

THE ROLE OF CLUSTERS IN GENERATING BREAKTHROUGH INNOVATIONS BY ENTERPRISES

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Abstract

The article focuses on the role of clusters in the increasing of innovative activity of enterprises that belong to them. The purpose of the work has been to study to what extent functioning within a cluster has a stimulating effect on inventive activity of firms. This aim has been achieved based on a comparative analysis of the number of patent applications filed by enterprises to the Industrial Property Office of the Czech Republic before and after the beginning of cooperation within a cluster. Therefore, the study period has been split into the period of total inventive activity up to the time of establishment of the cluster and the period from the date of establishment of the cluster to 2014. The study includes enterprises being members of industrial clusters of Ostrava. The conclusions of the work indicate that belonging to a cluster affects not only a general increase in the number of applications filed to the Industrial Property Office but also an increase in the number of enterprises that can boast of inventions.

Key words: cluster, inventive activity, patent applications

JEL Code: JEL Code, JEL Code, JEL Code (2 – 3)

Introduction

One of the foundations of modern economies focused on technological progress are inventions, defined as radical or breakthrough innovations. They include all new and unobvious technical solutions which may be used in business practice in any industry. Their role in increasing competitiveness and stimulating technological change has been important enough to receive special institutional protection in the form of exclusive rights (patents).

Simultaneously, in the face of the problem of insufficient supply of inventions, new solutions meant to stimulate patenting activities of business entities are looked for on the basis of economic theory and business practice. One of the concepts implemented at the regional level is concentration of enterprises within a cluster, whose function has undergone significant modification compared to the original assumptions. While the initial role of a cluster was

limited mainly to stimulating entrepreneurship and economic growth (by creating a network for multilevel cooperation of entities focused on achieving a common goal), currently the center of gravity has shifted towards stimulating innovation and consequently also economic development. A new term has even been coined – innovative cluster, understood as concentration of independent innovative enterprises and research institutions, which through intensive contacts, sharing of technical facilities, exchange of knowledge and experiences and formation of a network of relationships mutually stimulate their innovative activities.

Contrary to uncritically repeated opinions on the fundamental role of clusters in stimulating innovative processes in enterprises and regions, belonging to a cluster itself is not the key to achieving success in this area. The occurrence of effects in the form of increased inventiveness is determined by a number of factors, including geographical and historical conditions.

In light of the above, the purpose of the article is to study to what extent functioning within industrial clusters of Ostrava has had a stimulating effect on inventive efficiency of enterprises measured by the number of patent citations..

In order to be able to draw long-term conclusions, four clusters formed before 2009 have been taken into account in this work. Patenting activity has been measured with the number of patent applications for inventions rather than the number of patents received since they appear to be a better estimation measure of activity of entities in this area. Simultaneously, the time scope has been divided into two periods: the first one covering total patenting prior to the establishment of the cluster and the other from the date of the establishment of the cluster through March 2, 2014.

1 Cluster affiliation and inventive activity – literature review

It is widely believed that cluster affiliation lets its participants achieve a number of benefits, such as reduction in business costs, possibility of obtaining public funds or expansion into new markets. First of all, however, emphasized is the potential of clusters as places where diffusion of knowledge and, consequently, generation of innovations take place. From the point of view of the development of a region as well as the whole economy, the latter benefit is especially important.

The success of clustering in increasing innovative activity of enterprises may be a result of many conditions, it seems however that two of them are crucial. The first is the possibility of research cooperation between particular members of the cluster, which leads to

faster and more effective flow of knowledge and internalization of R&D work effects (Spence, 1984), as a consequence of which the enterprises have greater motivation to undertake creative effort. The second factor is geographical proximity between particular cluster members which is important for the establishment of close social relationships and promotes *face to face* contacts, which are especially important for tacit knowledge acquisition (Bodas Freitas, Geuna, & Rossi, 2013; Ceci & Iubatti, 2012; Azoulay, Zivin, & Sampat, 2011; Breschi & Lenzi, 2010). It is important in spite of the emergence of ICT technology, which is not able to replace direct contacts in the case of acquiring innovative know-how but only in the case of codified knowledge (Leamer & Stroper, 2001).

