaken by partners.
- Reconsideration of the modes of acquisition and transmission of knowledge by allowing the trainer to move from a posture of transmission of knowledge (teacher) toward a posture of a facilitator/mediator/accompanist/guide.
- Development of a teaching strategy supported by all common observations, a collection of practices and experiments in order to integrate the acquired knowledge into the referential data of initial and continuing training of trainers.
- Development of teaching tools adapted to the transmission methods of this informal knowledge.

As a results of our work the need for a comprehensive approach should be confirmed to the act of production centred around a specific agroecosystem level in which the producer is liable alongside the consumers in a social organization based on solidarity. The correctness, adequacy of quality criteria (organoleptic properties and vitality), should be taken into account when producing and buying. We also hope that the need and usefulness of the implementation or rehabilitation of eco-friendly production practices will come to the fore and the developed agroecological practices will become easily transferable. Furthermore, the integration of this approach in higher technical agricultural education will be visible. In the long run, it will have a direct impact on the farmers by the improvement of their knowledge through trainings offered by project partners.

MATERIAL AND METHODS

In order to gain best project result, eleven institutions (higher educational institute, high school, training centre, organized group, environmental or consumer NGO) from seven countries (France, Germany, Spain, Belgium, Slovenia, Romania and Hungary) are decided to work together during the implementation of the SAGITER project.

Partners selected several methodologies to formalize *"consciousness"* practices from which field data collection and observation represent an important practice in the method of learning. To transform the experience into learning, the project partners support the process of Kolb (Kolb 1984; McLeod 2013). Kolb's experiential learning style theory is typically represented by a four stage learning cycle in which the learner touches all the bases: Alternation of concrete experience phases; Abstract conceptualization; Active experience; Reflexive observation.

This theory helps to highlight the innovative practices that enable the trainer to progress in her/his transmitter's mission of knowledge towards a facilitator's posture in the learning process.

Direct target audience is the trainers, they will benefit from training modules elaborated by project partners. Then trainers will transfer their acquired knowledge to the final recipients (indirect target audience) that are students who will become farmers, processors, traders, agricultural advisers, bureaucrats and educators.

Knowledge transfer is a very complex discipline. There are three approaches that determine the selected knowledge transfer method:

1. Identification of user needs – one can apply this method when an individual, team, or organization has a specific needs in mind.
2. Identification of context and type of knowledge – one can apply this method when an individual, team, or organization has a specific type of knowledge to be transferred.
3. Identification of level of experience – one can apply this methods when the potential receiver of the knowledge has a specific level of experience.

In Hungary several pedagogical methods are used in practice for knowledge transfer (formal, informal knowledge transfer) that provided a starting point of our research work. We needed to apply that approach that identifies firstly the real user needs concerning ecological knowledge. After the identification of user needs by assessing their knowledge related to the subject, we are in the position of preparing practical case studies designed for them, as teaching material.

With these knowledge transfer approaches in mind, in 2014, a quantitative research was carried out to explore students' opinion and knowledge level about agroecological issues. 258 questionnaires were collected, with the participation of 215 students from the Szent István University (Gödöllő) and 43 from the University of Debrecen.

The main target groups were the BSc and MSc students from two faculties, studying agriculture and economics. The questionnaire contained 20 questions. 4 types of question were applied:

1. Simple choice question (with the answer 'yes or 'no')
2. Multiple choice question(one or more possible answers among several options)
3. 5-point rating scale question (in order to rank the importance of the listed items)
4. open-ended question (in order to gain more insight into the respondent's knowledge)

The questionnaire are separated into three parts, accordingly, our result analysis follows this structure. The three main parts are the following:

1. opinion about sustainable agricultural structure
2. environmental views
3. ecological farming

In the 'Results' we refer to concrete questions in order to make the result of the survey even more comprehensive.

In order to demonstrate knowledge gap, we used uni- and multivariable statistical analysis, such as independent sample test and one-way ANOVA.

RESULTS

I. Opinions about sustainable agricultural structure

Figure 1 shows that most of the respondents heard about sustainable agricultural production. (Survey question was: Have you ever heard the sustainable agricultural production expression?) On the other hand, students do not know the correct definition of sustainability. (Survey question was: What do you think is the meaning of mentioned expression?) One part of the respondents thinks, it means continues economical improvement/ innovation, usage of long lasting materials, long-term financial well-being. The other part says sustainable agricultural production connects to environmental protection. Appearance of environmental thinking is favorable, but not comprehensive. Only a small part of the respondents know the exact definition of sustainability, which includes environmental, economical and social viewpoints, and highlights a long-term thinking.

Figure 2 enforces students' strong environmental orientation in connection with sustainable agricultural production. (Survey question was: According to your opinion, what points play a significant role in the building

up a sustainable agricultural structure?) Hence, take into account environmental tasks (77.10%), maintain statue of environment (70.20%) and ensuring conditions of recycling (68.20%) are the most important factors to build up a sustainable agricultural structure. Transparency and documentation system are less important in the viewpoint of sustainable agricultural farming.

