KEYWORDS
sustainable food systems, simulation in food systems, Erasmus Mundus, joint master

ABSTRACT

Food production has to take into account a number of global challenges, such as growing demand for food worldwide, climate change, food loss, changing diets, and water scarcity, as well as competing claims, including the need for animal feed, fibre for clothing and biofuels for energy. Global warming is likely to lead to greater incidence of agricultural yield shocks in certain regions, land fragility, and seed fragility, and will add to the complexity of the challenges at hand.

A Master’s course with a specific integrated and international outlook would fill an increasing need and result in the transfer of knowledge, experience and standards to developing countries, as well as promote an excellence of European education. Hence the project group developed a unique proposal within Erasmus Mundus framework, European Master of Science in Sustainable Food Systems Engineering (FOOD4S - ‘food force’).

Quality assurance and monitoring of the programme is of utmost importance for the management board. The survey on ‘satisfaction analysis on teaching performance’ is currently being performed for the preceding Erasmus Mundus programme, on which the FOOD4S proposal has been built. The results will be used to improve the ongoing and perspective programme in terms of particular aspects.

INTRODUCTION

General aim of Erasmus Mundus, as a co-operation and mobility programme in the field of higher education, is to promote the European Union as a centre of excellence in learning around the world. By supporting European top-quality Masters Courses it enhances the visibility and attractiveness of European higher education in third countries. Selected courses intend to offer high quality education, promote the European dimension in higher education through joint curricular development, inter-institutional co-operation in teaching and supervising students, inter-institutional transfer of knowledge, joint recognition of qualifications, support mobility streams within Europe and between the EU and third countries, and finally contribute to the worldwide attractiveness and competitiveness of the EHEA. Promotion of European cooperation within the EM programme aims at developing long-lasting collaborative models among European universities for the delivery of international joint study (training / research) programmes with an integrated mobility component, and is in line with the objectives of the Bologna Declaration.

The newly proposed programme contributes also to strengthening European Innovation Capacity by providing knowledge in an area where many gaps exist. The tangible embedding of food safety and energy sustainability; environmental impacts of food production (Life Cycle Assessment); effects of climate change on food safety, sustainable food production and quality; predictive modelling and quantitative (microbial, chemical) risk assessment, providing predictive tools for the food industry, policy makers and managers to formulate and implement risk management policies and controls with the view to protecting human health will also have a major impact on uplifting Europe's innovation capacity. Current quality assurance and control tools are insufficient in dealing with the emerging threat of climate change, demonstrating the need for a concerted multidisciplinary effort to address this issue. In response to this challenge, predictive modelling tools can be applied to evaluate the effects of climate change on food safety with regard to managing this new treat for all stakeholders, including industry, government and regulatory agencies.

Not a single course currently exists, where the essential elements of risk assessment, predictive modelling and computational optimisation are brought together with both sustainability principles of food production and food processing as well as energy and food chain concepts, within one coherent structure at a level for master’s students.
NEEDS ANALYSIS

Transformations are taking place in agribusiness like never seen before. As global population and income rises, agriculture has become a key focus in a world that needs more food and energy. The industry is facing challenges driven by the globalization of food production and distribution, growing food price volatility, the rising importance of environmental sustainability, rapid technological innovation and new demands for biofuels (Munang et al. 2011). There are many different views as to what constitutes a ‘sustainable’ food system, and what falls within the scope of the term ‘sustainability’. Strictly speaking sustainability implies the use of resources at rates that do not exceed the capacity of the Earth to replace them. For food, a sustainable system might be seen as encompassing a range of issues such as security of the supply of food, health, safety, affordability, quality, a strong food industry in terms of jobs and growth and, at the same time, environmental sustainability, in terms of issues such as climate change, biodiversity, water and soil quality (Thompson et al. 2010; Frison et al. 2011). The value of world agriculture and agri-food trade has also increased in response to recent trade liberalization and economic growth. Producers are operating in a changing landscape of increased international competition, evolving consumer needs, supply and production challenges and complex legal requirements.