As it is emphasized in literature, however, geographical proximity and R&D cooperation connecting cluster members need not by themselves significantly affect behaviors in the area of innovativeness of enterprises. A number of other factors are also indicated, sometimes specific for a given region, which are indispensable in creating economic success of a cluster. An example in support of the above opinion are recent studies by Nishimura and Okamuro (2011) who observe on the basis of data on small enterprises in Japan that cluster membership alone does not contribute to increase in R&D productivity of those businesses. Moreover, research cooperation with a partner in the same cluster region reduces innovative productivity both in terms of quantity as well as quality of patents.

It is emphasized in literature that relying mainly on localized knowledge by lead to „closing“ of the cluster and to lack of new ideas, as a result of which proximity between cluster member rather than being an advantage becomes an obstacle in increasing their innovativeness. It is especially valuable therefore to found R&D activity not only on cooperation within a cluster but also on linkages with entities not belonging to the cluster (Morrison, Rabellotti, & Zirulia, 2013). An important role in building external relations of the cluster is played, among the others, by international corporations making foreign direct investments in the cluster. However, it should be emphasized that taking advantage of external sources of knowledge requires that cluster members possess general absorption capacities (Giuliani & Bell, 2005).

In the case of some clusters, or regions, crucial for innovativeness of its members is the inclusion of a university or scientific research center into cluster structures (Mowery & Ziedonis, 2001) and it may especially concern processing industry clusters (Loof & Brostrom, 2008). In other cases, like e.g. in New Zealand, knowledge acquisition and consequently innovativeness of cluster members are determined mainly by organizational proximity between the entities (Davenport, 2005). It is also emphasized that the development stage of

the cluster is not without meaning for the increasing of research productivity of its enterprises. Usually, the effects in the form of increased innovativeness of enterprises occur only in the second (growth) or third (maturity) phase of cluster life.

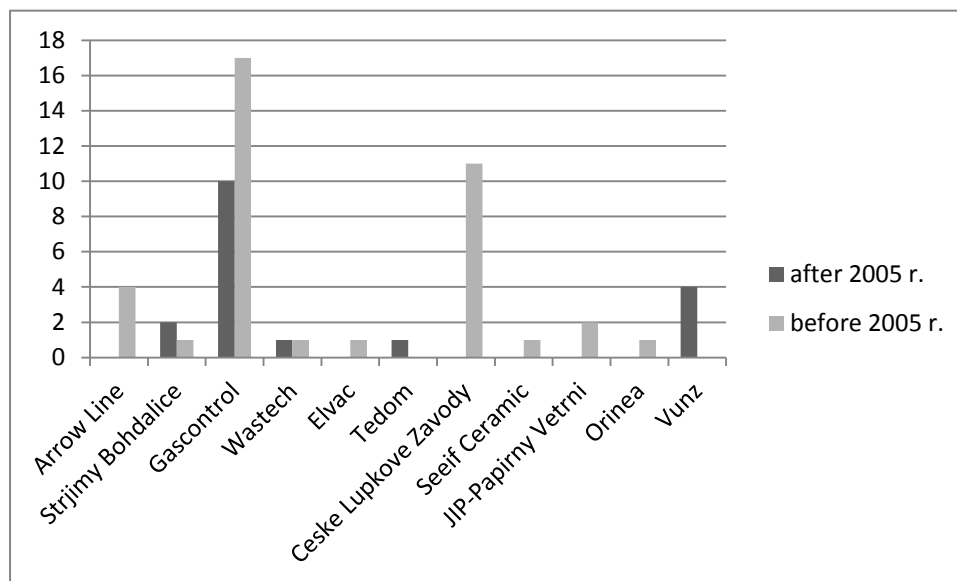
In countries which are transforming their economies and which relatively recently joined the EU, such as the Czech Republic and Poland, cluster structures are only beginning to form, which results in most clusters being only at the first stage of their lives, i.e. embrional phase. At this stage no spectacular outcomes should be expected in the area of cluster members' inventiveness. This is confirmed e.g. by studies of Polish clusters from Lower-Silesian region (Niklewicz-Pijaczyńska & Wachowska, 2014), in light of which only three out of nine analyzed clusters managed to increase their general levels of inventive activity. Patenting activity of four clusters stayed unmodified while in two clusters it even deteriorated. Simultaneously, although among 19 enterprises from all the clusters 10 companies (over 52%) increased their breakthrough innovativeness levels measured by the number of patent applications after the beginning of co-operation within a cluster, 6 of them (over 31%) observed deterioration of their results and the activity of 3 (over 15%) remained at an unchanged level.

