Innovative activity in chosen branches of the tertiary sector in the Czech Republic

Eliška Jirásková
Department of Business Economy
Technical University of Liberec, Czech Republic

Key words
Innovation, investment, services, Czech Republic, patent, protection.

Abstract
The aim of this paper is to provide a brief overview on innovation in services and their approach to the protection of intellectual property. The submitted article summarizes preparing part of a starting project mostly focused on investment environment. The area of interest is companies providing services in the territory of the Czech Republic. The aim of the project is supporting actions of promoting investment and innovative environment. It is necessary to exactly define innovation in services and to analyze innovative activity first so the aim could be achieved. A partial aim of the project will be finding out whether branches which report higher revenues from innovative activities are actively using the opportunity to patent their service because innovations are closely connected to the protection of intellectual property as well. The described part concerns innovations in selected branches of tertiary sector whereas all the branches which have been registered by Czech Statistical office, because of a validation of application for patent proceeding at least in two examined periods since 1993 are examined. Furthermore a possible dependency between an amount of patents in single regions and an amount of revenues coming from innovative companies to a region.

1. Introduction
Permanent innovative process is necessary for a successful entrepreneurship because according to Kotler and Armstrong (2004, p. 856), there are two types of businesses: those that change and those that disappear. Markets, competitors, customers, technology, everything around the business is changing. If a company wants to be successful, it must change, too. (Adamska and Minárová, 2014) It is common knowledge that innovative enterprises achieve higher revenues and that is the reason why regions try to attract new and innovative enterprises to their area. The aim of this report is to confirm that the more enterprises in the region innovate, the more income flows. This paper also examines the relationship between the amount of approved patents in chosen branches of tertiary sector and the amount of revenues of innovating enterprises. Finally the report is going to try to confirm a hypothesis saying the more new patents are in the region the higher are revenues of innovating enterprises. The main asset of the report is the identification of minor factors which could affect the amount of revenues.

2. The theoretical basis of innovation in services
Since there are many definitions of innovation it will be chosen generally acknowledged one according to the Oslo manual (OECD, 2005) which defines innovation as the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations. The general definition of innovation is not sufficient for innovation in services since services have certain specifics which affect the character and process of innovation. The main reason is the intangible nature of services which results in more non-technologic character of innovation in services. In general the services innovation is a topic of growing interest for

researchers and policy makers alike. (Miles, 2005, p. 433) There are many approaches to innovations in services. For instance Salter and Tether (2006, p. 4 - 9) divide evolution of thinking about innovation in services from the 1980s to the present day into 4 groups:

- **neglect** – until the 1980s very little research was undertaken on innovation in services.
- **assimilation** – by the early 1980s when the growth of services continued and it was hard to ignore it.
- **distriction** –the middle of 1990s is the primary focus of study by innovation researchers.
- **synthesis** – this approach highlights the increasing complex and multidimensional character of modern services.

Gallouj and Weinstein divided innovation in services into two complementary groups:

- group focuses on analysis of the introduction of technical equipment and systems in services,
- group of studies where the technologist gaze perceives nothing.

To define innovations in services is also necessary to include the fact that their products are often customized to particular client needs and we could often see a close relationship between service firms and their clients. (Miles, 2005 , p. 441) Gallouj and Weinstein (1997, s. 537) mention that analysis of innovation in service is difficult to define from two standpoints. On one site, innovation theory has been developed on the basis of analysis of technological innovation and especially for manufacturing. On the other hand, the specific nature of services makes it particularly difficult to measure them by the traditional economic methods.

Based on mentioned above innovation in service could be generally defined as: *any commercialized change which has not been realized in services yet and in most cases is based on customer's needs and it is not technological.*

One of the main reasons for focusing on tertiary sector only is:

- its growing importance which has been noticed during last twenty years. (Pazour, 2007, p. 9). It could be said, that in 1990s, a great number of research projects on services innovation were launched.
- service sector participated in the creation of GDP with about 70%.
- the dynamics of the branch.
- less stress on tertiary sector by innovation and by the protection of intellectual property.

It is also important to realize that service sectors are important for their productivity, quality of life and economic competitiveness also.

