Croatian Higher Education with regard to Teaching, Research and Transfer of Knowledge

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Abstract

With growing pressure for resources universities endure significant transformation. Croatia is a country with recent history of market transformation and has recently joined the EU. As a result of Bologna process and concept of Entrepreneurial University Croatian Higher Education is experiencing revolution of university functions: education, research and transfer of knowledge. Research data was collected via online questionnaire on two Croatian universities. Results indicate significant changes in all three functions of the university. Unfortunately they are not uniformly distributed across all faculties. Despite already made positive adjustments more hard work is expected. Systematic approach and cooperation from private sector will mark the key requirements for further success.

Introduction

As the global crisis took its toll resource management becomes more vital. After industrialism and massive exploitation of resources lost its ability to procure satisfaction, knowledge economy was introduced as an alternative solution (Heng et al., 2012). It is a system where creation and sharing of knowledge plays crucial role in producing prosperity. It is important to create advancement of knowledge and promote efficient use in all parts of society (Mortazavi & Bahrami, 2012). Productivity and growth are less dependent on natural resources and rely more on intellectual capacity and human resource. This transformation has given significant pressure on interaction between government, university and private sector (Heng et al., 2012). Regardless the differences between European and American universities similar developments were found in both systems of higher education. More than ever universities are expected to facilitate economic development and society welfare. With traditional role of education: research and transfer of knowledge become more essential. As with each addition and expectation added to the university agenda all of its previous functions become affected (Philipott et al., 2011). As Croatia became a member of the EU in July 2013 goals of the paper are to examine its higher education reform, starting position regarding transition, implementation of entrepreneurial concept, results of open economy as well as identifying barriers and places for improvement. Since Croatia is a part of one of the most wide ranging reforms of European higher education, implementation of entrepreneurial paradigm will be discussed with consideration of Bologna connection. Based on the primary data collected on two Croatian universities, paper will present results of higher education reform, differences regarding specific environment and its effect on three most important

functions of the university. Introduction of Bologna lead to a significant change of European higher education environment, both extensive and official. European world of higher education known as the 'Bologna Process' is the single most important reform of higher education to take place in Western Europe in the last thirty years (Davies, 2008). Changes involve curriculum reformation, quality improvement, implementation of control mechanisms, guarantee of European Credit Transfer System, promotion of mobility, education and research relationship, accessibility of education, internationalization, long life learning, cooperation with enterprises, openness of universities and design of strategy that would be consistent in obtaining these aspirations. Necessity for university independence and autonomy is also additionally emphasized (The Bologna Declaration on the European space for higher education: an explanation, 2012[i]). With the limitation of resources and increasing demand for efficacy, universities become battlefields of confronting agendas: reduction of budget cost, quality pressure and scope of service. Institutions facing the challenge tried to implement the concept of entrepreneurial university. Concept was introduced in USA and later became a part of the European higher education as well. There were several legal developments that preceded this transformation: Bayh Dole Act 1980, The Stevenson Wyler Technology Innovation Act 1980, Federal Technology transfer Act 1986, some executive orders, court decisions on patenting, licensing technology and subsequent discoveries. Another stimulus happened with relative decrease in government funding and change of R&D treatment (Welsh et al., 2008). Etzkowitz (2004) explained: It is a revolution of university: education as well as protection and dissemination of knowledge, research and application of research results are now all aiming to invigorate socio-economic development.

Transformation of European universities and their role in economic development

Besides entrepreneurs and new firm creation, policy has recently focused on other knowledge generating institutions: research laboratories and universities (EU2020 Strategy and the Education and Training 2020 initiatives). This approach was derived from the larger perspective for fundamental role of knowledge and innovation which is believed to precede production of economic growth, technological performance and national competitiveness (Baumol, 2002). After this premise was widely accepted and developed into main frame for policy creation: universities, public and private research laboratories and government agencies became important players in creating innovative capacity (Cowan & Zinovyeva, 2013). Following previously presented challenges paper examines its influence on university functions and its recursive effects. Two hypotheses were developed accordingly. First hypothesis is given regarding education.

