INNOVATIVENESS OF ENTERPRISESACCORDING TO ITS SIZE AND ECONOMIC ACTIVITY: CROATIAN CASE STUDY

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Abstract- One of the important factors that affects the competitiveness of enterprises is their innovativeness. The main objective of this paper is to researchthe innovativeness of firms in the Republic of Croatia, to compare it with selected European countries, and then to compare whether there are differences in the innovativenessof firms according to the affiliation of economic activity and a firm size. The hypothesis is that there are differencesin innovation activities of firms depending on its main economic activity, and that large firms are more innovative than medium and small enterprises (SMEs).Regarding the importance of the topic as well as a perceived deficiency of the relevant research in Croatia, the empirical research with those parameters was conducted. It was carried out online on a sample composed of 138 firms using the questionnaire. Results of the empirical research indicate that there is a difference in the innovativeness of firms depending on the affiliation to economic activity. The most innovative economic activities are Information and communication, Accommodation and food service activities, and Manufacturing. Also, the results indicate that more innovative are large companies, compared with medium, small and micro. Compared to the other countries, it can be concluded that Croatia is lagging behind, according to the patent applications indicator, which points to the need for more significant utilization of innovation potential in the Republic of Croatia.

Index Terms- economic activity, enterprises, innovativeness, the Republic of Croatia

I. INTRODUCTION

According to the theory of innovation systems one of the most important sources of economic and productivity growth is innovation. It is important for the development of national economy and for each economic subject individually. Regarding the relevance of the theme, and for the purposes of this paper, the authors have researched the innovation level of Croatian firms. Afterwards the innovation level was compared with the innovativeness of the elected European countries. In addition to the intensity of innovation, a further objective of this paper was to research whether there is a difference in the innovativeness of companies in the Republic of Croatia depending on the affiliation to economic activity, anddepending on the size of a company. The authors wanted to perceiveif some economic activities require a greater level of innovation compared to the average of the economy. The hypothesis in the paper assumed that Croatian innovativenessis lagging behind the average European innovativeness, and that there are visible differences in innovation based on affiliation to economicactivity as well as that large companies are more innovative in relation to SMEs.For testing the hypotheses the data from empirical research conducted in 2011 were used. The survey was conducted by the author of this article on a sample of 138 leading Croatian companies. The research was conducted in a much broader context in relation to the subject of this paper. Data obtained from the research are published in a doctoral dissertation titled Science-Industry Collaboration in the function of regional development.For the purposes of this study, only the data related to the innovation of companieswere used. The survey was conducted online by using the questionnaire. Methodology applied to present the results of the research encompasses descriptive statistics.The paper is structured in four chapters. Following an introduction, the second chapter provides an overview of scientific and professional literature. The third section provides methodology used in this paper and an analysis of the empirical results. The final chapter contains a concluding summary.

II. A BRIEF LITERATURE REVIEW

A. Definition of a concept of innovation

A paper that intends to write about the importance of innovation within the economy, it should begin with defining the very concept of innovation in order to explain the scope of the concept that has been used in the paper. If we are talking about the innovation within the economic entity, than we primarily think of something new that has emerged in the concerned subject, regarding the improvement of business efficiency. That novelty can refer to a new product/service introduced to a market or a new manufacturing process implemented within acompany. Whereas the novelty in business activity of a company is not manifested only through a new product, service or manufacturing process, it is necessary to distinguish the concept of innovation in a narrow and broad sense. The innovation in a narrow sense is manifested in the above-mentioned forms, and that is a new product, service or production process. The innovation in a wider sense, alongside the above-mentioned, includes also expansion into new markets, whether at home or abroad, a change in the organizational structure, changing the marketing concept, a new supply process of goods and services,

implementation of a new strategy, and everything that is new and contributes to the development of business activities.

According to the official website of the European Union, so called Eurostat, innovation is a new or a significantly improved product or service introduced to a market or an introduction of a new or a significantly improved production process within a company. From the mentioned definition arise an essential feature of innovation, and that is a market application of new ideas, respectively new products or services. If a new product or service is not introduced to a market, it cannot be regarded as an innovation, as well as a new production process that is not implemented into a company cannot be considered as an innovation.

