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Technological Innovation Capabilities of Small and Medium-Sized Enterprises

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Abstract:

Purpose: *The research objective of the article is to develop a model that indicates significant, from the perspective of introducing technological innovations by Polish small and medium-sized enterprises, internal factors that make up the company's innovation capability and build their competitive position.*

Design/methodology/approach: *The company's innovation capability can be divided on seven specific sub-capabilities, research and development, manufacturing, organizational, marketing, logistics, human factor and strategy. We also included some contextual factors in the model. Empirical studies were conducted in 2015, using the CAPI method, on the representative sample of 250 small and medium-sized enterprises. The analysis and assessment we based on the results of the ordered logit regression model estimation.*

Findings: *The obtained results indicate the significance of 19 variables from all specific capabilities and contextual factors. Their impact proved to be both positive and negative.*

Practical Implications: *The identified elements of innovation capability of small and medium-sized enterprises may be a recommendation for small and medium-sized enterprises' managers.*

Originality/value: *Determination of key elements of technological innovation capability of Polish small and medium-sized enterprises. The results can be compared with those obtained for other countries.*

Keywords: *Technological innovation, product and process innovation, innovation capability.*
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1. Introduction

Innovation is a very topical issue. The causes of innovative human behaviour are examined (Romero and Martinez-Roman, 2012; Liczmańska-Kopcewicz *et al*., 2018) as well as those of enterprises, regions and countries (Zastempowski and Przybylska, 2016). From an enterprise perspective, evolutionary theory plays a significant role (Dosi and Nelson, 1994). It indicates that the enterprise is a learning organization whose basic resource is knowledge that is created in a continuous and cumulative way. Knowledge, when being unique, is a source of diversity in enterprises, their market behaviour and competitive position. The evolutionary perspective leads to understanding innovation as a complex organizational learning process that is dependent on many factors. They may be internal or external in relation to the enterprise. In this paper, the focus is on internal factors that can contribute to the development of the company's innovation capability.

Small and medium-sized enterprises (SMEs) are equally current research subjects (European Union, 2018a; Hvolkova *et al*., 2019). They arouse constant interest because of their significant role played in modern economies. In 2017, they accounted for 99.8% of all non-financial enterprises of 28 European Union (EU) countries. They employed almost 94.8 million people, which accounted for two-thirds of total employment. They also generated 56.8% of sector value added (European Union, 2018b). A quite similar situation can be found in Poland. In the country, SMEs also play a considerable role. They constitute 99.8% of all non-financial enterprises, create 51.4% of value added and employ 68.1% of all employees in the non-financial sector (European Union, 2018b).

SMEs are also an important creator of innovation (Saunila *et al.*, 2014). Unfortunately, Poland is far away from the European innovation leaders in this matter - Sweden, Finland, Germany, and the Netherlands. The European Innovation Scoreboard (2019 edition) places Poland in 25th place, which means among moderate innovators (European Union, 2019).

The research objective of this paper is to develop a model that would indicate relevant, from the point of view of introducing technological innovations, internal factors that make up the company's innovation capability. However, contextual factors were also considered.

2. Theoretical Background

The discussion on what drives innovation is focused around two schools of thought, the market and resource schools. The former indicates that market conditions create a context that facilitates or enforces the degree of innovation activity of enterprises. The key issue is the ability of enterprises to recognize opportunities appearing on the market. Some researchers claim that only few enterprises have the ability to effectively research their environment (Cohen and Levinthal, 1990). The latter (*i.e*.,

the resource one) assumes that market orientation does not provide stable and strong foundations for building an innovation strategy for enterprises operating on dynamic and constantly changing markets. These are their own resources that are capable of providing more stable conditions under which innovation activity can be developed and their markets can be shaped. This school focuses on the enterprise, its resources, competences and skills (Grant, 1996). Considering the above, we decided to separate the following areas related to SME innovation for further analysis. These areas are innovation capability, contextual factors and technological innovation. They will be discussed in a further section of the paper.

