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SME Innovations and Performance: The Mediating Role of Product Innovation

Zhelyu Vladimirov[1]
Sofia University St. Kliment Ohridski, Bulgaria

Abstract. This study investigates the mediating role of product innovations between process innovations, and other external and internal factors, and performance. An exploratory analysis of 500 manufacturing SMEs provides seven factors. These factors were used in a path model of "innovations-performance" relationships with the mediating role of product innovations. The findings reveal that product innovations impact directly and positively on performance, while other process innovations and external factors have positive and significant, but only indirect influence on performance. Amongst internal factors, firm size and export orientation are related directly and significantly to both product innovations and performance. Therefore, product innovations mediate fully the effects of process innovations and external factors, and partially the effects of internal factors on performance. The study makes a contribution to the limited research dealing with the effects of innovation antecedents, types of innovations and their combined impact on SME performance.

Keywords: SME, types of innovation, innovation antecedents, mediation, performance**.**

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1. Introduction

The development of SMEs depends on their capacity to align with technological progress and innovations, although the detailed findings can be contradictory. Some research on innovation underlines the advantages of small firms, while other arguments favour the role of large enterprises (Hong *et al*., 2012: 424). SMEs advantages include a higher degree of flexibility, simple organizational structures, and closer understanding of consumers' needs. Nevertheless, the SME sector still suffers from an innovation deficit (O'Regan *et al*., 2005), and the lower level of SME innovation can be seen as a sign of their unrealized innovation *potential* (Chaminade and Vang, 2006). Entrepreneur-driven SMEs are

1. Corresponding author: Zhelyu Vladimirov, Sofia University St. Kliment Ohridski, Faculty of Economics and Business, 15, Tzar Osvoboditel, 1504, Sofia, Bulgaria. Tel.: +3592/8738123. Email: jeve@feb.uni-sofia.bg

considered to be more willing to innovate as they navigate the frontiers of business activity (UN, 2009: 2-3).

There are two main theories that seek to explain firms' performance. The resource based view (RBV) considers that this is based on their unique internal resources and capabilities (Grant, 2002: 139), while the industrial organisation (IO) theory focuses mainly on the industry external factors (Porter, 1991: 111). The work on innovation antecedents and determinants refers to the same groups of factors - internal and external to the firm (Becheikh *et al*., 2006). Therefore, the two groups of factors are considered to influence both innovations and performance. Not surprisingly, similar theories (RBV, knowledge-based view, organizational learning, and network theory) are also used in innovation studies (Crossan and Apaydin, 2010). Given that innovations are determined by the firm's internal and external factors, and have their own impact on performance (Roberts 1999), innovations seem to *mediate* the influence of some of these factors on performance.

A major review of the research on "innovation-performance" describes the evidence as "mixed", "inconclusive", and "contradictory" (Rosenbusch *et al*., 2011: 442). This uncertainty indicates a need for a more detailed study of the performance consequences of different types of innovations. The Oslo Manual (OECD, 2005: 47) has identified four types of innovations - product/service, process, organisational, and marketing innovations, along with the basic distinction between incremental and radical innovations. The research literature has mainly considered product innovations, while other types of innovations remain relatively understudied. In particular, process innovations and performance consequences in small firms are still under-researched (Hall *et al*., 2009: 15). Mangiarotti and Riillo (2014) have shown, however, that the inclusion of organizational and marketing innovations in the definition of innovation increases the percentage of small firms considered to be innovative from about 28 to 63 percent.

The existing research and theory suggest that the types of innovations are interrelated and influence each other (Reichstein and Salter, 2006). For example, Li *et al*. (2007) demonstrated that there is strong interdependence, complementarities, and mutual support between product and process innovations. Therefore, innovations can also influence firm performance directly or indirectly (through their interaction) (Gunday *et al*., 2011).

While some research have shown that product innovation impacts more directly performance (Rubera and Kirca, 2012), other studies indicated that process improvements did not seem to be related to SME profitability (Pett and Wolff, 2009). Based on a meta-analysis of 42 empirical studies, Rosenbusch *et al*. (2011: 444) concluded that the overall impact of innovations on SME performance is a result of both positive and negative *mediating* effects, which are moderated by contextual factors such as size, age, and type of innovation. There are, however, few *empirical* studies that investigate simultaneously the

performance effects of both innovation antecedents and types of innovations (Jin *et al*., 2004).

The present paper aims to contribute to filling this gap by investigating the mediating role of product innovations in the SME "innovations-performance" relationship. Specifically, it examines the direct and indirect effects of both innovation antecedents and determinants and types of innovation on performance. The research is based on data for 500 Bulgarian manufacturing SMEs. Along with some other East European countries, Bulgaria belongs to the group of *"Modest innovators*" with an innovation rate well below the EU average (EC, 2014a), a status which requires that more attention should be given to SMEs innovative capacities in these countries. The study is guided by the following research questions:

1. What are the specific types of manufacturing SME innovations?

2. How do innovation antecedents and determinants influence both innovation and performance?

3. How do product innovations mediate the effects of other types of innovations and other internal and external factors on performance?

To answer these questions an exploratory factor analysis was run, which resulted in seven factors. Based on these constructs, a path model of "innovations-performance" relationships with the mediating role of product innovation has been tested. The main findings reveal that product innovation impacts directly and significantly on performance. The process innovations contribute to SME performance *indirectly* (through product innovation), while others innovation antecedents and determinants have both direct and indirect influences on performance. Some practical implications are proposed based on these findings.

The study is organized as follows. The literature review examines the types of innovation, internal and external determinants of innovation, interaction between innovations, and the effects of different types of innovation on performance. This is followed by research methodology, main findings and discussion, and conclusions.

2. Literature Review

Definitions and types of innovations

According to Schumpeter (1934) entrepreneurs may introduce different types of innovation such as: new products; new methods of production; new sources of supply; new markets; and new ways to organize business. While product innovation refers to a good/service that is new or significantly improved, process

innovation relates to the implementation of a new or significantly improved production or delivery method (OECD, 2005: 48, 49).