Furthermore, there are significant differences in students' opinion in connection with sustainable agriculture factors. We explored that males, females and different classes have different knowledge about sustainable agricultural factors. Most of the time, women are more sensitive about environmental and social issues. In this case, men show a higher responsibility about sustainable agriculture. Results of our analysis demonstrate that the following sustainable agricultural factors are more important for men than for women:

- ensuring employees' well-being (male: 41.4%; female: 28.3),
- waste and pollution management (male: 71.7%; female: 57.2%),

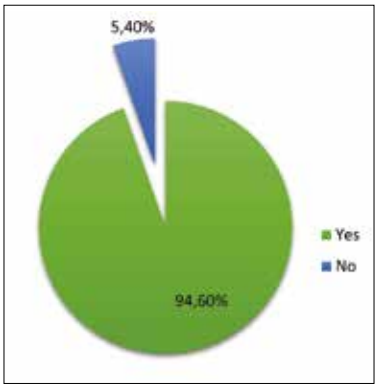

Figure 1: Knowledge about sustainable agricultural production
Source: Own research, N=258, 2014
(Yes: heard the expression; No: have not heard the expression)

- maintaining statue of environment (male: 77.8%; female: 65.4%),
- development of transparent production conditions (male: 26.3%; female: 15.7%),
- integrated farming (male. 46.5%; female: 25.2%),
- maintaining biodiversity (male: 75.8%; female: 62.3%),
- nutrition management, nutrition supplement (male: 46.5%; female: 25.2%),
- precision system (male: 38.4%; 8.2%),
- traditional livestock management (male: 40.4%; female: 26.4%),
- intensive livestock management (male: 22.2%; female: 11.3%) and
- development of documentation (male: 33.3%; female: 18.2%).

Investigating classes, we explored that, essentially first-year class students have lower knowledge about factors of sustainable agriculture. It means that, for first class students integrated farming (8.9%), maintaining biodiversity (48.9%) and traditional livestock management (28.9%) are less important than elder

