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SELECTED ASPECTS OF ASSESSMENT/IMPROVEMENT OF ACADEMIC RESEARCH QUALITY, ALSO OF INDUSTRIAL MANAGEMENT

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Abstract

In terms of publishing and commercialisation of academic research results, there may be more preferred qualitative research in the long term. But, not every research can be focused only on the quality of its outputs, but each output of the research, however, should have an adequate quality and added value. The main research question of this article may be determined as follows – How can the quality of academic research be better evaluated and thus improved, also in the area of Industrial management? It is not the intention of this article to perform statistical research in the field yet, but this study is based on empirical data and results.

Key words

Academic research, Assessment/evaluation and improvement of research, traditional and innovative approach, value-added, competitiveness, innovation, efficiency.

INTRODUCTION

Currently, many academic teams in the world try to cope with *the problem of the research funding decline* from public resources and increasing demands for self-acquisition of their own resources through national and international research grants, and the commercialisation of their own research and education. If this process is not properly regulated also in the EU, it can dramatically change the purpose and nature of academic institutions, namely from institutions primarily focusing on education, on institutions primarily focused on research. In countries like Spain, Italy, Greece, Portugal, France, Germany and the UK have already appeared several academic initiatives for the „conservation“, promotion and development of the public

research/education infrastructure, as the basis for high quality development (particularly of basic research), university education and knowledge society.

In Slovakia, universities face similar problems and challenges that are also multiplied by the continual decline in number of students, negative media marketing, growing demands on academic administration, the novelty of many international academic/scientific rules and standards and changing backgrounds, in terms of the long-term systemic public support for academic research, patenting and commercialisation of research results. In many spheres of public life, there are emerging views (in the long-term) that academic research/education is quite remote from real practice needs (Hargreaves, 1996). This issue may be however subject to individual circumstances, public and business support, fields/attractiveness of study, academic orientation and genuine interest of students in learning. It is not correct to evaluate all universities in this way, on the basis of partial weaknesses of some institutions. One of the main problems of academic teams (not only in Slovakia) is also a certain linguistic disadvantage/barrier, when it comes to publishing, patenting, or applying for international research grants compared to colleagues from the UK or USA. But, in terms of improving the quality of academic research, it is increasingly necessary (in the long-term term) to analyse, plan, organise, promote and supervise research activities also at the public level so as these follow and promote educational, business and socio-cultural processes and goals of academic institutions in a region, sector and country, where they operate. Thus, the academic research (also in Slovakia) requires *complex (public) coordination and support systems*, which will appropriately guide the focus and different aspects of academic research (including IP protection) and its links to enhancing the quality of education so that research and education mutually follow-up and do not change the (already mentioned) character and purpose of academic institutions. It is also necessary to systematically promote positive examples/practices of research and education at universities (also in the Slovak Republic), which are often (under modest conditions) comparable in many aspects with foreign universities. The need is also to make public efforts to attract foreign students, and to ensure that our students are not leaving abroad for study and subsequent work.

A high quality academic environment can promote the *better intensity of innovation activities* of enterprises in a region and sector. In developed economies, there are founded several thousands of new start-ups every year that significantly affect the regional business environment and employment. In Slovakia altogether, there are about 550–600 start-ups, while about 85 % of them are still in the development phase (It.justice.gov.sk, 2012). One of the main problems of these start-ups can also be an inadequate link of their innovation activities to academic research. For other SMEs in Slovakia, there exists a similar pattern/problem. One of the main assumptions of the synergy: science–research–education–business and society is to focus on more qualitative aspects of academic research and education, while taking these relations to prioritise and use the relevant regional resources, capacities, aspects and advantages. But, the so-called traditional linear model (basic research–applied research–development–dissemination of new knowledge etc.) however, in the current turbulent environment may not be fully applied. And, more research at universities may not secure also a higher quality of education or academic reputation (Lindsay et al., 2002). Academic research should be oriented so that it does not only bring a certain uniqueness, credibility and competence to the university, but also to the occupation, region and industry.

Because of the wide range of research quality issues, this article deals only with the selected aspects of academic research quality assessment and improvement, also in the area of

Industrial management. It is not the purpose of this article to analyse and assess, but partially to orient and support improvement of academic research quality, while this methodology could be similarly used in other areas of social and related sciences.