Meeus and Edquist (2006: 24) divided process innovations into non-technological (*organizational*) and *technological* changes. Technological innovations include the adoption of new machines and technologies (including software), while organizational ones relate to the implementation of new organisational methods, workplace organisation or external relations. According to Armbruster *et al*. (2008: 646), organisational innovations are new intra- and inter-organizational structures and proceedings. The intra-organisational innovations relate mostly to human resource practices, while inter-organizational innovations refer to cooperation with external institutions. *Marketing* innovations, as non-technological process innovations, involve the implementation of new marketing methods in respect to product promotion or pricing (OECD, 2005: 49).

Determinants of innovations

Many innovation studies have examined the determinants and barriers of new products development, mainly in the manufacturing sector (Hervas-Olive *et al*., 2014). The internal antecedents and determinants of innovation are related to the firm's resources and capabilities, while the external ones refer to the business environment. Research has indicated that the most important resources and capabilities for innovation are: knowledge (McAdam *et al*., 2014), organizational learning (Alegre and Chiva, 2008), the firm's absorptive capacity (Cohen and Levinthal, 1990), and human capital in general (Tang and Murphy, 2012). Particularly in SMEs the entrepreneur is a key figure in the innovation process. The demographic, psychological, and behavioral characteristics of owners/ managers, along with entrepreneurial, learning and market orientations, are among the strongest factors related to SME innovativeness (Rauch *et al*., 2009). The other internal determinants of innovation include: firm size, age, structure, strategies, advanced technology, and export-orientation. (Becheikh *et al*., 2006: 651).

The external antecedents and determinants of innovation refer to government regulations, the labor market, and the institutional environment. These factors are similar to those in Porter's diamond model (Porter, 1991) but with a greater emphasis again on knowledge and networking. The studies demonstrated the significance of external factors for innovation such as: access to both information and finance; intellectual property rights protection; industrial sector; competition; region; national innovation system and culture (Becheikh *et al*., 2006: 657; Hong *et al*., 2012: 435).

According to Chang *et al*. (2011: 1660), there is a lack of empirical research that examines the combinations of internal and external antecedents of innovation. At the same time, combining the two groups of factors leads to better understanding of the antecedents of innovation (Naranjo-Gil, 2009). This

combination is supported theoretically by the complementarity of the activity-based view and the RBV (Peteraf and Barney, 2003; Parnell, 2006). For example Carayannis and Wang (2012) found that both firm-level characteristics and national innovation systems are key factors in firms' innovation capacities. The estimations of Vega-Jurado *et al*. (2008: 631) demonstrated that the models, which include both internal and external factors, explain innovative performance better than those models that include only one type of factor.

The mediating role of innovation between innovation antecedents and performance

The majority of empirical research on the "innovation-performance" relationship revealed that this was positive (Hult *et al*., 2004), although some research showed negative, or a lack of such relationships (Lin and Chen, 2007). According to Santos *et al*. (2014), the relationship between innovation and performance remains an open question. The different findings can be explained to some extent by the context dependent "innovation-performance" relationship, as the performance is influenced by both innovations and other contextual variables (Rosenbusch *et al*., 2011: 441). There are, however, a few studies that link both innovation antecedents and innovation itself to performance. Crossan and Apaydin's (2010: 1176) review showed that empirical researchers have used either innovation outcomes or performance as a dependent variable. In contrast, including both of these in a single model would reveal the role of innovation outcomes as a *mediator* between innovation determinants and firm performance. The difficulty derives from the fact that the same groups of factors (internal and external) are antecedents or determinants of both innovation and performance, along with innovation exerting its own influence on performance. Therefore, innovations should *mediate* the influence of some of these factors on performance. Some research revealed the mediating role of innovations between firms' strategic orientations (market, entrepreneurial, and learning orientations) and performance (Han *et al.,* 1998; Medina and Rufín, 2009). As the types of innovations are interrelated and influence each other, they can also impact directly or indirectly (through their interaction) on firm performance (Gunday *et al*., 2011).

Performance effects of types of innovations and the mediating role of product innovations

Unlike the innovation determinants, less attention has been paid in the literature to the interaction of types of innovations. As Piening and Salge (2015: 93) stated, the extant literature tends to examine individual innovation activities in isolation. The research and theory, however, suggest that there is a general degree of association or complementarity between different types of innovations (Reichstein and Salter, 2006: 658). The notion of *complementarity* means that doing more of one activity increases the returns to doing more of the others. In

the case of the complementarity between types of innovations, it means that having more process innovations does not lessen the benefits of having more product innovations and vice versa (Milgrom and Roberts, 1995: 181, 198). There are, however, not many studies that investigate the interdependence of types of innovations and their combined impact on performance (Jin *et al*., 2004; Gunday *et al*., 2011).

Some studies identified strong complementarities between strategic and managerial innovations, strategic and marketing innovations, and between product and process innovations (Amara *et al*., 2009). Other research demonstrated that product and process innovations are mutually supportive and their simultaneous introduction has positive performance effects (Damanpour and Gopalakrishnan, 2001). Developing simultaneously product and process innovations leads to greater competitive advantages because of the acquired learning culture (Alegre and Chiva, 2008), and the increased firm absorptive capacity (Zahra and George, 2002).