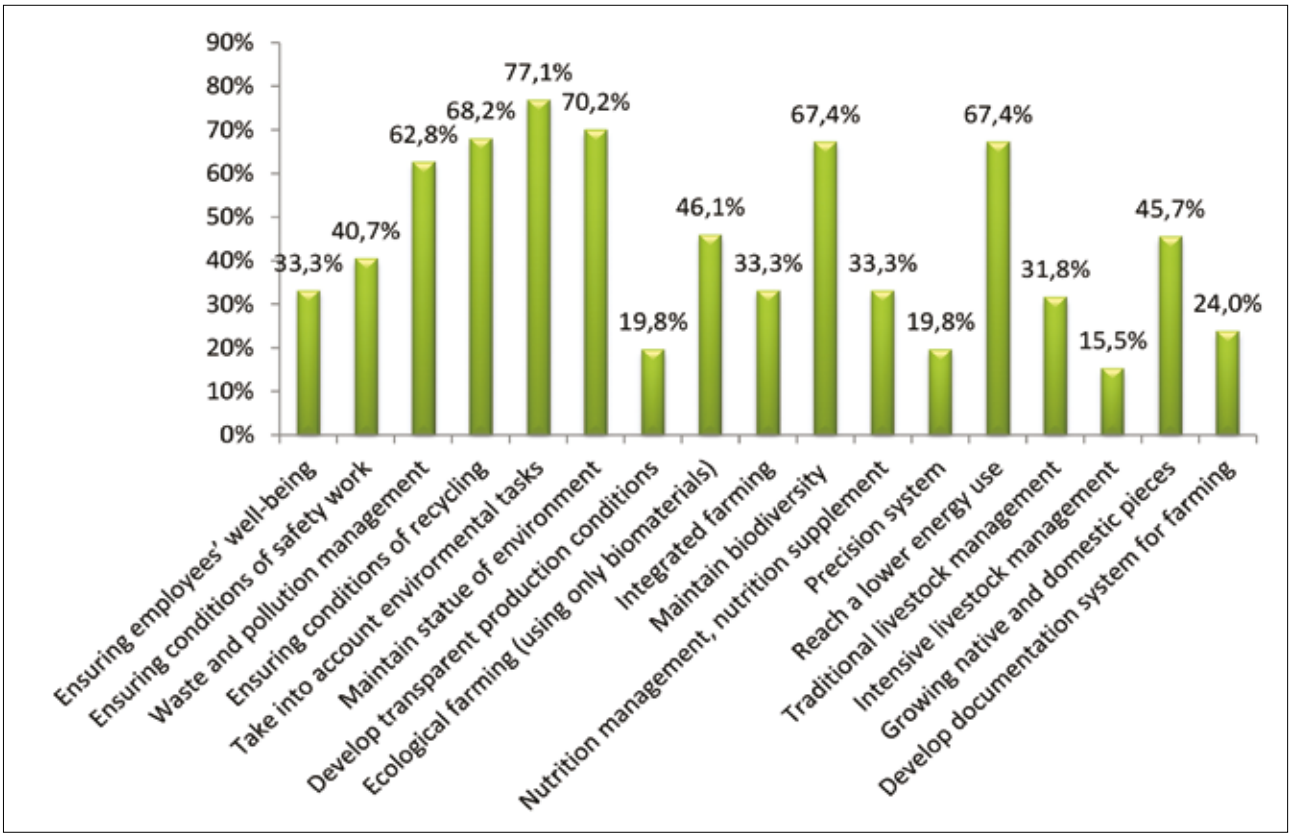

Figure 2: Factors of sustainable agriculture
Source: Own research, N=258, 2014

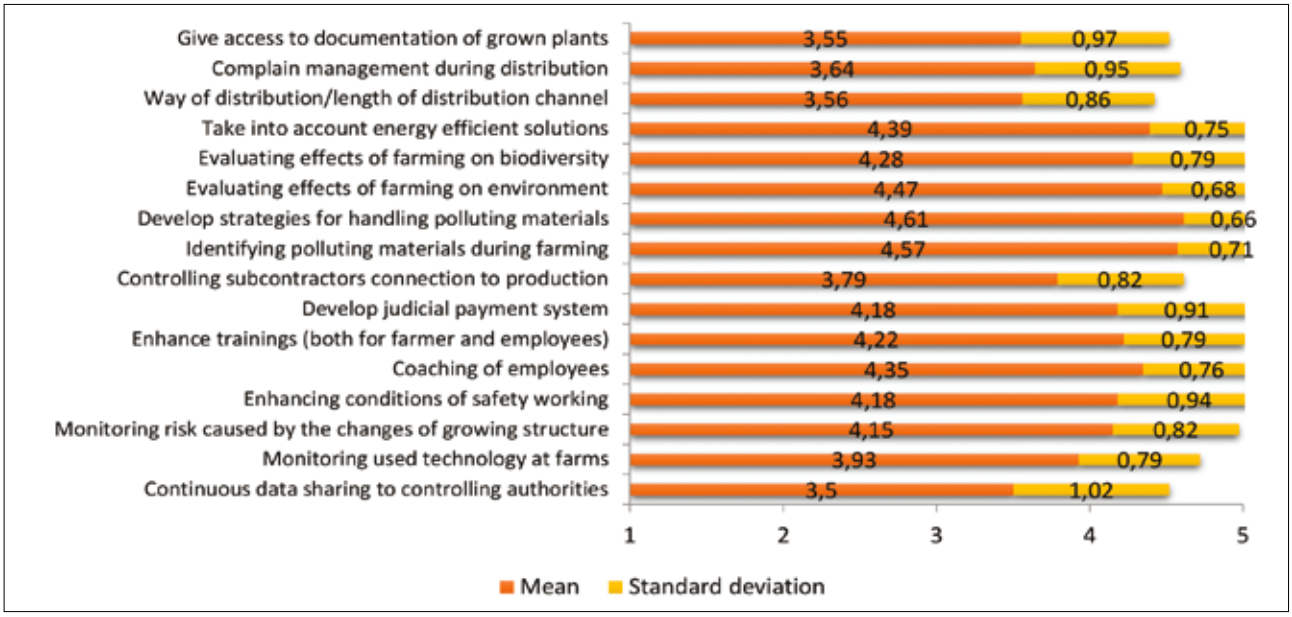

Figure 3: Judgment on factors of sustainable agricultural production
Source: Own research, N=258, 2014

students (they reached 60-80% in connection with the mentioned factors).

In order to get a deeper view about students' judgment on priorities of sustainable agricultural production, we used a 1 to 5 interval scale. In this case, we explored that, besides environmental concerns, social issues are getting a highlighted role (See Figure 3. Survey question was: According to your opinion, how important are factors below in connection with sustainable agricultural production). Both of the mentioned areas are rather important for the subject (means over 4.0). On the other hand, transparency (for instance importance of documentation, data sharing and controlling) still have not the most essential factor in connection with sustainable farming.

In Figure 3, there are eight cases, which have relative high standard deviation. It means that respondents have different opinion about these factors. Therefore, we carried out independent sample tests and One-way ANOVA tests to explore the reason of these dissimilarities. We concentrated on the research focus, therefore we primarily analyzed differences on the basis of gender, faculty, class, age and level of education. In this case, there was only one statement ("Developing judicial payment system"), which was really divisive according to level of education and classes.

On the basis of the categorical means, development of judicial payment system, in the viewpoint of sustainable agricultural production, is more important for Bachelor students (4.31) (first- and second-year class students) than Master student (3.88) (third-year class students and seniors). Moreover, second class students' (4.39) and seniors' (3.67) opinion showed the highest deviation in connection with judicial payment system.

Finally, we investigated students' opinion about how much do people take into account social and environmental issues in Hungary. (Survey question was: According to your opinion, at Hungary how much do people taken into account the factors connected to sustainable agricultural practice, nowadays?) As a result, it can be stated that both of the mentioned areas are relatively important in our country (Figure 4). On the other hand, standard deviations show a really big difference in respondents' views.

According to the research goals, there are two main

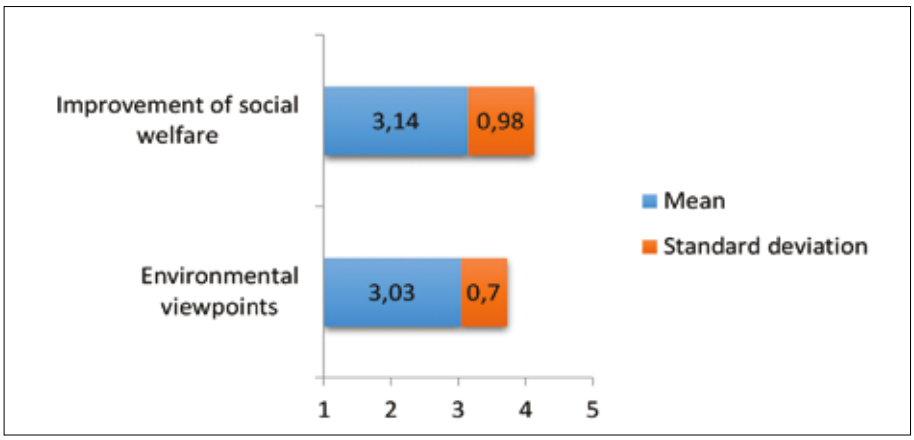

Figure 4: Importance of environmental and social issues in Hungary
Source: Own research, N=258, 2014

categories (gender and level of education), in which opinions about statue of improving social welfare are really divisive in Hungary. Hence, men (mean: 2.91) and Master students (mean: 2.92) are more skeptical about the mentioned issue than women (mean: 3.23) and Bachelor students (mean: 3.24).

