

Recognition of the determinants of innovation capacity of enterprises

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Abstract: The aim of this article is to present the concept of analysis aimed at evaluating the innovative capacity of enterprises. The starting point for its estimation is the innovative potential of the surveyed enterprises, while reference is made to the innovation system of enterprises. The aim of the research outlined in this way required the development of the concept of diagnostic analysis aimed at evaluating the innovative potential and capacity of an enterprise. An important research tool is the analysis of the relationship between the resources and the capacity, which shows the cause-and-effect relationship between these categories.

The following arguments have been assumed in the presented concept: 1) innovative capacity is both a function and a criterion for the evaluation of the innovation system of an enterprise, as well as for the projection of the possibility of expanding innovative activities; 2) innovative capacity can be seen in parts as well as in an aggregate structure for a given enterprise or the entire industry; 3) the value of innovative capacity (innovation potential, innovation system) can be classified at the following levels of quality: low, medium and high, using the method of categorization. The research procedure has four steps: 1) determination of the object and scope of analysis; 2) formulation of dimensions (criteria) of the innovation potential; 3) measuring the quality level of innovative capacity; 4) verification. For illustrative purposes, an example of the innovation capacity of enterprises was shown. The research included 316 enterprises from the Małopolska Region.

Key words: innovativeness of enterprises, innovation, innovative capacity

1. Introduction

It is often emphasized in already large and extensive literature that innovation of organizations increases their competitiveness and sustains the development of these organizations. Innovative capacity is the basis for innovation and a reference to its estimation at the same time. Innovative capacity in general is a criterion for the assessment of a given system, which can be an enterprise, institution, region or national economy.

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In its complexity, innovation is understood and defined in various ways. In this article, innovation is understood as any change in different areas of organization's activities, favourable as a rule, leading to progress in relation to the existing situation, assessed positively according to the criteria of a given organization. It is also assumed that examination of the innovation system of an organization requires the extension of the field of analysis to the problem of innovative potential on the one hand and to the issues of innovative activities, i.e. innovative capacity as well as invention and diffusion of innovation, on the other. Thus, innovation of an enterprise is the function of innovative potential and innovation activities of the enterprise, determined by innovative capacity (see Figure 1). Innovation system is in turn the systematization and location of actors, i.e. companies and other organizations that participate in generating, diffusion and application of useful novelties (the foreground), leading to economic benefits in the manufacturing process (Hall and Williams, 2008, p. 24).

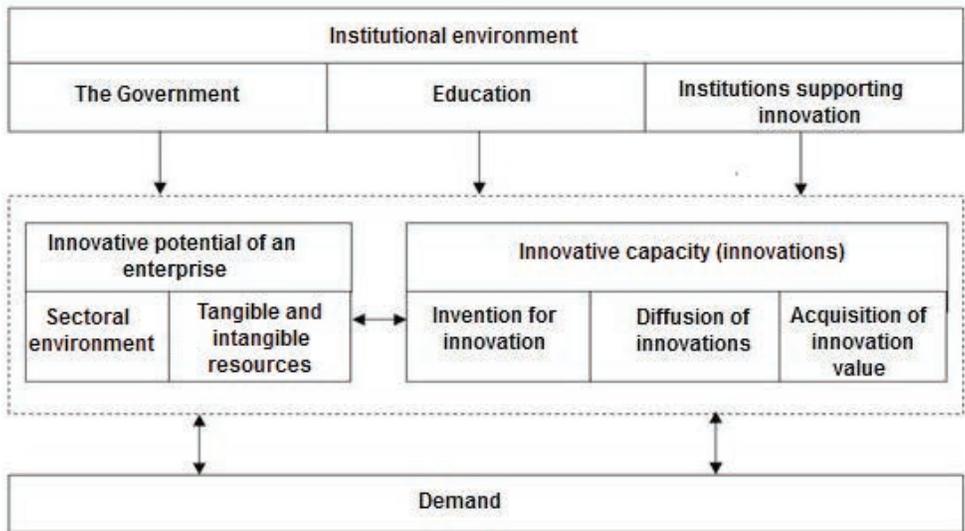


Figure 1. The innovative potential and innovative capacity within the innovation system of an enterprise

Source: (Koziol, Wojtowicz, Karaś, 2014, p. 49).

