

## THE EXPERIENCE OF MULTI-BRANCHES STUDY ON INSTITUTE OF ECONOMICS AND CONTROL SYSTEMS

Vladimir Kebo<sup>1</sup>, Vladimir Strakos<sup>2</sup>

**Abstract** *The Institute of Economics and Control Systems is one of the biggest on the Faculty of Mining and geology, VŠB-Technical University of Ostrava. The institute has got three departments, which grants five branches of graduate engineering study:*

- Automation and Computers in Raw Materials Industry
- Commercial Engineering in Raw Materials
- Economics and Control in Raw Materials
- Geographical Information Systems
- Systems Engineering in Raw Materials

*All the study branches have got the same scientific base, the information collection, information processing and information presentation for control and decision-making. The core of the study branches is utilisation of information on different levels of the control hierarchy of raw material industry.*

*Each institution has got limited sources for activity support, personal – social, educational, scientific, technical, etc. There is real economic purpose to arrange all the institute activities by the most effective way. It means good organisation of lectures and seminars in education, creation of multi-institutional teams in science (breaking of artificial borders between study branches, institutes, faculties, etc.), utilisation of science potential of all level students, cooperation with industry and utilisation of multimedia technique. The paper provides our experience of management of multi-branches study on our Institute of Economics and Control Systems in all above-mentioned basic areas.*

### INTRODUCTION - HISTORICAL ROOTS

The Institute of Economics and Control Systems was created by connection of two relatively independent departments of Automation in Mining and Economics in Mining. Before the connection there were next situation.

*The department of Automation* has supported two study branches:

- A) “AUTOMATION AND COMPUTERS IN RAW MATERIAL INDUSTRY”

Study of this branch is oriented to utilisation of computers systems for automation of production parts or technological

processes. Curriculum and subjects of this study branch consists of four parts:

- a) Theoretical subjects
- b) Hardware and technique
- c) Software and application
- d) Automation in industry

Graduates of this branch of study can work in all industrial branches, where we can use, for the analysis and synthesis of technical system, transportation or energy networks. They use the knowledge as designers and systems analytics at production or information complexes and the knowledge of up to date SW systems gives them possibility to find a job as supervisors of computers networks, systems programmers and experts for design, utilisation and improvements of computer and information networks. They obtain information and experience to work with algorithms and programming tools that provides them good chance for finding a job in information technology area.

- B) “GEOGRAPHICAL INFORMATION SYSTEMS”

This study branch has got interdisciplinary orientation that is unique within the whole Czech Republic. Geographical information systems are very useful especially in state administration and in up to date information technology that has utilisation in all branches, where it is necessary to process, to store and to present space- or geo- information. This could be firms and institutions, which use map information for their activities. They are for example bureaus of environmental protection, bureaus of mines, municipal bureaus, agricultural and forestry bureaus, etc. The most important source of space- and geo-data are not only the geodetically measured data and existing maps, but aerial and satellite slides and digital data from such a sources. The study has two regular forms Bachelor study and Engineer study.

*The department of Economics* has supported one study branch:

- C) “ECONOMICS AND CONTROL IN RAW MATERIAL INDUSTRY”

The study is oriented to economics and control of business bodies. Special subjects cover the area of economics and financial management, accountancy systems, decision and

<sup>1</sup> Vladimir Kebo, VSB-Technical University of Ostrava, Institute of Economics and Control Systems, 17. listopadu 15, Ostrava - Poruba, 708 33, Czech Republic, [vladimir.kebo@vsb.cz](mailto:vladimir.kebo@vsb.cz)

<sup>2</sup> Vladimir Strakos, VSB-Technical University of Ostrava, Institute of Economics and Control Systems, 17. listopadu 15, Ostrava - Poruba, 708 33, Czech Republic, [vladimir.strakos@vsb.cz](mailto:vladimir.strakos@vsb.cz)

optimisation systems, utilisation of computer technique, design of control and organisation structures, banking, marketing, quality control, business systems, commercial aspects, etc. Graduates from this branch of study should find jobs in the area of analysing and designing of commercial and business activities with respect to raw material connections. They are able to work at economics-managers positions, in commercial sector, financial institutes or economics-advising firms.