2.1 The protection of intellectual property

Innovations are closely connected with the protection of intellectual property as one of indicators of innovative activities. As mentioned, tertiary sector mainly deals with non-technological innovations which result less number of approved patents. From the figure n. 1 the important difference between manufacturing industry and services by comparing the number of approved patents could be found out. Strongly higher share of the protection of intellectual property in secondary sector is obvious from the first sight during whole monitored period. The same development can be found in utility models and other types of the protection of intellectual property (Statistics of patents, 2014) except of a trademark where can be predicted increasing importance due to intensity of the branch and constantly strengthening competition.
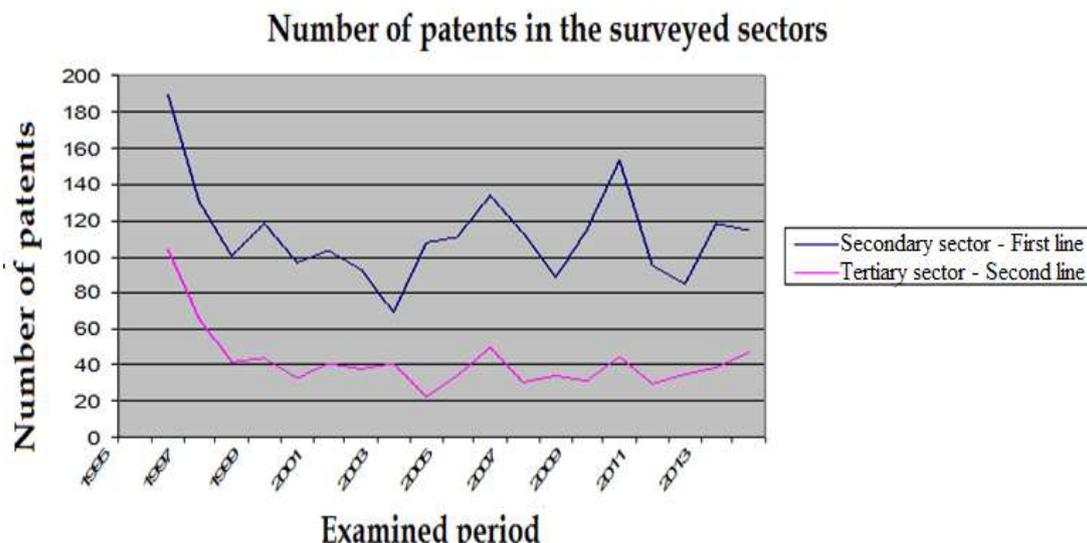
Number of patents in the surveyed sectors

Figure 1: Number of patents in examined branches
Source: Own processing according to Czech Statistical Office.

Services in the Czech Republic are divided into 16 categories, according to the branch classification CZ-NACE, the same effort to acquire patents cannot be seen in all of these categories. Examined branches and a number of assigned patents see tab. 1.

Examined branch	Number of assigned patents
Information and Communication	5
Financial and Insurance Activities	0
Transportation and Storage and Wholesale and Retail Trade	67
Professional, Scientific and Technical Activities	22
Architectonic and engineering activities, technical tests and analysises	43
Research and Development	99
Other business services	19
Health, community, social and other services	6

Tab. 1: Number of assigned patents in examined branches
Source: Own processing according to Czech Statistical Office

A contrast in the number of assigned patents in single branches is obvious in tab. 1.

We can say that services are highly diverse and that some areas of services are slow, whereas others are dynamic and open. Most patents were assigned to a section of research and development, followed by transportation and storage, which were examined with wholesale and retail trade. These sectors used more technologies and that is why there is greater need of the protection of intellectual property.

3. Methodology

Three hypotheses concerning a patent activity of companies executing their main object of interest in services were expressed. Regressive analysis and correlative coefficient were used to prove the expressed hypotheses.

The first examination concerns possible mutual dependency between a number of innovative companies and an amount of income coming from an innovative activity. By confirming this hypothesis it would be possible to prove that the more a company innovates the higher is the income coming from its entrepreneurial activity.