Innovative potential of an enterprise is defined as a set of socio-economic features, shaped within the development of a given enterprise, constituting the basis for its innovative activity. In particular, these are resources, processes, structures and factors inherent in the enterprise. Those elements which are regularly and effectively used for the creation of commercially important innovations constitute the innovation capacity of the enterprise.

Innovative potential is also determined by the sectoral environment, mainly the market, i.e. the enterprise with its customers, competitors, suppliers and cooperators (including in particular the relationship of the enterprise with its key stakeholders), since innovations especially appear at the interface with the market.

According to the researchers dealing with this issue, heterogeneity and dynamism are major indications of the development of the innovative potential of an enterprise. Without the differentiation of factors, functions and decisions, applications and subjective assessments of phenomena and processes, there is no innovative creation of wealth. On the other hand, dynamism means changes, i.e. both opportunities and uncertainty—key concepts for innovative activities (Arend and Bomiley, 2009, pp. 75–90; Foss et al., 2007, pp. 1165–1186; Bratnicki and Zbierowski, 2012, p. 80).

In conclusion of the short presentation of the issue of innovative potential and innovative capacity, it can be noticed that resources earned by an enterprise in the past affect the innovativeness of the enterprise and indirectly its innovative capacity, which is a variable controlling the innovation process implemented by the enterprise, and, above all, a regulator of the processes of invention and diffusion of innovations.¹

2. Key points of the concept of evaluation of innovative capacity determinants and research stages

The issues presented in the introduction are the basis for further analysis, in particular for the description of the concept of innovation system and innovation processes, identification and characteristics of innovative capacity determinants of enterprises in the Małopolska Region, the assessment of innovative capacity and innovativeness of these enterprises.

The aim of this article is to present the concept of analysis focused on the evaluation of innovative capacity of an enterprise. The starting point for its estimation is the innovative potential of the studied enterprises, while reference is made to the innovation system of an enterprise.

The basic problem described in this paper is the recognition of determinants of the innovative potential and the evaluation of their effectiveness as an indication of development of innovative activity and the promotion of innovativeness of enterprises, as well as formulating the model of innovative capacity of an enterprise.

The purpose of the research outlined in this way required the development of the concept of diagnostic analysis aimed at evaluating the innovative potential and capacity of an enterprise. An important research tool is the analysis of the relationship between the resources and the capacity, which shows the cause-and-effect relationship between these categories.

The following arguments have been adopted in the presented concept:

1. Innovative capacity is both a function and a criterion for the evaluation of the innovation system of an enterprise, as well as for the projection of the possibility of expanding innovative activities.

¹ Moderation occurs when the impact of the independent variable (X) on the dependent variable (Y) differs depending to the level of the third variable (Z), the so called control variable (moderating variable, moderator), which interacts with the independent variable (Baron and Kenny, 1986, pp. 1173–1182). The moderator affects the direction and/ or strength of the relationship between the innovativeness of an organization and its selective determinants, specifies the conditions in which the independent variables (resources) affect the dependent variable (level of innovation of the organization). In other words, the moderator decides on the increase, decrease or no change in value of the dependent variable (Pichlak, 2012, pp. 128–135).

2. Innovative capacity can be seen in parts (corresponding to the determinants of this capacity) as well as in an aggregate structure for a given enterprise or the entire industry.
3. The value of innovation capacity (innovation potential, innovation system) may be classified at the following levels of quality: low, medium and high, using the method of categorization.