On the one hand, awareness of consumer and product safety has probably never been so high. Food safety and energy sustainability has become a priority research area worldwide as the global food supply evolves. The consumers are now warier about the origin, traceability and safety of the food they eat. At the same time, making improvements to the food chain to reduce energy consumption and to ‘prolong shelf life is essential for food security and sustainability but represents a significant challenge for the industry. Food safety and quality worldwide faces increased pressures and challenges arising from the globalisation of food trade, intensive production systems and changing consumer preferences (King et al. 2017). On the other hand, it is estimated that the food chain is causing significant environmental impacts due to CO2 emissions and enormous food waste (Adekamaya et al. 2016; Wittman et al. 2016; Acevedo et al. 2018). Most of this can be avoided, and the vast majority of the remainder used as a resource into the food chain. Life Cycle Assessment (LCA) and related tools (such as carbon or water footprints) have proved to be an essential element on the evaluation of the environmental performance of food value chains (Biswas et al. 2010; Abecassis 2018).

In response to this challenge, predictive modelling tools can be applied to evaluate the effects of climate change on food safety with regard to managing this new treat for all stakeholders, including industry, government and regulatory agencies. Predictive modelling and quantitative (microbial/chemical) risk assessment play a crucial role in food quality and safety, providing tools which are used by the food industry, policy makers and managers to formulate and implement risk management policies and controls with the view to protecting human health and environment (Tamplin 2017; Acevedo et al. 2018). As highlighted in the EU SCAR report (2015), ICTs dominate innovation in our times and it can not only be supportive in innovation processes but also change research. Also in the farm sector and the food chain, the use of ICT has increased strongly over the last decade. However, this is just the start of what could become a revolution in agriculture. It has the potential to change the way farms are operated and managed and it will change the farm structure as well as the food chain in unexplored ways. ICT could support labour efficiency, resource efficiency and close the gap between the producer and the consumer. It is therefore not only relevant for conventional farming but also for organic farming and short supply chains. This means that an agenda for research and innovation topics should be based on a careful mapping of agricultural issues (challenges and opportunities) with the potential contribution of ICTs (favoured over other solutions) and to see where development of those ICTs then makes sense.

NEW PROGRAMME AND ITS STRUCTURE

The long lasting cooperation and the existing fully complementary expertise of five European partners (KU Leuven, Dublin Institute of Technology, University College Dublin, Anhalt University of Applied Sciences, and University of Malta) evolved into the development of novel and unique project, European Master of Science in Sustainable Food Systems Engineering (FOOD4S ‘food force’). This interdisciplinary programme in innovative fields assembles a broad coverage of areas and subjects that could not be provided at any single institution alone. It offers an education which is at the same time broad and in-depth aiming to foster and develop knowledge and awareness of scientific trends in food science, safety and quality, food product and process design, sustainable production, ecological footprint and quantitative methods and risk analysis in food systems in a global context as 4S stands for Science, Sustainability, Safety and Simulation. The needs analysis revealed there is a requirement for such oriented programmes in education and professional field. The proposal is also in line with the strategic objectives of the WHO European action plan for food and nutrition policy in protecting the food chain, prevention and control of foodborne contamination and food safety management, which makes FOOD4S very topical. Participation in the programme is not only beneficial to graduates but to the European Union as a centre of excellence in learning and is strengthening European Innovation Capacity.

FOOD4S is designed as a 2-years master programme of 120 ECTS. The Programme will commence with four compulsory modules (total of 30 ECTS) offered by KU Leuven, Technology Campus Ghent. These courses will provide students with the fundamentals of the programme, which are captured by the 4 S’s: Science, Sustainability, Safety and Simulation. Then students are given a choice between two blocks of modules (to be taken as a whole). UCD offers a module block on (Computational) Risk & Safety and DIT offers a module block on Innovative Technology. Each path in Ireland is awarding another 30 ECTS. In the second year of studies, students will select a module block of UMalta or UAnhalt dealing with, © EUROSIS-ETI
respectively Energy & Food Chains or Sustainable production. The module blocks organised by UCD and UMalta are primarily computationally oriented while the module blocks of DIT and UAnhalt are mainly technology oriented. Students can freely combine a module block of DIT or UCD on the one hand with one of UMalta or UAnhalt on the other hand, thus aiming at a computational orientation or technological orientation, or a mixture of these. This allows students to differentiate based on the knowledge and skills they desire to develop. Figure 1 illustrates possible tracks (students take one track of each colour, blue component being mandatory).

![Figure 1. Taught modules tracks](https://www.kuleuven.be/english/education/quality)

The programme will also require the students to undertake a professional competence module as well as to work on a scientific project (and to submit a thesis) in one of the partner institutions. Proper selection of the professional competence module location and the Master thesis subject further allows to strengthen the computational, technological, or mixed profile. The award of the European MSc degree will be based on the successful completion of the modules (80 ECTS), professional competence module (15 ECTS) and the Master thesis (25 ECTS). It is envisaged to deliver a joint degree to all successful graduates.