In the next two parts in our study, we analyze exact environmental protective behaviors and opinions about ecological farming. These two topics are really essential in connection with agroecology. On the basis of environmental protective behaviors, farmers can improve their farming activities. Moreover, ecological farming is a living example of basic agroecology. Hence, exploring eco-farming failures; principals of agroecological improvement could be defined.

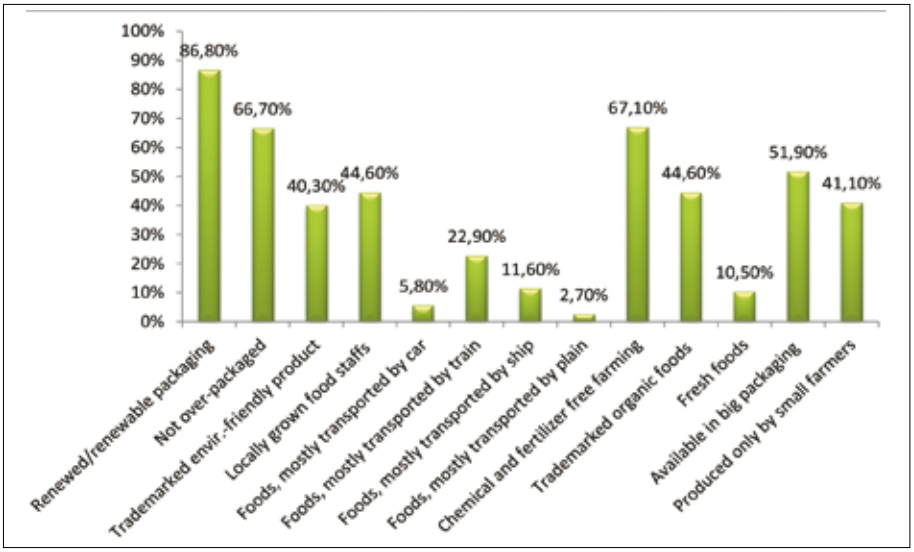

Figure 5: Characters of environmental friendly foods
Source: Own research, N=258, 2014

II. **Students' environmental views**

We investigate food characters connected to environmental protection. We concentrate on exact elements of environmental protection, food information on packaging and food miles.

In Figure 5 shows that respondents of the survey think, the most important food characters, in the viewpoint of environmental protection, are the follows: (1) renewed/ renewable packaging (86.80%), (2) chemical and fertilizer free farming (67.10%) and (3) not over-packaged products (66.70%). It is really essential that, among packaging types (external characters, consumers can check out during food purchasing) farming conditions also appear. It shows that students prefer foods from environmental protective farming. Moreover, method of farming is a confidential food character, since it is really difficult to verify at the time of food purchasing. For this reason, improvement of transparency is a key factor of agroecological development. (Survey question was: According to your opinion, what are the characters of environmental friendly foods?)

If we investigate socio-demographical characters, we can explore that there are two really divisive categories: organic foods (labelled) and chemical and fertilizer free farming. It means that 60.9% of students from University of Debrecen, 58.8% of the second-year class and 50.3% of Bachelor students think that organic foods are environmental friendly agricultural products. While, for women (72.3%), for students at faculty of Economics and Social Sciences (74.8%) and for first-year class students (82.2%) chemical free farming is the most important food character in the viewpoint of environmental protection. Chemical free farming is less crucial for men (58.6%), for students at faculty of Agricultural and Environmental Sciences (60.0%) and for juniors (53.2%). Organic food (trademarked) is less popular character among Master students (32.5%) and seniors (29.5%).

Furthermore, small farmer product is also an essential character for sophomores (56.9%), while renewed/ renewable packaging is important for juniors (4th class) (97.4%). Men prefer not over packaged foods (75.8%), locally grown foods (53.5%) and foods mostly transported by ship (17.2%). Besides organic foods (labelled), small farmers' products are also important for Bachelor students (47.4%).

Students' environmental and social views also appear in connection with information need. Figure 6 demonstrates, during food purchasing, students would like to be informed about the following food characters: Hungarian product (84.9%), avoid animal testing (54.70%), social fair company/farmer (for instance producer does not exploit his/her employees and meet requirements of law). (Survey question was: Which information can influence your decision during food purchasing?)

We also explored, animal tests are primarily influencing women's purchasing decisions. Hence, 61.6% of women prefer products are not tested on animals. Moreover, students from faculty of Agricultural and Environmental Sciences need information about producer activity at social events (23.7%), while students from faculty of Economics and Social Sciences prefer information about farmers' charity activities (41.5%).

