

INNOVATION POLICIES OF POLISH INDUSTRIAL ENTERPRISES BASED ON INNOVATION CUBE MODEL. RESEARCH RESULTS¹

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Abstract: Many theoretical concepts of studying innovation strategies concentrate on selected aspects and determinants of this phenomenon and dissemble cohesive and wider perspective. In result there is lack of comprehensive researches concerning innovation policies, especially covering long term, repetitive studies based on the same methodology. The main purpose of this article is to assess innovation strategies applied in Polish medium and large industrial enterprises based on three dimensional innovation activity model – innovation cube. Those dimensions are: place of creating, continuity of activity and way of innovation utilization. In result of imposition above criteria these model presents eight different variations of innovation policies. The most common innovation policy utilized in Polish industrial enterprises is individual innovator. This means that innovations were created in continuous manner, based on own resources and for own use. The test sample covered years 2007-2009 and 2012-2014. Surveys were conducted on group of medium and large Polish enterprises belonging to low-, medium- and high-tech industries. Each phase of research was based on the same methodology. From first stage 80 responses were obtained and from the second one 92.

KEYWORDS: INNOVATION, STRATEGY, INNOVATION POLICY, INDUSTRY, COMPANY

1. Introduction

Innovation is one of the key dimensions of functioning and development of the organization (Kaplan, Norton 1993:67-70). It can be perceived as decisive dilemma of company's success due to its dual role. On the one hand innovation can be seen as a source of change that can reshape company's competitive potential. On the other hand this requires investments and reconfiguration of key resources which raises uncertainty and is highly risky activity (Tidd et al. 2005:111). Therefore, innovation strategy must cope with both of these perspectives. Short term plan focused on orchestrating resource synergy and efficiency. However, long term perspective creates capacity and growth potential of organization. Moreover innovation strategy should also enable cohesion of wide scope of company's activities depending of current level of its competitiveness, development of technology and market conditions.

In general view, the key goal of the innovation strategy is to assure a long-term survival of the company and growth of its competitiveness by creating revenue streams based on delivery value to customers. On a tactic level innovation strategy should designate goals, create boundaries conditions and key assumptions for innovation process. Embeddedness of and consistency of innovation process within innovation strategy and both of them in organization's competitive strategy is crucial for achieving success in a longer perspective. These dependencies determine efficiency of innovation strategy based on achieving synergies from positive feedback between the subsystem of innovation and other subsystems of organization (Mielcarek 2016:29). Complex and multidimensional nature of this phenomenon is result of being conditioned on both, external and internal factors, as well as a need of coping operational activity with long term development.

There are many studies that emphasize one specific aspect or research perspective of innovation strategy. For instance in literature of last decades in reference to business environment and external conditions, there can be distinguished m. al.: managing relations (Ahuja et al. 2008), innovation network (Perri et al. 2006), innovation ecosystem (Iansiti, Levien 2004), business model and open innovation (Chesbrough 2006). Also in regards to organizational factors there are many concepts and research frameworks. For instance K. Zduńczyk and J. Blenkinsopp adapted idea developed by E. Martins and F. Terblanche (2003) consisting of four dimensions – strategy, structure, support mechanisms and behavior, to examine their influence on innovation (2007:25-40). In other research, to group of organizational factors researchers include financial expenditure, innovation culture, leadership, organizational structure and interorganizational relations (Assimakopoulos et al. 2011).

There are several studies and attempts of meta-analysis comparing relations of numerous factors in the context of innovation strategy (Damanpour 1991:555-590; Kimberly, Evanisko 1981:689-713). However most of those analyses are based on different scope and are focused on different level of complexity. Thus still exist a cognitive gap and need of analysis of this phenomenon that is up-to-date and based on complex research framework.