The research was divided into the following steps:

1. Determination of the object and scope of analysis.
2. Formulation of dimensions (criteria) of innovation potential.
3. Measuring the quality level of innovative capacity:
 - a) conducting of verification assessment,
 - b) categorization of enterprises.
 - c) verification.
4. Object of the study

For illustrative purposes, an example of innovation capacity of enterprises from the Małopolska Region was shown. The research included 316 economic entities.² The SME sector dominated among the respondents—79%, then, very large entities—14%, and large entities—7%. Nearly 40% of the respondents limited their activities to the region under analysis, 33% operated on the domestic market and 29%—on the international market. A half of the respondents were service providers, the rest were engaged in trade and manufacturing. A survey questionnaire was used as a research tool.

2.1. Identification of the subject and scope of analysis

In the light of the foregoing, innovative capacity was analyzed in an aggregate form. Aggregate innovative capacity is a synthetic criterion of evaluation of the maturity of innovative potential of an enterprise (a given system), which merges the partial forms of innovative capacity presented in Table 1 into a single formula. The innovative potential in its scope may be regarded as partial or overall. The partial range corresponds to different distinct types, such as competences of employees, organization of work, modernity of IT, types of innovations, etc.

2.2. Formulating the dimensions (criteria) of innovative potential

The issue of development of the enterprise innovation system is regarded in two specific dimensions: innovative potential and innovative capacity, and it involves mainly the creation of new products (invention of innovations) and their application in practice (diffusion of innovation). The correlates of both these dimensions are areas containing specific references to

² The research presented in this article was conducted in 2010–2012 by a Team of Employees of the Management Department for the purposes of their project *Innovative activities of enterprises from Tarnów and Małopolska Region*.

the form of innovation. The determinants of the development of enterprise innovative potential are presented in Table 1.³

Table 1. Determinants of the development of innovation potential of an enterprise

Determinants	Components
Competences of managers and employees	Level of education, investment in training, time and types of training, knowledge of foreign languages, ability to use modern technologies
Modernity of infrastructure	Databases, type and layout of the IT system, the degree of use of infrastructure, methods of communication within the company
Organization of work	Types of employment agreements, solving problems in teams, innovation culture, infrastructure supporting the decision-making process, rewarding for innovations, forms of work organization, internal relationships between positions, the existence of the R&D department
External cooperation relating to innovations (knowledge alliances)	Cooperation with other entities, scope of cooperation, sources of knowledge, the number of cooperators
Knowledge protection	Access to innovations, legal forms of protection used, outsourcing, database types

S o u r c e: (Kozioł, Wojtowicz, Karaś, 2014, p. 53).

On the other hand, the determinants of changes in and development of the innovative capacity of an enterprise are those from among the determinants of the innovative potential, which are efficiently and effectively used to create innovations. Above all, a characteristic class in this sphere is represented by innovations, whose detailed forms are the number and types of innovations, such as product, process, organizational and marketing innovations, results achieved in the short and the long term and other.

Those detailed forms of the sphere of changes and development of innovativeness of an enterprise are also the criteria for the evaluation of the spheres mentioned.

2.3. Measuring the quality level of innovative capacity

Verification assessment

Verification assessment is aimed at indicating the extent to which an enterprise realized its objectives (functions) and fulfilled certain requirements. The verification assessment formula is expressed by the relation of the factual status of an enterprise (S) to the model status (M). Thus defined verification assessment is also a tool for the normalization of the assessment criteria, whereby the aggregate evaluation is possible.

³The presented set of determinants of innovative potential was isolated from among many environmental variables and the organizations' resources, using the analysis of influence factors. Indicated were those of them whose cause-and-effect relationships with innovation had been and will be relevant. Several different sources of information were used in the process of their identification. The ones relating to the environment include statistical data, special reports, results of previous studies and experts' opinions. With regard to the resources of organizations, the opinions of managers and specialists of the surveyed enterprises were used. The collected comments and statements were the basis for the selection of determinants of the innovation potential of an enterprise.