Besides information need, participant of the survey think, it is important to reduce food miles to reach sustainable food systems (93.80%) (See: Figure 7. Survey question was: According to your opinion, is it important

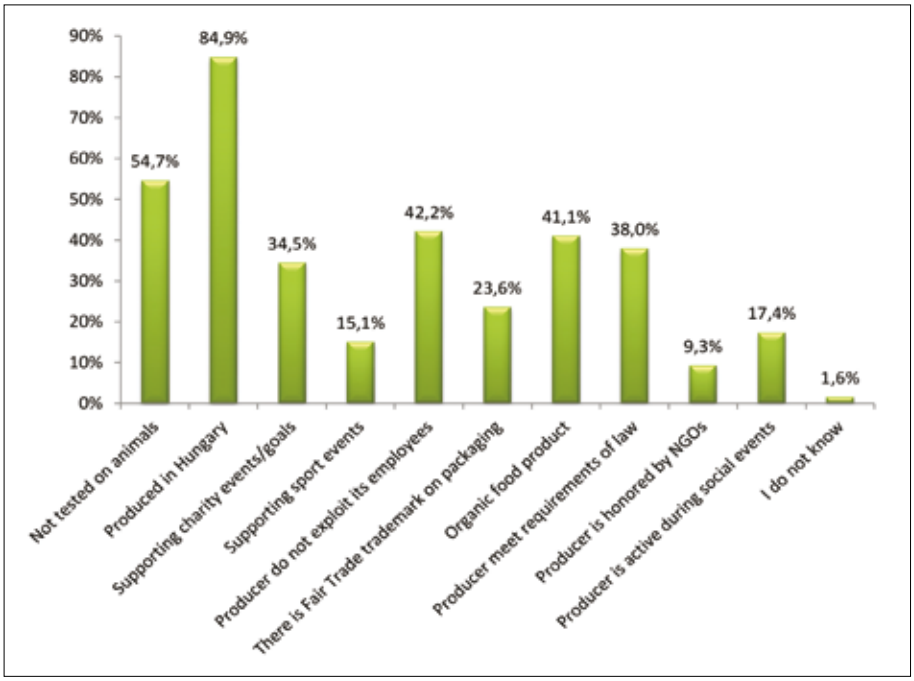

Figure 6: Influencing information during food purchasing
Source: Own research, N=258, 2014

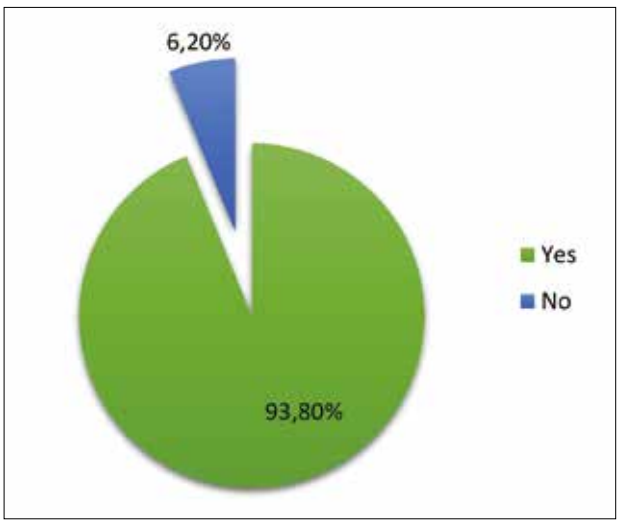

Figure 7: Importance of food miles reduction
Source: Own research, N=258, 2014

to reduce food miles to reach a sustainable food trade?). This result reflects to a more complex view. It means that, students have knowledge about that, agroecological problems have not been solved with a sustainable farming method. According to respondents, it is necessary to optimize food miles, which is an extended ecological management dilemma.

According to the professional literature, farmers' stores, community agriculture and origin labeling are the best ways to reduce food miles, while fair trade, private standards and traditional food chain system significantly increase food miles. Based on the results in Figure 8, most of the time, respondents could identify the most environmental protective food systems. (Survey question was: According to your opinion, which food system can effectively reduce food miles?) However, they have more positive attitude forward traditional food chain systems than origin labeling. Reason of this view can be derived from the method of origin labeling. Regularly, only the name of nation appears on food packaging (for example made in Hungary, made in the EU). So, consumers can not identify the exact region. On the other hand, there is a confidential question. Hungarian consumers are very critical about information connected to food stuffs. That is why origin labeling is less significant in connection with sustainable agroecological system.

It is also explored that men have a more positive attitude forward origin labeling. 19.2% of them think, it is important to reduce food miles, while only 9.4% of women have the same opinion. Moreover, community agriculture is more popular among students from University of Debrecen (66.7%) than respondents in Gödöllő. It refers to that communities have a more significant role in the rural area.

III. **Students' judgment on ecological farming**

As it was mentioned above, ecological farming is a good practical example how to reach a sustainable agroecological system. For this reason, in the last part of our study, we evaluate students' judgment on eco-farming.

At first, we investigated students' opinion about principals of eco-farming (See: Figure 9. Survey question was: According to your opinion, do statements below meet principals of ecological farming?). In this case, a strong environmental orientation (means over 4.0) also appear. On the other hand, exact actions and social issues get a lower importance (e.g. usage of renewable energy sources, growing food high in nutrition and acceptable salary). It refers to that students have environmental orientated attitude, although they do not recognize the concrete farming methods leading to sustainability.