INTRODUCTION TO SELECTED ISSUES OF ACADEMIC RESEARCH QUALITY IMPROVEMENT

Industrial management (IM) is a specific topic of research and study programmes in several academic institutions focusing mainly on the analysis, planning, design, innovation, implementation and organisation mainly of production systems/processes in industrially oriented enterprises and on the development of creativity in the field of engineering, and technology (PortalVS, 2015). IM can also include issues of strategic management of industrial enterprises, operations management, business economics, and even the extension in operational/system analysis, logistics, human resources, investment, financial innovation, information, and environmental management (MTF, 2013). IM can be an instrument based on the so-called managerial and engineering approach (i.e. Dual ladder system of education) aimed to analyse, synthesise, compare, and generalise systematically various aspects and issues related to the management of industrial processes and organisations. IM can also include the generation and modification of industrial systems that integrate soft and hard industrial technologies, information and knowledge, materials and energy etc. – in a more efficient, more productive and purposeful manner (JIMA, 2014 and CIM, 2015). The aim of research in the field of industrial and related management processes is to promote entrepreneurship based on industrial production, industrial innovation and related socio-environmental sustainability. Many famous universities have included these topics in their own research and education programmes, such as the *Illinois Institute of Technology; Fanshawe College London; Wayne State University (Detroit); Stony Brook University (NY); but also the Institute of Industrial Engineering and Management of the Slovak University of Technology, or the Department of Industrial Engineering and Management of the Technical University in Košice*.

In terms of the quality improvement and synergistic outcomes of academic research in the field of Industrial management, perhaps the best known example of the positive analogy/connection is *Stanford University and Massachusetts Institute of Technology* with companies in *Silicon Valley* (SV) (Jaffe, 1989). In the SV, however, there are also several other academic institutions: *the College of San Mateo; De Anza College; University of California, Santa Cruz; San José State University*, etc. Based on the analysis, we can say that all these institutions deal with the issues of research quality evaluation and improvement, and some included the quality of research in their curricula. Companies and institutions in the SV area provide about 1.4 million jobs, with an average monthly salary of about 8 100 EUR, and register about 15,000 technology patents P.A. (Siliconvalleycf, 2014). For the comparison, in Slovakia in the years 1980–2013, there were recorded together (in the database WIPO) 10,956 technology patents. Slovak universities register approximately 860 patents in the database ÚPV SR (ÚPV SR, 2015). Synergies that create science and technology parks and related research have significant effects not only on the regional economy, but also on the national attractiveness and competitiveness. According to the study of Stanford University, after the year 1990, approximately 39 % of the graduates have started their own business in the SV that contributed to the global economy with over 3 trillion USD (Siliconvalleycf, 2014). The most important companies in the area are: HP, Apple, Intel, Cisco, Oracle, etc., the global leaders in unique

research and technological innovation, which is largely conditioned by the quality of local academic research institutions. Other positive examples include top universities such as *Cambridge (UK), Harvard Business School and UC Berkeley (USA)*, but the positive results are achieved also by less known universities like the *University of Udine (IT), the Technical University in Brno (Czech Republic), or University of Ljubljana (SI)*, which are surrounded by technology and innovation companies and produce high (often radical) technological innovation in the industry. Positive examples of cutting-edge research can also be found at the STU. For example, *IBM in cooperation with the STU and DWC Slovakia* are working on the project named Research centre for analysis and data security for mobile devices. A positive example is also the university *science park STU in Trnava* (Cambo), focused on the research of materials engineering, especially ion and plasma technology, and the automation and informatisation of industrial processes, etc.

Also at the public level, many countries are now paying increasing attention to the quality of academic research as the key factor promoting their basic research, which often presents a radical (technological) innovation and significantly changing competitive forces in the region. Many countries support these activities by systemic strategic legislative actions. Among such positive examples can be included: *„Development Plan for World Class Universities and Research Centres of Excellence" (Taiwan); „Project 211 and 985" (China); „Center of Excellence for the 21st Century" (Japan); „Initiative for Excellence" (Germany); "Research Excellence Framework" (UK)* etc. At the EU level, in 2000, the EC adopted a strategic document entitled *"Towards a European Research Area"* in order to improve gradually the conditions and the environment for science and research in EU countries. In 2012, the EC adopted another important document entitled *„Enhancing and focusing EU international cooperation in research and innovation: a strategic approach"*. This document sets out a new strategy for international cooperation in research and innovation, particularly with regards to implementation of the programme Horizon 2020. However, these two strategic documents (as well as the *Lisbon Strategy*) do not contain many references to the improvement of research quality as the basis for better innovation and increased competitiveness of the EU. For example, in the US exists two public research agencies (NSF and NIH), which are designed to ensure the quality and integrity in research programmes. Since, high quality research can not only attract the best students, researchers and professors, but as well as more grants, subsidies and investments in the region and provide more innovation, patents, qualified workforce and the development of the necessary know-how and thus better living standards for people in the region.

