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Enhancing new product development capabilities of small- and medium-sized enterprises through managerial innovations

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ABSTRACT

This essay aims at finding empirical evidence on which types of managerial innovations actually promote new product development (NPD) capabilities of small- and medium-sized enterprises (SMEs). We built this study upon empirical data derived from 650 German SMEs that took part in the Community Innovation Survey (CIS) 2011. We applied principal component analysis (PCA) to detect three different NPD capability factors. Our findings indicate positive effects of the following two types of managerial innovations: innovations in organisational procedures and in organisational forms. The results imply that the best bet for SMEs aiming at improving capabilities that are important for the first phases of NPD are changes in their organisational procedures. On the other hand, firms gearing toward advances in the final phases of NPD should concentrate internal changes on their general work organisation. Our paper demonstrates that SMEs can actively reinforce their NPD capabilities by implementing the right changes in their organisations.

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1. Introduction

Markets have become progressively more competitive in recent years. To compete with the large players, small- and medium-sized enterprises (SMEs) often try to assert themselves through new product developments (NPDs). However, innovative products cannot be taken for granted since they require the full commitment of the organisation and its employees (Simon, Elango, Savelli, & Houghton, 2002). A compounding factor is that SMEs struggle with different obstacles, namely, limited resources (Garengo, Biazzo, & Bititci, 2005; Laforet & Tann, 2006) or skills shortages (Freel, 1999; Scott, Jones, Bramley, & Bolton, 1996). These restrictions raise the question of how SMEs can improve their NPD capabilities.

There have been several attempts to support SMEs' NPD capabilities by policy changes (Klomp & Roelandt, 2004; Massa & Testa, 2008) and public funding (Belitz & Lejpras, 2014; Wonglimpiyarat, 2013). Other studies scrutinised how far networks among SMEs can advance their NPDs (e.g. Soh, 2003). While these analyses eminently contributed to the understanding of how SMEs can enhance their NPD capabilities by external means, they neglected the question of whether the NPD capabilities could benefit from the implementation of internal changes. More recent studies introduced in this regard the term *managerial innovation* as a new subject of analysis that discusses changes in organisational structures, processes, and systems (Birkinshaw, Hamel, & Mol, 2008; Damanpour & Aravind, 2012). It has been emphasised that these changes are generally important to firms (Büschgens, Bausch, & Balkin, 2013; Hernández-Mogollon, Cepeda-Carrión, Cegarra-Navarro, & Leal-Millán, 2010) by being related to firm and innovation performance (Saunila, Pekkola, & Ukko, 2014). Although managerial innovations can be considered as a

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basis for NPDs (Damanpour, Szabat, & Evan, 1989), the number of studies dealing with the potentials of managerial innovations is still limited. What aggravates the situation is that managerial innovations are not without controversy. For example, Naveh, Meilich, and Marcus (2006) found that managerial innovations will not promote innovations under all circumstances. Boer and During (2001) examined that managerial innovations require longer lead times than NPDs and are related to higher complexity; Damanpour and Evan (1984) highlighted complex measurements and evaluations of managerial innovations in contrast to NPDs. It is therefore worth investigating whether or not the efforts to implement managerial innovations pay off for SMEs in terms of improved NPD capabilities. This leads us to the following research question:

RQ: *Do managerial innovations contribute to NPD capabilities of SMEs?*

Our study aims to shed more light on this issue by investigating the effects of different managerial innovations on NPD capabilities of SMEs. The findings should make a contribution to the field of innovation management in general. What is more, it should enhance our knowledge on the relationship between NPD capabilities and managerial innovations in SMEs and support managers in their decision on whether or not managerial innovations should be implemented.

We begin by developing a conceptual framework on managerial innovations and NPD capabilities. The paper will then go on to the method applied in this study. Part 4 interprets the results of the data analysis and discusses the findings with those from other studies. Finally, we draw a conclusion and implications in the final part of this paper.

2. Conceptual development

2.1. Managerial innovation

Research in the fields of innovation management has investigated NPDs in terms of new products or new processes thoroughly. Authors often make the distinction between incremental and radical innovations (McDermott & O'Connor, 2002; Oke, Burke, & Myers, 2007) or product and process innovations (Presley, Sarkis, & Liles, 2000). These concepts have been challenged by scholars who ascertained that those categorisations are problematic insofar as they disregard structural differences between the firms' internal, administrative, or managerial processes on the one hand and more technical processes that lead to new products or production processes on the other hand. The number of studies that address these differences is still very low. An example of a threefold differentiation of innovation types is provided by Mavondo, Chimhanzi, and Stewart (2005), who set administrative innovations apart from product and process innovations. Damanpour (1987) used the distinction between technical and administrative innovations, and Daft (1978) argued that there is a hierarchy of innovations in organisations. According to Daft (1978), administrative innovations have an impact on technical innovations, indicating that administrative innovations are on a higher hierarchy level than technical innovations. He supposed in his dual-core model that NPDs are accomplished at two different levels, the administrative and the technical core. While some NPDs can be balanced in terms of both cores, Daft (1978) claimed that differences in the innovativeness of firms could be traced back to varying predominance and couplings of either the administrative or the technical core.