B. Literature Review

The importance of innovation for a development of enterprises and economy in economic literature is analyzed through several theoretical frameworks. Innovation as a most important source of economic growth is highlightedin theory of innovation systems, theory of national innovation systems and in triple helix model. Each of those economic theories emphasizes innovation as a key driver of a growth, both at micro and macro level. Recent theories of an economic growth that represent the importance of innovation were created shortly after the appearance of endogenous growth theory. Regarding adeficiency of research aboutinnovation of enterprises according to their main economic activity, neither at national nor the international level, in further paper a brief general review of a literature on innovation systems will be presented.

The concept of innovation system was used for a first time by Briton Christopher Freeman in the analysis of growth of Japanese economy (Freeman, 1987). A few years later appeared the idea of a national innovation system, thanks to the textbooks of Swedish economists Beng-Åke Lundvall (1992) and American economist Richard R. Nelson (1993). After the initial publications of those authors, in the early 1990s,an important theoretical and empirical research on national innovation system (NIS) was published. Almost none concept had experienced such a rise as a NIS. It was accepted by both scientists and politicians. The concept was created as an extension of the neoclassical and endogenous economic growth model.

The Neoclassical growth model assumes that a main source of growth is technological progress, respectively the intangible factors of production such as education and research and development (R&D). However, the neoclassical growth theory does not explain the sources of the mentioned technological progress and therefore that technological progress is exogenous variable. Unlike the neoclassical growth theory, which attaches great importance to technological progress, but does not explain its sources, endogenous growth theory have gone further. The mentioned theory still consider technological progress as a main source of a growth, but now it is not external variable any more. **The endogenous growth models**attempt to include the drivers of technological progress (such as knowledge, R&D, education), that is to incorporate them into mathematical formalism of production function. At that way, R&D and education become factors of production such as standard factors of production(labor and capital) that creates a new value. Parallel with a developmentof the neoclassical growth theory increased an investment in R&D and education.

The concept of **national innovation system (NIS)** goes even further from the endogenous growth models. It emphasizes the role of endogenous factors in economic growth. However, the R&D and education are not main sources of growth per se (**linear model of innovation**). NIS points out an innovation as a main driver of economic development, whereat emphasizes the importance of interactive learning and collaboration of science and industry (**interactive model of innovation**). The essence of the concept is in development of a framework that encourages collaboration of government, science and industry in order to increase innovation in a society and economy. The main feature of the concept is that economic ability to innovate depends not only on activities of certain entities per se (firm, university, research institute, government institution, etc.), but also on how these entities collaborate between themselves as a part of a system.

Authors whose names are often cited in a literature as originators of the concept are Swedish economist Beng-Åke Lundvall and English economist Christopher Freeman. The author who first used the concept of national innovation system was Beng-Åke Lundvall, editor of original and provocative book (1992) about the innovation system. Lundvall, furthermore, points out that the concept of national innovation system is practically developed by Freeman while he was exploring the rapid development of Japan and used the concerned concept.Due to the economic slowdown in the United States of America (USA) the mentioned publication had revitalized the interest of scientists for exploring knowledge, technology and innovation as factors of a growth. For those reasons, development of conceptsis tied to economic success of newly industrialized countries of East Asia and Japan. Those countries, even with little scientific and research potentials, achieve significantly better results in commercialization of research results. Apropos they have more developed collaboration of science and industry. The former Soviet Union is an ideal example of a rich scientific potential in service of politics, but

not economy, that leads to lower economic growth and development.

To define the NIS is not easy, especially because there is as many definitions as the authors. According to Freeman NIS includes a network of institutions from public and private sectors whose activities and mutual interaction initiate, import, modify and broadcast innovation. NIS, according to Lundvall, includes key organizations that come into interaction in production, dissemination and use of new, economically useful knowledge, within the borders of a country. According to Lundvall, innovation system, in the narrow sense, includes only those institutions that are directly related to research and innovation, such as, for example, universities and industrial institutes.In a broad sense, it refers to innovation system that is composed of many elements and links between them, which cooperate in production, dissemination and implementation of a new and economically useful knowledge. Nelson defines NIS as a group of institutions whose interactions determine the innovative performance of national enterprises (Nelson, 1993).