The overview of subject literature shows that innovation capability is understood differently (Glabiszewski *et al.,* 2016). Important elements to be considered with regard to innovation capability (or the ability to innovate) are found in the works devoted to the competitiveness and strategy of enterprises. It is emphasized that the company's capabilities are an important element in the process of building and maintaining its competitive advantage and in implementing the strategy (Akman and Yilmaz, 2008; Guan and Ma, 2003). As a consequence, the sources of the modern understanding of innovation capability can be found also in the resource theory of the company (Barney, 2001), the theory of absorption capability (capacity) (Cohen and Levinthal, 1990; Limaj and Bernroider, 2019; Zahra and George, 2002; Zou *et al.*, 2018), the theory of knowledge-based company (Curado and Bontis, 2006; Spender and Grant, 1996), as well as in the theory of dynamic capabilities (Felin and Powell, 2016; Teece *et al.*, 2016; Rupeika-Apoga and Solovjova, 2016). Table 1 presents selected concepts of innovation capability.

Table 1. *Innovation capability*

Authors	**Innovation capability concept**	**Items**
(Guan and Ma, 2003)	Innovation capability is a special asset of the firm.	Innovation capabilities classified into seven dimensions: 1. learning capability, 2. R&D capability, 3. manufacturing capability, 4. marketing capability, 5. organizational capability, 6. resources exploiting capability, 7. strategic capability.
(Yam *et al.*, 2004; Yam *et al.*, 2011)	Technological innovation capabilities are a comprehensive set of characteristics of an organization that facilitates and supports its technological innovation strategies.	Technological innovation capabilities classified into seven elements: 1. learning capability is a firm's ability to identify, assimilate, and exploit knowledge from the environment, 2. R&D capability refers to a firm's ability to integrate R&D strategy, project implementation, project port- folio management, and R&D expenditure, 3. resources allocation capability is a firm's ability to acquire and to allocate appropriately capital, expertise and technology in the innovation

		process. 4. manufacturing capability refers to a firm's ability to transform R&D results into products, which meet market needs, accord with design request and can be manufactured, 5. marketing capability is a firm's ability to publicize and sell products on the basis of understanding consumer needs, the competitive environment, costs and benefits, and the acceptance of the innovation. 6. organizing capability refers to a firm's ability in securing organizational mechanism and harmony, cultivating organization culture, and adopting good management practices, 7. strategic planning capability is a firm's ability to identify internal strengths and weaknesses and external opportunities and threats, formulate plans in accordance with corporate vision and missions, and adjusts the plans for implementation.
(Wang *et al.*, 2008)	Technology innovation capability is a complex, elusive, and uncertainty concept that is difficult to determine.	Technology innovation capability classified into five interactive aspects: 1. R&D capability, 2. innovation decision capability, 3. marketing capability, 4. manufacturing capability, 5. capital capability.
(Cheng and Lin, 2012)	Technological innovation capabilities depend on determining multiple criteria and depends on building a performance and implementation plan.	Technology innovation capability classified into seven elements: 1. planning and commitment of the management capability, 2. marketing capability, 3. innovative capability, 4. knowledge and skills capability, 5. information and communication capability, 6. external environment capability, 7. operations capability.

Source: *Own research.*

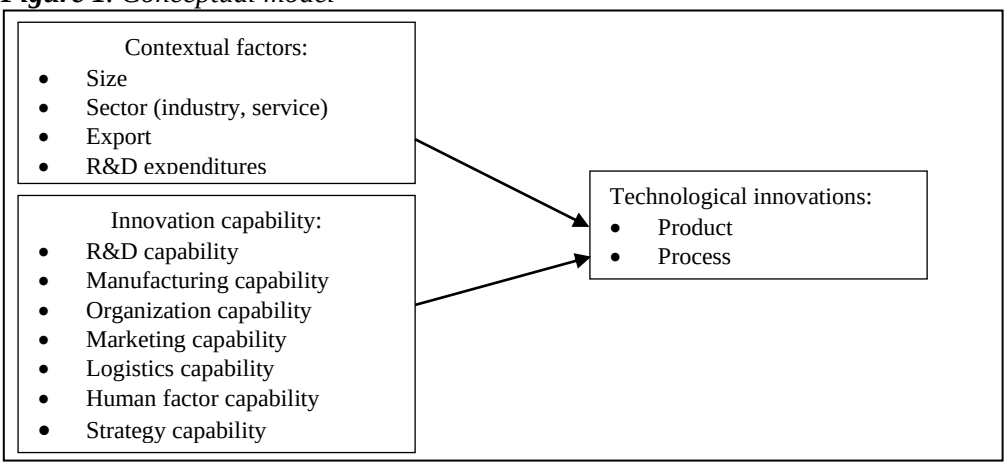
Based on and modifying the concepts of innovation capability by Guan and Ma, (2003) and Yam *et al.* (2004) in order to analyse and evaluate individual elements of the SME's innovation capability, we have divided it into seven detailed capabilities, covering various elements such as research and development (4 elements), manufacturing (4 elements), organizational (15 elements), marketing (6 elements), logistics (2 elements), human factor (9 elements), and strategic factor (5 elements). Their detailed description is presented in Table 2.