At this point, it is necessary to clarify terminology. For Mustafa (2015), organisational innovation describes new types of leadership and a changing organisational culture. Daft (1978) defined organisational innovation as an implementation of a new idea or behaviour. In addition, administrative innovations designate changes in the management system, processes, and social relations within the firm (Damanpour, 1987, 1991; Damanpour & Evan, 1984; Damanpour et al., 1989; Tanninen, Jantunen, & Saksa, 2008). However, since we focus on managerial innovations in our study, studies employing the term managerial innovation are of greater interest. This term was used by Birkinshaw et al. (2008) and Damanpour and Aravind (2012) to describe changes in organisational structures, processes, and systems. In their comparative study of organisational, administrative, and managerial innovation, Damanpour and Aravind (2012) ascertained that all three terms characterise similar ideas, which is the reason why we focus on one term only, namely, *managerial innovation*. Even though this term may indicate a higher degree of management influence on change management processes, we argue that the initial spark for such processes mostly depends on the manager. Reinforcing this mind-set, Lloréns Montes, Ruiz Moreno, and Miguel Molina Fernández (2004) suggested that management support is the starting point for innovations. We should note that the terms managerial innovation, administrative innovation, and organisational innovation are often applied synonymously. After outlining the different terms, for us, *managerial innovation* means a change in organisational structure that is new to the firm and that has not previously been introduced (Hernández-Mogollon et al., 2010).

The introduction of managerial innovations is not an end in itself. Instead, competitive advantages are based on organisational and managerial processes (Teece, Pisano, & Shuen, 1997). As empirical evidence shows, changes in administrative processes may serve technical innovations as a basis (Damanpour & Evan, 1984; Damanpour et al., 1989), but they also lead to a better firm performance (Ravichandran, 2000). According to Damanpour and Aravind (2012), managerial innovations can be separated into *innovations in organisational procedures* and *innovations in organisational forms*. The same authors describe the first as changes in business processes that may lead to cost reductions and the latter as changes in the firm's structure, signifying that new types of labour organisation will be accomplished. We follow this distinction in our paper. However, empirical findings have shown that changes in external relations can also support NPDs of SMEs. To us, innovations in external relations describe the establishment of relations of the firm either to existing partners in new forms or to new partners. The importance of external relations of SMEs' NPD activities has been highlighted by Gronum et al. (2012, p. 273), who emphasised in their study the role of networks in SMEs: A '(...) mechanism that unlocks the performance value of networks (...) may be of more value for SMEs than common enterprise networks. Moreover, Romijn and Albaladejo (2002) investigated determinants of innovation capabilities in SMEs,

finding that external relations to research and development institutions, and suppliers, contribute to firms' innovativeness in comparison to relations to customers or competitors.

One point of criticism on managerial innovations is that they are in comparison to technical innovations less tangible (Damanpour & Evan, 1984). In fact, the physical nature of technical innovations is easier to replicate and to evaluate than the more tacit managerial innovations (Birkinshaw & Mol, 2006; Nelson, Peterhansl, & Sampat, 2004). Teece (1980) concluded that they are also for that reason more difficult to protect. He further emphasised that in contrast to technical innovations, administrative changes frequently have a radical character, for example, through high costs and internal disruptions. Underlining these idiosyncrasies, Boer and Daring (2001) examined in their study on the introduction of total quality management in three Dutch organisations that managerial innovations are linked to high complexity and long lead times. Taken together, different studies indicate that managerial innovations are crucial to firms since they are regarded as drivers for technical innovations, although several difficulties ought to be considered connected with this innovation type.