- *H0: There is not any mutual dependency between an amount of innovative companies in single regions of the Czech Republic and an amount of income coming from an innovative activity.*
- *H1: There is a mutual dependency between an amount of innovative companies in single regions of the Czech Republic and an amount of income coming from an innovative activity. That means that the more companies innovate the higher their revenues are can be proved.*

The hypothesis concerning mutual relationship between a number of approved patents in innovative branches and an amount of revenues of these innovative companies was examined next. By verification of this hypothesis the need for innovation could be proved again if the service enterprise wanted to achieve higher revenues:

- *H0: There is not mutual dependency between a number of approved patents in chosen branches of tertiary sector and an amount of revenues of innovative companies.*
- *H1: There is mutual dependency between a number of approved patents in chosen branches of tertiary sector and an amount of revenues of innovative companies.*

Finally within the framework of examined categories there will be an effort to confirm a hypothesis saying the more patents in single regions company owns the higher are their revenues:

- *H0: There is not mutual dependency between a number of approved patents in single regions of the Czech Republic and an amount of revenues of innovative companies.*
- *H1: There is mutual dependency between a number of approved patents in single regions of the Czech Republic and an amount of revenues of innovative companies.*

Examined hypotheses were spoken because companies in tertiary sector often do not pay enough attention to patent process nor to innovation. The next reason is difficult measurability of innovative process in services. Because of it a size of the protection of intellectual property could be considered as quantitation factor of innovative process in services. If the hypothesis that the more patents were approved in chosen branches the higher revenues were achieved by innovative companies was confirmed that could be an impulse for bigger effort for the protection of intellectual property in tertiary sector. The remaining two hypotheses were expressed for complex analysis of chosen area.

All of the hypotheses were confirmed at the 5 % significance level using regression analysis of unilateral dependence. Regression analysis was chosen since expressed hypotheses compare independent variable and dependent variable. A model equation of simple regression task can be described using equation (1):

$$Y = a + b*x + e \tag{1}$$

where Y is dependent variable,
a is simple term,
b is regression coefficient,
x is independent variable,
e is residual deviation.

The correlation coefficient which determines the relative degree of linear dependence will be examined in single hypotheses as well to express mutual dependency. Correlation coefficient is defined as (2):

$$\rho(XY) = \frac{\text{cov}(XY)}{\sqrt{D(X)D(Y)}} \tag{2}$$

where the numerator expresses covariance and the denominator expresses square root of the product of divergences.

The correlation coefficient is within the limits *-1 ≤ ρ ≤ 1, where*

- $\rho = 0$, then *X* and *Y* are linearly independent (*b=0*)
- $\rho = 1$, then *X* and *Y* the correlation is positive (*b>0, direct linear dependency*)
- $\rho < 0$, then *X* and *Y* the correlation is negative (*b<0, indirect linear dependency*)

3.1 Analytical part – verification of given hypotheses

All of the expressed hypotheses were confirmed on the level of significance of 5 % thanks to the regression analysis. The mutual dependency between all the expressed hypotheses was confirmed. It could be said that there is a dependency between:

- The revenues of innovative companies and a number of innovative companies also for better interpretation the regression analysis was supplemented with the correlation coefficient which was 0,71 and that can be considered as medium strong dependency. Also there is stated value of the R-Squared parameter thanks to which is possible to say that the amount of revenues depends on innovative productivity of single companies in 51 %.
- Total revenues of innovative companies and a number of patents in chosen branches of tertiary sector. A mutual dependency can be considered very strong (CC=0,85) in this case and can be said also that the amount of revenues depends on the number of patents in examined branches in 73 %.
- Revenues of innovative companies and a number of patents not only in single branches of services (see the hypothesis 2) but also within single regions of the Czech republic. The dependency was measured 0,92 by means of CC, it means it was very strong.