Despite these research advances, it is still unclear what types of innovation have direct or indirect effects on performance as the evidence is inconsistent and fragmented. Some research found that *product* improvements are positively associated with firm growth (Pett and Wolff, 2009), while others studies have shown that process innovations may be an important source of firm performance (Keupp *et al*., 2012). However, Wolff and Pett (2006) indicated that a process improvement orientation may not yield growth and profitability. Moreover, according to Cabagnols and Bas (2002) companies with product innovation perform better than those with process innovations. These findings suggest that product and process innovations may have different effects on performance (Leipoen, 2000: 20). For example, Simonetti *et al*. (1995) showed that product innovations are related more to new market creation, while process innovations are mainly intended to decrease unit costs. And the picture is complicated because other studies revealed the positive effects of cost reducing technological process innovations on performance (Evangelista and Vezzani, 2010: 1262). However, while some process innovations are cost savings and thereby may influence performance positively, others may only support product innovations (Oke, 2007), and therefore contribute to firm performance indirectly (Bowen *et al*. 2010: 1181). More explicitly, Fritsch and Meschede (2001: 345) argue that the implementation of a product innovation can make corresponding process innovation(s) necessary, while the latter in turn may enable a firm to improve the quality of its products or produce completely new products. Where process innovations provide support to product innovations, they can be said to *mediate* the effects of process innovations on performance, as evidenced in the work of Camisón and Villar-López (2012).

The review of the literature indicates that: (1) both innovation and performance depend on the same groups of internal and external factors; (2) as innovation also influences performance, it appears to be a *mediator* between some

of the environmental and organizational antecedents and performance; (3) product and process innovations may have different effects on performance; (4) these effects might be direct or indirect due to the mutual interaction of different types of innovations; and (5) product innovation plays a central role in manufacturing performance. Few empirical studies, however, have explicitly taken into account this mutual dependence and the dependence on third factors. For example, Hoonsopon and Ruenrom (2012) investigated simultaneously antecedents (organizational factors), mediators (product innovations), and consequences (performance) of the development of radical and incremental product innovation. They found that the two types of innovations *mediate* the impact of both culture and structure on marketing and financial performance. The present paper aims to make a contribution to this field of knowledge by testing a model that includes the mediation role of product innovations between innovation antecedents and determinants, and other types of innovation, on performance.

3. Conceptual Model and Hypotheses

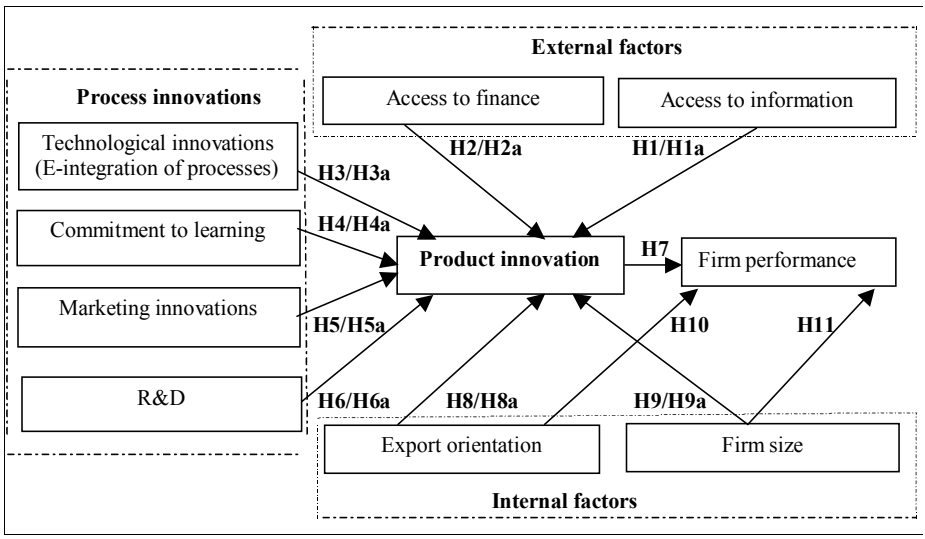
The findings reported earlier, supporting the notion of innovation as a mediator, do not imply that innovation is the only means to achieve superior firm performance. Other internal and external to the firm factors may also have direct influences on performance. In some cases the access to finance during the economic crisis (EC, 2014b), firm export orientation (Galende and de la Fuente, 2003), size, location, institutional context, etc. (Lin and Chen, 2007) might be more important than innovations for performance. Based on the literature review, the following conceptual model of the mediating role of product innovations between process innovations and other factors and performance is proposed (Fig.1). The process innovations are manifested in commitment to learning (as a part of learning orientation), R&D activities, technological (e-integration of processes) and marketing innovations. The model also contains two external (access to information and access to finance) and two internal (firm size and export orientation) factors.

The direct and indirect effects of process innovations and other factors on both product innovations and performance are reflected by three groups of hypotheses. The first group contains eight hypotheses about the *direct effects* of process innovations, external and internal factors on product innovations: access to information (**H1**), access to finance (**H2**), technological innovations (e-integration of processes) (**H3**), commitment to learning (**H4**), marketing innovations (**H5**), R&D activities (**H6**), export orientation (**H8**), and firm size (**H9**) influence product innovation directly and positively.

The second group refers to the *indirect effects* (through product innovation) of process innovations and other factors on performance: access to information (**H1a**), access to finance (**H2a**), technological innovations (**H3a)**, commitment to

learning (**H4a**), marketing innovations (**H5a**), R&D activities (**H6a**), firm export orientation (**H8a**), and firm size (**H9a**) impact indirectly and positively on firm performance. The third group includes three hypotheses about the *direct* and positive effects of product innovation (**H7**), firm export orientation (**H10**), and firm size (**H11**) on performance.

Fig. 1. Conceptual model of the mediating role of product innovation



4. Research Methods

The data are extracted from a larger questionnaire, which was developed to identify the factors which determine manufacturing SME performance in Bulgaria. The questions in the survey refer to *specific* innovations such as: product innovations; e-integration of processes; innovative marketing strategy; R&D and staff training; access to both information and finance. The answers to 7 questions with a total number of 30 items are utilised. All of the individual variables are scored on a two-point scale (0 = "none", and 1 = "yes"), except for some demographic characteristics.

