# STUDY PROGRAMMES INNOVATION IN THE BRANCH OF STUDY "QUALITY OF PRODUCTION"

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***Abstract:*** *The intention when writing this paper has been to present a relatively exhaustive set of the knowledge necessary for innovation the study programmes that fall, at Slovak Republic, under the study branch 'Quality of production'. Covered in the paper are principles and concepts of study, salient knowledge and capabilities of the student, and a proposal for innovation the study programme on all three levels of study. Though the paper is partially a result of resolving project included in it are findings identified during past and on the quality of production focusing projects of the authors, whilst the paper is, to a significant degree, influenced by the process and results of international evaluation of Higher Education Institutions (HEI) by the European University Association (EUA) of 2008, by results of complex accreditation of HEI of 2009 and also by results of evaluation according to the Academic Ranking and Rating Agency (ARRA) of 2010. It is intended for anyone interested in improving the quality of research and educational processes, and also for specialists performing in the field of quality.*

***Key words:*** *study programme, production quality, engineering and quality management, innovation of the study programme*

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## 1. Introduction

Study branch is a field of cognition that may become a subject of Higher Education Institution (HEI) teaching on some of its three levels. A study branch is demarcated by its content that is characterised especially by the field and extent of knowledge, abilities and skills that shape the graduate (Act, 2002).

The purpose of this paper is to present a relatively exhaustive set of the knowledge necessary for improving the quality and innovation study programmes that fall, at Slovak Republic, under the study branch code of 5.2.57 'Quality of production'.

Statement of the principles and concepts, clear formulation of the mission and vision and of salient knowledge and abilities of the graduate should always present the basis of a study programme resolving.

When arriving to a specific solution we expanded on our previous projects, have used survey of updated bibliographic resources focusing on supporting of the EU 2020 strategy, have included results of questionnaire surveys, and also results of interviewing students, teachers and employers.

Thus, the paper includes the study principles and concepts, salient knowledge and abilities of the student, and suggestions for improvements necessary to be introduced to innovate a specific study programme.

The solution contains a model of principal and related knowledge and work abilities for the study branch 5.2.57 'Quality of production', as well as a graphical aid for outlining the research and education according to groups of study branches.

## 2. Principles and concepts

To clearly define principles and concepts of the study, at disposal are paradigms and quality theories on one hand and legal regulations and external and internal directives holding for the institution on the other one. Domineering within developing our existing university study was the systemic quality paradigm (Zgodavova & Slimak, 2008), and within that especially:

- Persuading the university inside and outside environments in real time,
- Allowing for the fact that the system quality emerges from its components and manifests within internal and external relations of these components,
- Understanding the internal and external quality of any.

Pondering on the external quality of a HEI should be complex in the sense of reciprocal action of work, production and life of the people as regionally so globally. The study programmes resolving proposal rests in respecting the requirement for three-level university study in accordance with the Bologna declaration (Bologna process, 1999) at considering the corpus of knowledge of the Accreditation Committee, Advisory body of the Slovak Republic Government (AC).

Studying the production quality field should allow the student to attain the knowledge, foresight and skills necessary for achieving a successful career, and the mission and vision of individual study programmes should be accordingly thus oriented and drawn up too.

## 3. Methodology used

A host of experts and organisations define the concept of quality differently. Majority of them define quality as a 'degree' or 'level' – a stage on a scale of values. Individual definitions present varying possibilities of expressing gradation of the basic, philosophical understanding of quality. Yet, quality is that which makes the given stuff (entity) the specific given stuff (entity). And entity is whatever that can be really or virtually meaningfully contemplated. Following from the preceding considerations as the 'narrower' definition of quality that we are using for years in our undertakings:
"Quality is the collection of properties of an entity that manifest through salient functions in the given environment and time." (Mlcoch & Slimak, 1987).
The critical factor in change of the quality level is the notion of a quality optimum (i.e. requirements of people and organisations from the point of their perception of quality of work, production and life in a specific environment and time).