The NIS concept emphasizes the importance of flow of information, knowledge and technology among people, enterprises and scientific institutions as a key ofan innovation process. The basic starting point is that economic growth of a country does not depend only on size of scientific and research potential but also on its collaboration with industrial sector.According to the NIS theory it is extremely important to encourage all participants in innovation process to collaborate. It is particularly important to create a national institutional environment in which science and research will be the most effectively used to achieve innovation. The concept of NIS is focused on encouraging the development of those institutions that promote knowledge creation and its commercial application. Such institutions are: universities, research institutes, technology transfer offices or agencies, intermediary organizations, science parks, etc.

III. EMPIRICAL RESEARCH

A. Research Methodology

Innovation, as the main source of an economic growth, or a growth of companies, has been researched repeatedly in international scientific publications (for more, see the given review of the literature). Research of this kind are mainly related to research of innovativenessof economy, collaboration of science and industry and the like.**This paper indicates if there are any differences in innovativeness of enterprises in the Republic of Croatia, according to theireconomic activity and size. The assumption is that different economic activities require a different level of innovativeness as well as that large enterprises are more innovative in relation to medium and small ones.**In creating this paper the data from the empirical survey, conducted in 2011, were used. The empirical survey was conducted for a purpose of the doctoral dissertation titled Science-Industry Collaboration in the Function of Regional Development. For the purposes of this paper, only the data that are a subject of this paper were used. The research was conducted on a sample composed of Croatian companies from different economic activities.From each economic activity in a sample were taken enterprises that were leading in a terms of turnover in 2010. The research was conducted using a questionnaire, compiled by the author of this paper. Web questionnaire is constructed via web www.surveymonkey.com. The questionnaire was fulfilled by the most competent people. In enterprises that have R&D department, a questionnaire was fulfilled by its director. In enterprises that do not have such units, a questionnaire was fulfilled by its chief executive officer, board member, director or head of various departments.On the questionnaire, a part relating to innovation activities, responded total of 138 enterprises. The structure of surveyed enterprises according to their economic activity can be seen in Table 1. For distribution of enterprises, depending on economic activity, was used Croatian Statistical Classification of Economic Activities from 2007 (NKD 2007). The structure of surveyed enterprises according to its size can be seen in Table 2.

Table 1. Surveyed enterprises according to their economic activity

Main activity of enterprise according to NKD 2007	Number of enterprises	Share (%)
A Agriculture, forestry and fishing	2	1,4
B Mining and quarrying	2	1,4
C Manufacturing	60	43,5
D Electricity, gas, steam and air conditioning supply	3	2,2
E Water supply, sewerage, waste management and remediation activities	5	3,6
F Construction	6	4,3
G Wholesale and retail trade; repair of motor vehicles and motorcycles	13	9,4
H Transportation and storage	3	2,2
I Accommodation and food service activities	2	1,4
J Information and communication	18	13,0
K Financial and insurance activities	2	1,4
M Professional, scientific and technical activities	19	13,8
N Administrative and support service activities	1	0,8
P Education	1	0,8
R Arts, entertainment and recreation	1	0,8
Total	**138**	**100**

Source: Authors' edit according to the results of empirical research.

Table 2. Surveyed enterprises according to its size

Size of enterprises*	Number of enterprises	Share (%)
Micro (1-9)	32	23,2
Small (10-49)	21	15,2
Medium (50-249)	48	34,8
Large (250+)	37	26,8
Total	***138***	***100,0***

Source: Authors' edit according to the results of empirical research.*According to the Croatian Accounting Act (Official Gazette 78/15, 134/15) micro enterprises are those whose average number of employees during the financial year is less than 10, small enterprises are those that employ 10 to 49 employees,medium are those with 50 to 249 and a large one employs 250 or more people.

