

Marzena Krawczyk*
University of Łódź

Sources of Information for Innovative Activity of Enterprises. Types, Importance, Measurement**

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Abstract: *Innovation determines expansion or just existence of enterprises. It's an important element of competitive advantage and it is a characteristic that encourages customers to buy novelties. Unfortunately, with innovation activity closely related is uncertainty risk, that means insecurity that costly process of creating innovation solutions will succeed. By dint of necessity of high costs of innovation activity, only small percent of enterprises have their own research and development buck-up. More and more popular become external sources of information for innovative activity, such as: customers, research and development networks, conferences, scientist publications and journals. The paper presents sources of information used by polish enterprises in innovation activity, classify them and show its essence and importance. Main attention is put on sources, which according to modern theories of innovation and practice of innovative firms, are the most important, that means internal R&D activity and customers. An additional value of*

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* Contact: marzena.krawczyk@uni.lodz.pl, Wydział Ekonomiczno-Socjologiczny, Uniwersytet Łódzki; ul. Rewolucji 1905r. nr 39, 90-214 Łódź, Poland

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the paper is a discussion on the ways and the sense of measure the influence of chosen sources of information on the process of creation innovations in companies.

Introduction

Innovation is currently the subject of interest of many groups of stakeholders, starting from consumers of innovative products and services, through enterprises implementing or trying to create innovation to authorities seeing in innovation the factors for development and growth of prosperity. Innovation has become a desirable commodity which increasingly determines survival in a competitive and changing environment. Thus, the competitive position of economies, companies and other entities are less and less determined by available material, human, and financial resources. It is knowledge that gains importance, and especially innovative method of its deployment, allowing translating the acquired and processed information resources into innovation. The above seems to be confirmed by the current widespread of the concept of the “knowledge-based economy” (see OECD 1996).

To use knowledge in undertaken activities it is inherent to have information (Jaworski 2012, p. 73). Information is in fact an important stream of messages, which after processing becomes knowledge that can and should be promoted in the organization and fulfilled in the form of innovation. The company which gathers knowledge and uses this valuable resource becomes innovative, and as a result gains a competitive advantage (Nonaka, Takeuchi 1995, p. 3; Nonaka 2007, p. 163).

In times of growing significance and demand for information the cost of acquiring it is growing too. Consequently, one can observe the growing importance of all sources, from which data can be obtained, both the processed and unprocessed, useful from the point of view of the entity acquiring the data. This is particularly important with respect to innovation activity. Its characteristics, which are: uncertainty, above-average risk, cost-absorption, make it difficult for enterprises to be active in the field of innovation. That is why more and more firms begin to look for new sources for obtaining information about possible innovative solutions to implement. Companies appreciate and widely use the sources present in the market for a long time, such as consumers of innovative products and services, universities or scientific and specialized journals.

The aim of this paper is to present sources of information for innovative activity used by polish enterprises, classify them and show its essence and importance. The main attention has been focused on sources which based

on the theories of innovation and practice of innovative firms, are considered to be the most important, i.e., the consumers and companies' internal research and experimental development activity.

An additional advantage of the paper is a discussion on the measurement of the impact of the use of various sources of information on the process of creation innovation in companies.

Innovative Activity of Polish Enterprises

To understand the level of innovativeness of Polish enterprises it is necessary in the first place to show the difference between innovative firms and innovation-active firms, both on the definitional and empirical levels.

For the statistical and analytical purposes the innovative firm is perceived in the manner specified by the OECD in the Oslo Manual. The innovative firm is one that has introduced during the period under review at least one innovation, as defined by the OECD, regardless of the final result (success or failure) of the implementation of innovation (OECD 2005, pp. 58-59). This classification considers a company innovative when it uses its own innovative solution as well as when it uses solutions generated by other entities (Krawczyk 2012a, pp. 67-68).

The OECD has also identified in the Oslo Manual the institution of innovation-active firm which is "one that has had innovation activities during the period under review, including those with on-going and abandoned activities", for various reasons (OECD 2005, p. 59).