Proposal of innovation study programmes in the branch of 'Production quality' is based on three pillars of the EU 2002 strategy, i.e. on intelligent, sustainable and inclusive growth (European Commission, 2011), and its baseline are our previous KEGA projects (Zgodavova et al. 2010a), final evaluation reports of the European University Association (EUA) (Jensen, et al. 2007), survey of latest literature, a questionnaire survey and interviews with students, teachers and employers.

The knowledge attained from the above-mentioned projects and from the bibliographic survey has been arranged into five groups that are necessary for resolving the study programme:

- Meaningfulness of acting: Purposive orientation towards the mission, vision, values, salient functions, and specific subjects and phenomena.
- Complexity of quality: Understanding quality in an organisation must be complex in the sense of quality of work, production, life and current depth of cognition (Zgodavova, 2010).
- Management integration: Management of an organisation must be integrated in the sense of joint managing of quality, environment, safety, information, finances and social responsibility of the organisation (Ozen, 2011).
- Totality of the quality management: Quality must extend into all activities of the organisation processes totally. Total Quality Management (TQM) is crucial for reaching entrepreneurial success in the 21$^{st}$ century (Salvatore, 2007)
- Time and financial efficiency: Reducing costs by implementing new technologies and through using the top-notch Information and Communication Technology (ICT) (Erdem, 2006).

To help us better define varying quality levels of universities and of individual study programmes, as well as to incorporate the widely-changing idea of the notion of optimal level of students of 'better' and 'poorer' schools we chose to create combined

small-scale selections with 9 students in each selection, 9 teachers in the intentional selection and with 9 employers in the intentional selection.

Students:

- Selection of nine students; always and intentionally three from the best rated school (study programme), three from an average-rated school (study programme), and three from the worst rated school (study programme) – according to the criteria of AC and the Academic Ranking and Rating Agency (ARRA) – identical in this case.
- Selection of nine students deliberately made to reflect their study results (the best, average and the worst) from randomly selected various universities.
- Selection of nine students from randomly selected various universities.

Teachers:

- Selection of twenty-seven teachers, always deliberately three guarantees of a study programme, three guarantees of subjects, and twenty-one other tutors from randomly selected universities.

Employers:

- Selection of nine employers was performed intentionally: three of them from the region rendering the study programme, whilst three were from small-scale companies, three from medium-sized ones, and three from larger corporations.

Summary of the information attained from the questionnaire survey, survey of the literature, and Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis of study programmes falling under code 5.2.57: Quality of production, from the point of students, teachers, and would be HEI graduate employers (KEGA, 2010), when in the ‘eemployers’ part these were extended by information attained from a survey publicised in the Economic newspaper article (Chalupova, 2010):

- Students: Decrease the volume of graduate form of education; transparent determination of the study arduousness according to the European Credit Transfer System (ECTS); Use of case studies and of the best practice; participation on projects; specialised stays; lectures delivered by external experts; study flexibility (free choice of subjects).
- Teachers: ability of the student to learn, think critically and to self-assess their abilities; teamwork; work with information; learn from the better ones.
- Employers: communicability; problem-solving abilities and ability to present results; having spirit of enterprise; creativity; teamwork; enthusiasm.

Proposed, based on the above-outlined information, was to adjust the profile and advantages of an ISR study programme graduate, and submitted was a proposal to decrease extent of the study and to re-evaluate credits for individual subjects. Proposed to be included in the study were new subjects that support creativity, as well as new forms of education based on simulation games, case studies and best practices, and education utilising the terminology – Glossary Based Learning (GBL).

## 4. Salient knowledge and working capabilities

We propose to design the study programme in accordance with the matrix of required working abilities and salient knowledge that are outlined in Tab. 1, and in accordance with the synthesised pieces of knowledge derived from both domestic foreign study programmes and also considering requirements of the European Organization for Quality (EOQ), and moreover with strict adherence to the requirements of the American Society for Quality (ASQ) so that developed would come creativity, originality, professionalism and entrepreneurial spirit of the student. Special attention, when designing study programmes, should be paid to harmonising the process of research, education and business-making whilst not losing sight of salience of study lines of individual universities and faculties.