According to the questionnaire, in a part that relates to innovation activities, examinees had to indicate how much attention there are giving to their innovation activities. Then they had to indicate if they have introduced any form of innovationin the last three years (2008-2010). Afterwards they had to specify a number of innovations and patents realized in their enterprise in the mentioned period. And, at the end they had to assess the innovativeness of theirown enterprise in the mentioned period. The answers enablean analysis and comparison of enterprise's innovativeness, according to its economic activity and size.

B. Results of Empirical Research

The research results indicate that Croatian enterprises are not at a high level of innovation, as evidenced by indicators presented in this paper. However, they are very much aware of the importance of innovation, whereas 55.1 % of them (total 138) answered that they are giving a great importance to innovation activities in their business strategy. Then, 42.8% answered that there are giving a partial importance to their innovation activities, and only 2.2% answered negatively.

The responses to the question whether the company in the period from 2008 to 2010 introduced any form of innovation, are presented on Graph 1.The answers that were offered to the examinees included innovations in a broad sense (the meaning of the term is explained in II. A section of this paper).

Graph 1. Innovativeness of the Croatian enterprises (2008-2010) (Share of positive answers (%) in the total sample of 138 enterprises)

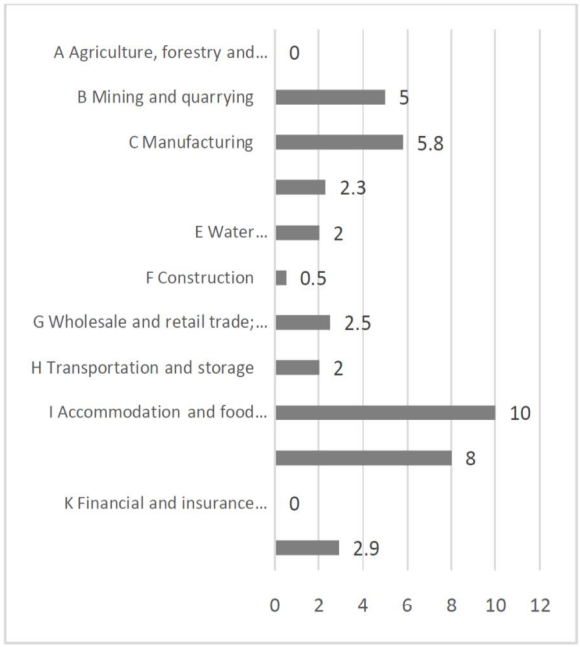


Source: Authors' edit according to the results of empirical research.

According to the Graph 1 it can be seen that the most common form of innovation (in a broad sense) of Croatian enterprises in the sample, is expansion into a new market (in a country and/or outside the country), followed by a new or a significantly improved product, and a new or a significantly improved production process (43.5%).

Regarding that the main objective of this paper is to examine whether there are significant differences in the innovativeness of the enterprises depending on the affiliation to economic activity and company size, the chart 2 shows the average innovativeness of them according to the economic activity. The examinees should indicate the number of innovations in their company in the observed period (only the innovation in a narrow sense: a new or a significantly improved product, service or aproduction process). Their innovativeness is considered separately for each economic activity. The total number of innovations in individual economic activity is divided by a number of companies that belong to that activity.

Graph 2. The average number of innovations per enterprise according to its main economic activity



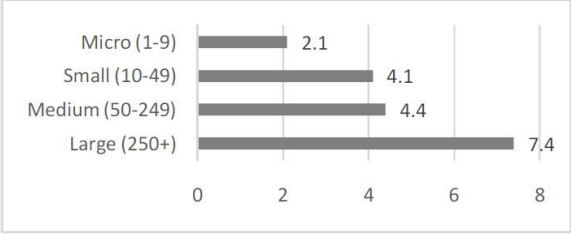
Source: Authors' edit according to the results of empirical research.