The department of Economics has had next activities in North Bohemia town Most, in the centre of brown coal colliery.

The reason for the joining of the departments was the reorganisation of our Faculty of Mining and Geology and the fact that there were a lot of relatively small departments (12 departments). The above-mentioned departments have similar objects – *control and management*, but for different hierarchical levels. The joining of pedagogues gives the possibility to improve the technical knowledge of economics part and next improvement of economical knowledge of automation part. There was a resistance again the joining, but now we can find more and more examples of interdisciplinary cooperation and information exchange among our colleagues.

After political changes in Central Europe there were changed economical relations and consequently there appear a shortage of economists with commercial education. The demand for new managers of small and middle enterprises initiated new branch of study “Commercial Engineering in Raw Materials”, as one of our most attractive study branches this days. The development of computers and information technologies changes the importance of systems engineering from the economical to cybernetic sphere. It was the reason to create new branch of study “Systems Engineering in Raw materials” which is oriented to application of general systems and control theory at all levels of management-control hierarchy.

### PEDAGOGIC AFTER DEPARTMENTS JOINING

Study programs on our faculty have some regulation and common study base. First year of study, first and second semesters, is common for all study branches of the same type. In second year of study there are common only three subjects in third semester. Next parts of study programs are organised by a branch supervisor that grants education and scientific level of students. Each study branch supervisor has got his own view of subjects’ composition within the study programme. There were, after departments joining, a lot of very similar subjects with different extents and names. This led to enormous demand to learning range of institute pedagogues. In table 1 we can find a part of subjects of third year of study. There are a lot of similar subjects with extreme variability of them.

The association of departments brings some advantages, as for example is:

- attraction of economical and commercial study branches brings next students to technical study branches of our institute,
- concentration of different specialisations of pedagogues brings new cooperation possibilities in the research area, we are able to solve multidisciplinary tasks and projects on our institute,
- the solving of multidisciplinary projects activates creativity of our pedagogues and researchers with reflection to innovation of educational processes, utilisation of multimedia technique, etc.,
- concentration of technical, economical and commercial study branches inside one institute has extended the offer of optional study subjects, it means economical subjects for technical study branches and technical subjects for economical study branches.

TAB. 1 EXAMPLE OF MANDATORY DISCIPLINES IN THIRD YEAR BEFORE JOINING OF DEPARTMENT

<i>Branch of study</i>				
<i>Automation</i>	<i>Economy</i>	<i>Commercial Eng.</i>	<i>Systems Eng.</i>	<i>GIS</i>
Computers	Norms	Law of works	Methodology	Photogrammetry
Non-linear systems control	Automation	Law of government	Operations analysis	Regions planning
Transportation Equipments	Prognostics	Safety in industry	Automation	Data processing
Automation of measuring	Accountancy 1	Foreign language	Systems	LD prospecting of earth
Models making	Accountancy 2		Programming	Automation
Apparatus for automation	Organization		Planning of systems	Safety of data
Mining	Finance		CASE	Modelling of landscape
Computers control			Firms theory	Software for GIS
			Stochastic	

TAB. 2 THE DISCIPLINES PROPOSEED AS COMMON FOR ALL STUDY BRANCHES

Statistic	Mining	Cybernetics	Ecology	Basics of GIS
Theory of Law	Preparation	Theory of Systems	Economics	Foreign language
Physics	Safety of Industry	Informatics	Economy of Firm	
		Computer Disciplines		
<i>Automation</i>	<i>GIS</i>	<i>Systems Engineering</i>	<i>Economy</i>	<i>Commercial Eng.</i>
Operation Systems	Operation Systems	Operation Systems	Accountancy	Accountancy
	Civil Service	Civil Service	Civil Service	Civil Service
	Database	Database	Database	Database
		Firms Theory	Firms Theory	Firms Theory
		Operations Analysis	Operations Analysis	