H1: Universities that accept entrepreneurial paradigm will transform their educational function

In the framework of entrepreneurial paradigm there is a tendency to create educational system that will act as a stepping stone for future entrepreneurs and ensure necessary qualification for realization of business ideas. Goal is to create institutional framework that will provide nurturing atmosphere for entrepreneurial spirit and benefit pro-activity of students, while creating mechanism that will provide long-term innovative solutions. Strategy is oriented toward promotion of entrepreneurial spirit and program reform is directed to endorse more space for creativity, innovativeness and international exchange. In order to achieve stronger entrepreneurial capacity more individuals need to be educated, number of years spent in school increased, proportion of international exchange extended and more experimental learning implemented. In its definition entrepreneurial university is striving to

achieve more entrepreneurial intentions of students, professors and employees. As the impact of university spinoff is known, recognition and stimulation of potential entrepreneurs are becoming one of the university's missions. With the implementation of certain specific educational activities there is an attempt to create an entrepreneurial incentive (Kuratko, 2005). In the framework of business management, surpassing boundaries of classical management, entrepreneurial education is in function of boosting entrepreneurial activity. Therefore, the methods of entrepreneurial education may somewhat vary compared with those of traditional university. Entrepreneurial universities encourage creative thinking, critical judgment, innovativeness and nurture entrepreneurial personality (Gibb, 2005). Miclea (2004) considers cultivation of these methods as most important element in entrepreneurial education. As a result of differences depending on the lecturer, motivation and needs of students it is difficult to describe the best methods for entrepreneurial education (Sexton, et al., 1997). Veciana et al. (2005) emphasize importance of successful entrepreneurs and believe their influence on students' with business ideas and entrepreneurial intentions can be measured significant. In addition, project work (teamwork and individual) is also found to be a good tool for experiencing conditions similar to those working in real life circumstances. Autonomy, flexibility, and customization are an important precondition of creating entrepreneurial atmosphere. One expression of flexibility is demonstrated in the environment where students are able to choose courses outside their major discipline. Students should have the option of choosing their obligatory and electives courses according to their personal preferences. They can listen to lectures and test their knowledge in several different studies at the same time. Business sector needs and topics can be incorporated in to the curriculum development as an important part of successful university-business cooperation. During summer leave students need to be able to engage in practical training and project work, often sponsored, where they have the opportunity to see the "real deal" and create networking for future carrier development. Therefore they can experience how things are being done in real life business circumstances where the final result is decided on the market. At the same time they will learn how to utilize university knowledge at work place. Students may foster passion for change, multidisciplinary approach, capacity for learning, social intelligence and competitive advantages (results from Tempus FoSentHE, 2012[ii]). Gibb (2002) argues that best presently available tools are: case study method, lectures, projects, enterprise visits and various types of trainings, while specific pedagogical tools are yet to be developed. These new methods are believed to be more efficient in development of entrepreneurial behavior, traits and skills that will provide experience of real entrepreneurship. There is an apparent transformation from nurturing "lecturing orientation" toward "experimental learning". As university tries to facilitate this entrepreneurial process some changes are happening even in the context of student admission. Some world-class universities have already started to implement new selection criteria. Until recently, only criteria for admission were the initial exam score and success made at the previous years of education. Nevertheless more and more attention is directed to special talents of students which previously were not a part of the selection process. Universities implement entrepreneurial approach in all levels of education: bachelor degree, masters and doctoral programs (Katz, 2003). For example, postgraduate studies with market potential have already demonstrated significant level of flexibility. Their market orientation has significantly influenced formation of its' content. Programs envisioned to be financed by participants who managed to create considerable demand were usually those who cooperated with most prestigious universities. In these types of symbioses universities with high reputation are responsible for providing image, curriculum and expertise of their lecturers, while the host university procures participants and funding that will allow the program to be executed according to desired standard. Additionally long life learning has been recognized as

significant source of funding. Since all the programs at the university are not equally commercialized some redistribution within the university will be necessary for all levels of education to run smoothly. According to literature entrepreneurial university will create significant change of curriculum and methods used in its delivery. With education historically being the basic function of university, following entrepreneurial paradigm research and knowledge transfer are becoming essential parts of economic development (Etzkowitz and Leydesdorff (2000). Therefore second hypothesis was developed as follows.

H2: Universities that accept entrepreneurial paradigm will transform their research function in order to better facilitate knowledge transfer

