

## New Agri-informatics MSc Curricula in the Hungarian Higher Education

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### ABSTRACT

The University of Debrecen in Hungary has already 30 years' experience in computing, informatics training in agriculture. The education programs in agri-informatics have been continuously changed in various accredited training programs. The different levels of IT knowledge and education programs / subjects exist in different levels, such as Vocational Education, BSc, MSc and PhD levels. The five years long Informatics Agricultural Engineer education program has been introduced in the 2002/2003 academic year. During the past decade the reform of higher education was started to implement according to the Bologna declaration. The new Hungarian Higher Education system (the Bologna system) was introduced in the 2006/2007 academic year. From this date two-tier (separate bachelor-and-master-level) programs were introduced on the 3 + 2 model in certain disciplines. The agro-informatics BSc in 2006 and a new MSc education program in 2013 have been accredited. The enterprises and farmers in the Hungarian agro-food sector and governmental offices demanded to start this course because there is digital gap between the sector of agro-food and other sectors, especially between rural and non-rural areas. This statement is justified by numbers of our researches and PhD thesis. The BSc course gives practice-oriented knowledge and competences, the MSc gives deeply theoretical ones. The rate of the core informatics and applied informatics subjects is about 40 % of the subjects groups (agronomy, informatics, economics and management, law and public administration). This paper gives information about the development roadmap, results, demands, the accreditation process, the content of the new MSc agri-informatics programs and the challenges.

**Keywords:** Higher education, informatics, agriculture, curricula.

### 1. INTRODUCTION

The Hungarian Higher Education Act terminated the former dual (college/university level) training system and provided opportunity for the implementation of the new linear higher education training system including the conditions and procedures of establishing and launching training programs. Hungary - with the exception of artistic training - switched over to the multi-cycle training, using the experiences gained from the experimental training launched in 2004 and 2005 (Herdon, 2005) with the comprehensive launch of Bachelor programs in September 2006. During the first cycle, in the fields where experimental training had commenced earlier (IT, engineering) the first students graduated in 2008; however, higher numbers of students were expected to finish their studies in 2009. The training frameworks of the various programs are defined by the program completion and exit requirements, which are regularly published by the

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Ministerial Decree. From 2009 the Master level training system has been built as a phasing-out system of the Bachelor level training system launched comprehensively in September 2006. The development of Master level programs began after the commencement of the first training cycle. The earlier university and college level training system played a less significant role in the establishment of programs (Herdon et al., 2003). However, in general, the higher education institutions strived to have a second cycle program built on the first cycle programs in every field. Professional university workshops also took the initiative, using their scientific background and personal conditions to prepare special training programs focused on narrower fields instead of more generalised programs (Csirik, 2008).

Looking back to 80's, we started to teach subjects in computing 30 years ago. After introducing a few subjects we created a specialised curriculum involved practice-oriented subjects (Herdon, 1997). During this period we developed more curricula and accredited education programs. The main milestones were the following on this path.

- 1987 Postgraduate Specialization on computing in agriculture
- 1995 Agricultural informatics specialization
- 2000 Business informatics specialization
- 2003 Agricultural informatics university degree education program
- 2005 Agricultural informatics and administration BSc program
- 2008 Informatics in rural development specialisation in Business informatics MSc
- 2009 Planning new postgraduate program in agricultural informatics
- 2014 Master in Agricultural Informatics and Administration Engineer.

## **2. THE DEVELOPMENT PROCESS**

### **2.1 Analysing the education programs**

In Hungary 3 universities, the University of Debrecen, the Corvinus University of Budapest and the Szent István University have developed a BSc curriculum, namely an 'Agricultural engineer for informatics and administration' (Herdon, 2005). The students have to get 180 credits in the training. The rates of the credits are the following: a. General knowledge 20%, b. Agronomy knowledge 16%, c. Administration 18%, d. Economics and related subjects, 13%, e. Informatics and specialised informatics knowledge, 33%.

