Developing a Joint Master of Sciences in Sustainable Food Production Systems in Western Balkan Countries: Evidence on the Design Process, the Structure of the Curriculum, and the Importance of a New Postgraduate Program

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Abstract. Food production systems are undergoing a structural transformation towards a sustainable resilient state, offering opportunities for economic benefits, employment creation, and enhanced food safety and security. Governing this sustainability transition is a complex process which calls for interventions at all policy levels, including higher education.

Adopting an agri-food systems perspective, the Western Balkans countries are facing challenges which are mostly related to issues such as the modernization of food engineering and food management practices, the organic agriculture production, the post-harvest processes, the supply chain management, the corresponding environmental footprint, etc. Tackling with the afore-mentioned topics requires educational interventions (among other actions), which may contribute effectively towards the specific sustainability transition.

To this purpose, and in light of these countries' current convergence, with the European Union, the Erasmus+ "STEPS" project offered a unique opportunity for collaboration between eleven (11) European partners, who led to the development of a joint Master of Sciences Program entitled "Sustainable Food Production Systems" with two directions: "Food Engineering and Food Safety", and "Food Production Systems Management".

The paper sheds light on the development process of the curriculum, providing evidence on the design process, the structure and the syllabus of the courses, the necessary accreditation process, and the benefits of the new joint postgraduate program.

Keywords: Erasmus+, higher education, master program, sustainable food systems, food engineering, Western Balkans

Introduction

The aspiration of the Western Balkan countries, Albania, Kosovo and Bosnia and Herzegovina to be part of the EU, goes hand in hand with the improvement in two crucial sectors of the economy and society: Agriculture and Food sector and the Education. The intervention and updating of these two sectors in compliance with European Commission requirements and legislation will enable a smoother transition toward the final destination which is EU integration. Western Balkans countries are facing similar challenges regarding

agricultural production, environmental conservation, food supply chain management, food quality and safety and consumer protection. All these challenges need interventions and need to be systematically addressed. To assure a long term and sustainable solution we strongly believe that these challenges should be addressed and reflected in study programs of Higher Education Institutions (HEIs). Furthermore, collaboration between the education sector and stakeholders from the food sector at all levels will aid in the design of a curriculum that reflect the agri-food issues that the Western Balkan countries face. In addition, global and European policies promoting sustainability were explored. The adoption of sustainable food production systems and sustainable educational policies will play a vital part in this strategy. The United Nations' Sustainable Development Goals (SDGs) and the European Green Deal sets addresses comprehensively the challenges of sustainable food systems and recognizes the inextricable links between healthy people, healthy societies, and a healthy planet.

The abovementioned issues were the main impetus for us to undertake and design a project of this nature with the final outcome the implementation of a joint scientific master in "Sustainable Food Production Systems" in HEIs of Western Balkans Countries (Albania, Kosovo, and Bosnia and Herzegovina). STEPS project[1] is co-funded by Erasmus+ Program of European Union, Key Action-2: Cooperation for innovation and the exchange of good practices, Capacity Building in the field of higher education (Project no. 598963-EPP-1-2018-1-AL-EPPKA2-CBHE-JP). For a successful implementing of the scientific master in "Sustainable food production systems", 6 (six) HEIs from Albania (Agricultura University of Tirana and European University of Tirana), Kosovo (University of "Haxhi Zeka" and Universium College) and Bosnia and Herzegovina (University of Sarajevo and University of Bihać) are involved and strongly cooperating with each other. Furthermore, a cantonal administrative body from Bosnia and Herzegovina, Ministry of Education, Science, Culture and Sport of Una-Sana canton, is involved and responsible of overseeing all the documentation required for the master's program's accreditation. The whole process for the design of curricula, program and courses as well as the implementation of the master will be under the guidance and advice of the HEIs partners of the European Union (Czech University of Life Science Prague, University of Agronomic Science and Veterinary Medicine in Bucharest, Agricultural University of Athens) and a private Company, Research Innovation and Development Lab. in Greece.

The master program is in compliance with the Bologna Convention. Moreover, it is designed in accordance with the recommendations and the needs of the target groups and stakeholders, which were identified during the preparatory activities of the project. The master courses are structured under two main pillars: (i) Food engineering, quality, and safety, (ii) Food production systems management. The main focus of the first pillar will be about advanced food science and technologies; innovation in harvest and post-harvest practices; food quality and safety; and energy design of processes and emission control. The main focus of the second pillar will be about agri-food marketing; industrial ecology and circular economy in agriculture; sustainable supply chain management; and innovation in sustainable food systems.