By their traditional nature universities are not entrepreneurial institutions. While the ratio for research in private sector is clear, its application in academic context remains controversial. Assumption says that university members are intrinsically motivated (Stern, 2004) and primarily concerned for academic freedoms (Aghion et al., 2005) and they get their motivation from other sources: mainly scientific promotion. Nevertheless, recent policy change designed to stimulate economic growth have caused universities and professors to take on a commercial resembling behavior. Even when deciding to embrace university-industry cooperation some dilemma may still remain. Lee (1996) found that primary goal of scientists is more easily met. When working with industry, scientist obtains access to new research funds, materials and equipment, while primary interest of industry representatives is not directly fulfilled. They seek easily marketed products ensuring new revenues and collecting new market shares. Nevertheless, industry representatives keep their insights into current scientific expertise. University discoveries are often distant form market commercialization and need extensive investment before returns become possible. Nevertheless, while managing market competition and R&D expenditure, private firms do seek new entries to external sources of knowledge (Chesbrough, 2003). Fabrizio & DiMinin (2008) claim if there is high level of innovativeness there will be less research. Murray and Stern (2000) disagree and argue substitution may be avoided if innovation is a result of research activity (instruments which are primarily designed for personal needs of researcher) or if research is simultaneously published and commercialized (like in the case of patent followed by publication of scientific work). Nonetheless, due to the nature of patenting results of the research cannot be published before its protection is ensured. Unfortunately academic innovations are stepping stones in market realization and many efforts are necessary to follow up with products ready for profit activities (Jensen and Thursby, 2001). Most data regarding the connection between scientific publishing and entrepreneurial activities is focused on patenting. According to scientific studies of such empirical data no tradeoffs between engagement in patenting activities and scientific publishing were found, while on the contrary some positive association was confirmed on the level of individual scientists (Fabrizio & DiMinin, 2008). It is explained by the resemblance of knowledge for both activities. Patenting and scientific publishing both demand advancement and contribution of thinking. Multiplicative effects might be accomplished whereby understanding leads to application and vice reverse (Callaert et al., 2008). Academic researchers who patent their discoveries are likely to publish more than average, but they are still not the most productive (Meyers, 2006). Breschi et al. (2005) found that patents have long term effects on publication only when scientist has at least two patents. Yet the number of papers is not the ultimate criteria of scientific accomplishment. For that reason impact of the paper should be a better measure of scientific quality. Hicks and Hamilton (1999) discovered that papers written in collaboration with private partners tend to be more cited. Vice reverse, firms that look for university partners for contract research tend to link with those who are more scientifically prominent (Van Looy et al., 2004). This relationship is very

complex. Scientists who do the contract research obtain more funds which consequently spillover into new research and new publications. Contract research may offer opportunity to assess theories in private sector. Theory testing can be interesting for academic community as well as private sector and provide inspiration for additional research (Crawshaw, 1985). Relevance of transfer mechanisms will depend on type of knowledge being transferred. Bulk of knowledge coming from the university is hard to codify (patent). Some tacit knowledge is more easily used trough spinoff activities of contract research (Grossman and Hart, 1986). When discussing relationship between patenting activities and contract research, universities should consider negative tradeoff effects. When creating fully controlled ownership of intellectual property, private firms may feel threatened from university competition. Wright et al. (2008) found that in average size university IP rights and royalty sharing are negatively associated. Similar effect is recognized between spinoff creation and amount of contract research. Representatives of the private sector might feel that the contract research conducted at the university might suffer significant spillover. When scientists already work and run companies in the same niche, private sector may be less willing to cooperate (Oxley, 1997). Although some spinoff activities and industries imply patents, some scientists argue for substitution (Van Looy et al., 2011). Assuming less time and risk prior to profits patents are considered interchangeable for spinoff activities. Therefore universities with more spinoff might have less patents. Stephan (2007) found balance between those who license technology to already existing corporations and scientists who takeover leading roles in newly based spinoffs. Strong positive connection is found for universities with high scientific productivity and entrepreneurial performance (Van Looy et al., 2011). It was decided that participating in contract research will result in better understanding of market potential and business approach. This way research is a starting point to a spinoff creation. Private firms prefer universities with spinoffs and therefore such activities may draw more contracts. On the other hand Bains (2005) argue that most efficient commercial activity for professors is in fact consulting. Klofsten and Jones-Evans (2000) conducted a study on the universities in Ireland and Sweden where they identified some of the entrepreneurial activities. They have come to the conclusion that scientists more often look and participate in consulting and contract research and less in starting new ventures and technology spinoffs. Dabić & Švarc (2011) argue that commercial orientation has caused some dissatisfaction about university independence and survival of science free of interest. In order to keep ethics and role of university as a critic to society Brooks (1993) argue entrepreneurialism should be avoided or least limited. They believe publication of research and education is more appropriate for institutions in service of public good. Even though scientists may be primarily interested in publication and scientific promotion financial incentive may be very convincing. Money could be used for buying equipment in university laboratory, creating funds for students or personal gain. Lee (1996) says that US universities support entrepreneurial initiative but sometimes are unwilling to cooperate with industry. He distinguishes two main reasons that might inhibit knowledge transfer: perception of reducing the level of federal funding and academic freedom. While most policy makers and public support technology transfer, some emphasize additional problems: competition between commercial and traditional activities, need for secrecy and shift of research interest (Thursby et al., 2007). Public interest science is only valuable for creation of economic development if it manages to maintain its traditional role as an unbiased source of information.