In Figure 9, high standard deviations can be seen, which refer to that students have different opinions about factors of eco-farming. We explored students' views differs according to level of education, faculty and class. Most of the time, Master students join real actions to principals of eco farming. Master students think that maximum use

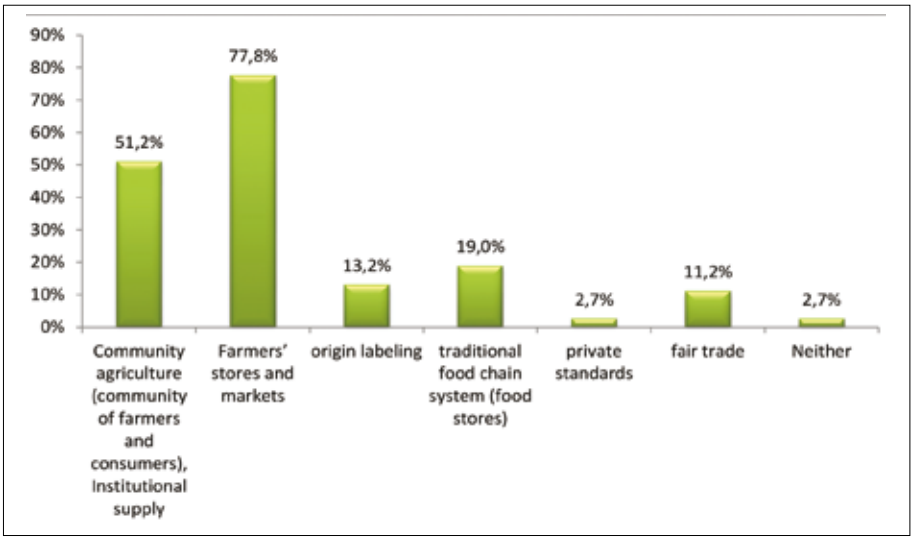

Figure 8: Food miles reducing food systems
Source: Own research, N=258, 2014

of renewable energy sources of local agricultural systems (mean Bachelor: 3.91; mean Master: 4.22), avoiding polluting effect of agricultural machines (mean Bachelor: 4.12; mean Master: 4.40), maintaining agricultural systems and genetic diversity of connecting areas, and conservation of living places of plants and animals (mean Bachelor: 4.06; mean Master: 4.33), and including renewable energy sources into agricultural processes (mean Bachelor: 3.89; mean Master: 4.18) are essential to develop economical farming systems. Moreover, Masters (4.16), juniors (4th class) (4.23) and seniors (4.10) highlight importance of wider social and ecological effects of farming.

Mostly second-year class students agree with that "production of totally depredating organic foods" (3.90) and "maximum work inside the boundaries of closed systems, reckon with organic substances and food ingredients" (4.12) statements are essential principals of eco-farming. In this case, first-year students reached the lowest means (3.32 and 3.63). Besides above, availability of acceptable salary and safe working conditions at farms are more important for students from faculty of Agricultural and Environmental Sciences (3.46).

Results show, environmental orientated educational structure plays a strong influencing role in respondents' knowledge. Furthermore, while younger students know some principals of sustainability, elder students can define exact actions to reach a sustainable farming structure.

Figure 10 shows, most of the listed factors are important to develop ecological farming systems. (Survey question was: Please mark those elements, which must be taken into account during formation of ecological farming.) However,