INSIGHT INTO SELECTED ISSUES OF ACADEMIC RESEARCH QUALITY ASSESSMENT/IMPROVEMENT

One of the main divisions of academic research is into basic and applied research, or theoretical/methodological and practically-oriented research. The core of basic research should be in the study, evaluation and generalisation largely of theoretical principles, methods, knowledge and laws (i.e. *pure basic research*). Theoretical research also requires investigation, testing or comparison of practical phenomena and processes in order to make generalisations of the examined theories. The new theory then to a greater or lesser extent reflects the real phenomena and processes, and may have the potential to be used in practice (i.e. *Oriented basic research*) (Eurostat, 2015). Practical/Applied research can (then) build on these new theories in

order to apply them in practice (i.e. *Pure applied research*). However, practical research may also examine the phenomena and processes that have not had defined generalisation yet, but have (but do not need to have) the potential to be applied in practice (i.e. *Oriented applied research*). Thus, to some extent, it is sometimes difficult to "isolate" basic and applied research and their forms, and it is also difficult to generalise precisely, what is the quality (criteria) of basic and applied research. However, in the perspective of general academic research, it is necessary to distinguish the criteria for the evaluation of basic and applied research.

The topics of Industrial management research may cover basic or applied research, depending on the purpose, scope, procedures and outcomes of this research. International and national pressures on academic institutions for creating their own financial funds including commercialisation of their own research may imply focusing researchers at universities more on applied research topics, which may have *less academic effects and the value* for the study. The second important effect may be the effort/need of researchers for the disproportionate acceleration of research (mainly of analytical phases), and thus the negative impact on the quality of research outputs. Therefore, one of the ways to promote/improve the quality of academic research is to define clearly, what is the role of specific research teams in the development of basic and applied research (also in terms of time and responsibility), and how to assess more complexly/objectively basic and applied research. Even within the social sciences study. There should be given adequate attention, evaluation and public support for basic research, which in turn can significantly promote the quality of applied research in various fields.

The research that is focused on the quality of its outputs and related effects can be called *qualitative research*. Qualitative research may require an approach, technology and methodology that has more an innovative unstructured nature; methods that are more "sensitive" to the socio-environmental context; a methodology that is more radical and inductive (e.g. long-term observations, video analysis, innovative analogy, unstructured expert interviews etc.); information that contains more complex and detailed data, more comprehensive, specific and valuable conclusions etc. (Spencer et al., 2013). Qualitative research usually focuses more closely on areas/problems that are analysed/researched within the available capacities/possibilities of the researcher/institution (i.e. *Depth of research*), not only in terms of the existing methodology and issues, but as well as to the analogies from other areas, significant practical applications, more innovative know-how, future prospects and circumstances of the research outputs application, generalisation and complexity of the research effects etc. Therefore, the procedures, criteria and evaluation scales of qualitative research should be more complex, for example, compared to (pure) quantitative research.

The diversity and specificity of academic research, but can also mean substantially simplified terms/conditions, procedures and outcomes of the research, also in terms of qualitative research. In academia, we can find two extreme possibilities of qualitative research: qualitative research based on analysis/synthesis/comparison of quantitative data and of qualitative data. It is usually necessary to combine both these options, especially when the more complex and long term research is performed (Ryan, 2005). The advantage of using quantitative data in research is the availability of faster, more accurate information. These are usually obtained by deduction, and have better controllability. *Qualitative data* may require more teamwork/expert assessment, induction, visualisation/ interpretation/testing, exploring their individual and group context, etc. But usually, they have higher information value regarding

the conclusions/benefits of research, and thus the better impact on quality of research results. Just this type of research can be significantly „weakened“, when accelerating the research.