The sample includes 500 SMEs from 18 manufacturing activities (Appendix A, Table A.7). The total number of manufacturing SMEs in 2012 was 30,038, of which: 23,064 (76.8%) were micro-enterprises (up to 9 employees); 5,271 (17.5%) were small (10-49 employees); and 1,703 (5.7%) were medium size enterprises (50-249 employees). Simple random sampling with replacement was used in the frame of preliminary defined sub-sector quotas. The sample includes 195 microenterprises (39% of the total), 202 small (40.4%), and 103 medium size enterprises (20.6%). The share of small and medium sized enterprises in the

sample is greater than their share in the population as they tend to be likely to make innovations. The field data were gathered by a professional vendor agency, *Noema,* in February and March 2013. The data were processes on the SPSS 20 and Amos.

5. Findings and Discussion

Results of exploratory factor analysis

We ran an exploratory factor analysis with a Varimax rotation, and a cut point of 0.35, which was appropriate for this sample size. The correlation matrix shows that there are sufficient numbers of correlations greater than 0.30, which allows for running the factor analysis (Appendix A, Table A.1). The determinant value is 0.006 which implies that there is no linear dependence in the correlation matrix. The anti-image matrix reveals that there is only one partial correlation greater than 0.5 and less than 0.7. The measures of sampling adequacy for individual variables range from 0.658 to 0.828, which is greater than the minimum level of 0.5 recommended by Hair *et al*., (2010: 103) (Appendix A, Table A.2). The KMO measure of sampling adequacy is 0.757, DF = 190, Approx. Chi-Square = 2533.282, and Sig. = 0.000 (Appendix A, Table A.3).

The rotation provided seven factors. Because of low and controversial loadings, ten items were excluded. The convergent validity of the remaining items was verified by analysing factor loadings and their significance. The communalities of all the individual variables are above 0.5 and all item-to-factor loadings are greater than 0.7, which demonstrate high items dimensionality (Hair *et al*., 2010: 117). Survey items, measurement properties, items loadings, communalities, and Cronbach's' Alpha are presented in the Appendix A, Table A.4. The total variance explained is 66.29%. The first factor does not account for the majority of the variance (20.18%), which suggests that common method bias is not of great concern (Table 1).

The first factor reveals small firm managers' awareness that their staff need training in different fields such as IT, foreign languages, management, marketing, sales, and exports. This reflects the first component of learning orientation, which is COMMITMENT TO LEARNING. Hult *et al*. (2004: 432) also focused on the organization's "commitment to learning" and "learning orientation" as antecedents of firm innovativeness. Other studies found a positive relationship between organizational learning, innovation and firm performance (Jiménez-Jiménez and Sanz-Valle, 2010). It is not surprising that amongst small firms, in a transition economy, the commitment to learning (and not the whole learning orientation) appears as an important factor for performance. It can be understood in terms of the limited market experiences of these firms.

Table 1. Rotated Component Matrix [a]

	Component						
	1	2	3	4	5	6	7
A30_4. The firm staff needs trainings in IT	.796						
A30_5. The firm staff needs trainings in foreign languages	.766						
A30_2. The firm staff needs trainings in management, marketing and sales	.732						
A30_3. The firm staff needs trainings in export	.706						
A8_2. The firm is going to develop a new product to be released soon on the market		.839					
A8_3. The firm intends to develop new products in the next years		.781					
A8_1. Last year the firm has released a new product (or an improve version of the existing product)		.756					
A31_5. Last year the firm has conducted a marketing survey			.803				
A31_4. The firm has an innovative marketing strategy			.781				
A31_6. Last year the firm has surveyed foreign markets for eventual positioning			.742				
A2_4. We have an access to information about good management practices				.833			
A2_3. We have an access to information about national and international programmes in support to business				.794			
A2_5. We have an access to information about international markets and potential partners				.705			
A3_2. Last year the firm has used a bank credit for working capital					.812		
A3_4. Last year the firm has used an overdraft on current account					.745		
A3_1. Last year the firm has used a bank credit for investments					.725		
A26_3. The firm has an enterprise resource planning system (ERP)						.851	
A26_1. The firm has a customer management system (CMS)						.812	
A9_2. The firm has employees with R&D tasks							.789
A9_1. The firm has an own R&D unit							.754
Cronbach's Alpha	.764	.785	.727	.706	.664	.653	.617
Eigenvalues	4.036	2.157	1.771	1.620	1.499	1.175	1.000
Percent of Variance	20.181	10.787	8.853	8.101	7.494	5.874	4.999
Total Variance explained	66.289						

[a] Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.a. Rotation converged in 6 iterations.

The second factor is PRODUCT INNOVATION, which reflects the release of a new product or an improved product version; new product development soon to be released on the market; and the intentions to develop new products in the next few years. It relates not only to the recent product innovations, but more generally to the commitment to and *continuity* of product innovation activities. As the specific product innovation only provides a temporary advantage, it is continuous innovativeness that matters in the long run (Sandvik *et al*., 2014: 170).

MARKETING INNOVATIONS shape the third factor. This is based on small firm efforts to develop an innovative marketing strategy, and to conduct marketing surveys of both national and international markets. Other research found a significant positive relationship between marketing studies, innovation, and performance (Darroch and McNaughton, 2002: 219).

The fourth factor relates to the ACCESS TO INFORMATION about national and international programmes of business support, good management practices, and international markets and partners. The findings of Zhang *et al*., (2006) demonstrated that SME owner-managers in innovative firms make more effective use of external knowledge and information. De Jong and Vermeulen (2006) also argued that the use of different information sources contributes to successful innovation.

ACCESS TO FINANCE is the fifth factor, and includes the use of bank credit for working capital and investments, and the current account overdraft. According to Schumpeter (1934), credit has a capacity to transform all available resources into productive forces if it falls in the hands of an appropriative entrepreneur. Studies of SME financing have confirmed the importance of this factor (Berger and Udell, 2006) because it facilitates the innovation expenses of R&D, staff training, etc.