Above mentioned discourse allows to formulate main purpose of this article which is assess of innovation strategies applied in Polish medium and large industrial enterprises based on three dimensional innovation activity model – innovation cube. In specific those three dimensions are: place of creating innovation (in-house / outside), continuity of activity (continuous / occasional activity) and utilization of innovation (own usage / commercialization). In result of imposition above criteria these model presents eight different variations of innovation policies. Adoption of main goal and presented model allows derivation following research questions assuming Polish industrial enterprises:

- 1) in terms of diagnosis of innovation strategies:
 - a. What is the distribution of each of abovementioned dimensions in cube model in both surveyed periods?
 - b. What is the distribution of eight variants of innovation policies in both surveyed periods?
- 2) in terms of innovation strategies effects assessment:
 - a. What type of innovation (according to Oslo methodology) was dominant in both surveyed periods?
 - b. How innovation importance phenomenon presents in both surveyed periods?
 - c. What other effects were obtained by applying innovation policies in both surveyed periods?

2. Innovation strategy - theoretical starting points

In general main goal of business activity is creating added value for its customers in order to make profit. That is why planners must cope with several functions of strategy, extending on corresponding dimensions of company's activity (Grant 2012). First of all strategy is way to achieve goals and ensure development of organization. Therefore it reflects to future actions and intended position that company wants to acquire. To put this vision into reality, strategy should also motivate and inspire organization members. Second dimension of strategy is to ensure cohesion of organization's decisions, which is essential for managers acting within limited rationality. In this sense strategy reduces risk and scope of possible paths of development into a satisfactory solution that meets accepted criteria. Third one is function of coordination and communication. Strategy enables

cooperation of different units and individuals within organization. Process of strategic planning leads to exchange of views of involved parties and in result, to achieve consensus about how organization should proceed and control its actions (Grant 2012).

Literature brings many different views and perspective of defining innovation strategy (see Table 1). Despite wide scope

Table 1. Criteria of defining innovation strategy

Scope	Criterion	Authors	Strategy variants	Main concern of
Decision makers	Development approach	H. I. Ansoff, E. J. McDonnell, 1988; H. Mintzberg 1987	Formal plan / Emerging plan	Level of complexity and detail in preparing development paths according to future environment fluctuation and potential organization's response.
Innovation character	Creating value	H. R. Greve 2007	Exploration / Exploitation	Acquisition and developing relations with entities in order to create or discount innovation.
	Level of technological change	C. Christensen, M.E. Raynor 2003	Incremental / Breakthrough	Defining technology capabilities and capacities. Providing market acceptance of innovation.
	Source of innovation	Rothwell R., Gardiner P., 1983; Rothwell R., Zegveld W. 1985	Technology push / Market pull / Coupled	Initiating and driving of innovation activity depending on the relationship between technology developments and fulfilling market needs.
	Type of innovation	P. Doyle, S. Bridgewater 1998; Oslo Manual 2005	Organizational / Market	Organizational innovations: modification of internal elements of company in coherent way, i.e. structure, processes, culture. Market innovation: delivery of value for customers via products and distribution.
Organization	Competition approach	C. Freeman, L. Soete 1997; R. G Cooper 1984	Offensive / Defensive	Balancing cost and revenue structure. Competition and risk assessment.
	Company's function	J. Tidd, J. Bessant, K. Pavitt 2005	Technology / Marketing / Production / Human Resources / Financial	Enabling cohesion and synergy effect between company's function.
	Value chain position	P. Drucker 2006	Pioneer / Imitating / Niche	Balancing cost and revenue streams in perspective of market needs and competition activity.

Source: own preparation.

First criterion presented in the table, perhaps most general, is decision makers approach to organization development, allowing divisions of rationalist and incremental types of innovation strategy (Whittington 1994). Rationalist approach, represented by H. I. Ansoff, is based on a formal and planned path of development that must cope, with complexity of interdependencies, in the long term perspective. It is crucial to ensure company's capacity to endure changes and provide coherence in goals with corresponding organization's procedures and routines. In second perspective - called incremental approach, represented by H. Mintzberg, innovation strategy comes to continuous and evolutionary adaptation to environment fluctuations based on exploring different development paths and create readiness to change strategy whenever new circumstance appears.

Different approach presents Peter Drucker, which emphasizes and relates innovation strategy to position of organization within value added chain (2006). In this perspective efficiency of innovation strategy depends on interactions with different entities such as competitors, suppliers and customers which both, directly and indirectly, determine level of expenditures, achieved income and rate of return from innovation activity. In this view expenditures are determined by cost of resources specialization, entry cost to industry, cost of access to technology or market and cost of innovation duplication. Whilst income and return rate are dependent on market scale, competition activity and possibility of achieving innovation rent.

of analysis, it is worth to notice that below list isn't exhaustive (more criteria and variants can be proposed). At the same time presented variants describing innovation strategies aren't alternative choices. This means that innovation strategy can be characterized by a combination of different variants, i.e. *global, offensive, imitating, marketing, production and technological*.