2.2. Embedding NPD capabilities in a framework of dynamic capabilities and organisational learning

The dynamic capability approach is an extension of the resource-based view (RBV) (Ambrosini & Bowman, 2009; Barreto, 2010). Dynamic capability can be defined as the '(...) firm's ability to integrate, build and reconfigure internal and external competences (...)' (Teece et al., 1997, p. 516) or as the '(...) firm's behavioural orientation constantly to integrate, reconfigure, renew and recreate its resources and capabilities and (...) upgrade and reconstruct its core capabilities (...)' (Wang & Ahmed, 2007, p. 35). Overall, dynamic capabilities are processes to improve the resource base of a firm (Ambrosini & Bowman, 2009) that transfer the firms' resources to specific outputs (Wang & Ahmed, 2007). It is important to note that dynamic capabilities are therefore not resources for themselves (Ambrosini & Bowman, 2009). NPD capabilities are acknowledged as one of the most relevant dynamic capabilities (Helfat, 1997). For the present study, we introduce the concept of dynamic capabilities since there is a broad consensus among scholars that they are preconditions of NPDs (Breznik & Hisrich, 2014; Rothaermel & Hess, 2007; Teece, 2007).

NPD capability (also called innovation capability) is a common term in the current literature in this regard. As stated by Wang and Ahmed (2007), these capabilities contribute to dynamic capabilities in general. In our paper, we follow the terminology of Lawson and Samson (2001, p. 394), who defined innovation capability as '(...) the ability to continuously transform knowledge and ideas into new products, processes, and systems for the benefit of the firm and its stakeholders'. This determination is very similar to what we understand by the term organisational learning. This is because both terms refer to the same concept: NPDs are considered to be a result of learning processes (Breznik & Hisrich, 2014). The term organisational learning denotes a competence of a firm to transfer and transform its knowledge, meaning that internal or external information will be used to generate ideas and finally commercialise them (Franco & Haase, 2009; Gilbert & Cordey-Hayes, 1996). Thus, a learning organisation can be defined as one that uses knowledge to strengthen their competitive advantages (Calantone, Cavusgil, & Zhao, 2002). In his study, among 18 Malaysian organisations that acquired ISO 9000, Ismail (2005) showed that structures of learning organisations explain NPDs. Increased innovativeness (Hult, Hurley, & Knight, 2004) and enhanced NPD performance (O'Connor, Ravichandran, & Robeson, 2008; Salavou, Baltas, & Lioukas, 2004) are more positive impacts of learning orientation. Whereas organisational learning represents a latent construct, NPD capabilities denote specific indicators that affect organisational learning. More precisely, NPD capabilities have been specified as skills and competences that enable firms to develop new products (Romijn & Albaladejo, 2002) and new processes or behaviours (Gieskes & Langenberg, 2001; Wang & Ahmed, 2004). In our paper, we focus on NPD capabilities contributing to product innovations, as it has been done by other scholars before (Hoffman, Parejo, Bessant, & Perren, 1998; Romijn & Albaladejo, 2002).

Comparing the concepts of dynamic capabilities and organisational learning shows the general starting point of our paper: in order to analyse the role of managerial innovations as antecedents of NPD capabilities, we draw our attention to NPD capabilities rather than to the more latent constructs of organisational learning or dynamic capabilities. Nevertheless, our analysis will contribute to the understanding of organisational learning and dynamic capabilities in SMEs since these constructs are linked to NPD capabilities. Existing research recognises the critical role played by NPD capabilities for organisations. Several researchers attempted to determine which firm capabilities actually promote NPDs (e.g. Herrmann, Tomczak, & Befurt, 2006; Kesting & Parm Ulhøi, 2010). These studies provide an essential fundament to classify our findings and to discuss the results in the final section of this paper. For this reason, we will examine this literature below. In light of what has been mentioned so far, we hypothesise the following relationships between managerial innovations and NPD capabilities:

- H1.** *Innovations in organisational procedures have a positive effect on the NPD capabilities of SMEs.*
- H2.** *Innovations in organisational forms have a positive effect on the NPD capabilities of SMEs.*
- H3.** *Innovations in external relations have a positive effect on the NPD capabilities of SMEs*

2.3. Distinguishing innovation capabilities

Having integrated NPD capabilities in a theoretical framework, it is now important to differentiate the individual capabilities from each other. NPDs are a result of idea implementation (Calantone et al., 2002). Teece et al. (1997) divided the process for NPDs into sensing activities that serve to identify opportunities and seizing activities, which support the idea implementation.

According to them, sensing activities require freedom for employees, while seizing activities benefit from formalised processes and structures. Similarly, Zaltman, Duncan, and Holbek (1973) separated innovation activities into initiating and generating activities. Moreover, Lubatkin et al. (2006) compared explorative and exploitative processes, and Hortinha, Lages, and Filipe Lages (2011) built on this differentiation and found that both types of NPD capabilities are relevant for firms.