2 Patenting activity of enterprises in Ostrava clusters

According to the European Cluster Observatory (ECO), 17 cluster structures functioned in the Czech Republic in 2010, which allowed it to achieve the third position in terms of the number of clusters among countries that joined the EU in 2004 (Pilarska, 2013). In this regard the Czech Republic was overcome by Poland (40 clusters) and Hungary (41 clusters). The Moravian-Silesian region in the Czech Republic belongs to more important ones in terms of the number and dynamics of creating of cluster initiatives.

The Envicrack cluster was created in 2005; its membership consists of 26 enterprises. Five of these showed inventive activity in the period prior to the establishment of the cluster, of which two did not file any patent applications after the date of the establishment of the cluster. Meanwhile, nine of its members filed applications to the Industrial Property Office. These enterprises included Arrow Line a.s, Strojimy Bohdalice a.s., Gascontrol společnost s.r.o., Wastech a.s., Elvac a.s., Ceske lupkove Zavody a.s., Seeif Ceramic a.s., JIP-Papirny Vetrni a.s. and Orinea s.r.o. (Fig. 1).

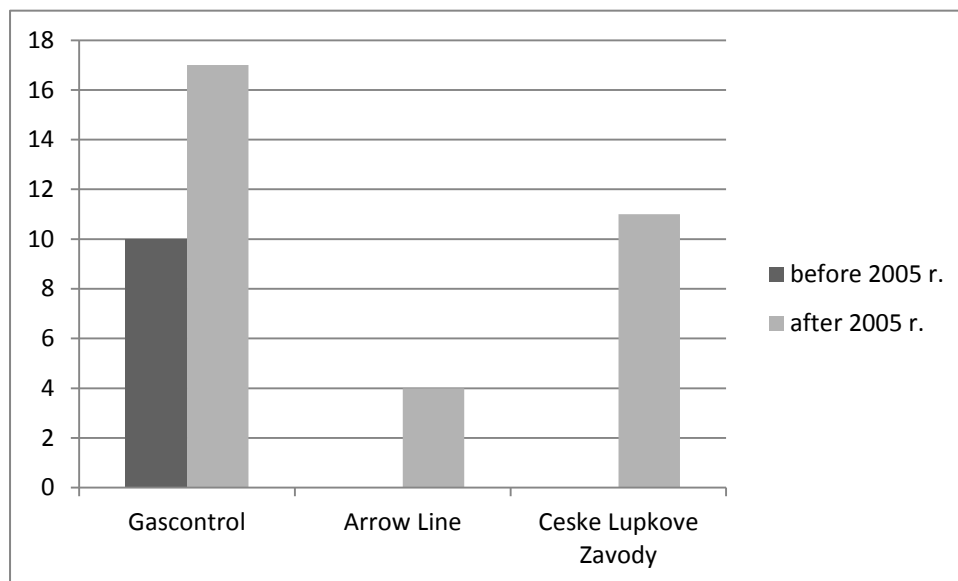
Fig. 1: Number of patent applications filed before and after cluster establishment (after 2005)



Source: own work

Among the firms covered by Fig. 1, the largest general patenting activity (in the whole studied period, i.e. both before and after the establishment of the cluster) was showed by Gascontrol (27 applications) and Ceske Lupkove Zavody (11 applications). The latter enterprise has also the most patents, i.e. seven, and all projects it filed for protection were developed in cooperation with third parties. Up to the moment of the establishment of the cluster, the largest patenting activity was shown by three of the enterprises covered above. These were Gascontrol, Strojimý Bohdalice i Vunz. The first one filed 10 applications requesting protection rights for inventions to the Industrial Property Office, the second one had two patent applications and the third one filed four applications. Meanwhile, after 2005 the largest patenting activity was shown by Gascontrol, Ceske Lupkove Zavody i Arrow Line. During that period, Gascontrol filed 17 applications to grant protection rights for inventions. What is interesting in the case of this company is that from 2011 a strong cooperation with third parties could be noticed since all its patent applications were prepared as a result of common research and development work. Ceske Lupkove Zavody filed 11 patent applications during that period. Meanwhile the third firm – Arrow Line, while it had no patent applications before 2005, it had 4 patent applications after 2005 (Fig. 2).