Another perspective of defining innovation strategy is based on relationship between technology developments and fulfilling market demand. Core concept were laid by R. Rothwell, P. Gardiner and R. Rothwell, W. Zegveld (1983; 1985) that described different model of innovation process according to main source of initiating and driving of innovation activity. Their assumption focus on dominating role one of two factors: technology developments or fulfilling market needs. Later, corresponding to those considerations, C. Christensen and M.E. Raynor focus on phenomena of technological innovation included in their concept of incremental versus breakthrough innovation (2003). In this approach company pursue to deliver proposition corresponding to level of improvements that customers are able to accept, whilst company has to strive to maximize sales and minimize costs. The acceptance level of novelty differs for each industry. There are some of the most demanding customers whose expectations won't be satisfy by any of the offered products on the market. On the other hand there is a group of potential customers who would buy the product if company would reduce its price. Nonetheless the pace of technological development usually exceeds the capacity to acquire new products by the average customers. It is also important that companies by developing innovations raise limit of customer's acceptance for new products (Christensen, Raynor 2003).

Propositions presented in above table do not deplete existing criteria of analysis of innovation strategy. They rather designate complexity and scope of this phenomenon. However, due

to fragmentation of listed criteria and concept, raise a need for synthesis aim at presentation of comprehensive and consistent concept describing types of innovation strategies.

3. Variants of innovation strategies – innovation cube model

Presented model covers innovation strategy variants based on several determinants such as: scale and scope of resource base, company's bargain power and position within its competitive environment and value added chain as well as market scope and demand. The basic assumptions that create foundation and boundaries condition of this model are as follow:

1) Each variant presents general overview of company's innovation strategy, that predetermine use and efficiency of most of engaged resources and overall of achieved effects. However, at the same time some of innovation projects can be realized outside of selected variant (based on different approach and/or resources usage).

2) The ability to achieve goals of innovation strategy is limited by set of simultaneously affecting boundaries conditions. Most important of them are coping with competitor's activities and simultaneously delivering value according to customer's needs. Based on above limitations, company can choose how to realize its innovative policy. In results managers can decide if they need to cooperate or not within innovation process? Is it crucial to run continuous innovative activity or based on solely projects? What is purpose and effect of created innovation?

3) Above assumption favor covering broad variety of different configurations of individual innovative behavior of organization. In results this put pressure to extend number of variants cover by innovation cube model. At the same time it was crucial to ensure readability of the model that will determine its utility and applicability, so to limit number of variants cover by cube model.

In result of overlapping abovementioned assumptions three dimensions were selected: (1) place of innovations creation (in house or outside), (2) type of activity in terms of its continuity (continuous or occasional activity), (3) utilization of innovation (own usage or commercialization). That allows setting a three-dimensional matrix consisting of eight different variants of

innovation strategy: buyers, collectors, individual innovators, occasional innovators, brokers, guerrillas, seller and casual sellers (see Figure 1).

First of dimensions is a place of innovation creation. Companies that build own research and development resource often meet several limitations hindering efficiency of innovation operations. That is why some of organizations build relationships with other entities within innovation process. The main reasons for this is reduction of transaction costs, division of labor and specialization of activities, access to technology, markets and know-how, or sharing the risk in the project (Bae, Chang 2013:968). However collaboration within innovation activity can bring several negative effects, such as knowledge spillovers, strategic drift, unnecessary diversification, raises cost of cooperation and relationship management, lowering efficiency and product quality or creates cultural conflicts (Tidd et al. 2005:292).

Second of dimensions is a type of activity in terms of its continuity of operation. Constant running of innovation activity enables fast and flexible reactions for changes appearing in the environment and within the organization. Moreover continues operation foster control and coordination, as well as favor process of innovation management. In result, it creates the conditions for synergy, which contribute to raising the efficiency of innovation activities. Also potential advantages can be gained by implementing constant improvement of activity due to business process orientation (Harrington 1991:16–21). But the realization of innovative activity in a constant manner is also costly and not always adequate to market demand or given competitive environment.