Employee motivation and reward systems are also considered as crucial NPD capabilities (Herrmann et al., 2006; Kesting & Parm Ulhøi, 2010; Koc, 2007; Lloréns Montes et al., 2004; Martins & Terblanche, 2003) because, according to Scott and Bruce (1994), innovation always starts with problem recognition and then idea generation, which both need specific incentives. In addition, a challenging environment for employees and internal competitions are contributors to productivity and NPDs (Birkinshaw, 2001; Ekvall, 1996). In order to increase idea generation, rewards should be linked to idea contests (Cummings & Oldham, 1997).

The suggestion was made by Martins and Terblanche (2003) that flexibility, freedom and cooperative teamwork contribute to NPDs. Moreover, Hasu, Honkaniemi, Saari, Mattelmäki, and Koponen (2014) underlined the importance of integrating ordinary employees in the NPD process. Investigating the management of creative people, Mumford (2000) emphasised in his study that time and autonomy are key drivers for employees to generate new ideas. A key work, which associated the role of employees to NPD capabilities, is that of Kesting and Parm Ulhøi (2010). In their conceptual paper, they identified core drivers of employee-driven innovations. Following their definition, employee-driven innovation is the result of idea generation and implementation derived by employees. In order to accomplish this, firms are required to involve employees in decision processes, which should increase employee satisfaction. The ideas of employee-driven innovations have been supported by other authors (Ahmed, 1998; Hasu et al., 2014). In addition to these antecedents, Koc (2007) stressed the crucial role of cross-functional teamwork in order to support innovations. Supporting this, Maes and Sels (2014) highlighted the importance for firms to provide a highly diversified work setting. As we already outlined in the first part of this paper, there is a strong connection between organisational learning and NPD. On this account, du Plessis (2007) exhibited in their literature review that effective knowledge management enables employees to collaborate and to establish competencies required for NPDs.

Similar to these ideas, the entrepreneurial thinking of employees, which includes the engagement of employees to develop and implement their own ideas, has been acknowledged as a main driver of NPDs (Hult et al., 2004). In addition, Koc (2007) investigated 91 SMEs from the field of software engineering and found that technological orientation is a major antecedent of NPDs. What is more, a detailed examination of the sources of innovation by Yam, Lo, Tang, and Lau (2011) showed that technological capabilities increase the NPD performance, and Wiklund and Shepherd (2003) found that technological knowledge drives NPDs.

In terms of customer orientation, Hortinha et al., 2011 emphasised that the manager's focus on customer demands is a crucial NPD capability. In the same vein, other studies stressed the general importance of a strong customer and also competitor orientation for NPDs (Herrmann et al., 2006; Jiménez-Jimenez, Sanz Valle, & Hernandez-Espallardo, 2008; Salavou et al., 2004; Tajeddini, Trueman, & Larsen, 2006). Finally, effective idea implementation is also a matter of time. For that reason, a low time to market is a further essential NPD capability for firms (Afonso, Nunes, Paisana, & Braga, 2008; Chen, Reilly, & Lynn, 2005; Kessler & Bierly, 2002; Lieberman & Montgomery, 1988).

3. Methods

3.1. Sampling and data collection

This study relies on quantitative data gathered by the Mannheimer Innovation Panel (MIP) in 2011 and provided by the Centre for European Economic Research (ZEW), which collected the data as part of the German contribution to the European Innovation Survey (CIS). We restricted the data set to merely research-intensive SMEs based on NACE Codes (20–21, 26–30), resulting in 650 firms with less than or equal to 250 employees. The sample's key data are shown in Table 1.

3.2. Independent variables

To determine whether managerial innovations had an effect on the NPD capabilities of SMEs, we followed the general distinction of *innovations in organisational procedures and forms* (Damanpour & Aravind, 2012). However, external relations have positive

Table 1
Description of the sample

			NACE	Total % of sample	Total % of sample
Firm size	01 to 50 employees	Chemicals and pharma	20–21	84	12.9%
		Electrical engineering	26–27	164	25.2%
		Mechanical engineering	28	91	14.0%
		Automotive	29–30	37	5.7%
		Total		376	57.8%
50 to 250 employees		Chemicals and pharma	20–21	50	7.7%
		Electrical engineering	26–27	102	15.7%
		Mechanical engineering	28	79	12.2%
		Automotive	29–30	43	6.6%
		Total		274	42.2%

effects on NPDs of SMEs as well (Gronum et al., 2012; Romijn & Albaladejo, 2002). On this account, we used three different independent variables to distinguish different managerial innovations. We measured managerial innovations with the binary variables *innovations in organisational procedures*, *innovations in organisational forms*, and *innovations in external relations*. In order to ensure an adequate understanding of the respondents, examples were provided in the questionnaire for each type of managerial innovation. For *innovation in organisational procedures*, the introduction of quality management, supply chain management, knowledge management, and lean production were listed. With *innovations in organisational forms*, measures such as decentralisation, job rotation, changes in teamwork, and reorientation of the divisional structure were meant. Finally, new alliances, cooperation agreements, new types of customer relations, and supplier integration were given as examples of the variable *innovations in external relations*.