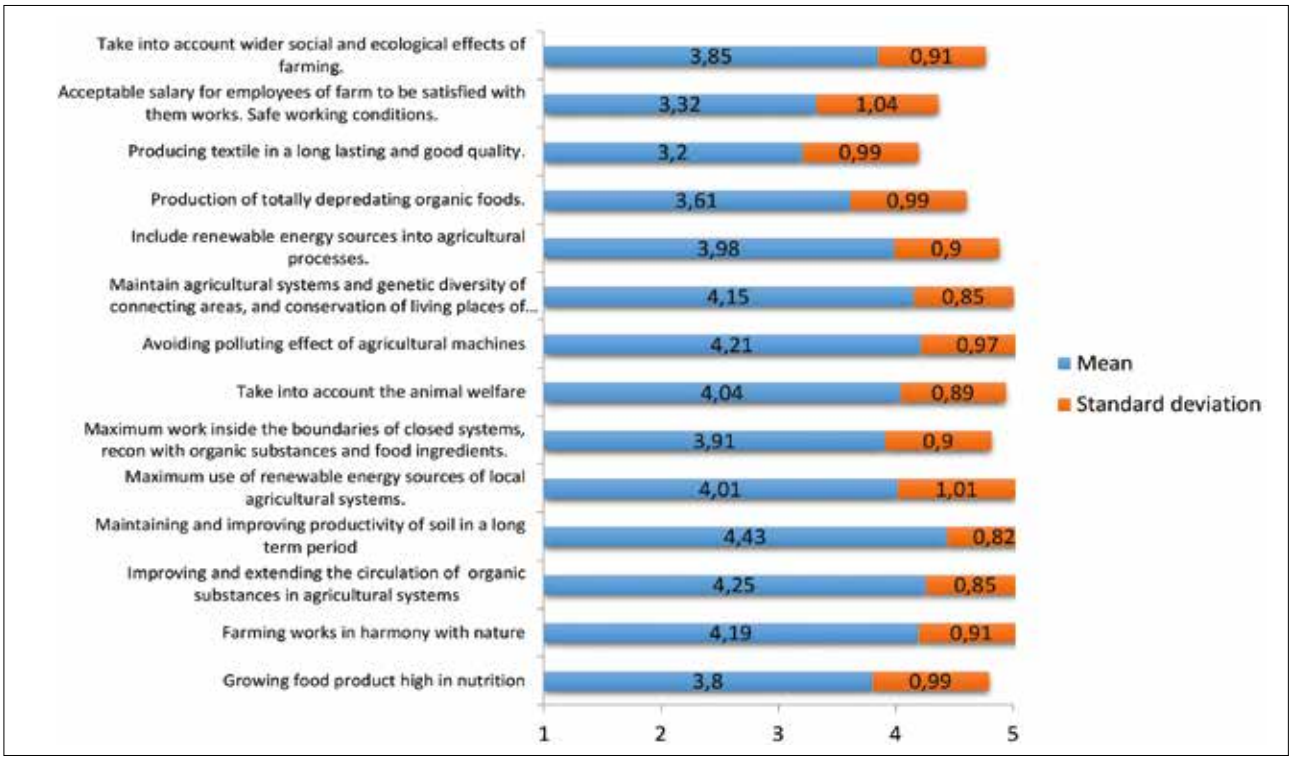

Figure 9: Principals of ecological farming
Source: Own research, N=258, 2014

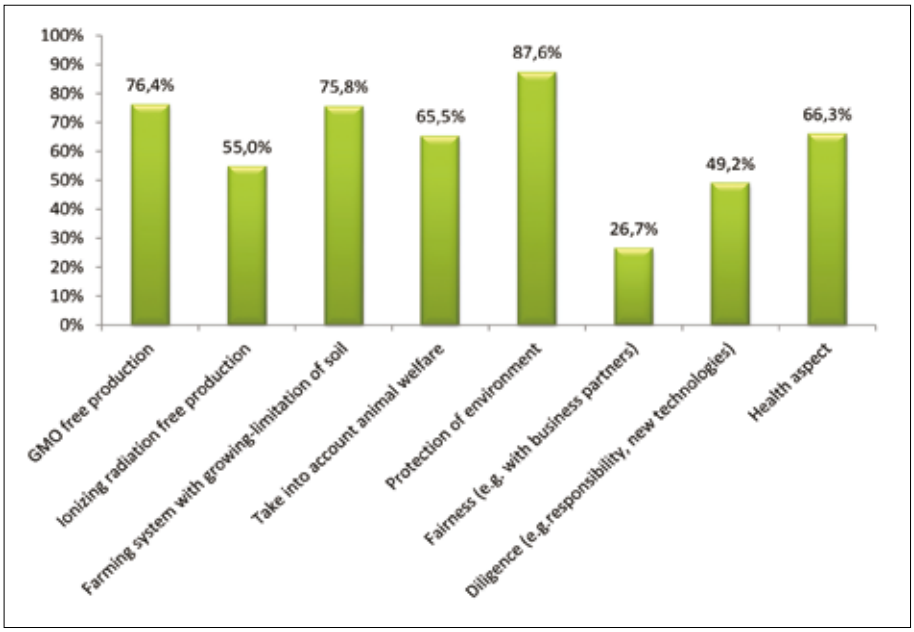

Figure 10: Aiding factors of eco-farming development
Source: Own research, N=258, 2014

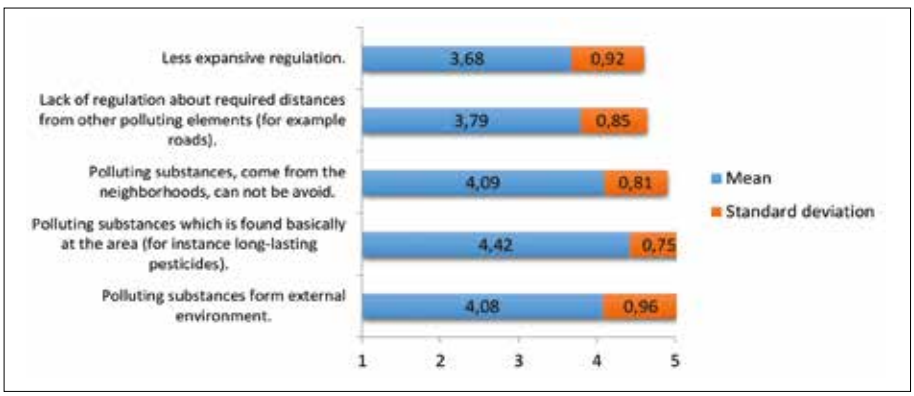

Figure 11: Barriers of eco-farming
Source: Own research, N=258, 2014

fairness reached a lower frequency (26.70%). It enforces the weakness of social attitudes. According to the professional literature fairness, diligence and health are the three basic element of ecological farming. Students highlight the importance of health, but the other two factors are less essential to them. It shows a knowledge gap. Hence, complex knowledge has still missing. Respondents could not recognize long term utilities. They focus on visible goals. We also explored that men and women have different opinion about the three mentioned principals. Men are more sensitive about these cases. 39.40% of them say fairness, 60.60% of them say diligence and 73.7% of them say health is a crucial principal of eco-farming. Moreover, GMO free production is preferred by Bachelor students (80.00%), while ionizing radiation free production is highlighted by second-year class students (72.5%). Importance of ionizing radiation free production reached the lowest ratio (41.80%) among juniors (3rd class).

In Figure 11 barriers of eco-farming are listed. (Survey question was: According to your opinion, how harmless are factors below in connection with foundation of ecological farms.) According to Biokontroll Hungária Nonprofit Kft. (Biocontrol Hungary Nonprofit Ltd.), most of the time, farmers are very critical about eco-farming in Hungary, because of factors in Figure 11. In reality there are solutions to avoid these problems and develop eco-farm systems. Our results show that students also think that external environmental effects are threats in the viewpoint of eco-farms. On the other hand, improvement of regulation system have secondary importance among barriers of ecological farming.