Graphical illustration of contents of study programmes within a three-level study in the branch 5.2.57 'Quality of production' and a brief description of the knowledge, skills and working abilities of the graduate of bachelor, engineer and PhD. studies are presented in Tab. 1, which may come handy also at resolving specific study programmes according to their scientific and pedagogical focus and at considering fields of research for individual universities or faculties.

Considering the broader, philosophical understanding of quality, quality of production can be both analysed and studied from a host of aspects, and besides it pertains to a variety of domains of the society. Engineering is exactly the branch that unifies the rest of scientific disciplines (CIRE, 2011) and especially quality engineering, quality management and integrated management are study programmes that are examples of it.

When outlining the focus of study programmes in the 'Quality of production' branch the problem may be disunity in breaking down fields of research in Slovakia, e.g. separation according to (System of study branches, 2002), according to research supporting grant agencies, e.g. Scientific grant agency of the SR Ministry of Education, Science, Research and Sports (VEGA) but also within Europe or globally. Just to throw some examples consider (System of study branches, 2002), (List of fields of research, 2006), (VEGA Committee, 2008) and according (FOS, 2007). Groups of fields of research and of study branches in Slovakia and FOS:

- Groups of study branches (System of study branches, 2002): 1 Training and education; 2 Liberal arts and arts; 3 Social, economical and legal sciences; 4 Natural sciences; 5 Design, technologies, manufacturing and communications; 6 Agriculture and veterinary sciences; 7 Healthcare; 8 Services; 9 Information sciences, mathematics, information and communication technologies.
- Groups of study branches (List of fields of research, 2006): 1. Pedagogical sciences; 2. Liberal arts; 3. History sciences and ethnology; 4. Art; 5. Designing, engineering, technologies and water management; 6. Social and behavioural sciences; 7. Law and international relations; 8. Economy and management; 9. Physics and sciences related to the Earth and Universe; 10. Environmental sciences and ecology; 11. Metallurgical and mining sciences; 12. Chemistry, chemical technologies and biotechnologies; 13. Living nature

related sciences; 14. Mechanical engineering; 15. Electrical engineering and power engineering; 16. Informatics, automation and telecommunications; 17. Engineering and technologies; 18. Medical and pharmaceutical sciences; 19. Agricultural and forestry sciences; 20. Veterinary sciences; 21. Sports related sciences.

- Groups of study branches (VEGA Committee, 2008): VEGA1 Mathematical sciences; VEGA 2 Physical sciences; VEGA 3 Sciences related to the Earth and the Universe; VEGA 4 Electrical engineering and informatics; VEGA 5 Mechanical, metallurgical and material engineering; VEGA 6 Building, architecture, mining and geo-technologies; VEGA 7 Medical and pharmaceutical sciences; VEGA 8 Molecular and cellular biology; VEGA 9 Biological and ecological sciences; VEGA 10 Agricultural, forestry and veterinary sciences; VEGA 11 Chemical and chemical-technological sciences; VEGA 12 Social sciences (philosophy, sociology, political science, theology); VEGA 13 Sciences about the man (psychology, pedagogy, physical education); VEGA 14 History; VEGA 15 Sciences on art, aesthetics and lingual sciences; VEGA 16 Economical and legal sciences.
- Groups of study branches (FOS – OECD, 2007): 1) Natural sciences; 2) Engineering and technologies; 3) Medicine and health related sciences; 4) Agricultural sciences; 5) Social sciences; 6) Liberal arts.

As an aid for drawing up research and education issues for individual branches of study groups, areas of research and educational levels whilst considering their varying segmentation, is a tool for developing variant of solutions. (Presented in Fig. 1).

Attained by rotating two or more circles (according to the field of interest of HEI or specific faculty) can be combinations reflecting various viewpoints, and next elaborated can be a more detailed description of the study programme reflecting its salient features and its complexity (Zgodavova, 2010).

