Agata MESJASZ-LECH
Czestochowa University of Technology
Faculty of Management

INEQUALITY OF THE DEVELOPMENT OF ENTREPRENEURSHIP AND INNOVATION IN POLAND

Summary. Entrepreneurship and innovation contribute to economic development through a change in the economic structure of businesses. Venturesome activities and innovation are about the creation of a resources configuration which allows to gain a competitive advantage. Innovation is perceived as an effect of entrepreneurship. It comes from this fact that entrepreneurship is understood as a capability to create new knowledge, and to find solutions to problems or situations. The goal of the article is to assess the inequality of the development of entrepreneurship and innovation among regions in Poland in based on levels of concentration. An analysis of the measures of entrepreneurship and innovation in relation to Polish provinces was carried out. The level of regional concentration of entrepreneurship and innovation in Poland was analyzed on the basis of separate measures.

Keywords: entrepreneurship, innovation, concentration

NIERÓWNOMIERNOŚĆ W ROZWOJU PRZEDSIĘBIORCZOŚCI I INNOWACYJNOŚCI W POLSCE

Streszczenie. Przedsiębiorczość i innowacyjność przyczyniają się do rozwoju gospodarczego dzięki zmianie w strukturze ekonomicznej przedsiębiorstw. Działania przedsiębiorcze i innowacyjne koncentrują się na tworzeniu takiej konfiguracji zasobów, aby możliwe było osiągnięcie przewagi konkurencyjnej. Innowacyjność postrzegana jest jako efekt przedsiębiorczości. Wynika to z rozumienia przedsiębiorczości jako zdolności do kreowania nowej wiedzy, sposobu rozwiązania problemu czy też sytuacji. Celem artykułu jest ocena nierówności w rozwoju przedsiębiorczości i innowacyjności w Polsce w kontekście koncentracji. Analizie poddano mierniki przedsiębiorczości i innowacyjności w odniesieniu do województw. Na podstawie wyodrębnionych mierników zbadano poziom koncentracji przedsiębiorczości i innowacyjności w Polsce w ujęciu regionalnym.

Słowa kluczowe: przedsiębiorczość, innowacyjność, koncentracja

1. Introduction

Research on different aspects of entrepreneurship and innovation analysed on a regional level allows to assess the processes connected with creation of new businesses and their orientation on innovation on the level of the regions of the world or regions of a country. Entrepreneurship and innovation are determinants of economic development in the aspect of adjusting to market needs and improving economic competitiveness.

Therefore, the level of entrepreneurship and innovation of provinces can have a bearing on their future revenues which will translate into the level of their populations' wealth. Entrepreneurial activities and innovation naturally complementing each other is often emphasized here. The goal of the study is to present the results of analyses concerning the non-uniformity of the development of entrepreneurship and innovation in Poland and to assess these processes in the context of concentration. Regional data (by provinces) covering the 2009-2014 period are analyzed.

2. Innovation as a result of entrepreneurship

A changeable and uncertain environment is conducive to the creation of new business entities capable of meeting the market demand. Such conditions are also challenging for existing businesses and require them to strive for economic stability and, most importantly, to develop and increase their competitiveness. Entrepreneurship in a broad sense means an ability to set up new businesses[1]. Viewed from a different angle, it is perceived as an ability to organize economic resources into new enterprises[2]. It is its task to stimulate innovation and development[3]. In the economic dimension entrepreneurship helps find new solutions in order to reasonably use the creative potential of people[4]. Therefore, it manifests

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itself through the initiation of enterprises and developing them in a creative and active way[5]. Entrepreneurship is a symptom of creative thinking which often is unique and unrepeatable. A person is the most important strategic asset of a business from the standpoint of innovative activity[6], and innovation is "a result of the combination of knowledge elements in organizations"[7]. Therefore, there seems to be a direct link between entrepreneurship and innovation and the latter is the effect of the former.

One of the premises of entrepreneurship is the creation of new ideas. A business can succeed through creating value in the marketplace by combining resources in a completely new manner[8]. Finding new ways of solving a given problem can lead to innovative solutions. Hence creativity is considered to be the key factor of innovation[9]. On the other hand, it is possible that innovation can become the premise for the creation of new businesses. Innovation is sometimes perceived as having a negative or destructive influence on the existing organizational forms and economic practice[10]. It is also thought to be the basic determinant of the development of businesses, and is discussed mainly in the context of competitiveness[11]. The implementation of an innovative solution can in this context result in the creation of a new business entity.