The new master program in "Sustainable food production systems" contains innovating elements that are going to add value to the education policies and agri-food sector within the Western Balkan countries.

STEPS Methodology for Curriculum Design

A comprehensive methodology was developed in order to design a scientific master's curriculum that would reflect the demands of the agri-food sector in the Western Balkans in

[1] https://steps-project.eu/

connection to sustainable food production, rather than just improving existing programs. The following are the main steps in the methodology:

1. *Assessment and analysis of stakeholders needs in Western Balkans*

Several research instruments have been employed in order to identify the competencies and skills needed by agri-food sector in Western Balkans (Albania, Kosovo, and Bosnia Herzegovina) in frame of sustainable food production systems, such as *in-depth interviews, online surveys and focus groups*. These research instruments allowed us to perform a deep analysis of the Food Chain Sector (from farm to table) in Western Balkans, where the main actors were the stakeholders and target groups: Students, academic staff, scientific staff, technical staff, certification bodies in food systems, trainee in food system development program, suppliers, farmers, food processing industries, government agency, NGO etc. (STEPS report, 2019).

2. *Survey on best practices of master programs in sustainable production systems in Europe, North America etc.*

Trace and investigation of at least twenty (20) scientific masters in the subject of sustainable production that have been implemented in various European Union, America, and international countries. The organization/structure of the scientific master program, its influence on the agri-food sector and society, as well as the mechanisms utilized to maintain constant communication with stakeholders and the labor market, were all examined (STEPS report, 2019)

3. *Defining mechanisms for a continuing communication and collaboration between stakeholders and HEIs.*

Data collection of stakeholders that perform in agricultural food sector in Albania, Kosovo, and Bosnia and Herzegovina, along with developing and improving communication channel between HEIs and stakeholders throughout and after STEPS master implementation and their involvement in designing and updating in the future the master program are well define.

4. *Design a harmonized STEPS curriculum and courses in sustainable food production systems within Western Balkans countries.*

The master curricula and courses are design and adapted with the results obtained from analyses of stakeholders needs in Albania, Kosovo and Bosnia and Herzegovina and moreover from the analyses of the best practice of homologue master programs in sustainable food production systems implemented in European Union countries, in America etc.

5. *Design a harmonized STEPS master program syllabus in sustainable food production systems within Western Balkans countries.*

Designing and developing a harmonized courses syllabus is a result of a close collaboration between academic staff of HEIs of Western Balkans and academic staff of HEIs of EU partners. The harmonized syllabus among others includes:

- Basic information about the course, such as course title and code, prerequisites, semester and ECTS units
- Professor/teaching assistances contact information
- Description of course purpose and link with specific processes, problems, and challenges
- Course learning objectives and learning outcomes for each of the sections of the course and skills that are expected to be developed bystudents
- Schedule and course calendar including the details of the educationalcontent that will be presented, activities that will be carried out, individual and/or team projects to be conducted
- Scheduled laboratory experiments and software simulations
- Additional learning resources and literature

- Evaluation and grading criteria for assignments, projects and laboratory reports and the percentage of the various grades to the final grading of students etc.

6. *Assessment of academic staff of HEIs of Western Balkans needs in terms of scientific background improvement.*

Mechanisms choose to fulfilled academic staff of HEIs needs in terms of scientific background improvement in the frame of sustainable food production systems are open lectures, seminars, workshops. Despite invited lecturers, academic staff of HEIs of EU countries involved in project will play a crucial role.

STEPS Master Program Structure and Courses

The scientific master program in " Sustainable food production systems" is designed and adapted by taking into consideration different variables and with the contribution of academic staff of HEIs of the consortium involve in STEPS project under the main supervision of USAMVB (University of Agricultural and Veterinary Medicine of Bucharest). The factors that served as the main driver and where the design of the master program was based are:

- *The results obtain after the analyzes of data of the stakeholders needs in frame of sustainable food production system in Albania, Kosovo, and Bosnia and Herzegovina.*
- *The results obtain after the survey of best practices in frame of sustainable food production systems master programs implemented in EU countries and worldwide.*
- *Bologna convention regarding the Higher Education Polices.*
- *Higher Education legislation and policies applied in Western Balkan countries, Albania, Kosovo, and Bosnia and Herzegovina.*