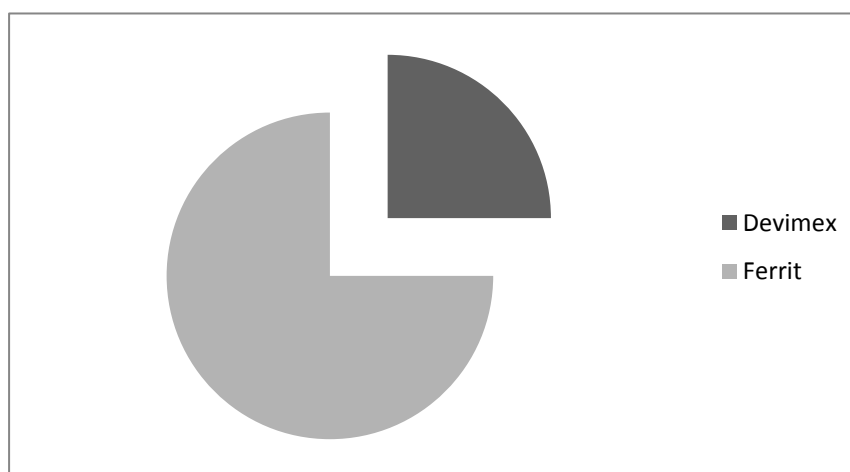
Fig. 2: Number of patent applications of Gascontrol, Ceske Lupkove Zavody and Arrow Line before and after 2005



Source: own work

In the case of the second cluster covered by this analysis, Národní strojírenský klastr established in 2003, only two of its members show inventive activity – Devimex s.r.o. and Ferrit s.r.o.; and it takes place only during the period after the establishment of the cluster. In the case of Devimex s.r.o. the application was filed to the Industrial Property Office in 2007 and resulted in granting of the patent four years later. Meanwhile, Ferrit s.r.o. filed an application thrice: twice in 2007 and once in 2009. All applications are being processed at present and the firm has not yet received any exclusive right to an invention (Fig. 3).

Fig. 3: Number of patent applications of Devimex s.r.o. and Ferrit s.r.o.

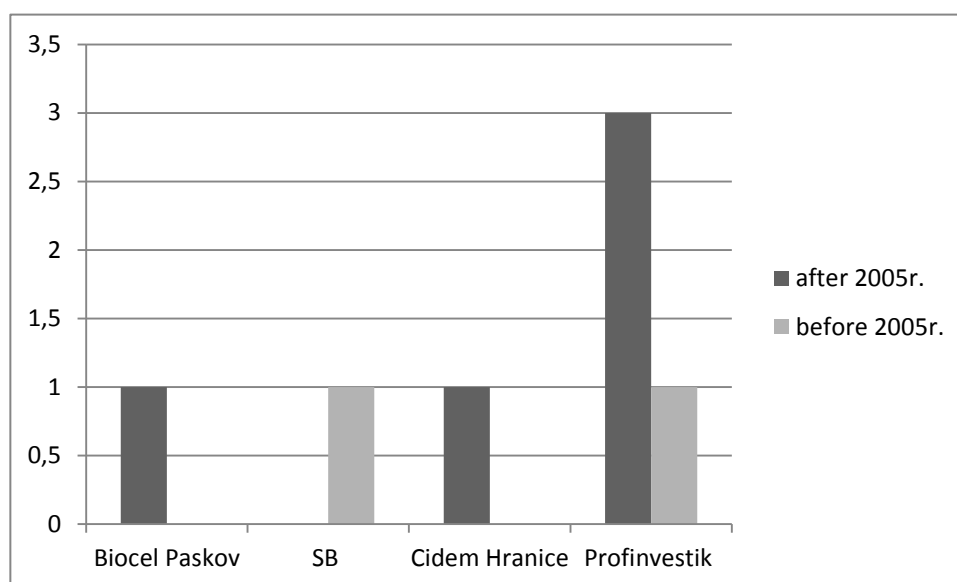


Source: own work

The remaining members of the cluster did not show and consequently do not show any inventive activity measured by the number of applications in the Industrial Property Office.

So far as the third cluster is concerned – Moravskoslezský dřevařský klastr established in 2005 – only four out of the twenty-three enterprises grouped in it showed or show patenting activity. These are Biocel Paskov a.s., SB s.r.o., Cidem Hranice a.s. and Profinvestik s.r.o. Among these four firms the last one stands out with four patent applications. The remaining enterprises filed one application each. At the same time, only two firms - Profinvestik s.r.o. and SB s.r.o. had one invention filed each after 2005, i.e. the date of the establishment of the cluster (Fig. 4).