Third of dimensions is innovation utilisation. Entities that implement innovations for their own use are usually driven by two different causes. First one is aimed at building and securing the leader position in a market. In this approach it is crucial to ensure long enough period of discounting incurred investment due to innovator rent. Second approach is to reduce the distance between the company and the market leader, which usually leads to create imitation of innovation or by providing lower cost of operation, in order to avoid risk carried out by leader (Tidd et al. 2005:121). In group of companies that aim at sales of innovations,

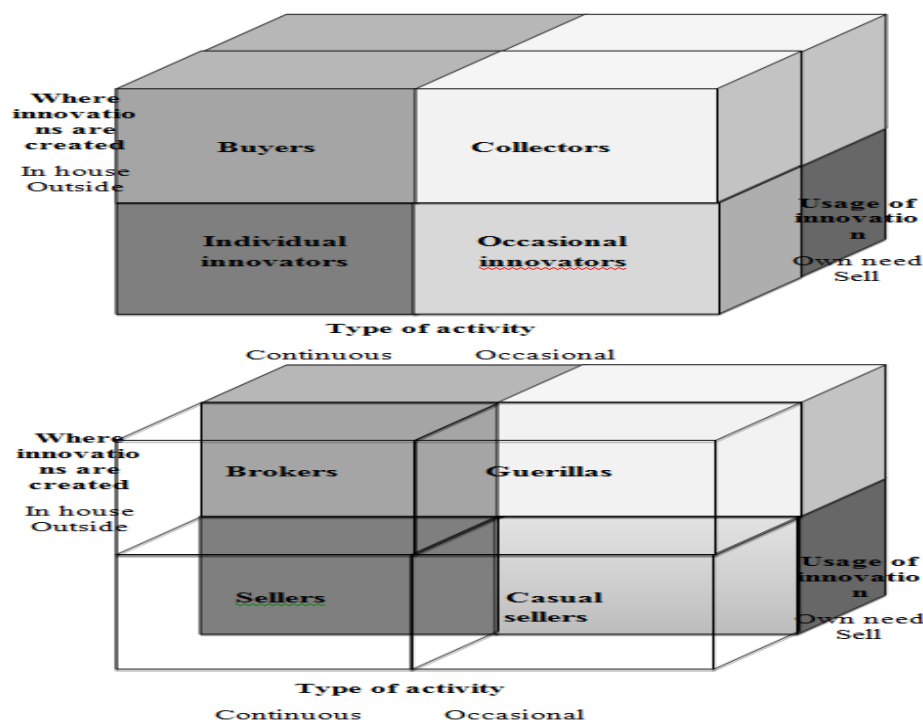


Figure 1. Matrix of innovation strategy

it is possible to distinguish few types of approaches. First of them is implemented by large companies while introducing new-generation of innovation. After successful entry to new geographical market they may decide to sell previous innovation to other, less advanced markets (Bennett 1995:273-275). Other approaches based on commercialization as innovation strategy, can aim at achieving advantage in market position due to monopoly or niche occupancy. According to M. Porter's five forces concept, along with increasing of company specialization, raises the cost of entering to industry, so other companies are forced to buy innovations introduced by more developed or specialized entities.

Above presented variants of innovation strategies correspond to both conditions created by the environment as well as the result of manager's decision and company's competitive potential and create framework for assessing innovation policies.

4. Effects of innovation strategies in Polish industrial enterprises - research results

Characteristics of the research sample

The analysed data are the result of nonprobability sampling procedure carried out on a group of medium and large Polish industrial companies. In specific, research covered six industries - two of each: low, medium and high technology. The twosteps research procedure was conducted in 2010 (the collected data cover years 2007-2009) and repeated in 2015 (the collected data cover years 2012-2014). Then responses were rejected from entities that do not establish innovation or have provided incomplete questionnaires. Altogether from a first stage of research 80 responses and from second 92 responses were collected.

The methods used in research were survey with a structured questionnaire including 17 closed questions. The questionnaire includes auto check questions in order to ensure the reliability of answers. Half of the responses were gathered via

traditional mail questionnaire survey and half were achieved by CATI method (computer-assisted telephone interview). The questionnaires were delivered to managers or specialists involved in innovation activity and R&D within companies.