When researches efforts help examine forces within commercial activities and national innovation system additional opportunities will arise. Regardless of presently small number of entrepreneurial activities in Europe due to vast numbers of universities and cumulative effect, final result in contribution may onset to be very substantial.

Methodology and data

Croatian academic network occupies six universities located in Dubrovnik, Osijek, Rijeka, Split, Zadar and Zagreb. According to their relevance and scope two of them were selected for the research: University of Rijeka and University of Zagreb. University of Zagreb (1669) is the oldest and biggest university in South-Eastern Europe. Ever since its foundation, it has been continually growing and now entails 29 faculties and three art academies. With its comprehensive programs and over 50,000 full-time undergraduate and postgraduate students, University is the strongest teaching institution in Croatia. University of Rijeka was founded in 1973 as a logical expansion of higher education institutions in western Croatia whose roots date back to the 17th century. From its founding it has undergone a series of transformations which were for the most part the result of changes brought on by the national higher education policies. Its vision targets the inclusion of the University of Rijeka within the top 500 European Universities, thus it has committed itself to dynamic development which systematically facilitates mobility and development of research careers while providing each individual with an opportunity to express their talents and entrepreneurial energy. According to University of Rijeka Strategy 2007-2013 key role of the higher education system, research and innovation in the development of economy becomes more and more evident. In regard, long-term higher education policy should reach two goals: strengthening the system of higher education and research, its efficiency and correlation of teaching and research components and strengthening the correlation between the system and community, especially in those segments which form a knowledge-based society.

Research investigates general support toward the concept of entrepreneurial university, best measurement of its accomplishment according to opinions of their members, different levels of suitability regarding specific characteristics of faculties[iii] and its influence on three most important functions regarding their role in economic growth and welfare of the community: education, research and transfer of knowledge. Extensive questionnaire containing 103 items was distributed among members of two previously mentioned universities. Staff members received the questionnaire via email addresses. These were obtained through official websites of the faculties. Feedback was approximately 10%. After collecting the data acquired sample was 99 questioners. According to Croatian scientific bibliographic base[iv] all respondents were classified in three groups. First group included faculties that belong to social science (economics, law, politics, informational sciences, sociology and psychology), second: natural science and medicine (pharmacy, medicine, chemistry, biology, dentistry) and third group included faculties from technical sciences (electrical engineering, mechanical engineering and naval architecture, construction, computer sciences). Items of the questionnaire were divided in three main parts: 1. education, 2. research and 3. knowledge transfer. Questions were given as Likert scale items ranging from 1 (strongly disagree) to 7 (strongly agree). Descriptive and inferential methods (ANOVA and Kruskal Wallis test) were used to analyze the data collected by the survey.

Development of entrepreneurial university: case of Croatia

Sample characteristics are described in following paragraph. Average length of employment was the longest in the group of social science (7,6 years), than technical (6,8 years) and finally natural science and medicine (5,19 years). Nevertheless, there was a high standard deviation which accounted 90%. Some respondents were very young scientific novices and other long time professors. On the other hand there was a gender balance where 51,5% were male respondents and 45,5% female. There was total of 45,5% scientific novices, 20,2% administrative staff (legal department, technology transfer office, board members ext.),

17,2% assistant professors, 8,1% associate professors and 6,1% full professors. 26,3% spent more than 6 months working abroad and 78,8% would like to do so. 25,3% of the respondents participated in a technological project, while 48,5% had a previous private sector engagement. As a result of working on technological projects 11% of them signed intellectual agreement contract. Number of those who said to be aware of the spinoff activities was even higher (42,4%). These facts do indicate some level of entrepreneurial activity and transfer of knowledge.

Since theoretical background of what is considered the framework of entrepreneurial university is fairly extensive it was important to get some insights into respondents' perception of the phenomenon. Most common choice of entrepreneurial university definition was the one by author Sporn (2001): Entrepreneurial University is the university which is directly involved in exploitation of research results, more intense collaborations with industry and regional economic development.

The level of staff support found among university members was high in all groups. 93,75% of respondents in social sciences support the concept of entrepreneurial university, 86,21% in the group of technical sciences and 81,81% in the group of natural science and medicine. Also it is confirmed by all respondents that the level of self-made income is the best measure of entrepreneurial university. Number of contracts with business sector, number of patents, spinoffs and finally organizational culture were considered as additional measures of entrepreneurialism. Respondents were asked to address the need for differential approach regarding the specific characteristics of each faculty that should or could be incorporated in the concept of entrepreneurial university. Necessity for differential approach was tested and recognized significant (social sciences: p=0,00, natural sciences and medicine: p=0,00, technical sciences: p=0,00). Respondents argue that some faculties are more suitable in creating their own income.