Fig. 4: Number of patent applications before and after cluster establishment (after 2005)

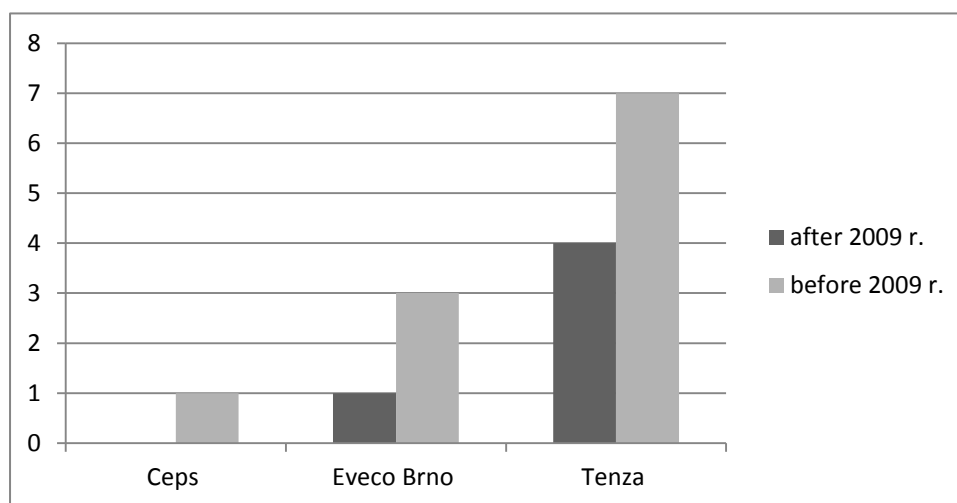


Source: own work

In the case of the last of the analyzed clusters – Moravskoslezsky energeticky klastr established in 2008 – only three out of its sixteen members show patenting activity (Fig. 5).

With regard to Ceps a.s., its only application is dated 2009, i.e. after the establishment of the cluster. The remaining two enterprises showed patenting activity also before 2008; in this period, Eveco Brno s.r.o. had one and Tenza a.s. four patent applications filed. Meanwhile, after 2009 the first firm filed three and the other filed seven applications requesting protection rights in the form of patents. Currently, both firms have one patent each.

Fig. 5: Number of patent applications before and after cluster establishment (after 2009)



Source: own work

Conclusion

The analysis of patent applications for inventions by enterprises belonging to clusters covered by this study shows that as many as three out of four observe an increase in the number of enterprises active in this area after the date of the establishment of the cluster. These include Moravskoslezsky energeticky klastr, Národní strojírenský klastr and Envicrack klastr. In Moravskoslezsky energeticky klastr there are three firms that are patent-active, with one having no inventions filed before the establishment of the cluster. In Národní strojírenský klastr two firms operate whose total patenting activity takes place during the period after the establishment of the cluster. The largest dynamics of increase in patent-active firms occurs in the third cluster - Envicrack klastr. Here, the number of firms filing its solutions to the Industrial Property Office almost doubled, from five before to nine after the moment of cluster establishment. It was only in Moravskoslezský dřevařský klastr that the number of patent-active enterprises decreased, from three to two entities. Moravskoslezský dřevařský klastr is also the only cluster in which the general number of applications decreased during the period after its establishment, from five to two. In the remaining clusters a systematic increase in the number of patent applications has been observed. This number increased from five to eleven applications in Moravskoslezsky energeticky klastr and to four applications in Národní strojírenský klastr with none before the establishment of the cluster. The largest dynamics of increase in patent applications, however, occurred in Envicrack klastr, where the number of applications increased from eighteen to as many as thirty-nine from the moment of the establishment of the cluster.

Thus, the research conclusions show that cluster membership affects not only the general increase in the number of inventions filed to the Industrial Property Office but it also activates patenting in economic entities belonging to the cluster. Although it happens that few enterprises do not show initiative in this area during the period after the establishment of the cluster, it is when the vast majority intensifies its patenting activity. Moreover, patenting activity of five out of the firms covered by the data started at the moment of the establishment of the cluster. What is important, also the dynamics of increase in the number of patent applications after the establishment of the cluster is considerably higher than observed before its establishment.

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