Thus the innovative firm is a narrower concept than innovation-active firm. The latter concept includes activities (OECD 2005, p. 59):

- "Successful in having resulted in the implementation of an innovation (...)
- On-going, for work in progress which has not yet resulted in the implementation of an innovation.
- Abandoned before the implementation of an innovation." (OECD 2005, p. 59).

Thus, the innovation-active firm is one that has had innovation activities regardless of the final result of this activity.

One of the entities gathering statistics of enterprise innovation in Poland is the Central Statistical Office (GUS). The surveyed companies are classified according to the number of employees. GUS ignores companies employing less than 10 people, the so-called microenterprises.

The GUS report identifies separately the percentage of Polish firms implementing product and process, organizational, and marketing innovations.

With regard to the first group, the report also shows the statistics of innovation-active firms. Firms operating in the industrial and services sector have been separately classified too (see GUS 2011, GUS 2012).

The GUS data show that regardless of the type of innovation implemented, large firms are more innovative than small and medium-sized (see GUS 2012). For details, see Table 1.

This may be due to larger and better R&D background, more staff, suppliers, and customers which could be an important sources of information about implementable ideas as well as greater amount of funds which can be employed in innovative activity.

Table 1. The proportion of innovative firms in all Polish firms in the years 2009-2011 by the number of employees

Type of innovation	Sector	10-49	50-249	250 and more
Product and process innovation	Industry	8.9	30.1	57.8
	Services	9.1	19.6	44.0
Marketing innovation	Industry	5.3	11.4	29.9
	Services	6.5	11.4	30.7
Organizational innovation	Industry	4.5	13.7	38.8
	Services	7.4	14.7	34.5

Source: (GUS 2012, pp. 26, 36, and 42).

Table 2. The proportion of innovation-active firms in all Polish firms in product and process innovation in the years 2009-2011 by the number of employees

Sector	10-49	50-249	250 and more
Industry	9.3	31.6	59.7
Services	9.7	21	46.1

Source: (GUS 2012, p. 21).

Interesting findings can be drawn by comparing the statistics of innovative firms with innovation-active firms in the field of process and product innovation (see Table 1 and Table 2). The percentage of the first type is lower than the latter, but slightly (see GUS 2012, pp. 21, 26) and therefore most innovative decisions taken in the period under review resulted in the implementation of product and service innovation or process innovation.

The innovativeness of Polish enterprises is relatively low. The proportion of small firms that have implemented innovations, regardless of their type and the business sector does not exceed 10%. Slightly higher is the

share of innovative enterprises in all medium enterprises, but also these statistics are not satisfactory. The percentage of large firms in all units employing more than 250 employees that have implemented innovations range from 29.9 to 57.8% (GUS 2012, pp. 26, 36, and 42).

This may be a consequence of a number of barriers to innovation activities. One can distinguish adaption barriers related to reluctance to introduce new innovation resulting from excessive bureaucracy and fear to cannibalise present products, adverse law and lack of access to human, financial, and material resources and knowledge (see *Analysis* 2010, pp. 43-44). The latter barrier can be of both endogenous and exogenous character to the enterprise. This may be a consequence of difficulty in obtaining the information which when processed can be helpful in introducing innovation or may result from the reluctance of an enterprise to learn. This confirms the importance of knowledge and sources of information in developing innovative solutions.

Classification of Sources of Information for Starting Up Innovative Activity

Before classifying the sources of information for innovation activity one should explain the difference between the concept of “sources of innovation” and “sources of information for innovative activity”. These terms are often confused with each other in the literature devoted to innovation which is a significant oversimplification of reality.

In this paper, the source of innovation will be understood, by analogy to the concept of “source,” the starting point of creating innovation (Janasz, Koziol-Nadolna 2011, pp. 34-36). According to Stawasz the said starting point can be interpreted as the impulse, inspiration, and a place to develop new solutions (Stawasz et al., 2005, p. 190). So the source of innovation is any entity that created innovative solution or idea conducting to the start of innovative activity.

The source of information is, in turn, the place where the information intended for popularisation and analysis arises or is (Puzio, Ziółkowska 1998, p. 65). This can be a person, institution, or document. By analogy to the above concept, and following Pence (1999, p. 158), the source of information for innovative activity is everything that is a creator of an idea, design, project, innovative solution or activities which contribute to the quest for innovation, excellence, and starting innovation activity.

