SMALL AND MEDIUM-SIZE ENTERPRISES SECTOR COMPANIES IN DISRUPTIVE INNOVATION

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Abstract

The aim of this paper is to present the results of the desk research on the determinants of innovation breakthroughs, considered in the context of distinguishing between the continuity of the development of the industry, segmentation technology and global conditions. The main aim is to highlight the position of the SMEs sector in the innovation system and the related strategic criteria that define the opportunities and risks of technological development.

Key words: breakthrough innovation, industry development continuity, value networks, innovation system.

Introduction - the impact of a technological change

The impact of a technological change can be seen from many perspectives. One of them, of particular importance from the point of view of small and medium-sized enterprises and of functional aspects of innovation systems, is to analyze the trajectory of technological progress (Dosi 1982: 147-162), analyzing simultaneously at least two dimensions, i.e.:

– the dimension of advancement in product characteristics, which is to draw the measurable path of improvement allowing for clear identification of the newly created technology that potentially improve performance in comparison to former products;
– the dimension of advancement in functional properties, which relies on the analysis of the context in which the technology responds to the needs of the market and the demarcation of measurable path of potential functional properties (of some value network) associated with the uses of technology. The range and the boundaries of the value network are defined by dominant technological paradigm of particular industry or industries for which it is possible to determine the trajectory of the development of the lower levels of the network.

The need to analyze the trajectory of technological progress carried out in the first dimension is due to strategically important differences between sustaining technologies, and the technologies disrupting the course of development of the industry.

Sustaining technology is a new technology that improves the functionality of existing products. It can be either discontinuous, radical and incremental. Common to all of this types of technology is that it improves the efficiency of existing products, which is measured by the existing parameters.

Technologies that interrupt the course of development of the industry (disruptive technologies), however, are understood as innovations that involve a deterioration of the functionality of bringing products to market very different from the existing ones and changing the perspective on the existing values. In general, products based on these technologies have worse characteristics than products with a stable position in the major markets, but have other characteristics that are appreciated by a certain group of customers (usually new). These products are usually cheaper, easier and often more comfortable to use while offering less of what the buyer from the previously established markets want and therefore are rarely of use to them. On the other hand, they are offering a different set of properties valued only on the emerging markets, far from the mainstream and not bearing much significance for them (Christensen 2010: 21-23, 58). These technologies emerge and develop on their own uniquely defined trajectories, within the original value network. When they develop to the point that they can ensure that the level and nature of the results required in another value network, they enter and displace the existing technology and its existing users with astonishing speed, simultaneously redefining the trajectory of development of the industry.

In fact, there are many examples of disruptive technologies in global reality and you should always be viewed in real time with respect to a key technology in the industry. As examples, among others, we could mention here in the context of cable telephony - mobile telephony, with respect to the light-sensitive photographic film - digital photography, notebooks - handheld digital devices, etc. Disruptive technologies can also be new business models, example of non-technological in nature are in-house corporate universities and managerial training programs, an innovation which became disruption in the course of development for postgraduate studies.

The necessity of analyzing the trajectory of technological progress in the aspect of improving the functional properties is determined by the results of several studies which showed that the rate of technological progress can exceed and often already exceeds the needs of the market. It is further justified by the fact that within the same broadly defined industries parallel value networks can exist, created in relation to opposing definitions of what makes the product valuable. The unique arrangement of the different characteristics of the product in terms of efficiency partially defines the borders of the network, where each network has a different order of the important value-making features for the same product.

Depending on the network can see the significant differences in the size of the production, the rate of its growth, product development cycle time and identifying customers and their needs. Inference of the area in terms of technological development management company and functional aspects of the innovation system in the industry is of great importance, because as you become experience the different stakeholders within the

framework of the network, they can develop the skills, develop organizational structures and cultures to create customized to the distinctive requirements of these networks[1].

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These views were confirmed by C.M. Christensen - the author of the study on the innovations in the hard disk drive industry. He put forward, based on the work of earlier researchers, "technological mudslide" hypothesis[2], which he then himself overthrew with the conclusion that at the root of failures of leading companies in the industry were neither the pace, nor the difficulty of introducing technological changes, nor are they a consequence of differences in the technological or organizational abilities, but it was the result of the positions these companies occupied in the various value networks that existed in the industry. His research has shown that innovation breakthroughs were made in the industry were, from a technical point of view, simple and largely relied on a combination of known technologies in a unique structure, allowing to achieve the value in use in new products. He proved that the leading role in the development and application of the technology disrupting the course of development belonged to those companies that made their debut in the industry, not the previous leaders. He also believes that the failure of the leaders in the industry was often the result of the delay in making the strategic decision to enter the emerging market, largely driven by the fear of the collapse of the sales of existing products. This indicates a certain regularity, that where new technology brings up the market for new applications, it does not have to be destructive in nature. However, in this case, it is self-destructive for industry leaders to wait for the new technology to reach the so called 'commercial maturity' and delaying their launch of their version of the technology to the time at which it becomes merely a response to the attack of the competitors. Businesses with stable position are particularly dynamic in their approach to sustaining innovation, while new businesses have a significant advantage in terms of vision and their mobility down the market, as well as they are characterized by having a high ability to find new applications and markets for new products.