The outcome was a modernized educational program, which will produce workforce armed to support the transition towards sustainable food production systems, by applying engineering advances, management approaches, policies, and reformations at all levels. Furthermore, the product is a program in line with the European vision for green, circular economy and the national strategies of Western Balkans countries, as related to agriculture restructure, business diversification and rural development. The master is organized in four (4) semesters, over two (2) years, with a total number of credits of 120 ECTS. Courses are divided into two main groups, core and elective. Furthermore, courses are structured under to main pillars of food productions systems:

- *Food engineering, quality, and safety (FEQS)*
- *Food production systems management (MFPS)*

The master in "Sustainable food production systems" will be implemented as joint in Albania between the Agricultural University of Tirana and the European University of Tirana, and in Kosovo between the University of "Haxhi Zeka" and Universium College. In Bosnia and Herzegovina, the master is going to be implemented separately in University of Sarajevo and in University of Bihać. Despite this fact, the core courses that will be developed during the first semesters of the first year of master implementation as define in table 1. are the same in all HEIs of Western Balkans involved in the project.

Table 1. Core courses implemented in the first semester of master program "Sustainable food production systems" in Western Balkans Universities involved in the project STEPS

Universities Agricultural University of Tirana; European University of Tirana; Universitu of "Haxhi Zeka"; Universium College; University of Sarajevo; University of Bihać.				
Semester	Courses	C/E*	Type*	ECTS
First semester	Fundamentals of Sustainable Agri Food Systems	C	FEQS	5
	Agricultural and Food Industry Waste Management	C	FEQS	5
	Advanced Food Science and Technology	C	FEQS	5
	Governance, Policy, and Legislation in the Agri-food Sector	C	MFPS	5
	Food Ethics	C	MFPS	5
	Research Methodologies and Tools	C	MFPS	5

Note: *C/E- core or elective courses. FEQS-food engineering, quality, and safety type of courses. MFPS- management food production systems type of courses.

Courses, such as, "*Fundamentals of Sustainable Agri Food Systems*" and "*Governance, Policy, and Legislation in the Agri-food Sector"* will orient the students toward sustainable concepts not only in agri-food systems production but also will inform them about the regional and EU legislation and policies that modulate the sustainability in food sector. Course in "*Food ethics*" will introduce students to the food ethics as one of the main principles of sustainable agriculture and diets. The course explores how people make decisions about what they eat, as well as the moral, ethical, gender, sociological, industrial, and environmental factors that influence food choices and values. Furthermore, by attending the courses on "*Advanced Food Science and Technology*" and "*Research Methodologies and Tools*" the students will be informed on new technologies and approaches on food production in frame of sustainability.

Two groups of elective courses are delivered based on the two main pillars mentioned above, distributed in the second and third semester of master implementation as described in table 2. The list of courses underline in Table 2 is not exhaustive, specification in elective courses for each Universities (in Albania, Kosovo and Bosnia and Herzegovina) are not mentioned. In the second and third semester will be developed 6 elective courses, 12 elective courses in total, and courses are credit with 5 ECTS each. In the fourth semester the students will be focused on the research work for the master theses.

Table 2. Pools of elective courses that are going to be implemented during the second and third semester of master program "Sustainable food production systems"

Universities Agricultural University of Tirana; European University of Tirana; Universitu of "Haxhi Zeka"; Universium College; University of Sarajevo; University of Bihać.				
Semester	Courses	C/E*	Type*	ECTS
2nd	Quality System Development, Management and Shelf-Life Assessment of Food	E	FEQS	5
	Quality and Sustainability of Plant-source Food Production	E	FEQS	5
	Traceability systems of food products	E	FEQS	5
	Nutrition	E	FEQS	5
	Innovative Practices of Harvesting and Post Harvesting	E	FEQS	5

	Sustainable Ecology for Fish Management and Conservation	E	FEQS	5
	Environmental Chemistry towards Food Processing	E	FEQS	5
3rd	Sustainable Technology of Dairy Products	E	FEQS	5
	Sustainable Technology of Fruit and Vegetable Processing Products	E	FEQS	5
	Sustainable Use of the Plant Protection Products	E	FEQS	5
	Sustainable Technology of Wine, Beer and Spirits	E	FEQS	5
	Sustainable Technology of Bakery Products	E	FEQS	5
	Consumer Science and Sustainable Consumption	E	FEQS	5
	Innovation and Entrepreneurship for Sustainable Food Production Systems	E	MFPS	5
	Marketing of Sustainable Agri-food Products	E	MFPS	5
	Total Quality Management in the Agri-food Sector	E	MFPS	5
	Sustainable Food Value Chain Management	E	MFPS	5
4th	***Master thesis***	C		30

Note: *C/E- core or elective courses. FEQS-food engineering, quality, and safety type of courses. MFPS- management food production systems type of courses.