Whole range of items was designed to measure university environment regarding its educational, research and knowledge transfer function. As the several items describe each function of the university linear combination was derived to form a single representation. As the value of measurement increase result is closer to the entrepreneurial paradigm. Education is the oldest and most traditional function of the university. Nonetheless it is expected to change under influence of entrepreneurial paradigm. In order for the university to become more active contributor in creating and transferring knowledge, educational and teaching methods will change to better facilitate this transfer. Results of the questionnaire show some level of change in educational function of the university. Technical faculties had a highest score of 4,36, natural sciences and medicine 4,27, while the lowest score was attributed to faculties in social sciences 4,07. When considering dispersion those differences were not found significant (p=0,742). Students from technical sciences and faculties are more reputable in acquiring high industry positions and more intensively encouraged in research with practical application. This indicates that the curriculum of technical faculties is fairly aligned with the practical needs of the private sector. On the other hand social and natural sciences and medicine are more likely to change their curriculum and teaching methods. Teaching methods and curriculum from technical faculties are probably more basic and therefore less likely to change over time.

Research function was most in line with entrepreneurial concept in the case of the technical faculties (4,80). Next highest score was found for natural science and medicine (4,10), while social science faculties lack behind in implementing these principles (3,57). This was most evident for items describing: financial benefit originating from the research efforts, cooperation with organizations outside the university which might significantly improve research activities, emphasizing applied research and acquiring funding from

sources other than government. These differences were found to be statistically significant (p=0,005).
Similar to education and research technical faculties are closer to entrepreneurial concept when transfer of knowledge is concerned. Technical faculties had the highest score (4,05), whereby natural science and medicine slightly lower (4,10), and finally social sciences (3,39). Significantly contributing to this variance regarding knowledge transfer is the outlook on the necessity of cooperation and relationship creation between the faculty and private or public sector organizations. That is considered to be one of the key requirements for knowledge transfer. Differences for knowledge transfer function was again found statistically significant (p=0.020).

According to correlations of university functions several high scores were found among some items. High correlation was found between Practical aspects of student research and Faculty members emphasizing applied research (.694**,788**), as well as Conducting research with nonacademic professionals(716**). High industry positions of students were correlated with Substantial contribution to industry or society by faculty members (.643**) and Recognition for flexibility and innovativeness by industry or society (652**). Furthermore, those who cooperate with non academic professionals are likely to make substantial contributions to industry or society (.661**).

Conclusion

When the necessity for university transformation was recognized, even in the case of Croatia which was considered to have a strong traditional background, significant transformation took place. It has influenced teaching curriculum, methods, sources of finance and accountability. Nevertheless, definite amount of time has passed and some problems have been resolved, but some are still yet to be decided. Policymakers need to have in mind specific circumstances regarding the structure of Croatian universities and differences arising from the specific environment of each faculty. Key point is to emphasize holistic approach that will account for those differences. Although, university staff generally support the concept of entrepreneurial university they are very sensitive about creating income parallel to budget financing. According to previous scientific work several weaknesses were specifically associated with Croatian universities. Specific limitation was found regarding international mobility and university-industry cooperation. Lack of the entrepreneurial incentive is worsened by the administrative problems and absence of systematic approach. Universities behave as educational-research institutions where final step of research effort is publication. Nevertheless, universities are not solely responsible for the lack of cooperation with private sector. Lack of interest and insufficient communication is often present in private sector as well. Barriers found to be causing this inefficient knowledge transfer are: distrust between business sector and university, fragmented organization, lack of legal frame, institutional rigidness and lack of benchmark (Singer & Peterka, 2010).

Limitations and directions for further research

One of the study's limitations is the size of the sample that was acquired via online questionnaire. 99 staff members do not completely represent the sum of these two universities. Furthermore, personal opinions of the respondent (staff) may not fully reflect the attitudes of their institutions. Specifically for each country and their academic hierarchies some of the policies are being decided on different levels of academic management. Croatian higher education is under management of the Ministry of science, education and sport. It

includes activities of universities, faculties, art academies, polytechnics and colleges. Survey included only two most prominent universities: University of Zagreb and Rijeka.

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[ii] FoSentHE survey results, http://web.fosenthe.efzg.hr/about-the-project
[iii] System of higher education in Croatia is consisted of seven universities total, each encompassing several faculties specializing in certain areas (biology, physics, computing, chemistry, medicine, agriculture ext.)
[iv] http://bib.irb.hr/bib_baze