The sixth factor refers to TECHNOLOGICAL INNOVATIONS in terms of adopting advanced IT applications – the e-management of relations with customer (CRM) and e-integration of processes (ERP). The investment in the firm's e-integration (or backend) is particularly important as it facilitates achieving higher efficiency levels by reducing operational costs (Kuk and Janssen, 2013: 449).

The seventh factor relates to R&D activities and includes the presence of an in-house R&D unit, and employees with R&D tasks. Beneito (2006: 513) has shown that in-house R&D activities are the main source of firms' more significant innovations.

The firms' PERFORMANCE was measured by perceptual changes in relation to four indicators in the last year: number of staff; revenues; profits; and market share. Innovation success has been often investigated by utilising these indicators, mainly because of the reluctance of small business managers to provide actual performance data (Han *et al*., 1998).

Results of path analysis

Path analysis is particularly appropriate for this analysis as it allows the simultaneous estimation of multiple relationships between independent variables and more than one dependent variable. For the purpose of the analysis, each factor from the EFA was transformed into a new single composite measure, representing an average of the values of its constitutive items ("summated scale" in Hair *et al*., 2010: 124-126). The same transformation was applied to the PERFORMANCE measures. The test of unidimensionality shows that the new

summated scales consist of items loading highly on a single factor, and the values of Cronbach's alpha reveals a good degree of consistency of each scale (Appendix A, Table A.4). The correlation matrix of individual variables shows also a high convergent validity between each factor's items (Appendix A, Table A.1), while the correlations between new concepts are relatively low, demonstrating a sufficient discriminant validity (Appendix A, Table A.5).

The data reveal some positive and negative skewedness and kurtosis, but the multivariate normality has acceptable parameters (kurtosis = -0.869) with the critical ratio (c. r. = -0.627) being less than 5 (Byrne, 2010: 104). The correlation matrix shows that all the factors are positively correlated, with the highest correlation being between firm size and export orientation (0.425) (Appendix A, Table A.5). The model's goodness of fit was assessed through the maximum likelihood method. The X^2 value is 7.505 with DF=6, the ratio X^2/df = 1.251, and the probability level p = 0.277. The goodness of fit indices are respectively: GFI = 0.997, RMR = 0.003, NFI = 0.990, IFI = 0.998, TLI = 0.984, CFI = 0.998, RMSEA = 0.022 (with LO 90 = 0.000 and HI 90 = 0.065), and PCLOSE less than 1 (0.823). The goodness of fit indices are at acceptable levels for this analysis. The standardized regression weights of the direct effects are presented in Table 2.

Table 2. Standardized regression weights of direct effects

			Estimate	Hypotheses
F4_Access to information		F2_Product innovations	.104**	H1 - supported
F5_Access to finance		F2_Product innovations	.088**	H2 - supported
F6_Technological innovations		F2_Product innovations	.067 (n.s.)	*H3 - non supported*
F1_Commitment to learning		F2_Product innovations	.193***	H4 - supported
F3_Marketing innovations		F2_Product innovations	.090**	H5 - supported
F7_R&D		F2_Product innovations	.303***	H6 - supported
A14_Export orientation		F2_Product innovations	.204***	H8 - supported
B7_Size		F2_Product innovations	-.153***	*H9 - partially supported*
F2_Product innovations		P1_Performance	.171***	H7 - supported
A14_Export orientation		P1_Performance	.201***	H10 - supported
B7_Size		P1_Performance	.209***	H11- supported

The results show that all the hypotheses about the *direct* effects of process innovations and other factors on both product innovation and performance are supported, except for the direct impact of technological innovations on product innovations (H3), and the significant but negative influence of firm size on product innovations (H9). The model explains about 29% of the variance of product innovations and 18% of the variance of performance.

Direct effects on product innovations

R&D activities are particularly important, having the strongest direct and positive impact on product innovations (0.303***). This can be explained by the fact that investment in internal R&D increases the firms' absorptive capacity (Zahra and George, 2002). More than one half of the studies included in Becheikh *et al*.s (2006: 655) review identified R&D as an explanatory variable of innovation, and nearly 80% of these found a significant positive relationship between the two variables. Keizer *et al*., (2002) also demonstrated the role of R&D in helping companies to create, exploit and transform the acquired knowledge into new products.

The firm's export orientation is the second significant factor, and positively influences product innovations (0.204***). Other research have shown a positive relationship between internationalization and both product and process improvements (Wolf and Pett, 2006). According to Cassiman and Veugelers (2006: 74), more export-oriented firms are also more innovative, presumably because of their more competitive environment.

Although the commitment to learning represents only one component of the learning orientation construct, it appears as the third important factor for higher product innovation (0.193***). This corresponds with Calantone *et al*. (2002: 516) observation that the more the organization values learning, the more likely it is that learning will occur. The direct and positive effects of organisational learning capability on product innovation performance was also demonstrated by Aragón-Correa *et al*. (2007).

Firm size impacts significantly and negatively on product innovations, which suggests that smaller firms in this sample appear to be more innovative (-0.153***). Some research has demonstrated that firm size has highly significant and positive effects on all measures of innovation outputs (Santamaria *et al*., 2009), while other studies found a negative relationship, a U-shaped curve, and a hump-shaped curve (Bertschek and Entorf, 1996). These findings are explained by the impact of other (mainly external) factors on the innovation-firm size relationship. Damanpour and Wischnevsky (2006: 277) concluded that there is "no clear resolution as to whether small or large organizations tend to be more innovative."

Access to information is the fifth important factor influencing product innovativeness directly and positively (0.104**). De Jong and Vermeulen (2006) found that the use of external information sources increases the small firm's knowledge and contributes to successful innovation. According to Gallego *et al*. (2012: 568), innovation is becoming increasingly related to the firm's ability to absorb information from external sources.

Marketing innovations affect product innovations directly and positively, although not so strongly (0.090**). In general, good marketing strategies contribute to commercial success, and even to the exporting of new products/

processes, thereby encouraging firms to innovate more (Baldwin and Johnson, 1996: 796).