Courses, such as "*Sustainable Technology of Dairy Products*", "*Sustainable Technology of Fruit and Vegetable Processing Products*", "*Sustainable Technology of Wine, Beer and Spirits*" etc. will inform students for the new technologies applied in the production of dairy products, wine, beer vegetables in the viewpoint of sustainability. Whereas courses such as "*Marketing of Sustainable Agri-food Products*", "*Total Quality Management in the Agri-food Sector*" etc. will inform the students on the agri-food supply and value chains which are addressed in the context of the relationships of all constituent actors such as agriculture, agro-food processing industry, trade, catering, and consumption.

As mentioned above the elective courses in general are the same with a small difference which depends on the results of stakeholders needs in the three countries, Albania, Kosovo and Bosnia and Herzegovina. The master is in the second year of implementation in Bosnia and Herzegovina (University of Sarajevo and University of Bihać) and in Kosovo (between University of "Haxhi Zeka" and Universium College). The joint master in Albania (between Agricultural University of Tirana and European University of Tirana) is still in the procedure of opening with the premise to be open in September 2022.

Significance and Impact of STEPS Master

The main goal of STEPS project goal is to implement a Scientific Master in "Sustainable Food Production Systems" in HEIs of Western Balkans Countries (Albania, Kosovo, and Bosnia and Herzegovina). The project seeks to strengthen partner countries' higher education institutions' capability in providing high-quality education, as well as their ability to conduct research, innovate, and contribute to the Western Balkans' socioeconomic transformation. A relevant question that arises spontaneously is: Why now? Many factors influenced our decision to pursue such a project with the support of EU funds through the Erasmus + program. First and foremost, the necessity that agri-food and education sectors are facing for intervention and improvement in the Western Balkans. Intervention that will be consistent with EU policy, requirements, and legislation, which Albania, Kosovo, and Bosnia and Herzegovina have been attempting to join for many years. It is a novelty for Western Balkan countries implementing a master program, whose courses are totally oriented towards sustainability of a food chain, in terms of food production and management. This will serve as a cornerstone for the orientation

of educational and food sector policies, including safety and food quality, towards sustainable policies in accordance with EU directives and legislation regarding these two sectors. The impact of the project is going to be threefold: (i) improving HEIs curricula and education, (ii) in food industry labor market and (iii) in society. Academics, managers, and scientific staff at the university will benefit from the project's implementation by getting hands-on experience with collaborative activities, cultural exchange, and practical understanding of educational program design and development. The project's outcomes will be shared with counterparts outside of the consortium to foster new collaborations and synergies. The strengthening of HEIs' institutional capacity will provide the foundation for their participation in local, regional, European, and international networks. On a professional level, the project will assist faculty members by providing them with the opportunity to expand their scientific knowledge, become familiar with innovative teaching approaches, and put them into practice using current facilities and resources. The project's most essential outcome will be the development of a competent workforce capable of meeting the demands of food production systems. Graduates will be able to work in the sector as engineers or managers, as well as develop and start new companies in rural areas, depending on their specialization. The focus of their companies based on their education and qualification will be the promotion of slow food, and food production in respect with the environment. The benefit to society stems from its role as a consumer, as food products will be of higher quality and safety, and more importantly, will be available to a wider range of population.

Discussion

Food systems include all actors involved in the production, aggregation, processing, distribution, consumption, and disposal (loss or waste) of food products originating from agriculture (including livestock), forestry, fisheries, and food industries, as well as the larger economic, societal, and natural environments in which they are embedded (von Braun J. *et al.,* 2021). Food systems operate on a global, regional, national, and local scale. They are available in a wide variety of patterns and are specific to each location. Nowadays in Western Balkan countries food production is an intensive activity with profound impacts on the environment (Županić *et al.,* 2021). It consumes large amounts of natural resources such as water and energy, results in the loss of biodiversity, and contributes to climate change (Županić *et al.,* 2021). Globally food production is responsible for 21-37% of greenhouse gas emissions (Lynch *et al.,* 2021).