No matter how entrepreneurship is defined it is always connected with something new and a particular set of qualities and behaviour of managers. Entrepreneurship is seen "from the perspective of knowledge creation used to restore organizational capabilities"[12]. It is connected with such notions as flexibility, taking risks, innovation, creativity, dynamism and being development-oriented[13]. Additionally, an innovation-oriented society displays a tendency for self-employment and looking for new technologies and solutions[14]. In this way

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entrepreneurship leads to changes in the economic structure of companies understood as both the size structure and the frequency of occurrence. Changes are indicative of increased production and economic development which is helped by innovation.

3. Methodology and data description

The description of the structure of the analyzed population is the basis of the statistical study performed in this research. One of the groups of measures allowing to carry out such an analysis is the concentration measures. They let us determine the concentration level of a feature's value. Concentration measures are often used in the analysis of the distribution of business entities over a given area[15]. That is why they were used in this research to analyze the non-uniformity of the development of entrepreneurship and innovation in provinces, which are the main administrative unit in Poland. In view of the fact that concentration can be discussed using different approaches, the study proposes the following concentration measures:

- Kurtosis.
- Herfindahl-Hirschman index.
- Florence location index.

Kurtosis (K) determines the level of the concentration of the value around the average. It is calculated through the formula:

$$K = \frac{\mu_4}{S^4},$$

where:

μ_4 – the fourth central moment,

S^4 – standard deviation in the 4th power.

It is proved that for the normal distribution K = 3, for the leptokurtic in relation to the normal distribution K > 3, and for the platykurtic distribution K < 3. For this reason the K coefficient is often examined in the form of:

$$K' = \frac{\mu_4}{S^4} - 3.$$

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where:

K′ = 0 means the distribution is mesokurtic,

K′ > 0 – the distribution is leptokurtic,

K′ < 0 – the distribution is platykurtic.

The Herfindahl-Hirschman index (HHI) is defined as the sum of squares of market shares, and is designated according to the following formula:

$$HHI = \sum_{i=1}^{n} z_i^2 ,$$

where: z_i means a share of the value of the analysed feature for the i-th object in the total value of the analysed feature for all analysed n units. The higher its value is, the greater the concentration is in the analyzed area. The value of the index less than 0,10 indicates a lack of concentration, when it is between 0,10 and 0,18 – a moderately high concentration, and a very high concentration, when it is above 0,18.

The Florence location index (F) lets us draw conclusions about the spatial differences in the distribution of the analyzed phenomena, and helps us better understand the spatial structure of the phenomena. It is calculated through the formula:

$$F = \frac{\frac{1}{2} \sum_{i=1}^{N} (S_i - U_i)}{100} ,$$

where:

S_i – the percentage structure of the first analyzed phenomenon according to the spatial units,

U_i – the percentage structure of the second analyzed phenomenon according to the spatial units,

N – the number of spatial units.

The formula concentrates on only positive differences between S_i and U_i. The Florence location index is within the interval (0, 1], and its values close to 0 denote almost full correspondence of the territorial distribution of two analyzed phenomena. There is a full inconsistency of these phenomena when the value equals 1.

The study presents a concentration analysis which uses the measures defined above. The following variables were taken into account:

- New registered entities (*NENT*).
- Share of net revenues from sales of innovative products in the industrial enterprises (*SREV*).
- Total expenditures on innovation activity in industrial enterprises (*TEXP*).

- Expenditures on R&D in industrial enterprises (*REXP*).
- Expenditures on acquisition of external knowledge in industrial enterprises (*KEXP*).
- Expenditures on acquisition of software in industrial enterprises (*SEXP*).
- Capital expenditures on buildings, structures and lands in industrial enterprises (*BEXP*).
- Capital expenditures on instruments and equipment in industrial enterprises (*IEXP*).
- Expenditures on staff training connected with innovation activity in industrial enterprises (*CEXP*).
- Expenditures on marketing for new and significantly improved products in industrial enterprises (*MEXP*).
- Innovative enterprises in industry (*IENT*).
- Enterprises, which introduced new or significantly improved products (*PENT*).
- Enterprises, which introduced new or significantly improved processes (*RENT*).