Research results

First step of **innovation strategies diagnosis** was analysis of the three dimensions characterizing innovation policies of Polish industrial enterprises. In general in both surveyed periods most of responders were creating their innovations in house, based on continuous manner and for own use (see Figure 2). This kind of orientation of innovation policy is typical for closed innovation model, which seems to be less effective in highly dynamic and competitive environment.

However there can be indicated changes in patterns in both analyzed periods that mark new trends. Including dynamic perspective there tendencies between 2007-09 and 2012-14 were noticed. 1) There was raise of concentration on endogenous potential and own resource base in creating innovation (from 61% to 95% of companies). This change can be interpreted as further closing of company innovation process within organization boundaries. As advantages of this orientation are economics of scale and rise of resource efficiency but at the same time there is strong dependency of current resource base and limitation of stimulus of development. 2) There is decrease of continuity and regularity of innovation activity (drop from 67% to 54% of companies). This can mean that more enterprises turn towards use of project orientation instead of consistent innovation process. So it can reflect raise of dynamic and discontinuity of environment, especially customer's needs. 3) There is also growth of company's percentage that creates innovation for commercialization (raise from 13% to 37%). This also support view of innovation policies focused on customer's needs.

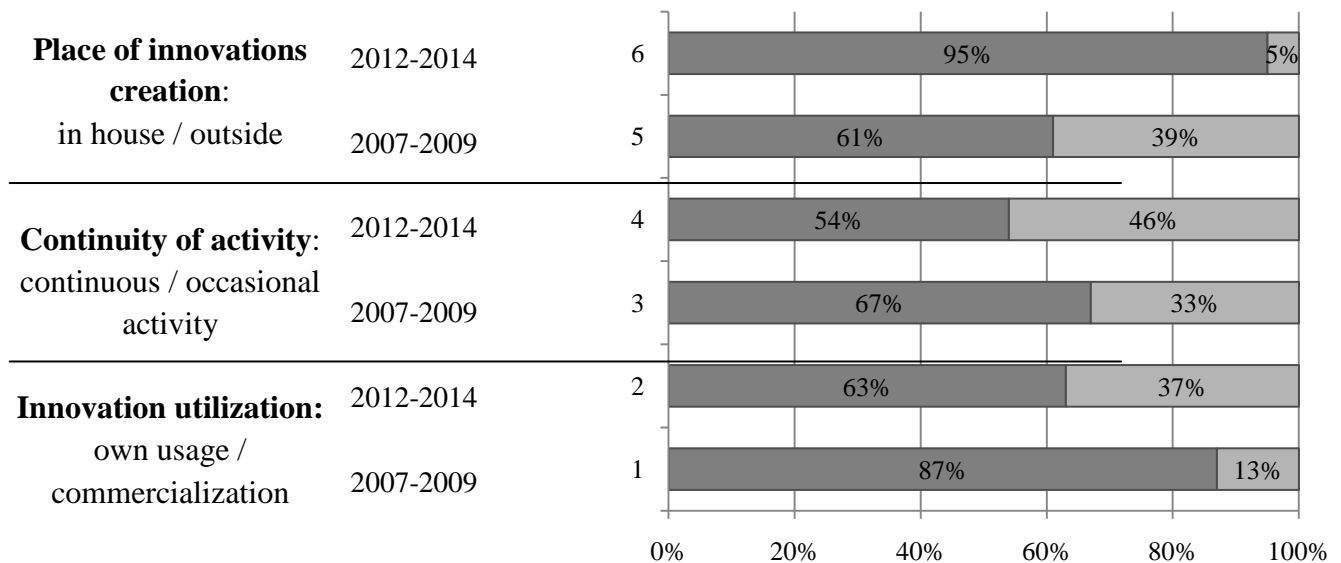


Figure 2. Three dimensions of innovation policies in Polish industrial enterprises Source: own work.