Access to bank financing has a direct and positive influence on product innovations, although this is not so strong (0.084**). Other studies have also supported the important role of bank financing for SME innovations (Vera and Onji, 2010). According to Beneito (2003) financial autonomy increases the probability of engaging in R&D and generating innovations.

Technological innovations (e-integration) appear as a factor, which has a positive, but none significant, impact on product innovations (0.067). The adoption of new technology, and particularly advanced IT applications, mainly improve the firm's productivity by *reducing costs* (O'Mahony and van Ark, 2003), which can explain its weak influence on product innovations.

The mediating role of product innovations

Product innovations are the only innovation factor which impacts *directly* and positively on performance (0.171***). Other research has also demonstrated that product innovation is a critical driver of innovation performance (Calantone *et al*., 2010: 1076). Some studies found that product innovation influences performance more directly, while other research has revealed how process innovation underpins successful product launches (Bowen *et al*., 2010: 1181).

Although the Amos of the SPSS can display direct, indirect, and total effects (Appendix A, Tables A.6), it does not automatically provide the significance of indirect effects. These significances have been obtained by using bootstrap estimates, standard errors, and confidence intervals. Table 3 shows that all of the indirect effects of process innovations and other factors on performance (through product innovations) are statistically significant.

Table 3. Multiple indirect effects: (All - Defaut model)

Parameter		Estimate	SE	Mean	Lower	Upper	P
Estimand 1	H1*H7 = **H1a** - supported	.028	.013	.028	.008	.053	.028
Estimand 2	H2*H7 = **H2a** - supported	.026	.016	.027	.007	.065	.010
Estimand 3	H3*H7 = **H3a** - supported	.022	.013	.021	.005	.049	.033
Estimand 4	H4*H7 = **H4a** - supported	.057	.018	.057	.031	.091	.007
Estimand 5	H5*H7 = **H5a** - supported	.033	.019	.032	.008	.073	.028
Estimand 6	H6*H7 = **H6a** - supported	.088	.025	.087	.049	.132	.008
Estimand 7	H8*H7 = **H8a** - supported	.043	.014	.043	.023	.070	.009
Estimand 8	H9*H7 = **H9a** - *partially supported*	-.012	.005	-.012	-.022	-.005	.010

Damanpour and Gopalakrishnan (2001) considered that product and process innovations have different performance impacts. According to Fagerberg *et al*. (2005), if the new products generally have a positive effect on the firm's growth, the effects of process innovations are less clear.

Our findings show that process innovations and external factors contribute positively and significantly, but *indirectly* (through product innovations) to SME performance. In other words, the indirect positive effects of access to information (0.028**), access to finance (0.026**), technological innovations (0.022**), commitment to learning (0,057**), marketing innovations (0.033**), and R&D (0.088**) on performance are significant at 0.5 level.

According to Piening and Salge (2015: 84) process innovations are *intermediate* outcomes to achieve higher-level performance, rather than being a goal in themselves. Oke (2007) considered that process improvement is a driver for the success of product/or service innovation. Walker (2006: 314) also argued that process innovations do not *directly* yield products or render services, but indirectly influence their introduction. Similarly, Tang and Murphy (2012: 54) revealed that technological innovations cannot influence firm performance until the ideas have been introduced to the market, e.g. through new products/services.

These results are in line with the few studies which have investigated the interdependence of types of innovations and their effects on performance. For example Gunday *et al*. (2011: 671) revealed that process innovation influences innovative performance through product innovation, while organizational and marketing innovations have both direct and indirect (through product innovation) effects on innovative performance. According to Schmidt and Rammer (2007), the innovation success can be obtained via some combinations of product and process innovations, with marketing and organisational innovation. Similarly, Evangelista and Vezzani (2010) considered that a combination of product, process and organizational change gives firms a true competitive advantage.

The data show that firm size and export orientation both have significant direct (respectively 0.209*** and 0.201***) and indirect (respectively -0.012** and 0.043**) effects on performance. Firm size directly and positively influences performance, while it has significant, but negative *indirect* effects on performance. This is due to the negative impact of firm size on product innovations as a mediator. The two factors also have the greatest total effects on performance (respectively 0.183*** and 0.236***) (Appendix 1, Table 6).

6. Conclusions

The goal of this study was to investigate the mediating role of product innovations between process innovations and other internal and external factors, and SME performance. It was found that R&D has the highest direct and positive effects on product innovations, followed by firm export orientation, commitment to learning, and access to information. Access to finance and marketing innovations also impact positively and significantly on product innovations, although not very strongly. Firm size significantly, but negatively, influences product innovations, which suggests that smaller firms in this sample are more innovative.

Product innovations is the only factor which impacts directly and positively on SME performance, while other process innovations and external factors have significant and positive (except for firm size), but indirect influence on performance. Therefore, product innovations *mediate fully* the effects of process innovations and external factors and *partially* the effects of firm size and export orientation on performance.

The last two factors also have the strongest total effects on performance, which means that the firm's resources and export capabilities are more important than innovations for performance. The small contribution of innovations to the performance of manufacturing SMEs in Bulgaria is supported by secondary statistical data for the industry sector enterprises (as there are no particular data for the manufacturing sector). The share of new-to-the-market products in the firms' total turnover is only 2.2%, while the share of new to the firms' products, but not new to the market, is 3.3% (National Statistical Institute, 2015)

The *implications* of these findings for managers are that they need to take into account the respective process requirements before introducing new products. These requirements follow from the notion of complementarity, which is symmetric (Milgrom and Roberts, 1995: 181). The positive indirect effects of process innovations suggest that arriving at a successful product innovation requires significant activity which includes changes in organisational, technological, and marketing processes. On the organisational side it means accelerating innovation activities such as R&D, external knowledge acquisition, and innovation-related training. On the technological side it requires upgrading the existing equipment and particularly the IT applications. Additional activities are needed to make product innovations more visible through new marketing initiatives. All these changes assume certain costs which do not translate directly into better performance. These activities can contribute to higher performance *indirectly* through the success of the new products. Therefore the SMEs need to introduce a bundle of different types of innovations over time.