The results of empirical research, presented in Graph 2, indicate that the most innovative are companies engaged in economic activity I: Accommodation and food service activities. That is not surprising, since it is the simplest way to be innovative when it is about food. At second place are companies that belong to economic activity J: Information and communication (8 innovations per company). They are followed by economic activity C: Manufacturing and B: Mining and quarrying. Research results are in line with the expectations of the authors, and now it is empirically

confirmed. The average innovativenessof companies according to economic activity is interesting to compare with the average innovativeness of the whole sample. The average innovativeness of the all companies in the sample is 4.64 innovations per company.

On Graph 3 is presented the total number of innovations according to the size of a company. The number of innovations is considered particularly for micro, small, medium and large enterprises. Total innovations that belong, for example, to small enterprises are divided with a number of small enterprises.On that way we have got the average innovativeness per enterprise in a group of small enterprises. The same logic has been used in calculating the average innovativeness of the other groups of enterprises' size.

Graph3. The average innovativeness per enterprise according to its size

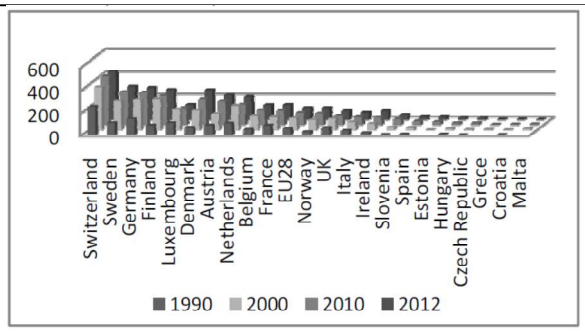


Source: Authors' edit according to the results of empirical research.

In line with expectations, the results indicate that the most innovative are large companies, followed by medium and small. The least innovative are micro companies. The research results are consistent with the expectations, as large companies have R&D departments whose primary purpose is to develop company's activities and innovation.

That the Croatian economy is not too innovative indicates a Graph 4. Graph 4 shows the innovativeness of the Croatian economy according to thePatent applications to the European patent office (EPO) by priority year. The total European patent applications refer to requests for protection of an invention directed either directly to the European Patent Office (EPO) or filed under the Patent Cooperation Treaty and designating the EPO (Euro-PCT), regardless of whether they are granted or not. The data shows the total number of applications per country per million inhabitants. If one application has more than one inventor, the application is divided equally among all of them and subsequently among their countries of residence, thus avoiding double counting (Eurostat, 2015).

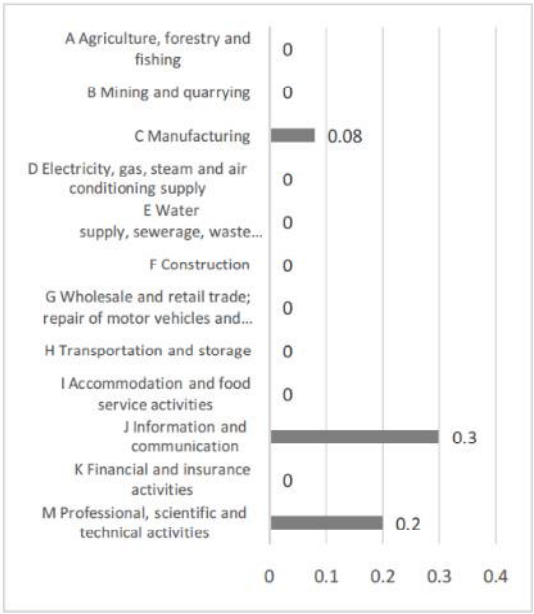
Graph 4. Patent applications to the European patent office (EPO) per country per million inhabitants, selected countries (1990-2012)



Source: Authors' edit according to the results of empirical research. Data available at: http://ec.europa.eu/eurostat/tgm/refreshTableAction.do?tab=table&plugin=1&pcode=tsc00009&language=en [18th of December 2015]

Graph4indicates two important facts. The number of patent applications in the analyzed sample is increasing. Almost all countries in the sample have a trend of increasing the number of submitted applications. In 2012, the average number of patent applications per million inhabitants in the EU 28 was 112.6. The same indicator on the Croatian level was 6.8. According to the countries in the sample, poorer indicator of the Croatian had only Malta. If we consider the whole EU (according to the data available at Eurostat), worse indicator than Croatia had only Bulgaria, Romania, Malta and Cyprus. Lithuania had the same number of patent applications as Croatia. The presented indicators point to overall low innovativeness of the Croatian economy.
The following chart (5) shows the number of registered patents per companyaccording to the economic activity, and on graph 6 according to the size of a company.