As can be seen, the terms “source of innovation” and “a source of information for innovative activities” are not identical, although quite similar and often overlap.

In the aforementioned *Oslo Manual* OECD points out the essence of information sources of innovation activity. Among them (OECD 2005, pp. 78-80) are:

- Open information sources provide access to information and even knowledge without the need to pay high fees or free of charge. Open information sources do not provide access to ready-made solutions (machines, patents etc.)
- Acquiring knowledge takes form of a purchase of information or ready knowledge or employing employees with new ideas.
- Innovation co-operation based on active involvement in joint projects and exchange of information.
- Internal sources of information (R&D, marketing, and production departments etc.)

The Central Statistical Office, in turn, classifies sources of information which can be used by innovation-active or innovative firms dividing them into four categories (GUS 2011, p. 74):

- Internal (e.g. employees ideas, firms’ internal R&D back-up, other entities of the group).
- Market (e.g. ideas of broadly understood customers, partners, solutions used by competition, consulting firms, private laboratories).
- Institutional which can include R&D centres (R&D units, universities, Polish Academy of Sciences institutions).
- Other (conferences, fairs, exhibitions, magazines and scientific publications, scientific societies).

The Importance of Sources of Information for Innovative Activity of Polish Firms

Based on the GUS studies one can conduct an analysis of significance of particular sources of information on implementable innovation activities. The statistics presented in Table 3 focuses on the sources regarded by Polish innovative-active firms as “high”.

Table 3. Percentage of Polish innovation-active enterprises in 2008-2010, which found the importance of classified by GUS sources of innovation as “high”

Details		Industry		Services	
		Public sector	Private sector	Public sector	Private sector
Internal sources	Within the enterprise	40.9	43.9	44.9	44.2
	Other enterprises in the same group	4.1	8.7	3.9	11.8
Market sources	Suppliers of equipment, materials, components, and software	22.0	20.4	21.3	21.6
	Customers	17.7	18.6	11.8	19.8
	Competitors and other enterprises in the same field of activity	9.6	10.0	11.0	13.6
	Consulting firms, commercial laboratories, private R & D institutions	5.0	5.4	6.3	6.7
Institutional sources	The Polish Academy of Sciences research institutions	3.3	3.7	3.2	3.3
	R&D units	8.4	5.8	3.9	3.9
	Foreign public research institutions	2.4	3.5	2.9	2.9
	Domestic and foreign universities	9.3	5.6	4.7	4.4
Other sources	Conferences, trade fairs, exhibitions	15.8	14.5	15.7	10.3
	Scientific magazines and publications	16.6	10.0	14.2	9.7
	Scientific and technical societies and associations	5.0	4.9	5.5	4.4

Source: GUS (2011, p. 75).

The Polish innovation-active enterprises found the ideas of their employees and their own internal R&D back-up as the most important source of information about feasible and implementable projects, ventures, and

innovative solutions. The significance of this internal source was confirmed by 43.6% of industrial and 44.3% of the service sector companies (including together private and public sectors), making it the most important source.

Broadly understood suppliers are second in the classification of significant sources of information. Over 20% of industrial firms and nearly 22% of service enterprises define the significance of this source as “high”. Customers, that means users of the offered products and services, rank third. Thus, at the forefront of the most significant sources of information, are two sources, classified by the GUS as market sources.

Institutional sources were recognized by the Polish innovation-active firms as the least important. Only 6% of industrial enterprises found R&D units significant and 4.4% of enterprises from service sector defined universities as important sources for starting innovative activities. This state is quite alarming because it demonstrates poor condition of cooperation between business and science. Among other sources, attention should be paid to conferences, trade fairs and exhibitions and scientific journals in the context of finding their significance as relatively high (see GUS 2011, p. 75).

More detailed information, broken down into private and public sectors, is presented in Table 3.