The data for the analysis come from the Central Statistical Office. The variable new registered entities reflects the level of entrepreneurship in Poland. The other variables are the manifestation of the innovativeness of businesses. All variables are analyzed in relation to businesses in the industrial sector. Placing the focus only on this sector is done by reason that they lead in terms of innovation[16]. Accordingly, businesses in the industrial sector are the main suppliers of innovative solutions. Such sectors include: Mining and quarrying, manufacturing, electricity, gas, steam and air conditioning supply, water supply, sewerage, waste management and remediation activities. The analysis covers the years 2009-2014. The goal of the analysis is to determine the level of the concentration of entrepreneurship and innovation in Poland in a territorial view by province and to compare changes in this respect over a selected period. Choosing provinces as the objects of the analysis comes from the fact that regional policy is increasingly thought to play an important role in improving the innovation policy[17], and regions are considered to be the main sources of innovation processes[18].

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The assumed measure of entrepreneurship was the number of new registered entities. This way of measuring entrepreneurship is from understanding it as a capability to create new businesses. The assessment index of an innovative activity is the share of revenues from new or significantly improved products launched in the last three years from the total value of sales (79). As the chosen variables are measured annually, the effects of innovative activity were measured on the basis of the share of net revenues from sales of innovative products in a given year. The assumed measure of innovation was primarily the number of innovative enterprises in the industrial sector. This measure was also broken down into enterprises which introduced new or significantly improved products and those which introduced new or significantly improved processes – innovativeness here is defined as the capability of businesses to introduce innovation[19]. This capability should translate into the number of innovative enterprises. The above measures, therefore, can be treated as suitable for the assessment of the size of innovative activity. The measures, though, do not fully reflect the complexity of problems inherent in innovative activity in industrial enterprises[20]. Keeping in mind the fact that the main factor determining the ability of enterprises to implement innovative activity is the structure, size and dynamics of financing innovative activities[21], total expenditures on innovation (in which expenditures on R&D, on acquisition of external knowledge, on acquisition of software, on buildings, structures and lands, on instruments and equipment, on staff training, and on marketing) was also assumed as a measure.

4. Concentration of new enterprises and innovation measures in Poland – a territorial view

In order to analyze the concentration of the values of features around the average, the kurtosis for all variables over the whole period was calculated. The results are presented in table 1.

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Table 1

Kurtosis for specific features and years

Variable	2009	2010	2011	2012	2013	2014
NENT	2,23	-0,17	0,23	2,32	0,83	0,39
SREV	4,26	11,28	9,72	13,01	3,12	9,22
TEXP	3,99	4,86	0,92	4,00	-0,70	-0,83
REXP	5,26	5,83	-0,23	4,15	1,00	2,33
KEXP	3,32	13,30	15,50	2,18	4,08	9,12
SEXP	-0,50	6,34	0,36	0,51	9,16	6,16
BEXP	10,35	13,07	8,38	10,82	1,24	0,04
IEXP	2,66	1,42	3,42	0,07	-1,20	-1,39
CEXP	0,56	8,76	-0,85	1,42	2,59	-1,01
MEXP	8,97	6,68	3,67	1,40	3,46	4,86
IENT	0,25	0,20	-0,94	-0,09	0,19	-0,96
PENT	1,58	0,06	-0,24	0,05	1,31	0,65
RENT	0,20	-0,18	-0,69	-0,24	0,90	-1,04

Source: Own calculation.

The majority of variables have a leptokurtic distribution (a positive value of the concentration coefficient). This lets us conclude that the number of provinces where the values of individual variables deviate significantly from the average is low. The highest values of kurtosis in the analyzed period are observed in industrial enterprises for expenditures on acquisition of external knowledge, expenditures on marketing for new and significantly improved products, expenditures on R&D, and capital expenditures on buildings, structures and lands.

The Herfindahl-Hirschman index was used to assess the concentration of entrepreneurship and innovation. It allowed us to see if some of the provinces had an extremely big share in the discussed features. The values of Herfindahl-Hirschman indexes are presented in table 2.

Table 2

The Herfindahl-Hirschman index for specific features and years

Variable	2009	2010	2011	2012	2013	2014
NENT	0,095	0,092	0,095	0,100	0,094	0,092
SREV	0,077	0,116	0,109	0,113	0,077	0,093
TEXP	0,148	0,158	0,115	0,113	0,100	0,105
REXP	0,184	0,225	0,128	0,147	0,137	0,131
KEXP	0,195	0,408	0,552	0,205	0,236	0,302
SEXP	0,128	0,187	0,151	0,119	0,149	0,146
BEXP	0,181	0,283	0,191	0,152	0,112	0,104
IEXP	0,144	0,125	0,133	0,104	0,104	0,112
CEXP	0,124	0,208	0,111	0,104	0,140	0,094
MEXP	0,190	0,199	0,181	0,160	0,232	0,215
IENT	0,063	0,063	0,064	0,064	0,064	0,064
PENT	0,064	0,063	0,065	0,065	0,064	0,063
RENT	0,064	0,063	0,064	0,066	0,065	0,064

Source: Own calculation.