The *traditional assessment* of academic research by standards of research outputs may often fail (Boaz – Ashby, 2003; Lin et al., 2014). One of the reasons can be a very individual (basic) nature of the research, the lack of links between the orientation of research, education and innovation activities in the region and industry, lack of time and know-how for the assessment, and consensus among evaluators (Furlong – Oancea, 2008). A common problem of the research evaluation is possible bias of the evaluators, improper composition of the assessment team, and its own goals, priority goals of the research sponsor focused on maximum economic impacts and rapid return on investment, lack of knowledge on the research issues and legislation, constantly changing rules, failure to identify deception in research, etc. (Boaz – Ashby, 2003). In terms of traditional (bibliometric) assessment of basic and applied research, one of the most exact indicators (in terms of publications) is the *Citation Index* (Lin et al., 2014). Citation Index, however, depends not only on the quality of research, but mainly on the applicability of research results in practice, the possibility of research commercialisation, the attractiveness of research, the reputation of the journal, the publisher, the author and institution. Thus, even lower quality of research can be more cited. But, the number of citations is only a quantitative indicator (Zinkhan, 2004). Citation Index for the following reasons may be considered also as a complementary indicator of research quality. With the number of citations is also related the so-called *Impact Factor* (IF) of academic journals. IF reflects the average number of citations of recent (usually annually calculated) articles published in the journal. IF is calculated by Thomson Reuters. IF as a criterion for evaluation may also have the weakness: the so-called distribution and averaging of citations within the journal can be distorted/overvalued by particular periodicals, because the input data is not publicly available and submitted by the journal. (ASCB 2012) For many top research teams in the world, IF is often used only as an indicator of the relative importance of research within their field.

Regarding the criterion: *number of published articles*, this criterion can be also applied as a complementary indicator of research quality. Articles published in leading/reputable scientific journals (with a long tradition) can be a certain, but not complete guarantee of research quality. Based on the analysis of Lillard et. al (1986) carried out in the years 1977–1986 on five major business journals, this criterion can be also considered as relative. This analysis was focused on the quality of input data of several dozen research articles. The results show, for instance, that none of the authors did pay sufficient attention to examining the quality of own input data. In this context, also important is the issue of articles/patents authorship and the actual research share of individual authors. The quality of academic research can be negatively evaluated, while on less complex research and its publication were *"involved" 5–8 autho*rs. Each of these authors should have a significant role/contribution to the analysis/synthesis/comparison of research results and take full responsibility of the research results (ESF, 2000). In recent years in the academic sphere, there are also appearing “offers” *to publish articles in "reputable" journals* from unknown publishers. Among them are some, who have set up false web pages, „invent“ editorial board, IF, ISSN etc., and then ask for payment to review and publish these articles. Similar procedures are also used for "organising" conferences, "mediation" of licensing agreements for invention, "securing" marketing for approved patents etc. (Kolata, 2013 and Jalalian – Mahboobi, 2014) These shortcomings of traditional research (quality) evaluation, however, are not always valid, but for more objective evaluation of scientific work, it is

necessary to prevent these problems by more comprehensive, less administrative, and more expert-based research quality evaluation.

In terms of *expert evaluation* of the quality of academic research, in 2008, in the UK was conducted the exercise/survey (also to compare traditional and expert forms of research quality assessment) – *UK's Research Assessment Exercise, RAE*. The survey was based on the division of the best academic research results into 67 groups (resp. Evaluation units). The assessment itself was carried out in 15 panel discussions, as well as cross- panel discussions, by the nature of research. The rated research findings were classified into 5 categories (the world's quality, internationally excellent quality, internationally deductible quality, nationally deductible quality, and unclassified research). The evaluation of the academic research quality in the UK was considered as the most comprehensive in history (RAE 2008, Kenna – Berche 2011a, 2011b). The differences between traditional and expert evaluation of research quality were significant. For this reason, the research quality evaluation systems and the subsequent allocation of investments in the UK are primarily based just on this methodology – RAE, while this assessment is repeated every five years. Of course, by this method is not possible to evaluate all the academic research results, but only the most significant ones. This approach also requires specific legislation, infrastructure and capacities, and it is also a more time-consuming approach. But, this research assessment system ensures more accurate results as to the differences between scientific disciplines, since some disciplines may have certain disadvantages, such as biology, mathematics, or physics etc.

In recent times, there have also appeared various critical views on objectivity/impartiality of research quality evaluation based on the RAE methodology, as experts in this evaluation, are just from academic and research institutions. UK government agency aimed at setting and monitoring standards in the field of education (OFSTED) performs also the surveys, how the quality of research at universities affects the quality of education. Based on these surveys, we can say that the academic research in the UK is more focused on business and social spheres as to improve the quality of education. This is the issue in many European countries. At the same time, the problem is also the academic research simplification, shortening of analyses, but also misunderstandings, logical errors in research etc., and only about 30 % of the analysed research results had sufficient scientific quality. (Goldstein, 1998 and Eliott, 2012) *In what way we can more complexly, more precisely and objectively evaluate the academic research (quality) within the existing legislation and capacities? The proposal may be in a combination of these two aforementioned methods of research evaluation.*