1. The company in terms of a technological change

The analysis of desk research shows that observations of the company in the face of technological change are usually carried out in three aspects: i.e. with the focus on management-related reactions (in particular the organizational and cultural aspects), with the focus on the primary competencies and the ability of the company and with

[1] For example, the efficiency of a hard disk drive as the final product is measured in this value network in terms of information capacity, speed and reliability of data transfer, while the value network of mobile computers the same product would be evaluated in terms of shock resistance, low power consumption and small size.

[2] The synonym of businesses struggle with relentless onslaught of technological change. Based on the analysis of a technical database and on operational documentation on the hard drives of all models produced in the years 1975-1994. Christensen determined how new technologies over time spread in the industry and how these changes have affected the business enterprises.

the focus on the value network. Each of them provides an important source of knowledge on the causes of the success and failure of enterprises in the context of changes in technology and market structure. The characteristic behaviour of firms in the face of technological change provide knowledge on the functional aspects of the innovation systems, in particular the important issues that determine the management of technology transfer. Ex-post evaluation analysis of phenomena in the context of evaluating the trajectory of development of the industry and the position of enterprises in networks has allowed for the formulation of some conclusions about the determinants of their typical behaviour in situations of technological change. The result of the analysis is illustrated in Table 1.

Table 1. Enterprises in the face of technological change

	Market Leaders	Beginning Enterprises
Organizational Conditioning	As a rule, the organizational structure of these companies make it easier to introduce sustaining innovation on the level of product parts, but when the basic structure of the product requires to be changed, it hinders innovation because it requires redefinition of the principles of cooperation and communication systems	The organizational structure and cooperation of people is reflected in the way new products are designed for companies, because beginners' advantage is the fact that both the organizational structure and how in the group of people can work together to shape to facilitate the design of the most important product.
Philosophy	„Changing technology invalidates the value of the previously acquired skills". It means that leaders are guided by the philosophy of improving what they have long been „doing well" inputting their skills in the product and when an optimal solution to the problem of the technical characteristics of a product or process requires knowledge quite different than the one that is already accumulated the company does not take the challenge.	This type of enterprises has a greater use of new technologies, often because they take them from other industries in which they have been developed and tested. It involves a high risk of taking measures at the same time using the principle of non-explicit trading strategy actually selling the product to anyone who is willing to buy it.

Commercialization	For them the commercialization of the technology is based on the needs of customers - they decide to introduce innovations finding funds for its development and implementation in response to the needs of the market. If the customers do not need the innovation, commercializing is considered impossible by the company from the point of view of technical solutions. For the technology with a small demand in the market and with poorly developed customer needs, they do not invest their resources and thus more frequently implement sustaining innovations.	Market debutants are new companies in the industry at a given point of technological development. They have a high ability to find new applications and markets for new products. Innovations introduced by them to both the nature of technology and the new business model. They are characterized by a broad perspective view of the market and the lack of characterization of the target customer. Often disruptive technology that interfere with the course of development of technology is created by engineers within the structure of the industry leaders with the illicit use of their resources, and commercialization is done by setting up their own business.
Value Network	As part of a given network of values the market choice of the company is determining its perception of economic value of the new technology. It affects the shift of the resources of these companies to sustaining technologies rather than to one disrupting the course of development of the industry. Cost structure typical to a given value network has a very large impact on the types of innovation that companies consider to be the most profitable.	New companies define new stem networks of values by introducing innovation that disrupt the industry development course and that start commercial life in defined by it value networks and then invade the existing networks. Each value network has a different order of the important characteristics of the product, even in the case of one and the same product.

A significant difference between companies with a leading position in the industry, and the new enterprises is the asymmetric perception of the market situation. Dominant companies recognize primarily unattractive margins and size of emerging markets, in contrast debutants perceive potential production volume and existing margins, which in their judgment appear attractive for the implemented innovations. As shown by global examples of already implemented technologies that disrupt the course of development of the industry, the clients of the so-called 'old market' eventually accept the new products, which they rejected the initial phase of implementation. After satisfying the required properties of essential functional properties, the advantages of a simpler construction, lower price, and convenience to use offered as key in the value network of new buyers are also absorbed by the established markets. This phenomenon is an undeniable proof of justifying the necessity for widening the perspective in perception of the environment by smaller enterprises,

beginners, which in the vast majority do not analyze their market opportunities in the context of the entire innovation system, the trajectory of development of the industry or other value networks besides those already in operation.