	1. hypothesis	2. hypothesis	3. hypothesis
P-Value	0,0447	0,0286	0,0009
Correlation Coefficient (CC)	0,718382	0,858635	0,927577
R-squared	51,60%	73,72%	86,03%

Tab. 2: Correlation analysis
Source: Own research. Statgraphics

4. Discussion and conclusion

The aim of this article was to confirm possible dependency of sales of innovative companies on the external circumstances like a number of patents or a number of innovative companies. Since all of the three expressed hypotheses were on the significance level of 5 % possible to verify, a conclusion can be made that the more companies try to innovate the bigger their revenues are. Next it can be assumed that the more companies care about the protection of intellectual property the higher are their revenues. The innovation and also patent proceedings can be considered as a driving force of the economy of the Czech Republic. Not only the need of companies for innovativing and increasing revenues, also the need for improving innovative and investment environment for potential investors show the results. The Czech Republic was placed on the 19th place of rankings of EU of investment environment and friendly climate for innovation. Looking at the individual categories the Czech Republic can be rated as above average for introducing new high-tech procedures and technologies. Next advantage increasing

the attractivity of investment environment for foreign investors is rising quality of graduates. The disadvantages in the Czech Republic are an ability to electrify processes in public administration and worsened ability to mobilize and allocate development capital. (Zahradník, 2013)

Research carried out by the European Commission shows more shortcomings of innovative and investment environment of the Czech Republic. Poor cooperation between scientific community and business sector is stated as the main shortcoming. On the other hand the European Commission proclaims 5 areas (transportation, construction, energy industry a environment) where strong cooperation between scientific outputs and patent applications was noticed (European Union, 2013).

5. Limitations of research and the new direction for further research

As mentioned above the shortcomings of investment environment of the Czech Republic could be definitely an object of closer examination. The results found out by this research which shows direct dependency between an amount of revenues and an amount of approved patents or a number of innovative companies could be implemented as well. An effort to attract investors by using various programs concerning innovation is obvious now, that is why I would like to recommend focusing on the oft-repeated protection of intellectual property which is being ignored mostly by service companies. Most patents in the Czech Republic were registered by companies Zentiva and Škoda Auto in the recent years. Both of them are from secondary sector which implies that tertiary sector does not engage in patent proceedings much. To better illustrate the discussed issues it is possible to state the relationship between an intensity of research and a number of innovative companies. Figure 2 shows that the Czech Republic lags behind the European average in the long term. Figure 2 also shows that the Czech Republic could approach the targets of European Union or overcome them even in the future.
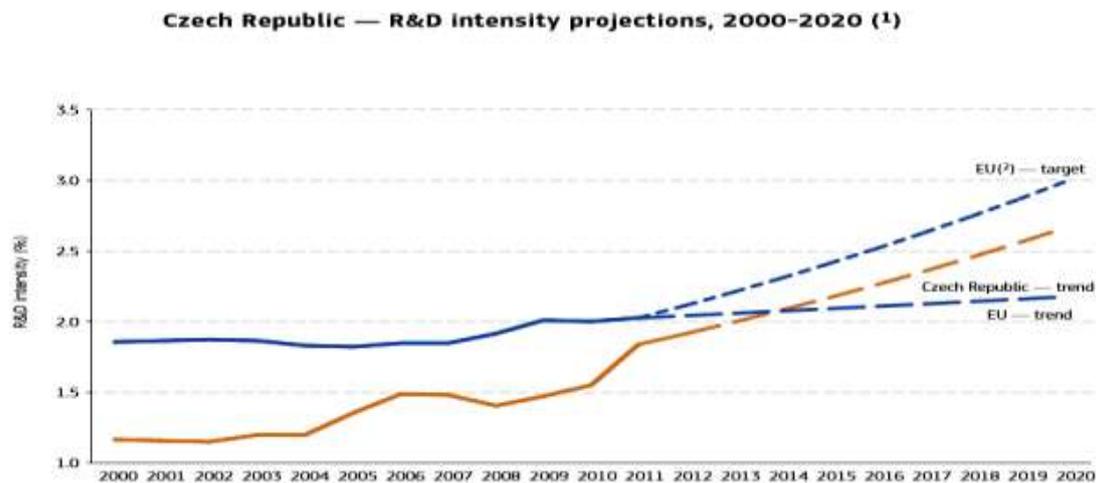

Figure 2: R&D intensity projection in Czech Republic
Source: EUROPEAN UNION, 2013. *Research and Innovation Performance in Czech Republic.* ISBN 978-92-79-30865-9.