Research on innovation takes into account also contextual factors (Martinez-Roman *et al.*, 2011). The size of the company is one of the most commonly used (Akman and Yilmaz, 2008; Nassimbeni, 2001). Other relevant contextual factors include the industry or sector of operation (Forsman, 2011; Lin, 2007; Martinez-Roman and

Romero, 2017), type of market (Nassimbeni, 2001) and level of expenditure on R&D (Martinez-Roman *et al.*, 2011).

When assessing the level of innovation, the following two basic types are most frequently analysed, product and process. They are referred to as technological innovations. Due to the high degree of utilization in statistical and research activities, we understand product and process innovations in accordance with the 3rd edition of the Oslo Manual (OECD and Eurostat, 2005). Consequently, product innovation is the introduction of a product or service that is new or significantly improved in terms of its features or applications, while process innovation is the implementation of a new or significantly improved production or delivery method (OECD and Eurostat, 2005). As a result of the above considerations, we developed a conceptual model that is presented in Figure 1.

Figure 1. *Conceptual model*



Source: *Own research.*

3. Research Methodology

Empirical studies, the fragment of which is discussed here, were conducted in 2015, as a part of a research project of the Polish National Science Center. The main part of the research was conducted using the CAPI method and a representative sample of Polish small and medium-sized enterprises. A random selection of the sample was conducted by the Central Statistical Office in Warsaw. The representativeness was based on the following criteria, company size, type of business activity according to the Polish Activity Classification sections (PAC) and the minimum five-year period of market activity.

The size of the research sample was defined assuming that the total SMEs population (without micro ones) is 176,276 entities; p = 0.95, the fraction share (% of innovation in the population) – 0.2), the maximum error - 0.05. Assuming such

criteria, the minimum size sample should be 246 entities. Finally, the research involved 250 SMEs.

Table 2 presents the description and scales of all variables of the model. As can be observed, the model includes the explanatory variables (contextual factors, innovation capability), labelled from x1 to x49 and the explained variable (innovation), labelled as *y*. The variables constituting the innovation capability were assessed from the perspective of their importance in the process of creating and implementing innovations, and the following ordinal scale was used: 0 - lack of resource, 1 - low, 2 - medium, 3 - high. The innovation, as the ordered variable, could have the following values: 0 - no innovation; 1 - product or process innovation; 2 - product and process innovation.

Table 2. *Description of variables*

Categories	**Description**	**Scales and variables**	
EXPANATORY VARIABLES			
Contextual factors			
Size	Number of employees	Numerical	x1
Service	Service activities	Dichotomous	x2
Export	Sale on a foreign market	Dichotomous	x3
R&D expenditures	Expenditure on R&D (% sales revenue)	Quotient	x4
Innovate capability			
Research and development capability	Own R&D section	Ordinal (0-3)	x5
	Budget for R&D	Ordinal (0-3)	x6
	Modern R&D technical equipment	Ordinal (0-3)	x7
	Possession of patents	Ordinal (0-3)	x8
Manufacturing capability	Modern machines and devices	Ordinal (0-3)	x9
	Machines and devices flexibility	Ordinal (0-3)	x10
	Modern technology	Ordinal (0-3)	x11
	Automation and robotization of production processes	Ordinal (0-3)	x12
Organization capability	Possession of an official quality certificate	Ordinal (0-3)	x13
	Processes and products improving quality systems	Ordinal (0-3)	x14
	Employee recruitment and selection systems	Ordinal (0-3)	x15
	Employee training systems	Ordinal (0-3)	x16
	Management motivation systems	Ordinal (0-3)	x17
	Enterprise management systems	Ordinal (0-3)	x18
	Group problem solving methods	Ordinal (0-3)	x19
	Information exchange systems	Ordinal (0-3)	x20
	Internal information system efficiency	Ordinal (0-3)	x21
	Firm's ability to learn	Ordinal (0-3)	x22
	Well-known product brands	Ordinal (0-3)	x23
	Ability to create new products	Ordinal (0-3)	x24
	Ability to create new processes	Ordinal (0-3)	x25
	Past experience and contacts	Ordinal (0-3)	x26
	Experience in implementing innovative projects	Ordinal (0-3)	x27
Marketing capability	Current market situation knowledge	Ordinal (0-3)	x28
	Ability to predict future changes in the market	Ordinal (0-3)	x29