A lack of concentration in all studied years is observed for registered entities – those enterprises which introduced new or significantly improved products, and those which introduced new or significantly improved processes. The index values of these variables are generally constant over the studied years. A lack or a moderate level of concentration was observed for the share of net revenues from sales of innovative products in the industrial enterprises. Total expenditures on innovation activity in industrial enterprises and capital expenditures on instruments and equipment in industrial enterprises has a moderate level of concentration. A high concentration level over the whole studied period characterized expenditures on acquisition of external knowledge in industrial enterprises and expenditures on marketing for new and significantly improved products in industrial enterprises. The concentration levels of the other variables were on a moderate or high level, with an exception of expenditures on staff training connected with innovation activity in industrial enterprises which did not show any concentration in 2014, yet had a high concentration in 2010 and a moderate concentration in the other years.

In order to compare the territorial conformity of the distribution of new registered entities, the values of Florence indexes were calculated with the other features, and the results were presented in table 3.

Table 3

The Florence index for specific features and years

Variable	2009	2010	2011	2012	2013	2014
SREV	0,12	0,14	0,12	0,11	0,11	0,11
TEXP	0,18	0,14	0,13	0,13	0,12	0,14
REXP	0,21	0,21	0,17	0,18	0,18	0,17
KEXP	0,25	0,30	0,30	0,27	0,27	0,22
SEXP	0,20	0,17	0,17	0,12	0,14	0,11
BEXP	0,20	0,18	0,17	0,15	0,15	0,11
IEXP	0,18	0,11	0,14	0,12	0,14	0,15
CEXP	0,17	0,21	0,13	0,13	0,15	0,14
MEXP	0,21	0,17	0,20	0,20	0,25	0,23
IENT	0,14	0,15	0,16	0,17	0,15	0,14
PENT	0,15	0,15	0,16	0,17	0,14	0,14
RENT	0,14	0,15	0,16	0,17	0,15	0,14

Source: Own calculation.

The Florence location coefficients for the analyzed variables in the whole period studied have values from 0,11 to 0,30. In all provinces the distribution of new registered entities corresponded with the other variables. The highest values of the coefficient in the analyzed years are observed for expenditures on acquisition of external knowledge in industrial enterprises, expenditures on marketing for new and significantly improved products in industrial enterprises, and expenditures on R&D in industrial enterprises. We can conclude,

therefore, that with respect to expenditures on intangible innovations compared to the number of new registered entities, the biggest differences occurred in individual provinces.

The studied period shows a significant variation in the values of Herfindahl-Hirschman and Florence indexes (tab. 4). The variability coefficient for the Herfindahl-Hirschman index exceed the value of 30% for the variable expenditures on acquisition of external knowledge in industrial enterprises, capital expenditures on buildings, structures and lands in industrial enterprises, and expenditures on staff training connected with innovation activity in industrial enterprises. The coefficient of variation for the Florence index was the highest for the variable expenditures on acquisition of software in industrial enterprises and expenditures on staff training connected with innovation activity in industrial enterprises, but it did not exceed the value of 25%.

Table 4

Coefficient of variation for Herfindahl-Hirschman and Florence indexes

Variable	The coefficient of variation for	
	Herfindahl-Hirschman index	Florence index
NENT	3,22%	-
SREV	18,34%	10,15%
TEXP	19,32%	15,76%
REXP	24,27%	9,44%
KEXP	44,24%	12,28%
SEXP	15,87%	24,22%
BEXP	38,24%	19,77%
IEXP	13,75%	19,25%
CEXP	31,92%	20,14%
MEXP	12,93%	14,02%
IENT	0,80%	7,34%
PENT	1,11%	7,59%
RENT	1,07%	8,70%

Source: Own calculation.

The high variation of the index values is indicative of a lack of stability in uniform development of innovation in provinces. Especially big is the variation in terms of the concentration of innovation concerning expenditures on acquisition of external knowledge in industrial enterprises and capital expenditures on buildings, structures and lands in industrial enterprises. It seems, then, that the years 2009-2014 saw not only a non-uniform distribution of expenditures on acquisition of external knowledge and on buildings, structures and lands but also a significant variation in terms of the dominance of provinces in individual years.