Despite all efforts and the close collaboration with European Union, access to safe and nutritious food is still problematic for parts of the Western Balkans population. According to Global Nutrition report (Country profile, Albania 2021; Bosnia and Herzegovina, 2021) obesity and diabetes and other non-communicable disease often related to unhealthy food offering and poor dietary choices have become a major public health issue in the Western Balkans, with additional negative effects on economic.

Orientation of food production system into a sustainable food production system is not a regional issue, i.e., an issue of the Western Balkan countries, but a global issue, accompanied by numerous efforts over the years to manage and regulate human food supply and minimize impact on ecosystems (Holden *et al.,* 2018). For the case of European Union countries despite all the efforts and the achievements, the European food system is currently neither sustainable nor ‘just’ with respect to environmental, social, and economic elements (according to EC, *Toward a sustainable Food Systems*, 2020). Furthermore, the EC, within the Farm to Fork strategy has taken an initiative to define a legislative framework for sustainable food systems by the end of 2023. Its goal is to accelerate and make the transition to sustainable food systems easier (according to EC, *Farm to Fork strategy*, 2020). Moreover, Food and Agricultural Organization (FAO, 2014) have underline five principles to support a common vision for

sustainable agriculture and food. These are: (i) improving efficiency in the use of resources (ii) action to conserve, protect and enhance natural resources; (iii) protect and improve rural livelihoods, equity, and social well-being (iv) enhanced resilience of people, communities, and ecosystems; and (v) effective governance mechanisms.

Based on the foregoing, there are numerous challenges in the production systems that must be addressed in order to orient themselves toward sustainable production systems. We feel that one of the most essential steps in this approach is the intervention in the Education systems in order to educate the next generation on how to produce food in a sustainable manner and sustainable eating habits while protecting environmental biodiversity. While there is extensive research on education for sustainable development, limited research has been conducted on the specific topic of education for sustainable food and nutrition (Tippmann, 2020). In the frame of STEPS project, we have designed a master program not only to be in line with the needs of stakeholders that perform in agri-food sector in Western Balkan countries, but what's more important a master program that contain courses that will inform and oriented students toward sustainable food production systems. To our knowledge, this is the first time a master of this complexity, totally focused on sustainable production systems, has been implemented at the Universities in Albania, Kosovo and Bosnia and Herzegovina. By taking into consideration the complexity of a food chain the courses implemented into the master program are oriented into two main pillars*: (i) Food engineering, quality, and safety (FEQS), (ii) Food production systems management (MFPS*). Courses, such as, "*Fundamentals of Sustainable Agri Food Systems*" and "*Governance, Policy, and Legislation in the Agri-food Sector", "Food ethics",* "*Sustainable Technology of Dairy Products*", "*Sustainable Technology of Fruit and Vegetable Processing Products etc.* will orient the students toward sustainable concepts and technologies in agri-food systems production but also will inform them about the regional and EU legislation and policies that modulate the sustainability in food sector. The outcome of this master will be labor force educated with the new vision, new policies, and technologies in frame of sustainability of food chain production and management. We understand that this endeavor alone will not be sufficient to provide a long-term sustainable food production and management chain, which is why we not only encourage but strongly believe that more initiatives should be undertaken in the near future.

Conclusion

The main outcome of STEPS project, co-founded from the Erasmus + Program of European Union, is the implementation of scientific master in "Sustainable food production systems" in Western Balkans countries, Albania, Kosovo and Bosnia and Herzegovina.

Momently the master is implemented in Kosovo, as a joint master between the University of "Haxhi Zeka" and Universium College. In Bosnia and Herzegovina, the master is implemented separately in University of Sarajevo and University of Bihac. Both in Kosovo and Bosnia and Herzegovina the master is in the second year of its implementation. For the case of Albania, the master is still in the procedure of opening, and it is going to be implemented jointly between the Agricultural University of Tirana and European University of Tirana. The master program is entirely compliant with the Bologna Convention, meets all agri-food sector needs in the Western Balkans, and, most importantly, is in line with the EU's Green Vision initiative and From Farm to Fork strategy.

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