	Knowledge of customer needs, preferences and behaviours	Ordinal (0-3)	x30
	Ability to predict future changes in customer needs	Ordinal (0-3)	x31
	Knowledge of the current situation on supply markets	Ordinal (0-3)	x32
	Ability to predict future changes in supply markets	Ordinal (0-3)	x33
Logistics capability	Convenience of location in relation to sources of supply	Ordinal (0-3)	x34
	Relations with suppliers	Ordinal (0-3)	x35
Human factor capability	Employee inclination to raise qualifications	Ordinal (0-3)	x36
	Employees' risk appetite	Ordinal (0-3)	x37
	Leadership skills of management staff	Ordinal (0-3)	x38
	Attitude towards changes of management staff	Ordinal (0-3)	x39
	Foreign languages knowledge among management staff	Ordinal (0-3)	x40
	Knowledge, experience and skills of management staff	Ordinal (0-3)	x41
	Knowledge, experience and skills of project managers	Ordinal (0-3)	x42
	Knowledge, experience and skills of marketing staff	Ordinal (0-3)	x43
	Knowledge, experience and skills of logistics staff	Ordinal (0-3)	x44
Strategy capability	Firm's development strategy	Ordinal (0-3)	x45
	Ability to implement and control firm's development strategy	Ordinal (0-3)	x46
	Ability to monitor the enterprise environment	Ordinal (0-3)	x47
	Ability to predict technological changes	Ordinal (0-3)	x48
	Ability to create a lobby to support the firm	Ordinal (0-3)	x49
EXPLAINED VARIABLE			
Innovation	Product and process innovations	Ordinal (0,2)	y

Source: *Own research.*

We used the ordered logit model whose specification is an extension of the binary model specification to more threshold. The model is described by the following equation:

$$y^* = x'\beta + u \tag{1}$$

where y^* is the exact but unobserved dependent variable, x' is the vector of independent variables, u is the error term and β is the vector of regression coefficients which we wish to estimate. To estimate the model, we use the maximum likelihood estimation method and the STATA.16 software.

4. Results and Discussion

In order to identify the factors that significantly determine the introduction of product and process innovations by SMEs, the ordered logit model was estimated using the maximum likelihood estimation method. The model estimation results are presented in Table 3.