2. Strategic criteria for SMEs in the innovation system

The existing most commonly used approach in the assessment of technological development is based on the finding that the primary manifestation of the business transition to innovative production techniques are changes in production technology in the whole industry and its sectors. It can therefore be noted that technological progress is conditioned by its own historical course on which companies in the business may have a major impact by taking their place in the trajectory of technological progress.

Models of behaviour in the context of two types of companies in the innovation system in the industry (i.e. the industry leaders and new businesses), lead to the conclusion that in the case of sustaining innovation, it becomes increasingly important to increase investment in research and development, particularly in the creation of research consortia, joint projects, as well as the adoption of longer investment horizons and planning. In addition, it is important to research, predict and reverse-engineer technology. The leaders mostly represent the most rational model of managerial decision-making, which works well in the context of sustaining innovation. It is based on value networks in which these companies make their money. Perceived this way value network determines which customers' issues will be satisfied by the company's products and services, and what costs may be incurred by the company to implement the innovation. This model does not apply in the case of disruptive technology that interrupts the course of development, because the value and use is uncertain, according to the criteria adopted by the established firms. For this reason, industry leaders often ignore the revolutionary technology that is seemingly not desirable in the first place and do not meet the needs of their customers. By investing in product performance characteristics hypertrophy, they miss the moment when the technology disrupts the current course of development and when it can attack sensitive points on the prime market especially winning by satisfying the demand of the market on the functionality and because it is simpler, cheaper and more convenient than that the technology used previously.

These observations led to the attempt to set a strategic criteria that define the opportunities and threats of SMEs in the innovation system. The basis for it has become the two-dimensional definition of a hypothesis that the boundaries of the value network in terms of technological change are determined by the unique characteristics of the product[3] and the specific cost structure.[4] In principle, the so-called general criteria relating to understanding innovation definitional forms to which they belong were defined as follows[5]

[3] It is the arrangement of the various properties according to its importance for the production results significantly different from the one applicable in other systems used within a given widely-defined production.

[4] The cost structure is appropriate to meet the needs of customers within the given network, and can have a very big impact on the types of innovation that companies consider profitable.

[5] According to which it is: the introduction of a product or service, a new method of production, opening a new market or a change in its current structure, as well as getting a new source of raw materials, semi-finished products, the change of business model or any other innovation, the implementation of which creates a certain economic value.

(Schumpeter 1960: 104):

- strategic embedding in the innovation system,
- focus on technological development,
- contextual understanding of the business,
- technology market monitoring (including the identification of potential disruptive technology that interrupts the continuity of development) by designating the trajectory of improvements and the trajectory of improvement of product characteristics and improvement of functional properties (Foster, Kaplan 2003: 134).

Small and medium-size enterprises have the greatest impact on building solid foundations for economic growth. As shown in the example of the hard drive industry, they can significantly alter the course of development of the industry. One advantage of SMEs in this context is the predominance of organizational skills to better adapt to rapidly changing market conditions. It is for these reasons, small and medium-sized enterprises by changing the way they function, in terms of the perspective of its place in the wider innovation system, get a chance to take their place in the trajectory of technological progress.

As a reason for the low level of innovation in SMEs primarily many barriers in the economic environment are listed, but in the face of the presented facts, the mentality and the management are the main reason for the technological marginalization of the industry.

Conclusions

The ability to collect resources and the ability to focus on overcoming the technical and organizational obstacles in the implementation of innovations primarily influenced by the context in which the entity competes.

Innovator's task is to ensure that innovation - technology which does not have a point to exist today - is taken seriously within the company, but without compromising and putting at the risk the needs of current customers, who make the company's profit and enable development.

Thus, new markets should be defined and developed based on the new definitions of value in separate networks. The responsibility for the creation of a business rests on focusing on its creation organization, the amount and interests of which are closely matched not only to the unique needs of customers in a given market, but also with the size of the whole system of innovation.

Universal access to patenting, analysis and prediction of events in the context of the trajectory of development of the industry, considered as both improvement of product characteristics and their functional properties, enables for a significant increase in the context of the enterprise. Increases the same vigilance on emerging markets, creates opportunities for involvement in the trajectory of technological development and significantly broadens the horizon perception of new value networks.

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