Normalization of point aggregation type was used in the procedure of evaluation of innovative capacity. It was adopted that the scoring system of the model for each evaluation sub-criterion (component) was 1 (positive scale) and 0 (negative scale). If at least 30% of scores of components of a given determinant were positive (positive scale, i.e. 1), the qualification of this determinant of innovative potential of an enterprise was positive.

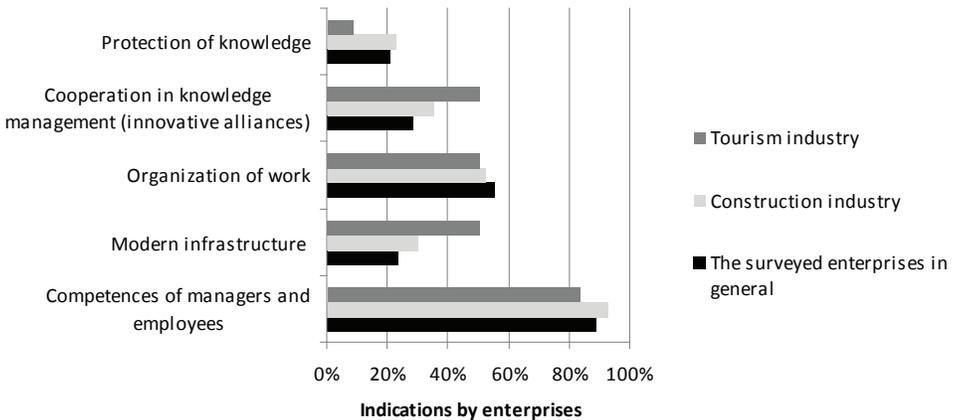


Figure 2. Determinants of innovation capacity of enterprises in construction and tourism industries (in the aggregated form) against the determinants of innovative capacity of entities from the Małopolska Region

Source: Authors' own elaboration.

The analysis of the collected data indicated that 281 surveyed enterprises employed suitably qualified personnel who have special qualifications in the field of innovation (Figure 2). The organization of work was pointed out by 176 of the surveyed enterprises as the second significant determinant of creating innovations. The fact that cooperation in the knowledge management is vital was shown by 90 enterprises (see also Koziol et al., 2013; Wojtowicz and Koziol, 2012), and modern infrastructure and taking actions for the protection of knowledge was indicated by 74 and 60 enterprises respectively.

Further analysis allowed to determine that an important factor differentiating the configuration of individual determinants of innovative potential was, among others, the industry in which the enterprise operated.

Categorization of enterprises

Categorization is a research procedure which aims at establishing the quality level of innovation capacity of an enterprise. Categorization of enterprises was carried out with respect to the levels of innovative capacity of these enterprises, comparing them with the innovations introduced (innovative activities); enterprises with low, medium and high level of innovative capacity were distinguished. It was adopted that a low level of innovative capacity was characteristic of entities which met 1 determinant of innovative capacity, medium level of capac-

ity—using 2–3 determinants by an enterprise, high level of innovative capacity—meeting 4–5 determinants. Conditional inference was used to assess whether a determinant was met.

A low level of innovative capacity is a characteristic of 115 enterprises, medium—137 (this is the dominant category of enterprises). As much as 64 entities can be classified as having a high level of innovative capacity.

In the process of assessing the innovative capacity of enterprises from the Małopolska Region, it was established that each enterprise (including those with a low innovative capacity level) was able to create and implement innovations.

Verification

Verification involves comparing the quality level of the innovation capacity of an enterprise (category) to the number of implemented innovations and their generic structures. It seeks to confirm the thesis that innovative capacity affects innovative activities (innovations) as the number and type of innovations or as a demonstration of absence of innovations.