Discussion on the Measurement of Impact of Selected sources of Information About Innovative Activity on the Innovativeness of Enterprises

Internal resources of an entity, in particular the employees and R&D activities conducted in the enterprise, are fundamental and crucial determinants of innovation processes. Experimental development works carried out by human resources employed in R&D are internal innovation capacity of enterprises (Krawczyk, Kurczewska, Mikołajczyk 2012, p. 253). The employees in R&D departments, who implement experimental development activities of their own devise as well as commissioned works (including those from outside of the enterprise), are a very important source of information on the implementable innovative activities. This was confirmed by the said GUS studies which demonstrated that information flowing from the inside of the organization is the most important source (GUS 2011, p. 75). This necessitates the on-going evaluation of research and experimental development which, in the context of the goal of this paper, takes the form of determining its impact on the level of innovation in enterprises.

The need to produce statistics and measure R&D activity has been proved by a broad group of researchers (cf. Ojanen, Vuola 2006, p. 280; Giovannini 2008, p. 106). Although a lot of research and activities have been made in this field, the R&D activity is taken into account only to a limited extent in public reports which focus attention on innovation.

In Europe, the Summary Innovation Index (SII) is the best known method for measuring innovativeness of economies (cf. IUS 2012, pp. 66-68; Krawczyk 2012b, pp. 25-33). The method takes into account R&D activity but only on the input side, by measuring the two indicators included in the SII (IUS 2012, pp. 66-68):

- Public R&D expenditures as a % of GDP.
- Business R&D expenditures as a % of GDP.

Despite the fact that the indicators making up the index SII have been divided into three groups: enablers, firm activities, and outputs, the index under consideration did not take into account any measure which would indicate the impact of internal R&D sphere on enterprises innovation activity. What is more, none of the elements, which make up the SII composite indicator, measures the degree to which enterprises use sources of information about implementable innovation solutions or their impact on the implementation of innovation. The indicators used in the SII methodology can only indirectly inform about that and about enterprises' innovation potential, for example, by indicating the percentage of firms collaborating with others in innovation activities (IUS 2012, pp. 66-68).

The share of the innovations implemented as a result of the R&D activities of the internal R&D cells in all new innovative solutions implemented by the enterprise can be a measure showing the impact of the R&D on enterprise innovativeness. It will show which part of the implemented innovations is a result of the research and experimental development activities conducted in the enterprise.

Similarly, it is possible to measure the indicator which shows the share of innovations implemented as a result of employees ideas in all new implemented innovative solutions. This measure shows how much innovation was an idea or an initiative of the firm's employees. The information content of this indicator will be greater if it is more detailed in regard to particular types of innovation (product, process, organizational or marketing) or in terms of departments – places of employment (R&D, marketing, logistics, and production). This indicator can also show the innovative potential of human resources and be a part of the measurement of intellectual capital. From the point of view of an internal R&D activity it will be important to know what percentage of innovation attributed to R&D department employees has been successfully implemented and what is the share of these

innovations in all innovations created by the enterprise. Such an approach may reveal the importance of source of information, such as R&D conducted in the enterprise and people who conduct them, for the innovativeness of the enterprise. The higher the values of these indicators, the more important will be the internal R&D sphere as a source of information for conducting innovative activity and will stronger affect the innovativeness of firms.

The aforementioned GUS statistics show that suppliers and customers have also been recognized by Polish innovation-active enterprises as a significant source of information for innovation activity (GUS 2011, p. 75). This is reflected in the recently observed increase in popularity of the User-Driven Innovation (UDI) concept and with respect to consumers is a confirmation of the research conducted by von Hippel since the 1980s (cf. von Hippel 1986; Warzybok, Pander, Górzyński 2008). Von Hippel argues that consumers are aware of their own needs and often themselves alter the products and services offered in the market making them useful for them. Such modifications are generally innovative in nature and provide inspiration for the enterprises to make changes. Firms should therefore observe their customers and carefully listen to signals coming from them, and then attempt to implement the signals (von Hippel 1988, pp. 11-26).