Despite some changes and observed tendencies in innovation policies, still the most common type of strategy is based on close innovation model. More than one third of surveyed companies were using individual innovator (35%), then seller (28% of respondents), occasional innovator (18%) and casual seller (14%). Rest four variants represent 5% of company's behavior (see Figure 3). Two variants: individual innovator (creating based on own resource, continuous manner and for own use) and casual innovator (creating based on own resource, in discontinuous manner and for own use) are covering 53% of all innovation policies in Polish industrial enterprises in 2012-2014. This also reflects and confirms

domination of close innovation model. Next innovation policies in term of distribution are seller (creating based on own resource, continuous manner and for sell) as well as occasional seller (creating based on own resource, in discontinuous manner and for sell). Both of those variants represent 42% of innovation policies in Polish industrial enterprises. This emphasis importance of marketing orientation in adopted strategies.

According to changes between analyzed periods there is significant growth of market orientation policies (raise about 17% of those two variants) in comparison to decrease in adoption of close innovation policies (drop about 10%).

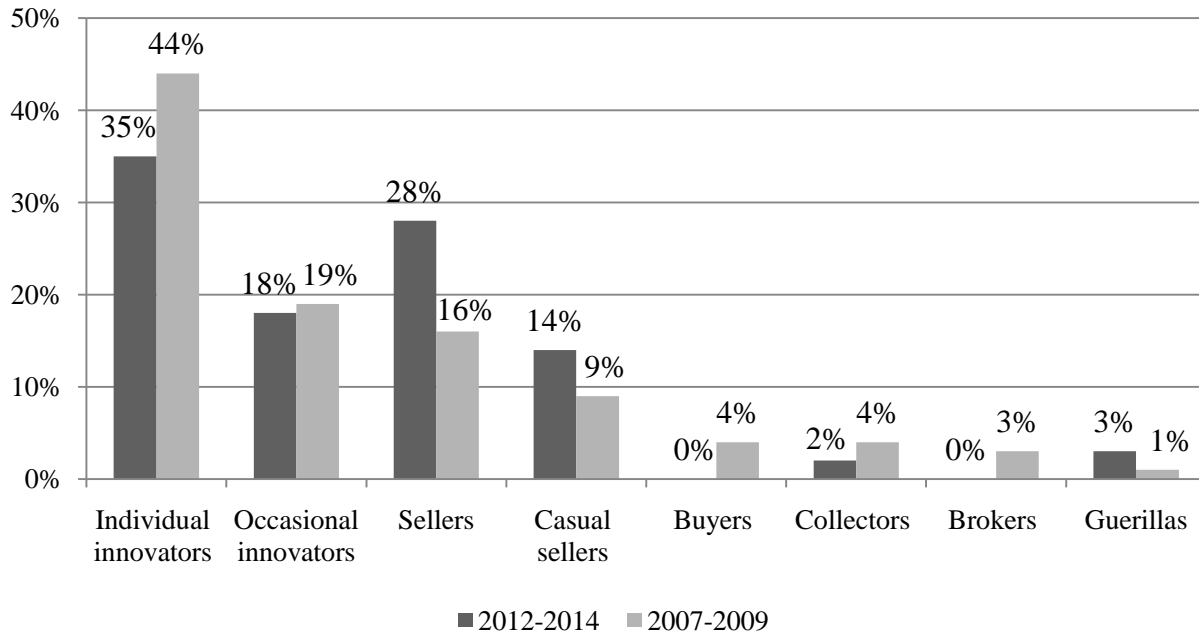


Figure 3. Distribution of variants of innovation policies in Polish industrial enterprises Source: own work.

Second part of analysis refers to **effects of innovation policies**. In this area there was analyzed innovations activities for each of innovation type (product, process, marketing and organizational) in refer to its geographical scope/importance of created innovation (see Table 2). There was assumption that the wider the geographical scope of created innovation the greater is its importance and novelty level. Innovation activity was presented as percentage (values shown in below table response number of companies that introduce at least one innovation in given period).

In general most of surveyed companies were creating product innovation, then process innovation, marketing innovation and lastly organizational innovation. In comparison between two analyzed periods more companies were carrying innovation activity

in regards to all of four innovation's types. The average values rise from 29% in 2007-09 to 35% in 2012-14.