The credit belongs to the main different groups of subjects:

|   |             |
|---|-------------|
| a. General knowledge:                                 | 28 credits  |
| b. Agronomy:  | 21 credits  |
| c. Public administration:                             | 18 credits  |
| d. Economics and related subjects:                    | 24 credits  |
| e. Informatics and specialised informatics knowledge: | 36 credits  |
| f. Special subjects:                                  | 29 credits) |

There are two specialisations of this course (two training directions) in the 3 academic years. Students can gain specialised knowledge in public administration and informatics. In the informatics specialization they can learn the following subjects: Agricultural information systems: FADN, IACS, Market Information Systems, Statistical System; Internet application development; Information management; Management and organisation; IT in food quality

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management; Management information systems; Expert systems; Project management; Remote sensing; Sector specific solutions. Other optional subjects that can be chosen free by students take 9 credits and the value of thesis is 15 credits.

## 2.2 The Hungarian Higher Education System

Actually in Hungarian Higher Education there are both BSc and MSc courses in the field of applied agricultural informatics. The BSc course is called Agricultural Engineering in Agricultural Computing and Policy Administration. Currently this BSc course is running at the University of Debrecen Faculty of Applied Economics and Rural Development and at the Corvinus University of Budapest Faculty of Horticultural Science. Earlier, this course was also started at the Pannon University, at the Szent István University and at the University of Szeged.

The new MSc course seems to be started at the University of Debrecen Faculty of Applied Economics and Rural Development in the next semester (2014/2015 academic year). Why are these courses important? First of all, the requirements of the potential workplaces were considered during the preparation of these courses. In our opinion the potential workplaces are the following: governmental offices (ministry, agricultural administration), food industry (mainly enterprise information system expert), the traditional agriculture (producer, activity controller), and education (agricultural professional, agricultural informatics).

The trend in Hungarian agricultural informatics education is the following. When the BSc course started in 2005 there were three determining universities (Corvinus University, University of Debrecen, Szent István University) in this course. Because of the alteration of the Hungarian Higher Education currently it is reduced to only two ones.

The Hungarian Association of Agricultural Informatics started a student thesis competition for applied agricultural informatics. If we look at the student thesis activity (92 thesis were applied) we can see that the students of the Corvinus University (26 thesis) and the University of Debrecen (40 thesis) made the most of the thesis. We hope that the new MSc course will be popular and also supported by the employer's.

## 3. THE NEW AGRO-INFORMATICS MSC

### 3.1 Planning the education program

The agricultural informatics university level training program was introduced into the Hungarian Higher Education system in the 2003/2004 academic year (Herdon et al., 2003). Students started their studies in three sequent years at the University of Debrecen. Our five years' experience met our expectations, as 50% of the first students finished their studies in the 2007/2008 academic year. Based on our experience we developed a new BSc program, called „Informatics in agricultural administration” which started at 4 universities. Although the officers in the Ministry of Agricultural and Rural Development and other professionals expressed their demand for such training programs and experts, the supported intake remained low. The facilities of graduated student for continuing their studies on master level are not clear yet. The best solution could be a master similar to the former university level program.

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That is why we made a proposal for agricultural informatics course based on the “agricultural engineer for informatics and administration” BSc course. The antecedent of our MSc course proposal is the present university degree program and our long term experiences in specialized courses. The appropriate conditions of human resources and other education facilities were provided.

The areas of main studies were the following:

- General natural sciences (5-10 credits)
- Economics and agronomy (8-20 credits)
- Applied informatics (10-30 credits)
- Different informatics topics and applications (25-45 credits).

The education system is based on the MSc course and on the appropriate BSc course regarding the content and competence aspects. The BSc course tried to give practical oriented knowledge, while the MSc gives deeply theoretical one.