Table 3. *Ordered logistic regression and odds ratio*

Variables	Coef.	Std. Err.	Z	P>|z|	95% conf. interval		Odds. ratio
x1	1.072741	.8004282	1.34	0.180	-.49607	2.641551	2.92338
x2	.5104565	.49047	1.04	0.298	-.450847	1.47176	4.356897
x3	2.240833	.9674895	2.32	0.021*	.3445883	4.137077	9.401158
x4	.0428883	.0252919	1.70	0.090	-.006682	.0924595	1.043821
x5	-.9862973	.5154087	-1.91	0.056	-1.99648	.0238852	.3729551
x6	-.6410855	.5282872	-1.21	0.225	-1.67650	.3943384	.5267204
x7	1.310827	.4907727	2.67	0.008**	.3489298	2.272723	3.709238
x8	.650915	.3959376	1.64	0.100	-.125108	1.42693	1.917294
x9	1.724899	.4683779	3.68	0.000**	.8068949	2.642903	5.611953
x10	-.7944619	.4702832	-1,69	0.091	-1.7162	.1272763	.4518243
x11	.6042346	.5828202	1.04	0.300	-.538072	1.746541	1.829851
x12	-1.902877	.5877024	-3.14	0.001**	-3.05475	-.751001	.1491389
x13	.5501471	.3643205	1.51	0.131	-.163908	1.264202	1.733508
x14	.7283735	.4043184	1.80	0.072	-.064075	1.520823	2.071708
x15	-.8532307	.4244675	-2.01	0.044*	-1.68517	-.021289	.4260363
x16	1.889989	.4992778	3.79	0.000**	.9114227	2.868556	6.619297
x17	.9104306	.4849317	1.88	0.060	-.040018	1.860879	2.485393
x18	.8337156	.4707745	1.77	0.077	-.088985	1.756417	2.301856
x19	-.9651561	.5136981	-1.88	0.060	-1.97198	.0416737	.3809237
x20	-.7612736	.5297151	-1.44	0.151	-1.79949	.276949	.4670712
x21	.5925823	.4778098	1.24	0.215	-.343907	1.529072	1.808653
x22	.4153036	.3621737	1.15	0.252	-.294543	1.125151	1.514831
x23	-.8226263	.4285992	-1.92	0.055	-1.66266	.0174127	.4392765
x24	1.666497	.4911006	3.39	0.001**	.703958	2.629037	5.293594
x25	-.4482157	.4681538	-0.96	0.338	-1.36578	.4693489	.6387669
x26	1.100492	.5042992	2.18	0.029*	.1120835	2.0889	3.005644
x27	-1.266995	.642548	-1.97	0.049*	-2.52636	-.007624	.2816767
x28	1.484233	.4544949	3.27	0.001**	.5934393	2.375026	4.41158
x29	-1.023586	.4974872	-2.06	0.040*	-1.99864	-.048528	.3593043
x30	-1.115586	.5384005	-2.07	0.038*	-2.17083	-.060339	.3277233
x31	.3044961	.4830058	0.63	0.528	-.642177	1.25117	1.355942
x32	-.6595404	.4675624	-1.41	0.158	-1.57594	.2568652	.517089
x33	1.292845	.568833	2.27	0.023*	.1779532	2.407738	3.643138
x34	1.03934	.396911	2.62	0.009**	.261409	1.817272	2.827351
x35	-2.625533	.6259937	-4.19	0.000**	-3.85245	-1.39860	.0724012
x36	-.6650476	.4249366	-1.57	0.118	-1.49790	.1678128	.514249
x37	.2895956	.357809	0.81	0.418	-.411697	.9908885	1.335887
x38	-.0819657	.3233191	-0.25	0.800	-.715659	.5517282	.9213036
x39	.9104306	.4849317	1.88	0.060	-.040018	1.860879	2.485393
x40	-1.209359	.4177294	-2.90	0.004**	-2.02809	-.390624	.2983884
x41	.7425179	.5043491	1.47	0.141	-.245988	1.731024	2.101219
x42	-.5785243	.5406002	-1.07	0.285	-1.63808	.4810328	.5607252
x43	1.474091	.477409	3.09	0.002**	.538386	2.409795	4.367062
x44	1.379365	.5522404	2.50	0.012*	.2969938	2.461736	3.972379
x45	.0979169	.4719527	0.21	0.836	-.827093	1.022927	1.102871
x46	-.1065779	.4343601	-0.25	0.806	-.957908	.7447524	.8989051
x47	-.3216604	.4819166	-0.67	0.504	-1.2662	.6228788	.7249443
x48	-1.321771	.5284849	-2,50	0.012*	-2.35758	-.285959	.2666626
x49	.863675	.5006378	1.73	0.085	-.117557	1.844907	2.371861

Note: *** p-Value <=0.01. * p-Value <=0.05.* ***Source:*** *Own research.*

The conducted test (LR chi2 (49) = 192.72; Prob> chi2, 0.0000) indicates the significance of the whole model, which gives grounds for further interpretation of the results obtained. McFadden's pseudo-R^2 is a measure of the quality of matching logit models to data. It is 0.44714. This means a relatively high degree of explanation of the dependent variable.

As can be seen, in this model parameter estimates take both positive and negative signs. In other words, the impact of the explanatory variables included in the model on the dependent variable causes, on the one hand, an increase, and on the other hand, a decrease in the chances of introducing product and process innovations by small enterprises. The variables that proved to be statistically significant were: sale on a foreign market, modern R&D technical equipment, modern machines and devices, automation and robotization of production processes, employee recruitment and selection systems, employee training systems, ability to create new products, past experience and contacts, experience in implementing innovative projects, current market situation knowledge, ability to predict future changes in the market, knowledge of customer needs, preferences and behaviours, ability to predict future changes in supply markets, convenience of location in relation to sources of supply, relations with suppliers, foreign languages knowledge among management staff (owner), knowledge, experience and skills marketing staff, knowledge, experience and skills of logistics staff and ability to predict technological changes.