The complementarity of the organisational elements also raises some research issues. One of these is to estimate how strongly are various elements of the systems linked (Milgrom and Roberts, 1995: 205), while the other is to identify the way these elements are linked. This study adds a new knowledge to the linkage of types of innovations and the combined effects of innovations antecedents and determinants on SME performance.

The *limitations* of this research are, first, the reliance on subjective evaluations of innovations and performance by the interviewed managers. Second, the study is based on the survey responses of only one manager in each SME. Third, the cross-sectional data of 18 manufacturing sub-sectors are used, which prevents inferences about cause and effects. As Damanpour (2010: 1008) noted, testing the fit between innovation types is challenging because, given differences in organizational contingencies, the fit may be unique to individual firms, and not even common across types of organizations. These limitations call

for comparative research, which takes into account specific sub-sectors, more detailed size groups, and the effects of more environmental factors on SMEs innovativeness and performance. Additional longitudinal data are also needed to provide more reliable data in relation to the "innovations-performance" effects.

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Appendix A. Tables

Table A.1 Correlation Matrix [a]

	A2_3	A2_4	A2_5	A3_1	A3_2	A3_4	A8_1	A8_2	A8_3	A9_1	A9_2	A26_1	A26_3	A30_2	A30_3	A30_4	A30_5	A31_4	A31_5	A31_6
A2_3	1.000	.499	.374	.060	.115	.106	.099	.103	.112	.036	.040	.066	.040	.094	-.015	.068	.063	.155	.137	.086
A2_4		1.000	.460	.074	.061	.102	.104	.131	.136	.075	.105	.148	.088	.074	-.018	.089	.069	.174	.204	.084
A2_5			1.000	.000	.092	.105	.132	.159	.160	.097	.156	.140	.012	-.060	-.073	-.024	-.016	.219	.198	.251
A3_1				1.000	.428	.318	.063	.118	.102	-.012	-.013	.165	.084	.163	.096	.144	.149	.047	.073	.031
A3_2					1.000	.443	.113	.117	.123	.043	.026	.170	.117	.020	.008	.022	.068	.097	.141	.159
A3_4						1.000	.136	.131	.092	.103	.126	.154	.088	.105	.016	.127	.134	.056	.099	.071
A8_1							1.000	.584	.493	.302	.288	.154	.179	.176	.136	.114	.225	.185	.198	.139
A8_2								1.000	.569	.279	.278	.165	.211	.184	.200	.076	.155	.152	.157	.087
A8_3									1.000	.295	.278	.122	.144	.221	.175	.136	.180	.159	.154	.055
A9_1										1.000	.447	.126	.166	.049	.021	.073	.109	.182	.208	.183
A9_2											1.000	.144	.122	.038	.040	.084	.111	.166	.182	.147
A26_1												1.000	.485	.149	.129	.124	.163	.259	.244	.126
A26_3													1.000	.077	.144	.083	.121	.206	.169	.114
A30_2														1.000	.541	.393	.396	.086	.103	.008
A30_3															1.000	.391	.379	.112	.110	.064
A30_4																1.000	.591	.140	.192	.093
A30_5																	1.000	.182	.177	.041
A31_4																		1.000	.618	.367
A31_5																			1.000	.413
A31_6																				1.000

[a] Determinant = .006

Table A.2 Anti-image Matrices (Anti-image Correlation)

	A2_3	A2_4	A2_5	A3_1	A3_2	A3_4	A8_1	A8_2	A8_3	A9_1	A9_2	A26_1	A26_3	A30_2	A30_3	A30_4	A30_5	A31_4	A31_5	A31_6
A2_3	.720[a]	-.380	-.183	.017	-.075	-.013	-.020	-.004	-.004	.014	.041	.055	-.013	-.092	.055	-.018	-.005	-.056	.016	.012
A2_4		.703[a]	-.325	-.049	.053	-.014	.021	-.018	-.013	.001	-.021	-.037	-.047	-.041	.053	-.050	.007	.013	-.098	.078
A2_5			.733[a]	.056	-.004	-.050	.004	-.053	-.073	.031	-.061	-.104	.120	.096	.020	.048	.016	-.067	.020	-.194
A3_1				.728[a]	-.336	-.137	.048	-.065	-.018	.044	.043	-.076	.018	-.081	.012	-.055	-.030	.005	.004	.019
A3_2					.658[a]	-.351	-.016	.013	-.076	.021	.053	-.052	-.029	.075	-.007	.079	-.022	.018	-.049	-.116
A3_4						.736[a]	-.037	-.030	.062	-.039	-.083	-.035	.001	-.064	.073	-.071	-.025	.037	-.004	.027
A8_1							.826[a]	-.388	-.196	-.075	-.066	-.004	-.026	-.039	.048	.037	-.125	-.009	-.034	-.056
A8_2								.784[a]	-.352	-.044	-.059	-.003	-.083	.000	-.123	.069	.021	.011	-.002	.020
A8_3									.828[a]	-.109	-.076	.035	-.004	-.098	-.010	-.043	.007	-.033	.001	.083
A9_1										.801[a]	-.344	.009	-.071	-.003	.064	.000	-.024	-.013	-.053	-.088
A9_2											.802[a]	-.052	.011	.042	.003	-.020	-.019	-.012	-.024	-.027
A26_1												.740[a]	-.438	-.084	.006	-3.575E-005	-.032	-.080	-.066	.032
A26_3													.693[a]	.073	-.086	.011	-.006	-.065	.022	-.036
A30_2														.755[a]	-.423	-.110	-.119	.019	-.006	.022
A30_3															.746[a]	-.155	-.109	-.025	.004	-.053
A30_4																.736[a]	-.475	.038	-.084	-.068
A30_5																	.768[a]	-.085	.001	.078
A31_4																		.761[a]	-.502	-.135
A31_5																			.756[a]	-.227
A31_6																				.768[a]