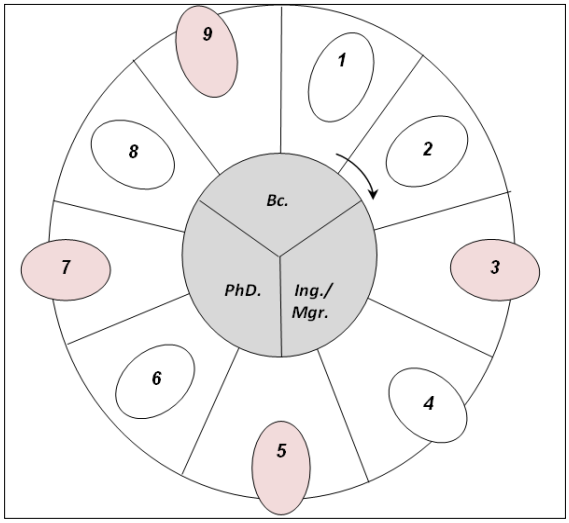


Fig. 1. Aid for drawing up research and education per groups of study branches according to the field of interest of HEI or specific faculty.
– selected study branches of the HEI

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|---|---|---|---|---|
| **WORKING ABILITY** | Principles and concepts of an ahead complex innovation with regard to uniqueness of the organisation. | | | **3rd level PhD.** |
| | Researching complex improving of the organisation quality of work, production and life. | | | |
| | Assessment of the standing and development of the tendencies of quality of work, production and life of the organisation. | | | |
| | Re-engineering (radical improving of) quality of work, production and life of the organisation. | | **2nd level Ing.** | |
| | Total quality management and complex management of the quality of work, production and life of the organisation. | | | |
| | Measuring and assessing results of the production quality engineering and managing. | | | |
| | Production processing operative quality management. | **1st level Bc.** | | |
| | Step-by-step quality of production improvements. | | | |
| | Measuring and assessing the production quality. | | | |
| | | Branch-wise metrology of the quality of products and processes. | Engineering metrology. | Theory and methodology of the situation measurement |
| | | Theory and methodology of operative quality control. | Theory and methodology of managing and improving quality of production. | Theory and methodology of complex improving. |
| | | Kaizen – Incremental improvements. | Re-engineering – radical improvement. | Theory and methodology of creative thinking and innovative acting. |
| | | **SALIENT KNOWLEDGE** | | |

Tab. 1. Illustrative description of principal and related salient knowledge and working abilities for the study branch 5.2.57 ‘Quality of production’ is presented below

## 5. Conclusion

Success rates of the HEI study graduate in "Quality of production" is subject to their creative thinking and innovative actions in originality of designing, in meticulousness of makings and in the level of rendering appropriately innovated production, which guarantees continuous loyalty of all interested parties in the given environment and time.

Universities, companies and research centers of the European Union should collaborate for increasing the quality of the educational process, for an increased competitiveness at an international level, for the development of competences of the teaching personnel as well as the improvement of administrative and legislative mechanisms in order to encourage the development of e-learning (Negrut, et al., 2010).

To further develop HEI studies in the branch of 'Quality of production' in Slovak Republic, though the same holds also for any country, summarized can be the below pieces of knowledge:

Principles:

- Philosophic understanding of quality and quantity of salience, and complexity of entities.
- Thorough exercising of the systemic paradigm of improving entities in the given environment and time.
- Attaining synergic effects of external and internal managing of situations, processes and products.

Concepts:

- Appropriateness in respecting complexity of quality of work, production and life within study programmes falling under the study branch and field of research.
- Proportional gradation of the structure and extent of the bachelor, engineer and PhD. education.
- Training.
- Orientation to the success of research, education and practice in the branch of 'Quality of production' according to genetic and dynamic dominants, as well as to current barriers existing in the broader vicinity of the HEI whilst considering the extent of globalisation (and impacts of the crisis).

Recommendations:

- Establishing new and innovating already existing study programmes depend on capabilities and creativity of their authors: guarantors and the research team, etc.
- Developing creativity in study programmes can be effected especially within volitional subjects and by gradual improving independent work of the student

based on new ideas and suggestions assigned within seminars, semester projects, bachelor, and diploma and dissertation projects.

- Factoring in creative ideas when developing new study programmes beginning with human resources as the students are, through the academic staff up to external interested parties.
- The most appropriate solutions of the creative teams for improvements can be implemented by creative improvement teams in educational, research and entrepreneurial processes.
- Utilisation of salient abilities based on dominants of the Slovakian development.

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