Interpretation of the obtained model can be carried out on the basis of odds ratios - Table 4 (the odds ratio column). Bearing in mind the assumption of *ceteris paribus* - that is, other variables of the model unchanged - the following information was obtained:

- sale on a foreign market increases the odds ratio (chance) of introducing product and/or process innovation by SMEs by 9.4 times on average,
- a higher evaluation of modern R&D technical equipment increases the chance of introducing product and/or process innovation by 3.7 times on average,
- a higher evaluation of the modern machines and devices increases the chance of introducing product and /or process innovation by 5.6 times on average,
- a higher evaluation of automation and robotization of production processes decreases the chance of introducing product and/or process innovation by 86% on average,
- a higher evaluation of employee recruitment and selection systems decreases the chance of introducing product and/or process innovation by 58% on average,
- a higher evaluation of employee training systems increases the chance of introducing product and/or process innovation by 6.6 times on average,
- a higher evaluation of ability to create new products increases the chance of introducing product and/or process innovation by 5.3 times on average,
- a higher evaluation of past experience and contacts increases the chance of introducing product and/or process innovation by 3 times on average,

- a higher evaluation of experience in implementing innovative projects decreases the chance of introducing product and/or process innovation by 72% on average,
- a higher evaluation of current market situation knowledge increases the chance of introducing product and/or process innovation by 4.4 times on average,
- a higher evaluation of ability to predict future changes in the markets decreases the chance of introducing product and / or process innovation by 65% on average
- a higher evaluation of knowledge of customer needs, preferences and behaviours decreases the chance of introducing product and/or process innovation by 78% on average,
- a higher evaluation of ability to predict future changes in supply markets increases the chance of introducing product and/or process innovation by 3.6 times on average,
- a higher evaluation of convenience of location in relation to sources of supply increases the chance of introducing product and/or process innovation by 2.8 times on average,
- a higher evaluation of relations with suppliers decreases the chance of introducing product and/or process innovation by 93% on average,
- a higher evaluation of foreign language skills of management staff (owner) decreases the chance of introducing product and/or process innovation by 71% on average,
- a higher evaluation of knowledge, experience and skills of marketing staff increases the chance of introducing product and/or process innovation by 4.4 times on average,
- a higher evaluation of knowledge, experience and skills of logistics staff increases the chance of introducing product and/or process innovation by 3.9 times on average,
- a higher evaluation of ability to predict technological changes decreases the chance of introducing product and/or process innovation by 74% on average.

The results obtained point to several important issues.

First of all, in terms of contextual factors, only one of them proved to be statistically significant, *i.e.*, exporting. This result corresponds to the results of other research on innovation (Guan and Ma, 2003). It is worth emphasizing, however, that in the scope of the surveyed Polish SMEs, the fact of undertaking export activity by them turned out to be the variable with the greatest impact (increase in innovation opportunities by 9.4 times on average). It is evident that this form of internationalization of business, which leads to contacts with foreign competition, actually compels SMEs to introduce innovations.

Secondly, in terms of R&D capability, only one element is statistically significant, namely the modern R&D technical equipment. Its influence was positive. One may be tempted to pose a thesis that functioning under the conditions of industry 4.0

causes that SMEs which have their own R&D sections and want to build their innovation based on them should also strive to have modern R&D equipment, since the newer it is, the greater the chances of implementing innovation.

Thirdly, in terms of manufacturing capability, two elements proved to be statistically significant. The first - modern machines and devices - corresponds to the modern R&D technical equipment. Also, here the impact is positive. The second, *i.e.*, automation and robotization of production processes - has a negative impact, which means that the more robotic the production processes in SMEs are, the smaller the chance for introducing product and process innovations. This result seems to be surprising. For many enterprises - especially larger ones - a high level of robotization means more innovation. Employees have more time for creative activities, which they are also urged to do. In the case of the surveyed SMEs, however, the opposite thesis can be formulated - the more robotization, the less of 'the human factor' and human creativity - process automation replaces employees in the sphere of production. Moreover, automated production processes are, in essence, much less flexible than manual or even mechanized ones, and thus leave less space for different and therefore innovative operation.

Fourthly, in the area of organization capability, five elements proved to be statistically significant. Three of them - the employee training systems used, ability to create new products, as well as past experience and contacts - have a positive impact. The higher their evaluation, the greater the chance of introducing product and process innovations. Based on them, it can be indicated, for example, that the more good, properly selected and valuable training sessions, primarily related to the implementation of new solutions (innovations), the more innovative SMEs will be. On the other hand, in the case of the other two – employee recruitment and selection systems and experience in implementing innovative projects - the impact is negative. In the first case, this result may suggest that the higher evaluation of employee recruitment and selection systems, the more formalized and standardized they are, and the less they capture employees with unique competences, including those capable of creativity and willing to change. In the second case, the result obtained indicates that the more experience we have in the implementation of innovative projects, we operate more schematically and the chances of innovation decrease, because the experience acquired with the implementation of subsequent innovative projects may serve not so much the increase of innovation obtained in the enterprise, but rather routine or certain automatism, *i.e.,* following already checked paths of action and applying known practices.