**QUALITY ASSURANCE SYSTEM**

The consortium is committed to maintaining its academic standards across all courses and enhancing the quality of its learning and teaching provision. Quality assurance will be based on both internal and external assessment measures. The KU Leuven system of internal quality review will be fully implemented in the total of the course, and will be supervised by the quality management service of the coordinating partner KU Leuven (https://www.kuleuven.be/english/education/quality):

- **COBRA - INTERNAL QUALITY ASSURANCE METHOD** - stands for Cooperation, Reflection and Action, with attention for Checks & Balances. The assurance of educational quality is the central focus of the study programmes at KU Leuven.

- **EXTERNAL QUALITY ASSURANCE** – Programme assessment and accreditation - KU Leuven takes care of and accounts for the quality of its educational policy and quality assurance.

**Instruments for educational internal quality**. KU Leuven has various instruments to monitor and stimulate the development of educational quality (e.g. student university-wide surveys, blueprint and programme action plan):

- University-wide surveys gather data in a systematic and standardized way. These data provide both the course programmes and the university as a whole with information on several aspects of education: (i) All course units are evaluated via the student evaluation of teaching, (ii) The curriculum evaluation surveys bachelor and master students who are about to graduate, about the quality of their course programme and the preconditions necessary for offering the course programme, (iii) Every two years the alumni survey gathers information from graduated master students about the course programme they followed and about their career. At the moment of the survey, the alumni have graduated about one year before.

- In the blueprint course programmes indicate the way in which they translate the university-wide and faculty vision on education, present their profile, and explain what they stand for.

- The programme action plan receives input from the information and action points that come up in COBRA, and also gives an interpretation of the priorities in faculty policy plans and developments within the course programme itself.

In addition to the central quality system of KU Leuven, the FOOD4S course will also apply an additional joint questionnaire on **Satisfaction analysis for students on lecturers and teaching methods**, which allows for an immediate and individual electronic fast-format assessment of every lecturer in every module. These actions will be conducted both for the course units taught at KU Leuven and the course units taught in the other consortium partner institutions. Essentially, this tool is mentioned to provide the lecturer quickly with an idea of the perception by students on his teaching activities and hence, allow to improve teaching performance. The short questionnaire is including questions on the teaching style and methods, the teaching materials and content and the appropriateness of that lecture/topic in the module. At the end of each module, all students are requested to fill in the online questionnaire for each lecturer who was active in this module. Students are filling in the survey anonymously using an online learning platform Toledo.

The proposed project is yet to be approved for funding by the EACEA upon submission with the current call for proposals EAC/A05/2017. The satisfaction analysis has been thereby based on the preceding programme, European Master in Food Science, Technology and Business (BiFTec), on which the current FOOD4S proposal has been built (www.biftec.be).

**SATISFACTION ANALYSIS RESULTS**

32 lecturers teaching to three cohorts of students (2015 to 2017) in 12 different modules offered along the consortium partners have been assessed by this means. 80% of students responded to each online questionnaire on the specific teaching staff. The results have been gathered and presented in Figures 2-10.
Figure 2. Satisfaction analysis on Choice of Learning Content

Figure 3. Satisfaction analysis on Teaching Time

Figure 4. Satisfaction analysis on Teaching Performance

Figure 5. Satisfaction analysis on Structure of the Lecture

Figure 6. Satisfaction analysis on Contact with the Students

Figure 7. Satisfaction analysis on Self-confidence of the lecturer

Figure 8. Satisfaction analysis on Pace of Teaching

Figure 9. Satisfaction analysis on Availability of Learning Materials
findings to verify the efficiency of taken corrective actions.

Corrective actions and suggestions will be made to improve as well as overall summary among the entire gremium. The questionnaires will then be compared with the present outcomes for the individual teaching staff, the results are a satisfaction. Upon careful analysis of the particular materials could be further improved to increase the overall satisfaction. Satisfaction analysis on teaching staff performed among latest three cohorts of students of the preceding Erasmus Mundus programme revealed that overall teaching performance is considered as “very good” to “good” by 78% responding students, “acceptable” by following 19%, “rather bad” by 2% and “bad” by 1%. Corrective actions are applied on annual basis serving for continues improvement of ongoing programme as well as these results will also provide a good basis when setting up teaching staff for the new project.

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WEB REFERENCES

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