SELECTED SUGGESTIONS ON INNOVATIVE RESEARCH QUALITY EVALUATION MECHANISM FOR ACADEMIA

The quality of research is a factor that significantly affects innovations and their commercialisation and the subsequent goodwill of the institution (Fogarty – Blake, 2002). Thus, successful products, services or technologies are also one of the indicators of the quality of research. However, there is usually a time lag until the results of research are translated into final products and services. So, from the perspective of objective research assessment, it is necessary to take into account also a certain delay of success/patenting/capitalisation/ recognition of research results. Academic research is not usually primarily focused on innovation and commercialisation, but on the improvement of academic education (Viceník, 1988), but many universities "produce" cutting-edge innovation. Therefore, alongside of

traditional quality evaluation of academic research, this process may also require the use of the expert assessment quality criteria that may better reflect the multiple dimensions and effects of the research (e.g. educational, medical, economic, technological, social, environmental, psychological etc.) depending on the specifics of research. A possible complementary system of research quality indicators may be based on the assessment of scientific, application, economic and social dimensions of the research and related criteria. However, it is necessary to take into account also the time factor, harmlessness, eligibility, legality, ethics, width and depth of applicability, as well as the improved reputation of the research team/university. It is necessary to take into account also *the differences in the quality of research*/development/patenting/publication related to the scope and purpose of research, and its impacts, costs/expenses and real benefits/outcomes of the research etc.

Additional research quality criteria are related to return on invested funds, but also better competitiveness of research institutions. An economic dimension of academic research should not be overestimated compared to other dimensions and effects of the research: regional, industrial, political, security/critical, ethical, educational, etc., but appropriately incorporated into the evaluation mechanism. Assessment of academic research quality should not only be an administrative, but also teamwork expert process within the capacities and capabilities of the academic institution. It is also necessary to consider, which criteria are most appropriate for the institution, and what are the weights of these criteria. This process can be started with the traditional evaluation and completed by the appropriate expert evaluation of research results. In this evaluation, it is also necessary to take into account also specificities of the research, such as differences between academic disciplines and real possibilities of research results commercialisation, forms of researcher´s employment, length of practice, age, nature and characteristics of academic work, but also created relationships, reputation, competences, value of research, and forms of results. The important factor determining the quality of research is also the quality of scientific, information, knowledge, financial, legislative, and related supporting infrastructure in a place/region, where the research is carried out, but these are the issues for further a more statistical study. In the following diagram, we can find four main dimensions of academic research, and selected criteria that may have an impact on the research quality (Fig. 1).