Table 2. The number of implemented innovations according to the level of innovative capacity

Types of implemented innovations	Innovative capacity level						Total number of innovations
	Low		Medium		High		
	Number of innovations		Number of innovations		Number of innovations		
	In general	Per 1 entity	In general	Per 1 entity	In general	Per 1 entity	
Product innovations	2	0.02	15	0.1	23	0.4	40
Process innovations	28	0.2	38	0.3	39	0.6	105
Organizational innovations	73	0.6	79	0.6	56	0.9	208
Marketing innovations	34	0.3	87	0.6	57	0.9	178

Source: Authors' own elaboration.

The analysis of data in Table 2 shows that the most frequent type of innovations introduced by the enterprises were organizational innovations (208), then, marketing innovations—178, and process innovations—105. However, relatively few innovations of the most valuable type—product innovations—were introduced, only 40. Enterprises with high innovative capacity created 23 product innovations, and enterprises characterized by a medium capacity—15. Only 2 product innovations were introduced by enterprises with a low level of innovative capacity. In terms of the number of implemented innovations per 1 enterprise, the most efficient in innovation activities were enterprises with a high innovative capacity level. Enterprises characterized by a medium level of innovative capacity introduced a relatively greater number of innovations than enterprises with a low capacity for innovation. Moreover, they created relatively more product innovations, which are the most valuable. It is noteworthy that the analysis of the data indicates that enterprises with a relatively low level of innovative potential, or capacity, can and do create innovations.

The number and types of introduced innovations were used to determine the innovation level of the studied enterprises: 55 of them did not introduce any innovation, 100 of them were characterized by a low innovation level (they introduced 1 innovation of any type except for product innovations), 82 enterprises were characterized by a medium innovation level (they implemented 1 product innovation or 2 from among organizational, process and marketing innovations). A high innovation level characterized 79 enterprises, which introduced 3 or 4 innovations.

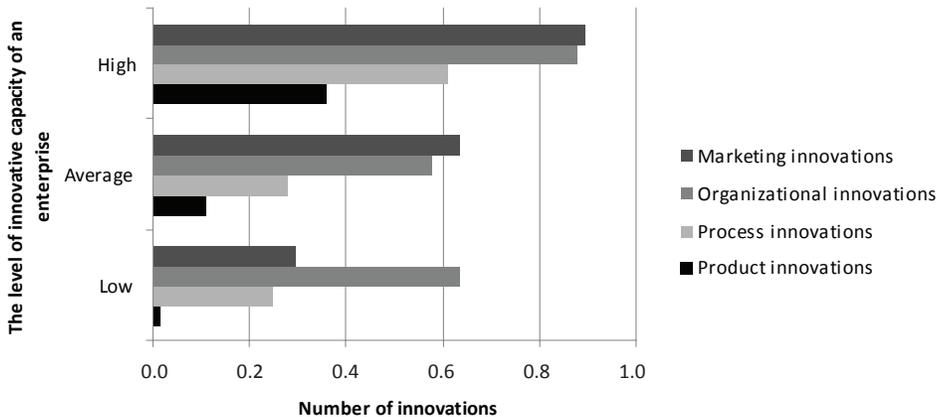


Figure 3. Number of innovations per one enterprise according to the level of innovative capacity

Source: Authors' own elaboration.

As shown in Figure 3, enterprises with a high innovative capacity used their potential most effectively. Almost 3 innovations are attributable to each one of them. Enterprises with a medium innovative capacity implemented ca 1.5 innovations, and companies with a low innovation level—only 1 innovation in general.

The research results presented in the first part of the article show that enterprises from the Małopolska Region are capable of innovations, and what is significant, for the most part, this innovative capacity is used effectively in the process of creation and diffusion of innovations.

3. Final remarks and conclusions

Studying the innovative capacity of an enterprise is a special area of analysis of innovative activities of this enterprise; it is a field of research aimed at assessing the progress in all or in certain spheres of innovative activities of the enterprise as well as programming changes and development of such activities.