In terms of innovation importance most common are in house innovations (implemented within company so can be interpreted as imitations in regards to their competitors) that were created in more than 50% of surveyed companies. On the second place there were innovations with country scope, next innovations with regional scope and lastly with global scope. It is worth to emphasize that innovation characterized with global scope, which are assumed with the highest novelty level, had raise from 12% in 2007-09 to 23% in 2012-14. This almost doubles the amount of companies that created breakthrough innovation. Observed tendencies confirm raise of efficiency of innovation policies in Polish industrial enterprises.

Table 2. Innovation activity of Polish industrial enterprises – breakdown of innovation type

Innovation type	Innovation importance (geographical scope)									
	In house innovation		Innovation with regional influence		Innovation with country influence		Innovation with global influence		Average	
	2007–2009	2012–2014	2007–2009	2012–2014	2007–2009	2012–2014	2007–2009	2012–2014	2007–2009	2012–2014
Product innovation	58%	74%	23%	49%	58%	48%	21%	38%	40%	52%
Process innovation	63%	44%	15%	28%	25%	32%	13%	21%	29%	31%
Organizational innovation	56%	46%	2%	25%	19%	27%	0%	16%	19%	26%
Marketing innovation	40%	44%	15%	22%	40%	31%	13%	18%	27%	29%
Average	54%	52%	14%	31%	36%	35%	12%	23%	29%	35%

Source: own work.

Besides innovation activity also other effects of innovation policies were analyzed. Respondents could choose any answer out of ten propositions: brand building, cost reduction, gaining competitive advantage, income rise, fulfilling law and polices, new market entry and rise of market share, reduction of environmental hazards, rise of production flexibility rise of production capacity, rise of production flexibility (see Figure 3). In both surveyed periods most common effect of innovation strategies was enter on new market or rise of share on current market (respectively 62% in 2007-09 and 79% in 2012-14). Next there were achieving competitive advantage and rise of production capacity. Less common response from all effects was fulfilling law and polices.