6. Conclusion

The research mentioned above shows that innovations are positive entrepreneurial impulse and that innovative enterprises produce bigger amount of revenues. The reason for continuing innovative processes should not be only an effort to achieve short-term higher rate of

profits but primarily implementation of innovative strategy to a long-term entrepreneurial plan. The need for continuing innovation comes from a present globalizing world where traditional competitive advantages are becoming more available and forcing society to innovate. A part of this process should be a continuing effort to protect intellectual property. Thanks to these factors, not only an entrepreneurial but also investment environment will improve. (Maskell, 2001, p. 4) As Crescenzi points out (2007, p. 682) the process of making innovation is influenced by many factors in which a traditional amount of investment in primary inputs and also institutional framework for making innovation belong. A part of this innovative process should be not only suppliers but also clients.

Finally, tertiary sector is less innovative than secondary sector (Salter and Thether, 2006), but it should not be a reason to underestimate the innovation process and the subsequent protection of intellectual property.

Since the project dealing with investment environment is in the initial phase it is possible to start an international cooperation. If a research team from abroad is interested in participation on a research, contact us via contact email. The results which come from this article will definitely be a base for further research.

References

Adamska, M. And M. Minárová. 2014. Role of learning organization in building consumer konfidence. *E + M Ekonomie a Management.* 2014, vol. 14, iss. 1, pp. 62-72. ISSN 1212-3609.

Crescenzi, R., etc. 2007. The territorial dynamics of innovation: a Europe-United States comparative analysis. *Journal of Economic Geography.* 2007, vol. 7, iss. 6, pp. 673-709. ISSN 1468-2702

European Union, 2013. *Research and Innovation Performance in Czech Republic.* ISBN 978-92-79-30865-9.

Gallouj, F. and O. Weinstein. 1997. Innovation in Services. Research Policy. *1997, vol. 26, iss. 4, pp. 397-603. ISSN: 0048-7333*

Kotler, P. and G. Armstrong. 2004. *Marketing.* Praha: Grada Publishing, 2004. ISBN 80-247-0513-3

Maskell, P. 2001. Towards a knowledge based theory of the geographical cluster. *Industrial and Corporate Change.* 2001, vol. 10, iss. 4, pp. 921-943. ISSN 0960-6491.

Miles, I. *Innovation in Services.* The Oxford Handbook of Innovation, 2005, ISBN 0-19-926455-4 .

OECD 2005. Oslo Manual. Guidelines for Collecting and Interpreting Innovation Data. 3rd ed. Paris : OECD 2005.

Pazour, M. 2007. Typologie inovačního procesu ve službách. *Politická ekonomie.* 2007, CES VŠEM, Bulletin CES VŠEM, vol. 10, pp. 9-11.

Salter, A. and S. B. Tether, 2006. Innovation in services: Through the Looking Glass of Innovation Studies. *Advanced Institute of Management Research and Innovation Studies Centre,* Tanaka.

Zahradník, P. *Investiční prostředí u nás.* Conseq, 2013.

Appendices - Documents for the hypotheses:

1. Hypothesis

Regions in Czech Republic	Reveneus of innovative enterprises	Number of innovative enteprises
Prague	1256258	2340
Central Bohemia	388281	857
Southwest	216754	1107
Northwest	261560	801
Northeast	248574	1433
Southeast	283566	1894
Central Moravia	244974	1223
Moravia-Silesian	320459	968

2. Hypothesis

Selected branches	Whole reveneus of innovative enterprises	Number of patents
Transportation and Storage and Wholesale and Retail Trade	353767	67
Financial and Insurance Activities – K /64-66/	361 824	2
Architectonic and engineering activities, technical tests and analysises – M71	13 733	43
Information and Communication – J62	183819	5
Publishing – J58	9 408	12
Czech Republic together	**3 220 427**	**129**

3. Hypothesis

Regions in Czech Republic	Revenues of innovative enterprises	Number of patents
Prague	1 256 258	813
Central Bohemia	388 281	177
Southwest	216 754	167
Northwest	261 560	90
Northeast	248 574	345
Southeast	283 566	258
Central Moravia	244 974	186
Moravia-Silesian	320 459	164

Own processing according to:

Produktová inovace [online]. Czech Statistical Office, 2014 [vid. 2014-06-26]. Available from: http://www.czso.cz/csu/2014edicniplan.nsf/t/BA00252B56/$File/21300314a04.pdf