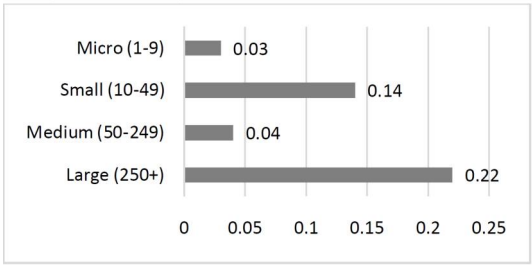
Graph 5.The average number of registered patents per enterprise according to its economic activity



Source: Authors' edit according to the results of empirical research.

Considering the indicators related to patent applications, it can be seen that Croatian economy in relation to the European countries is not innovativeenough. Analyzing the registered patents within the single economic activity, regardless of the low level of innovation, there can be seen some differences. Only enterprises from three groups of economic activities have reported at least some registered patents. Those economic activities are: J Information and communication, M Professional, scientific and technical activities, and then C or Manufacturing. The obtained results are consistent with the results obtained by analyzing enterprises according to the number of innovations. The only difference is that Croatian companies have so little registered patents compared to the number of realized innovations. So, it is very hard to make any conclusion from this indicator.

Graph 6. The average number of registered patents per enterprise according to its size



Source: Authors' edit according to the results of empirical research.

The results in the previous chart (graph 6) once again indicate that large companies are more innovative, probably because of the already mentioned reason, i.e. large companies have departments that particularly deal with research and development.

The last question, relevant to this paper, was the assessment of own innovation. The examineeswere supposed to evaluate the innovativeness of their enterprise from 1 (very low) to 5 (very high). The average score, according to the criteria of their own innovativeness, for all the companies in the sample was 3.1. As the most innovative were evaluated companies from the following economic activities: Accommodation and food service activities (I) (score 4.0), Information and communication (J) (score 3.8), Professional, scientific and technical activities (M) (score 3.8) and Manufacturing (C) (3.2 score). The other companies in the sample have their own innovativeness generally assessed with an average score 3. The results confirm again greater innovativeness of the already mentioned economic activities.

CONCLUSION

The main objective of this paper was to research whether there is a difference in the innovativeness of business entities in the Republic of Croatia according to the affiliation to economic activity and depending on the size of the company. The initial hypothesis was that affiliation to different economic activities means a different level of innovativeness and that larger firms are more innovative in relation to medium, small and micro.A review of previous empirical studies indicated a deficit of the relevant research, because none of the relevant studies on this subject were found. The fact that in the Republic of Croatia anyresearch of innovativeness of the Croatian economy, according to economic activity,has not been conducted,was the motive for the presentation of research results in this paper. The research was conducted by the author of this paper in 2011, on a sample composed of 138 business entities. The survey instrument that has been used in the research was a highly structured questionnaire. Within the surveyed companies, the questionnaire was fulfilled by adirectorof a department for research and development. If a company did not have such a department, the questionnaire was fulfilled by its chief executive officer, board member, director or head of various departments.The survey results indicate that there is a difference in the innovativeness of the companies according to its economic activities.According to theindicators: number of innovations and number of registered patents, the most innovative companies belong to the following business activities: Information and communication (J), Accommodation and food service activities (I) and Manufacturing (C). The results also indicate that, in accordance with the mentioned indicators, the more innovative are large companies, and then medium, small and micro. The results of empirical research are in accordance with the initial hypothesis assuming that large companies are more innovative and that there isa clear difference in the innovation activities of the firms depending on the affiliation to economic activity.

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