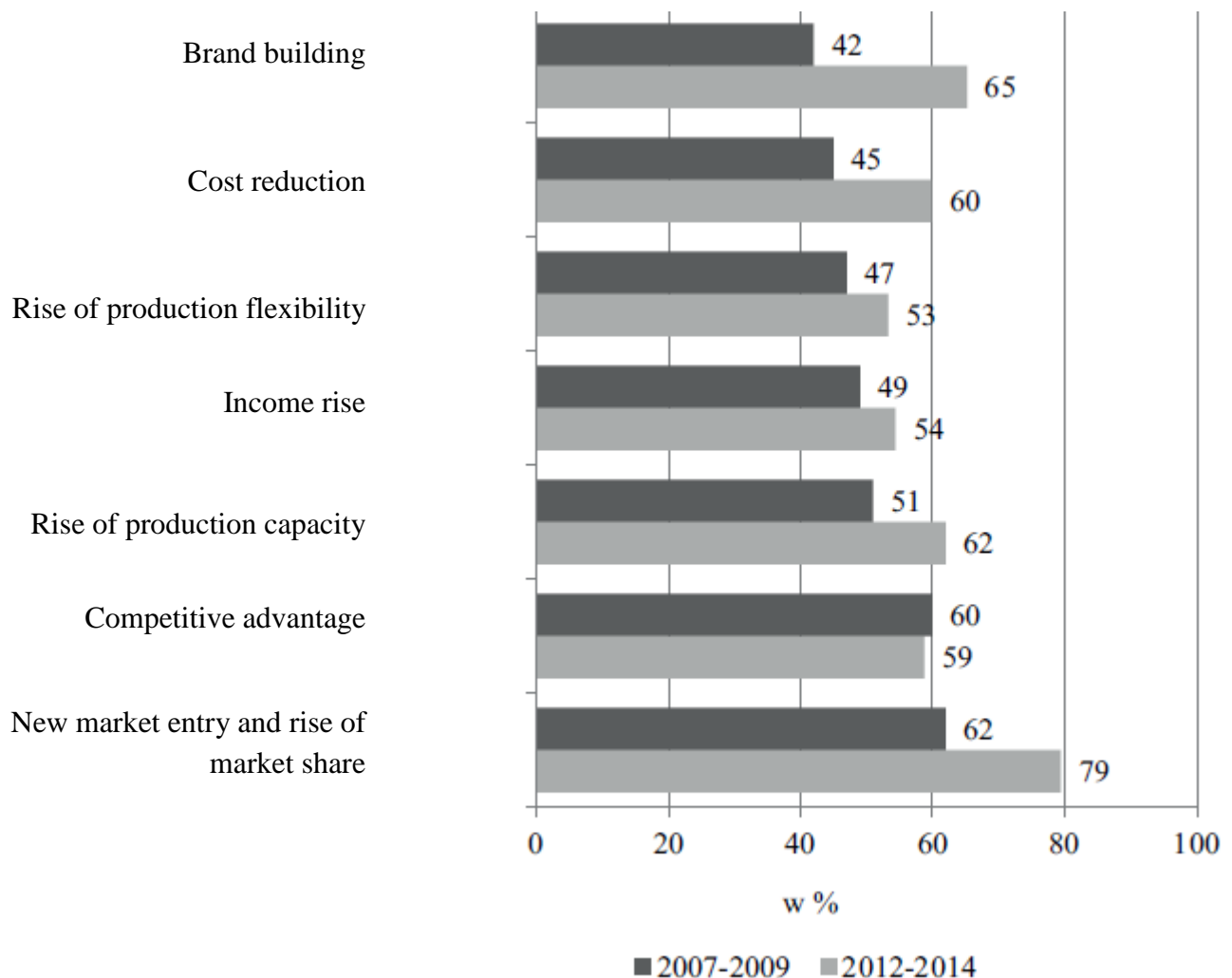


Figure 3. Distribution of effects of innovation policies in Polish industrial enterprises Source: own work.

5. Conclusions

The main purpose of this article was to assess innovation strategies applied in Polish medium and large industrial enterprises based on three dimensional innovation activity model – *innovation cube*. In refer to the main goal two research fields were indicated: innovation strategies diagnosis and effects assessment.

In terms of diagnosis of Polish industrial enterprises the most common adapted strategy was individual innovator (creating innovation based on own resources, in continuous manner and for own use). Second most popular variant is seller (creating innovation based on own resources, in continuous manner and for sell). Next two are occasional innovator and occasional seller. Those four variants out of eight altogether represent 95% of adopted innovation policies in surveyed companies. It is worth to emphasize, that despite some ongoing changes, still most popular is closed innovation model that designate and create framework of companies behavior as rather self-sufficient and independent entities.

These finding might be surprising especially in contrary to one of key theoretical paradigm and widely comment open innovation model. Partly the reason of this state might be found on macroeconomic level in refer to Poland i.e. low interpersonal trust that transfer on interorganizational trust, complex and illegible law and tax system, underfunded research institution and lack of incentives for business – since cooperation. Those factors hindered

building relationships and innovation networks which are one of crucial elements of open innovation strategies.

To gathered full view of innovation strategies, indicted policies were assessed by criterion of achieved effects. Namely distribution of four types of innovation was presented as well as innovation scope in terms of its geographical influence. In general, since first research phase more companies attended to innovation activity (growth from 29% in 2007-09 to 35% in 2012-14). Most of surveyed companies were creating product innovation, then process, marketing and lastly organizational innovation. In comparison between two analyzed periods innovation activity rise in regards to all of four innovation's types. In terms of innovation importance most common are imitation changes however between two surveyed periods there was significant rise of global innovation that can be identify with breakthrough and highly novelty of introduced solutions.

Obtained view of innovation policies of Polish industrial enterprises is rather complex and hard to explain with a few regularities. One of observed trends is change towards market orientation between both surveyed periods (rise of share of seller and occasional seller as well as enter on new market and increase market share as the effect). Also despite some gaps in environment embeddedness and innovation networks building (open innovation

model) there is consistent rise of innovation activity as well as growth of importance and novelty level of created solutions.

Conducted research also has some limitations. First one is lack of financial results of each of implemented strategy as well as no precise information about profitability of created innovations. This is commonly found obstacle in all of innovation research due to tangible/intangible and complex character of this phenomenon as well as rather long and hard to defined scope of investment return. Second group of limitations is result of sample size and characteristics. It would be preferred to carry out more research based on probability sampling and wider scope of selected industries (services, agriculture e.t.c.) as well as to provide some multinational comparisons for analysis.

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