In this case, there are three barriers with a high standard deviation (polluting substances form external environment, lack of regulation about required distances from other polluting elements, for example roads, and less expanded regulation). Concentrating on research goals, we identified the reason of this dissimilarity. It is found that, there is only one case (polluting substances form external environment), where respondents' opinion differs according to the basic socio-demographical characters. Hence, external polluting substances are considered more risky by women (4.22) than men (3.86).

DISCUSSION

According to our result we highlight the following points in connection with judgment of sustainable agricultural structure:

- Students have a strong environmental orientated view.
- Beside environmental protection, social issues also get a higher importance.
- Students concentrate on exact parts of a sustainable agricultural system, but they are not aware of the complexity of agroecology. Hence, it is important to improve their knowledge about the whole ecological

process (for instance they have to learn about transparency, goal of documentation and controlling systems).

• There are differences in students' opinion according to gender, class and faculties. Ordinary the younger ones and women are more optimistic about the statue of agroecological issues. It reflects to that, education give a realistic knowledge about the investigated topic, but a complex understanding of system mechanisms, as we detailed above, has been still missing.

Related to students' environmental views, on the basis of our analysis, the main findings are the follows:

• Parallel with results related to the judgment of sustainable agricultural structure, students have a strong environmental protective attitude. They know that not only external food characters (checkable during purchasing) are important. Confidential food characters also get an essential role in agroecological farming.

• Results show that respondents have a more complex view about environmental protective farming. They think, transportation and social issues are also important in order to develop a sustainable agroecological system.

• On the other hand, most of the time, students' opinion is different. Bachelor students are more optimistic in connection with environmental issues than Master students. Moreover, subject from a rural university (Debrecen) sometimes have a different priority in the viewpoint of factors of agroecological systems (way of farming and food miles reduction). This tendency can be caused by that student at a rural university have more personal experiences about food systems and farming practices. Therefore, direct practice is a must to understand real connections between farming and supply.

Finally, we can highlight the most important results in connection with students' judgment on ecological farming system:

• Evaluating a living example (eco-farms), students show a deeper knowledge. They can identify problems, threats and weaknesses of eco-farming systems. It refers to that it is easier to turn theoretical knowledge into practical actions with the aid of experimental learning. The need of experimental learning is enforced by the knowledge level of students come from a rural university.

• Students' knowledge are not homogenous. Most of the time, Master students with environmental background have more complex views.

• Mostly, respondents have a strong environmental orientation but short term thinking. They cannot identify long term utilities, and extended social and economical goals of agroecological systems.

CONCLUSIONS

The examination of the results reveals the key factors that can improve educational system and knowledge transfer in Hungary and suggest further acts for the SAGITER international project team. The key factors are the following:

Complexity – besides environmental orientation, social and economical goals should be better highlighted. Agroecological knowledge has to be extended to the whole food chain.

In the case of BSc students, knowledge on social issues and necessity of documentation systems should be improved, while during the knowledge transfer toward to MSc students, the necessity of the whole food chain management should be more detailed.

Transparency – besides complexity, students have to understand the necessity of transparency. Managing the whole food chain, it is essential to develop correct documentation and controlling system.

Between BSc and MSc students, knowledge gap on importance of documentation and controlling systems can be detected, therefore they have to be taught the wider effect of agricultural farming.

Social sensitivity – students need to understand that fair working conditions also play an important role in agroecological improvement.

As a future task for the teachers, it is important to demonstrate for BSc students that farming plays a strategically role in social welfare. Therefore, it is crucial to take into account working conditions at farms and presenting practical case studies.

Dissimilarities in knowledge – economical education has to be extended with ecological studies. Women' agricultural integration is also a crucial factor of education development. Bachelor students have to get a more practice-oriented education, whilst students from the Faculty of Economics and Social Sciences should complement their studies with environmental issues. They primarily concentrate on economical development. They should understand the importance of environmental protection and social fairness, and they should also understand the long term outcomes of economical decisions.

In general, our results show, that men have a wider knowledge on agricultural issues. Women should be better integrated into agricultural activities. Women have to get a complex knowledge on farming systems, strength and weaknesses of agricultural farming and ecological knowledge transfer and development.

Experimental learning – visualization and experiments are the best methods to provide students with practical knowledge. Besides theoretical classes, living examples have to get a higher importance in educational structure.

For BSc students that would be advisable to have a more practical education. It is necessary to visit farms and meet with farmers during their studies. Our results show that living examples (field visits, case studies) are the best indicators of understanding the complexity of agroecological problems.

In the case of the metropolitan students, the individual experiences are also key factors in order to give a deeper knowledge on agroecological issues. Students, come from rural area, have direct experience with farming problems. On the other hand, it is difficult to identify agroecological actions for metropolitans. These underline the necessity to use relevant knowledge transfer methods and practical case studies during their studies, thus theory can grow from experience.

One single project cannot result a complete change in knowledge transfer method applied at universities in Hungary, but the practical method collection related to knowledge transfer designed for educators elaborated by SAGITER project team will surely support them during teaching. This collection will also reinforce the better understanding of the complexity of the sustainable agriculture by providing a better view of the whole picture. The main expected outcome of the project is still the awareness of the importance of those knowledges that cannot be acquired by university text books and the educational foundation of future responsible actions.

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