TAB. 3 THE PROFESSIONAL DISCIPLINES FOR INDIVIDUAL BRANCH OF STUDY

<i>Branch of study</i>				
<i>Automation</i>	<i>Systems Engineering</i>	<i>GIS</i>	<i>Economy</i>	<i>Commercial Eng.</i>
Theory of Automation	Informatics	Photogrammetry	Norms	Working Law
Automation of Measuring Apparatus for Automation	Operations Analysis	Regions Planning	Prognostic	Administrative Law
Models Making	Methodology	Data Processing	Accountancy	Commercial Law
Computers Control	Systems	LD Prospecting of Earth	Organization	Financial Law
Automation of Production	Planning of Systems	Safety of Data	Finance	Environmental Law
Automation of Technical Service of Production	Models Making	Modelling of Landscape	Theory of Firm	Public Law
Dispatching Control	Computer Networks	Software for GIS	Management	Criminal Law
Distributing Control	Objects Programming		Prices	Economy of Firm
Robotics	Stochastic		Market	Management
Artificial Intelligence			Personality	Accountancy
				Business
				Finance

**SUGGESTION OF COMMON ORGANISATION OF FIVE YEARS MASTERS ENGINEERING STUDY**

The main aim of new study organisation is improvement of efficiency of our educational programs and rationalisation students curricula of our all study branches. This way we can increase effectively our pedagogical activities and create capacity for research and scientific activity. So the first step was unification of subjects content, unification of range and names of similar study subjects. Now are lectures of such common subjects collective for a few study branches. One of possible new study organisation we will find in table 2. In the table there are not subjects of first year of study and obligatory subjects. Average student has to choice about ten obligatory subjects during five years of regular engineering

study. In table 3 you see professional disciplines for the individual branch of study. As we have got 26 pedagogues on our institute, we can derive from tables 2 and 3 that they have to support 58 compulsory subjects. It gives about 8 hours of lectures per one week and per one pedagogue. In comparison to actual state it gives reduction of educational charge to one half.

**SUGGESTION OF THREE STAGES STUDY**

The three-stage study program means implementation of Bologna declaration into practise. We do some steps to prepare our study programs and branches to be competitive within study programs all over the world.

TAB. 4 THE MANDATORY DISCIPLINES FOR BACHELOR STUDY. THE OPTIONAL DISCIPLINES ARE CHOSED BY STUDENTS ACCORDING TO ABOVE PRESENTED BRANCH OF STUDY.

<i>Informational and Systems Management</i>		
<i>1. Year</i>	<i>2. Year</i>	<i>3. Year</i>
Mathematics 1	Applications Programming	Analysis of System
Mathematics 2	Multimedia Systems	Systems of Integration
Physics	Operations System	Accountancy and Finance
Descriptive Geometry	Control of Systems	Management in Economy
Science of Earth	Theory of firm and Marketing	Sociometric and Prognostication
Basics of Informatics	Stochastic Methods of Modelling	Design Seminar
Basics of Economy	Logistic of Industry	Semesters of Project
CAD - Constructive Geometry	Political Science	
Informatics System	Theory of Law	
Theory of Systems	Foreign Language	
Psychology		
Foreign Language		

We have got deep tradition of university education in Central Europe, as our Charles University is one of the worlds oldest (founded in 14-th century). We have got about 300 years of technical education tradition, where the full engineering education needs five years of hard study. This way it is very difficult for us to split the five years into 3 bachelors study years and next 2 years of engineering study. As we cultivate students in five up to date study branches (automation, GIS, systems engineering, commercial engineering, economics and management) we create the base of new bachelor study program to support next development of information technologies.

As the first step to three stage study system we prepared bachelor study branch "Informational and systems management, ISM". The base of compulsory subject of this new study branch ISM is in table 4. We have the idea that this bachelor study branch will create the core of next common base of first step of study program on our institute. Formation of next engineering stage will be supported by the obligatory subject, see table 3.

The third stage – the doctoral (Ph.D.) studies are the most specialised and have got only a few common disciplines. We do not feel necessity of reorganisation of our doctoral study stage, where we have got three study branches:

- Automation of technological processes
- Economics and control of enterprise
- Geoinformatics

### CONCLUSION

Next development in our society and on the world will evaluate our plans. We hope we will have the possibility to present our experience on some of next ICEE conferences.

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