[a] Measures of Sampling Adequacy (MSA)

Table A.3 KMO and Bartlett's Test a

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,757
Bartlett's Test of Sphericity	Approx. Chi-Square	2533,282
	df	190
	Sig.	,000
a. Based on correlations		

Table A.4 Survey items, measurement properties, items loadings, communalities, and Cronbach's' Alpha

Constructs and Items	Mean	S.D.	Items loadings	Communalities	Cronbach's Alpha
F1. Commitment to learning [a]	**.34**	**.358**			**.764**
A30_2. The firm staff needs trainings in management, marketing and sales	.33	.471	.732	.605	
A30_3. The firm staff needs trainings in export	.26	.439	.706	.603	
A30_4. The firm staff needs trainings in IT	.30	.460	.732	.687	
A30_5. The firm staff needs trainings in foreign languages	.44	.497	.706	.639	
F2. Product innovation [a]	**.51**	**.418**			**.785**
A8_1. Last year the firm has released a new product (or an improve version of the existing product)	.53	.499	.756	.648	
A8_2. The firm is going to develop a new product to be released soon on the market	.51	.500	.839	.749	
A8_3. The firm intends to develop new products in the next years	.48	.500	.781	.668	
F3. Marketing innovations [a]	**.35**	**.378**			**.727**
A31_4. The firm has an innovative marketing strategy	.42	.494	.781	.683	
A31_5. Last year the firm has conducted a marketing survey	.42	.493	.803	.708	
A31_6. Last year the firm has investigated foreign markets for eventual positioning	.22	.417	.742	.573	
F4. Access to information [a]	**.54**	**.392**			**.706**
A2_3. We have an access to information about national and international programmes in support to business	.63	.484	.794	.647	
A2_4. We have an access to information about good management practices	.54	.499	.833	.715	
A2_5. We have an access to information about international markets and potential partners	.45	.498	.705	.597	
F5. Access to finance [a]	**.28**	**.348**			**.664**
A3_1. Last year the firm has used a bank credit for investments	.26	.439	.725	.583	
A3_2. Last year the firm has used a bank credit for working capital	.29	.456	.812	.703	
A3_4. Last year the firm has used an overdraft on current account	.29	.453	.745	.625	
F6. Technological innovations [a]	**.17**	**.327**			**.653**
A26_1. The firm has a customer management system (CMS)	.18	.383	.812	.730	
A26_3. The firm has an enterprise resource planning system (ERP)	.17	.376	.851	.757	
F7. R&D [a]	**.24**	**.361**			**.617**
A9_1. The firm has an own R&D unit	.22	.417	.754	.654	
A9_2. The firm has employees with R&D tasks	.25	.432	.789	.683	

P1. Performance [b]	**,82**	**,615**			**,834**
A34_1. Number of staff	,79	,702	-	-	
A34_3. Revenues	,84	,810	-	-	
A34_4. Profits	,75	,799	-	-	
A34_6. Market share	,89	,692	-	-	
D1. Demographic data					
B6. Firm size (number employees) [c]	2.71	1.351	-	-	
A14. Export orientation [a]	.44	.497	-	-	
Measures: a (0 - "none"; 1 - yes"); b (0 - decrease"; 1 - "without change"; 2 - "increase"); c (Ln)					

Table A.5 Implied (for all variables) Correlations (Group number 1 - Default model)

	A14	B6	F7	F3	F6	F1	F5	F4	F2	P1
A14_Export	1.000									
B6_Size	.425	1.000								
F7_R_D	.205	.116	1.000							
F3_Marketing	.259	.276	.273	1.000						
F6_Technological	.215	.241	.190	.307	1.000					
F1_Learning	.058	.153	.102	.184	.188	1.000				
F5_Finance	.211	.347	.070	.190	.195	.149	1.000			
F4_Information	.233	.313	.126	.245	.121	.036	.130	1.000		
F2_Product	.293	.103	.403	.281	.225	.258	.171	.191	1.000	
P1_Performance	.340	.312	.134	.158	.132	.088	.144	.145	.251	1.000

Table A.6 Standardized Direct, Indirect, and Total Effects (Group number 1 - Default model)

	A14	B6	F7	F3	F6	F1	F5	F4	F2
F2_Product innovation									
- Direct	.204	-.153	.303	.090	.067	.193	088	.104	.000
- Indirect	.000	.000	.000	.000	.000	.000	.000	.000	.000
- Total	.204	-.153	.303	.090	.067	.193	.088	.104	.000
P1_Performance									
- Direct	.201	.209	.000	.000	.000	.000	.000	.000	.171
- Indirect	.035	-.026	.052	.015	.011	.033	.015	.018	.000
- Total	.236	.183	.052	.015	.011	.033	.015	.018	.171

Table A.7 Sample distribution of firms by sub-sectors

Subsectors (core activity)	**Number of SMEs**	**%**
1. Food production	32	6.4
2. Beverages	20	4.0
3. Chemical and pharmaceutical products	21	4.2
4. Textile and textile products	22	4.4
5. Wearing, leather and leather tanning	30	6.0
6. Furniture	28	5.6
7. Machines, equipment and home devices	30	6.0
8. Electrical machines and apparatus	25	5.0
9. Transport equipment and other than motor vehicles	16	3.2
10. Rubber and plastics	23	4.6
11. Medical, precision and optical apparatus and instruments	14	2.8
12. Office machinery and computers	22	4.4
13. Wood and wood products, except furniture	52	10.4
14. Pulp, paper, and paper products	59	11.8
15. Publishing, printing and reproduction	31	6.2
16. Non-metallic and mineral products	22	4.4
17. Metal products, except machinery and equipment	32	6.4
18. Radio, television and communication technics	21	4.2
Total	500	100