The agricultural training program specialized in informatics designed Master of IT in agricultural engineering should be established according to the trade unions and different professional organisations. The IT in agricultural engineering (MSc) training program has been developed. This training program is based on the university level program which was introduced in 2003/2004 academic year. The first student graduated in the 2007/2008 academic year. According to our experience, the involvement of the demand side into providing the appropriate conditions is necessary. The main academic training areas are the following:

- a.) **General Basic Knowledge.** The specific sections of mathematics and informatics (especially including the applications of mathematical methods, operation, mathematical statistics, information and system theory) and there is some need for further basic science. (25-35 credits)
- b.) **Main Economical and agricultural skills.** The engineering features of the content and extent of special agricultural knowledge (environmental and water management, Grassland, Plant, animal, crops and livestock) and agro-economic skills (business economics, organizational and management skills, accounting, logistics, marketing). (25-45 credits)
- c.) **Applied IT skills.** The department ensures that the area will be converted into knowledge about the most useful application of information technology in the rural areas: databases, application development, infrastructure management, integrated information systems, multimedia, high-precision agriculture. Deep, detailed technical knowledge, research and development work are necessary to develop professional skills related to IT applications in different fields: industrial management, information systems, e-government, e-business, computer-aided design, modelling, special applications (soil information systems, health information systems, food safety, information technology support) (20-30 credits)
- d.) **Other Knowledge.** Students can learn subjects in other training at our or other university. ( 6 credits)

### 3.2 The content of the application

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Training is required for the rural and agricultural development. In order to increase the efficiency of management, business, association, the innovative capability must be improved and regional and specialized levels of management have to be created at the level seen in the industry (Nábrádi, 2007). The various sectorial issues, such as food quality, product monitoring, logistics systems, the development of rural areas, the spread of electronic business systems, the necessary services, the biological and technical data and the development of knowledge, can't work without the appropriate application of information technology, economic and agricultural knowledge and the existence of professionals who are capable of developing information systems and operating them in a creative way. The information systems-specific technologies have been and are increasingly used in practice in the e-government, e-business, agricultural engineering, environmental protection areas, as well as agricultural management. The new functions and systems of knowledge and utilization of such knowledge are essential for the rural areas, agriculture and the closely related sectors (Csótó and Herdon, 2008).

### **3.3 The Curricula**

The development of the curriculum based on our experience and demands was started in 2013 and coordinated by the Department of Business and Agricultural Informatics. The curriculum consists of three main parts: informatics, agricultural economics and engineering knowledge complemented by general knowledge (human, social and language).

The aim of the MSc level training is to train experts for developing and managing informatics systems related to agricultural and linked area in the knowledge based information society. The graduates have to be able to understand the real production, operation and business model and they have to be able to make information models, to develop the informatics systems and run them. They can solve the problems related to informatics and information system with rapid developing and changing computing and telecommunication tools. The ability of modelling and creating or finding the suitable solver algorithms is also necessary. An important objective is that the professionals can understand the agricultural, economic and administration flows supported by informatics systems and can cooperate with experts of other areas. The MSc degree course takes 2 academic years, the necessary total learning time are 1500 hours and the necessary credits are 120. The rates of subject groups are the following (Figure 1.):