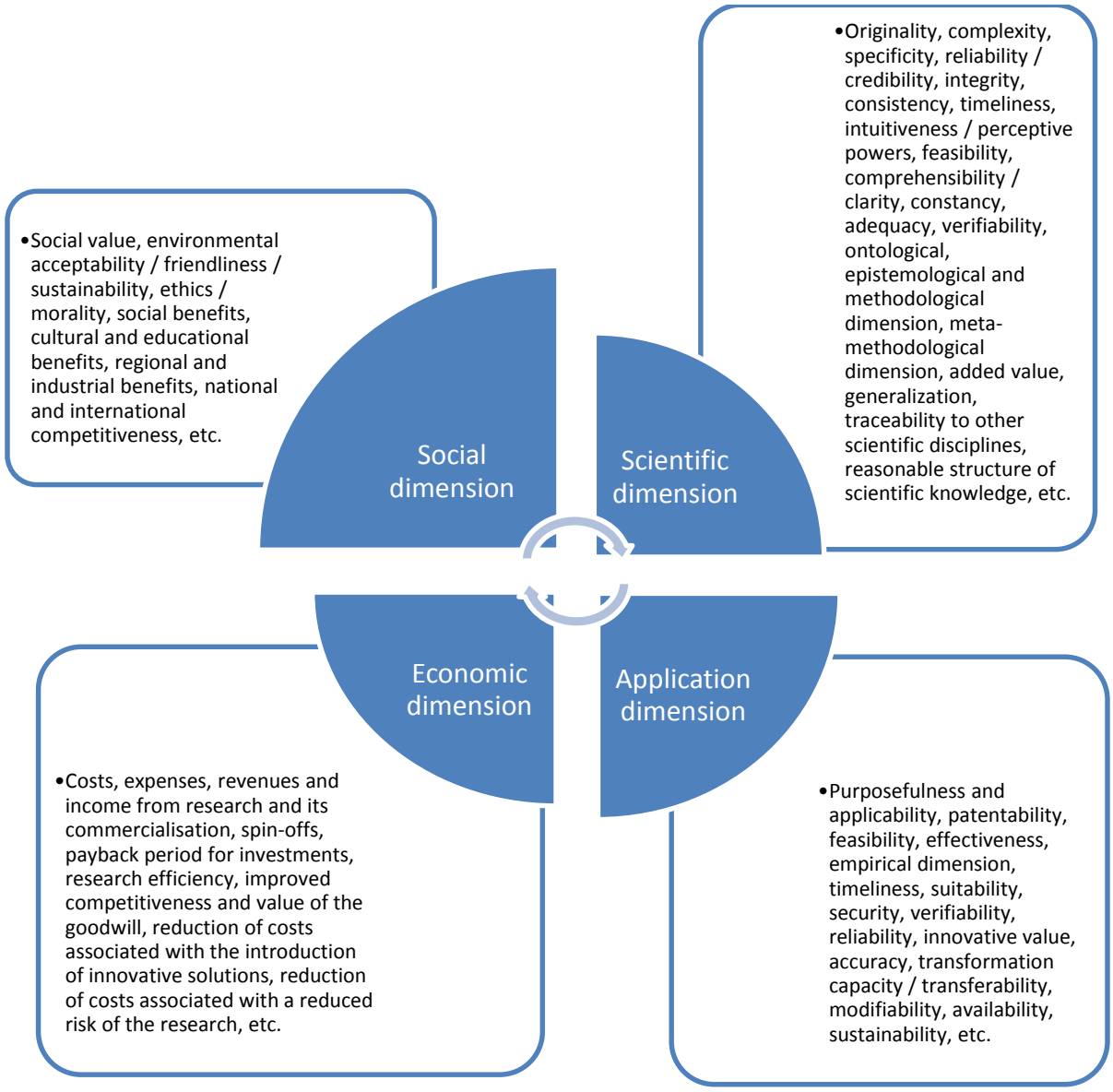

Fig. 1 *Selected key dimensions and criteria of academic research quality, also in the field of Industrial management*
Source: (Own scheme)

CONCLUSIONS

Academic institutions must, in the first place, take into account the general rules and evaluation standards of academic research in view of ensuring their accreditation and related processes. For improving the quality of their own research/education and thus the reputation of the institution, it may be appropriate, if the institution (within its possibilities and capabilities) takes into account also the mentioned criteria and individual dimensions of its research. It is necessary to ensure that this evaluation has objective and positive incentives, and that the university (by this assessment) does not increase, but more facilitate their administrative

activities. It is also appropriate, if to the assessment of academic research quality are also invited some external collaborators from public organisations or private companies. The issue of improving the quality of academic research is not only a matter academic institutions and synergistic relations with the industry and regions. Although, there are significant links between the quality of education, university research results, regional innovative activities and patenting innovations. In these relations is often an important intermediary and coordinator – the state and its supporting institutions. But, this support often requires very specific and interpersonal cooperation with research teams, high level of commitment, awareness, flexibility and willingness of the workers concerned, it is not just the task of certain supporting institutions and general support. The important role in ensuring the quality of academic research, however, primarily has the academic institution and its supporting/motivation, supervision and evaluation processes.

One of the main problems of research in the field of social sciences (also of Industrial management) is that related issues and methodology can have a non-cumulative nature, because only few research teams (worldwide) have been dealing with the acquisition, evaluation, testing, categorisation and „expansion" of related knowledge in complex terms (Hargreaves, 1996). Improving the quality of research within the social sciences has more interdisciplinary dimensions and more direct social impacts, therefore, this research often requires interdisciplinary knowledge and cooperation with other research teams, longer-term specialisation, while there may be fewer opportunities to commercialise research results, particularly as regards to patents, or spin-offs. Therefore, also within the assessment of the quality of this academic research, we should take into account these specificities. In the same time, it is necessary adequately to attract, motivate and stabilise researchers/teachers, and systematically to support research and education oriented to specific curricula and the real needs of practice, profession and region. In spite of numerous supporting European institutions and programs for (academic) research development, there is a certain lack of trust in the society and some disappointment (ESF, 2000). Increasing pressures on researchers regarding the acceleration and quantification of research results must not lead to unwanted results and impacts on the quality of research, education as well as weakening the educational and cultural mission of academic institutions. Otherwise, it is possible that the EU countries will achieve their research goals by 2020, but these results may not have the expected positive impacts on the economy and society!

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