In order to determine the direct links between the development of entrepreneurship and innovation, the relationship between the number of new registered entities and the other variables was analyzed (they were paired according to the year). The Pearson correlation coefficient was used. The results were presented in table 5.

Table 5

Pearson correlation coefficients for amount of new registered entities and other variables

Variable	Years					
	2009	2010	2011	2012	2013	2014
SREV	0,674052*	0,536925*	0,657635*	0,712949*	0,480625	0,666872*
TEXP	0,332794	0,812780*	0,539537*	0,535541*	0,592076*	0,549588*
REXP	0,315547	0,609113*	0,474552	0,550484*	0,535560*	0,475403
KEXP	0,236322	0,598064*	0,489205	0,161032	0,328123	0,640795*
SEXP	0,256804	0,756355*	0,484303	0,748561*	0,747983*	0,770516*
BEXP	0,308426	0,727671*	0,625820*	0,532026*	0,412102	0,682479*
IEXP	0,320450	0,825923*	0,527236*	0,451784	0,480727	0,420765
CEXP	0,301318	0,483316	0,647334*	0,583162*	0,676481*	0,461823
MEXP	0,325067	0,817709*	0,602213*	0,439809	0,469688	0,421920
IENT	0,087032	-0,164507	-0,195478	-0,607942*	-0,363547	-0,013541
PENT	-0,217757	-0,140258	0,020330	-0,636151*	-0,127319	-0,039352
RENT	0,094766	-0,196385	-0,199297	-0,553267*	-0,213650	0,192648

*Correlation coefficients statistically significant at a significance level of 0,05.

Source: Own calculation.

The years 2010-2014 show a moderate correlation mainly between the number of new registered entities and share of net revenues from sales of innovative products, between amount of new registered entities and total expenditures on innovation activity in industrial enterprises, and between the number of new registered entities and capital expenditures on buildings, structures and lands in industrial enterprises. This leads us to the conclusion that the development of entrepreneurship in a given year is chiefly connected with investments in real estate fixed assets. In the year 2012 there was a correlation between the number of new registered entities and the majority of the other variables. In fact, this year did not show a correlation only between the number of new registered entities and: expenditures on acquisition of external knowledge, capital expenditures on instruments, and equipment, expenditures on marketing for new and significantly improved products. In general, though, we cannot prove a direct correlation between entrepreneurship and innovation expressed through the expenditure and the number of innovative enterprises.

Conclusions

The subject literature emphasizes the fusion of entrepreneurship and innovation and the necessity to discuss them together. Innovation is often an effect of entrepreneurship because creative ideas are rendered into business categories. As they create good conditions for development, entrepreneurship and innovation bring success to companies as well as the whole regions.

Entrepreneurship and innovation complement each other, which gives good foundations for studies of the inequality of their development. There is, however, a significant difficulty. It is hard to determine the method for measuring entrepreneurship and innovation as the understanding of the two notions is broad. The measures of entrepreneurship and innovation presented in the article were based on a definition of categories which prevails in the literature. The analysis of concentration and correlation brought us to the following conclusions:

1. A lack of or a moderate level of concentration in the case of the share of net revenues from sales of innovative products in industrial enterprises is indicative of a non-uniform distribution of the effects of innovative activity achieved in individual provinces. Therefore, there are no provinces whose effects measured by the share of net revenues from the sales of new or significantly improved products differ much from the other provinces. A lack of concentration is also observed in the number of new enterprises in individual provinces. This lets us conclude that there is a uniformity of the development of entrepreneurship and innovation in Poland in a regional view.

2. Provinces diversify expenditures on innovative activity as the concentration of this variable is moderate or strong. Particularly big differences in the non-uniformity of the distribution are observed for expenditures on acquisition of external knowledge and capital expenditures on buildings, structures and lands in industrial enterprises.

3. The correlation analysis did not show any direct link between entrepreneurship measured through the number of new registered entities and innovation expressed through the number of innovative enterprises and volume of expenditures on innovation activity. Except for the year 2013, there was, however, a moderate correlation between the number of new registered entities and share of net revenues from sales of innovative products. This means that entrepreneurship translates into the basic effect of innovation.

Provinces realized innovation policy to different degrees in individual years which is revealed by a significant variation of the values of concentration indexes. In all the analyzed years and provinces we observed a conformity of the territorial distribution of new registered entities with innovation measures. This leads to the conclusion that entrepreneurship and innovation complement each other.

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