Fifthly, in terms of marketing capability, four elements are statistically significant. Two of them - knowledge of the current market situation and ability to predict future changes in the market - have a positive impact. This result suggests that in the case of the SMEs surveyed, we deal with demand innovations and that their innovations are based on changes in supply markets. Some elements of the theory of innovation by R. Henderson and K.B. Clark can be traced (Henderson and Clark, 1990). The

innovations of the surveyed SMEs can be based on changes in the key components. The result in the area of the other two statistically significant elements of this capability is also very interesting - the capability to predict future changes in supply markets and knowledge of the needs, preferences and behaviours of customers. Their higher evaluation reduces the chances of implementing innovations. Trying to interpret this result, it is worth referring to the theory of disruptive innovation by C. Christensen (Christensen, 1997). The results obtained seem to confirm it, the more we focus on the needs of current customers and are able to anticipate them, the less attention we pay to other potential customers and we may not notice the impending innovation, which may be destructive to our industry.

Sixth, in the area of logistics capability, both assessed elements proved to be significant. In the case of convenience of location in relation to sources of supply, the impact is positive, and in the case of relations with suppliers, it is negative. In other words, in the second case, the higher evaluation is given by SMEs to their relations with suppliers - maybe the more they are formalized and limited by contracts - the chances of innovation decrease.

Seventh, in terms of human factor capability, three elements are statistically significant. Two of them, the knowledge, experience and skills of marketing and logistics staff, have a positive impact. The result of the third element, *i.e.*, knowledge of foreign languages of management staff (owner), is interesting. The higher it is evaluated, the chances of innovation decrease. This suggests that the more educated the owner of the researched SME is, the more its innovation will decrease. It is worth recalling here the results of eight years of research conducted by Dyer *et al*. (2011), whose aim was to find the answer to the question - where do groundbreaking business models come from? Trying to understand the way in which breakthrough innovators work, these authors found that such innovators have five basic 'discovery skills', namely the ability to associate, question, observe, make contacts and experiment (Dyer *et al*., 2011). They also pointed out that the ability to generate innovative ideas is not only a function of the mind, but also a function of behaviour (Dyer *et al.*, 2011). This conclusion is extremely valuable, since it proves that if we are able to change our behaviour, then we can improve our own creativity - and consequently the innovativeness of the organization in which we are associated. It is worth emphasizing that the indicated exploratory skills are not related to knowledge of foreign languages. In addition, knowledge of foreign languages encourages business owners to enter foreign markets, which seems to be a big challenge for enterprises in the SME sector. In such a situation, depressed by the weakness of their potential, they more often take up the strategy of market expansion imitating the solutions existing on these markets, rather than implementing their own innovations to build competitive advantages.

Eighth, in the area of strategy capability one element is important. This is the ability to predict technological changes. The founding is interesting - the higher the evaluation of this capability is, the chances of innovation decrease. On the one hand,

it may correspond with the result saying that the more we focus on predicting technologies known to us, the less we see of potential changes of a radical nature. On the other hand, however, in the case of the SMEs surveyed, their interior and their absorption capability are more important in creating innovation than the external environment and the impact of technology changes (the Technology S-Curve theory).

5. Conclusion

The research objective of the article was to develop a model that indicates significant, from the point of view of introducing product and process innovations by Polish SMEs, internal factors that make up the company's innovation capability. We based this capability on seven specific capabilities: research and development, manufacturing, organizational, marketing, logistics, human factor and strategy. We also included contextual factors in the model. We based the analysis and assessment on the results of the ordered logit regression model estimation. We conducted the interpretation based on the odds ratios. The results obtained indicate the significance of 19 variables derived from all specific capabilities and contextual factors. Their impact proved to be both positive and negative.

In conclusion, it can be seen that the issue of innovation of small and medium-sized enterprises is on the one hand very extensive, and on the other hand very complicated and detailed. This paper and the conclusions drawn in it, illuminate only a narrow section of the issue. However, it seems that they may contribute to further research in this area.

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