This article presents a new concept of innovation system of an enterprise, the essential elements of which are innovative potential and innovative capacity of an organization as determinants of invention and diffusion of innovations. Such an approach to innovativeness on the one hand allows to assess the progress in all or in the selected areas of innovation in an enterprise, and on the other hand it allows to programme and plan the dynamics and shape of this

innovativeness in accordance with the strategy and business model of an organization. Also, a research procedure measuring the level of innovative capacity of enterprises was described and a procedure for its verification was provided.

As demonstrated by the studies presented in this article, there is a connection between the potential for innovation and innovative capacity, although it is not a directly proportional relationship. There is also a correlation between innovative capacity and innovative activities (innovations), but also in this case, this is not a dependency with a similar relationship to both figures. Furthermore, the analysis of the data shows that enterprises with a relatively low level of innovative capacity can and do create innovations.

Considerable innovative potential of the studied enterprises is used to a small extent, especially in the field of organization, technology and knowledge protection. The intensification of the use of these determinants will provide a development of innovation in the future.

The principal determinants of creation and development of innovative capacity in current ages are:

1. Managers' and employees' competences, especially knowledge from experience and knowledge gained from the outside.
2. Organization of work, in particular its features such as teamwork, innovation culture, rewarding for innovations or the existence of the R&D department.
3. Cooperation in terms of knowledge, i.e. building knowledge alliances with customers and other stakeholders, as well as using open sources of knowledge or possibly the purchase of technology.

The enterprises based the development of their potential mainly on the so called soft resources, i.e. human resources and knowledge alliances. To a large extent, the enterprises rely on absorptive capacity, which proves the use of an adaptive approach instead of a strategic approach to innovation.

In the light of the results of own empirical research as well as the outcomes of previous studies, it can be stated that enterprises compete with one another by means of the innovations created as well as by their innovative capacities. It is the development of these capacities that rises to the rank of the primary determinant of survival and growth of enterprises. Therefore, the evaluation of innovative capacity may be useful in determining competitive and strategic positions of enterprises in a given sector.

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Identyfikacja determinant zdolności innowacyjnej przedsiębiorstw

Abstrakt: Celem artykułu jest przedstawienie koncepcji analizy ukierunkowanej na ewaluację zdolności innowacyjnej przedsiębiorstwa. Punktem wyjścia do jej oszacowania jest potencjał innowacyjny badanych przedsiębiorstw, natomiast odniesienie stanowi system innowacyjności przedsiębiorstwa. Nakreślony w ten sposób cel badań wymagał opracowania koncepcji analizy diagnostycznej ukierunkowanej na ewaluację potencjału i zdolności innowacyjnej przedsiębiorstwa. Istotnym narzędziem badawczym jest analiza relacji między zasobami a zdolnościami, która ukazuje związek przyczynowo-skutkowy między tymi kategoriami.

W prezentowanej koncepcji przyjęto następujące tezy:

1) zdolność innowacyjna jest funkcją i zarazem kryterium oceny systemu innowacyjności przedsiębiorstwa, jak również projekcji możliwości dynamizowania dzia-

łalności innowacyjnej; 2) zdolność innowacyjna może być rozpatrywana w postaciach cząstkowych, jak też można ją ująć w formule agregatywnej dla przedsiębiorstwa lub całej branży; 3) wartość zdolności innowacyjnej (potencjału innowacyjnego, systemu innowacyjności) może być kwalifikowana na następujących poziomach jakościowych: niskim, średnim i wysokim, wykorzystując w tym celu metodę kategoryzacji.

W postępowaniu badawczym wyróżniono następujące etapy: 1) określenie przedmiotu i zakresu analizy; 2) sformułowanie wymiarów (kryteriów) potencjału innowacyjnego; 3) pomiar poziomu jakościowego zdolności innowacyjnej; 4) weryfikacja. Dla potrzeb poglądowych przedstawiono przykład zdolności innowacyjnej przedsiębiorstw. Badaniami objęto 316 podmiotów gospodarczych z regionu Małopolski.

Słowa kluczowe: innowacje, innowacyjność, zdolność innowacyjna przedsiębiorstw