## Share of subjects groups in the curriculum

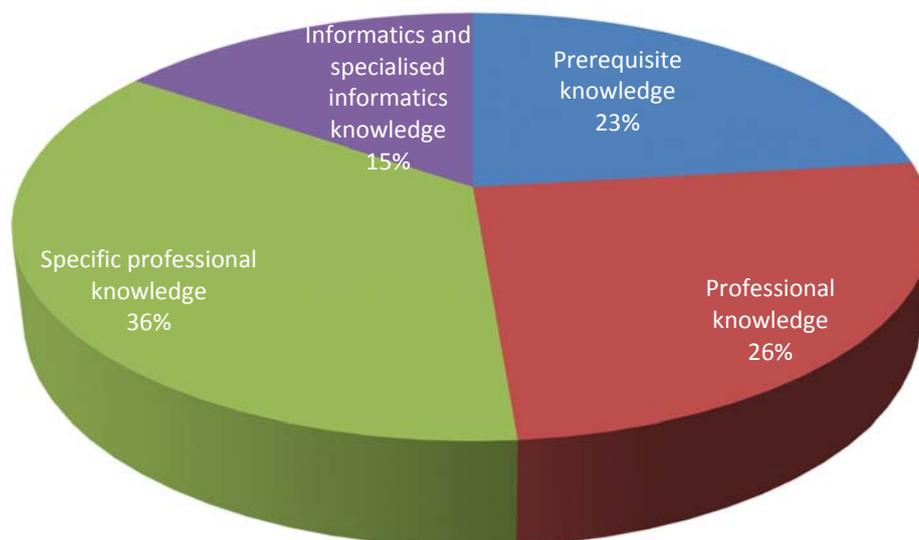


Figure 1. Subject groups in the Master in Agricultural Informatics and Administration Engineer course

a. The subjects of prerequisite knowledge (26 credits) are the following: Software development technologies, Sustainable agriculture (horticulture and animal husbandry), Business law, Modelling agro-ecological systems, Agri-environment, Business economics, Managers accounting, Research methodology.

b. Professional knowledge (37 credits): The features of the training determine the necessary knowledge in Agricultural economics and informatics. The main subjects are the following: Development of agricultural-specific software systems, Info-communication network systems, Database systems development, The agricultural public administration and organizational management system, Management information systems, Environmental informatics - Remote sensing, Agricultural economics and Agricultural policy, Agriculture and environment statistics, Agricultural information systems, Decision support methodologies and applications.

c. Specific professional knowledge (31 credit): Datamining, e-Agricultural public administration, e-Business, Biometrics, Environment economic modelling, Precision agriculture, Expert systems in agriculture, Local Rural Development and extension, Environmental and nature protection policy, Management and organization theory, Economy of agricultural sectors, Quality management, Ecological Land Use, Food Chain Management, Logistics.

d. Informatics and specialized informatics knowledge (6 credits). This gives convertible informatics knowledge which can be used in different areas in agriculture and rural development.

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The optional subjects are the following: Mobile Internet applications in agriculture, e-Learning Technology and Knowledge Transfer, Traceability in the food chain, Information systems development methodologies, Internet application development, IT controlling and audit.

The professional training enables graduates to work in the agricultural public administration organizations, local authorities, research and development institutions, economic organizations (agricultural and food industry, IT companies). This work is related to the diploma thesis and it takes at least 4 weeks (160 hours) professional activity.

This course is unique in the Hungarian Higher Education System. We start our program this year in September. We hope other universities are going to be interested in similar training too.

### **3.4 The training and outcome requirements**

The various sectorial issues, such as different kinds of information systems, the development of agro-environment, the necessary services, the agricultural and technical data and development of knowledge, can't work without the appropriate application of information technology, economic and agricultural knowledge and the existence of professionals who are capable of developing and operating information systems in a creative way. The information systems-specific technologies have been and are increasingly used in practice in the e-government, e-business, agricultural engineering, environmental protection areas, as well as agricultural management. The new functions and systems of knowledge and utilization of such knowledge are essential for the agricultural areas and the closely related sectors. This can be the demand of the Agricultural Engineer in Agricultural Public Administration and Agro-informatics MSc. The aim of this MSc course is to educate agricultural professionals who are able to develop a knowledge-based information society on the field of agro-business, value-creating processes and related IT systems, management and operation of developments. Professionals must create an interaction between the IT system and its' supporting agricultural, economic, public administration management system processes, cooperation with the experts in particular fields, formulating strategic and operational tasks related to the organization and in conjunction with that process experts able to find a solution for the information management system.

## **4. CONCLUSION AND FURTHER PLAN**

The University of Debrecen, Hungary has already 30 years' experience in agricultural computing, informatics training. It has been continuously changed in various accredited training curricula which have been developed and introduced. They have been introduced with a lot of difficulty but they have been a success. The university was the unique who introduced the IT in agricultural engineering training program in the country. 5 universities have introduced the new BSc. The current barriers, the economic informatics MSc with IT in rural development specialization may be appropriate for an intermediate solution. However, the MSc educational system is about to start, but we hope to succeed in this field by implementing an appropriate and useful training program

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