The UDI, in turn, is based on the belief that only companies which are able to create, often in close cooperation with customers, products and services with features desired by users will survive in the market. In order to achieve the above, enterprises are trying to identify the hidden, often unconscious, needs of users, in order to try to meet these needs (UDI – Consumer Voice) or implement ready-made innovative solutions attributed to consumers (UDI – Consumer Leadership) (Warzybok, Pander, Górzyński 2008, pp. 4 and 10). At the same time the concept recognizes both individual consumers and cooperating companies (e.g. suppliers) as customers.

Due to the growing significance of users as a source of information for innovation activities it is important to create measures which could assess the impact of this source on company innovativeness. Analysing the available research results on the measurement of innovativeness in Poland, attention is drawn to the insufficiency of indicators taking into account the impact of customers on companies' decisions to undertake innovative activity.

With respect to all innovation-active companies relevant information about the importance of users can be provided by the analysis of the dynamics of the index studied by the GUS (2011, p. 75) defining customers as an important source of information. The increase or decrease in the value of this index will show whether the ideas and/or ready-made solutions provided by customers are used for creating innovation and whether the customers are becoming an increasingly important source of information.

This indicator, however, will not specify the impact of this source on the level of innovativeness of a company which has used it.

Similarly to indicators measuring the importance of internal R&D, the impact of a customer can be expressed as a percentage of (product / service / marketing or organizational) innovations implemented in the enterprise as a result of the implementation of consumer ready-made solutions in relation to all innovations introduced by the enterprise (Krawczyk, Mikołajczyk 2013). High values of this index will indicate that users are a significant source of information, used in conducting innovation activity. This will confirm the impact of consumers on company innovativeness.

The importance of customers as a source of information for innovative activity can also be reflected by the indicator showing relation between the revenues from the sale of innovative goods and services inspired by the customers and total sales revenues. The information content of this indicator is limited, however, it shows how the revenues from sales change due to the introduction of innovation (by examining the dynamics of revenues) and whether the implementation of innovation which was a response to users' needs contributed to an increase in revenues from the sale of innovative solutions. The increase in this indicator will show the influence of consumers on innovativeness of companies, but indirectly.

Conclusions

Today, innovation is an important determinant of development and even the existence of business entities. Innovation becomes a good desired by many "actors" of the innovation stage. Innovation provides competitive advantage to enterprises. For consumers it is a tool to meet their needs, and for authorities it is a factor for the increase of prosperity. Due to the fact that these are the firms that are the main source of innovation it is becoming increasingly essential to recognise the sources of information about implementable products / services and other innovative solutions as well as assess their importance, including their impact on the level of innovation in enterprises.

Today, enterprises can benefit from a variety of sources to obtain information useful in terms of their possible conversion into knowledge and use of this knowledge to start innovation activity. The most significant include internal sources (employees, intramural R&D) and market sources (in particular customers and suppliers). The GUS classification distinguishes also institutional sources including R&D units, universities and other sources (conferences, fairs, specialized and scientific magazines) but only a small

proportion of innovation-active firms considers these sources as significant which is disturbing since it reflects poor cooperation between business and science. In the context of a diversity of sources it should be remembered that a wider range of information about implementable innovations will be acquired by way of diversification of the above sources.

Due to the necessity to incur high expenditures on R&D activity only some enterprises conduct their own R&D activities. On the other hand, the sources of information for innovation activity outside the internal sphere of the enterprise and in particular the said customers and suppliers, are gaining importance. The increase in popularity of these sources is a consequence of the easy access and relatively low costs of access to information flowing from these sources.

In order to get a full picture of the innovativeness of enterprises one cannot ignore the analysis of sources of information used in starting innovation activities. It is important to know how the obtained information is converted into knowledge and knowledge into innovation. It would be helpful in this respect to measure the impact of particular sources of information on the level of enterprise innovation. Unfortunately, this is an extremely difficult issue since it requires capturing direct and cause-and-effect relationships between a specific source of information (for example customer idea) and the implemented innovation. Consequently, there is a lack of measures and sources of information are not taken into account in the indicators which show results of innovation and in innovation measurement methodologies. These imperfections could be eliminated by the use e.g. of the indicator which shows the share of the implemented innovations attributed to company's own experimental development in the total number of implemented innovations and other measures presented in this paper.

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