3.3. Dependent variables

As indicated in the conceptual development of this paper, scholars discussed NPD capabilities broadly and defined them differently. For the purpose of our paper, we gathered different indicators to measure NPD capability and synthesised them to three NPD capability factors. The first step in this procedure was to identify adequate items to measure NPD capabilities. On this account, we implemented the recommendation of many researchers to measure NPD capabilities in a multidimensional way (Hogan, Soutar, McColl-Kennedy, & Sweeney, 2011; Saunila et al., 2014; Wang & Ahmed, 2004). All of the items in our study derived from the literature. Table 2 shows the individual items together with their classification and references.

In a second step, we undertook a principal component analysis (PCA) with oblique factor rotation (Oblimin Quartimin-Q) to identify latent constructs that refer to different types of NPD capabilities. Instead of applying classical PCA, which rests upon Pearson correlations, we used R Factor 2.3 to examine component loadings based on polychoric correlations between individual items (Basto & Pereira, 2012). We chose this approach since polychoric correlations handle nominal and ordinal data more adequately, meaning that this procedure provides more accurate results (Basto & Pereira, 2012). Supporting this, Gilley and Uhlig (1993) argued that Pearson correlations are inappropriate for nominal and ordinal data. Following Kaiser's criterion of eigenvalues above 1, three factor components were extracted that together explained 67.03% of the variance. In addition to that, a KMO value of .783 and a statically significant Bartlett's test of sphericity, $p < .000$, proved that correlations were adequate for PCA. In order to test reliability, we calculated an ordinal coefficient alpha for each of the three constructs (Gadermann, Guhn, & Zumbo, 2012; Zumbo, Gadermann, & Zeisser, 2007). As all factor component variables had values above .7, we found no indications for reliability issues. Table 3 features the results of the PCA. The items *individual responsibility of employees*, *creativity of employees*, and *internal cooperation between divisions* mainly loaded on Component 1; *internal competition among product ideas* and *incentive systems* mainly loaded on Component 2; and *tracking of customer needs*, *quick implementation of ideas*, *quick up-take of novelties from competitors*, and *development of new technical solutions* mainly loaded on Component 3. Finally, the three extracted components revealed the latent dependent variables *NPD stimulation capability* (*NPD_stim_cap*), *NPD generation capability* (*NPD_gen_cap*), and *NPD implementation capability* (*NPD_impl_cap*) that subsequently served as dependent variables.

3.4. Control variables

To control for effects of firm size and industry, we integrated two control variables in our analysis. More specifically, we employed a dummy variable *firm_size* to differentiate small firms (0) with less than or equal to 50 employees and medium-sized firms (1) with more than 50 but less than or equal to 250 employees. Since our analysis focused on research-intensive industries exclusively, structural varieties between the branches involved could have had an impact on the results. We thus used the nominal variable *branch* to control for these effects.

Table 2
Constructs and their related items, antecedents, and references.

Item	Antecedent	References
Incentive systems	Rewards	Herrmann et al. (2006), Kesting and Parm Ulhøi (2010), Koc (2007), Lloréns Montes et al. (2004), Martins and Terblanche (2003)
Internal competition among product ideas	Idea contests	Birkinshaw (2001), Ekvall (1996), Cummings and Oldham (1997)
High individual responsibility of employees	Freedom	Wang and Ahmed (2007), Martins and Terblanche (2003), Mumford (2000)
Creativity of employees	Creativity	Martins and Terblanche (2003), Amabile (1988), Tesluk, Farr, and Klein (1997)
Internal cooperation between divisions	Cooperation	Maes and Sels (2014), Koc (2007), Swink, Talluri, and Pandejpong (2006)
Tracking of customer needs	Customer orientation	Herrmann et al. (2006), Hortinha et al. (2011)
Quick up-take of novelties from competitors	Competitor orientation	Tajeddini et al. (2006), Jiménez-Jimenez et al. (2008), Salavou et al. (2004)
Development of new technical solutions	Technical knowledge	Wiklund and Shepherd (2003), Vicente, Abrantes, and Teixeira (2015), Yam et al. (2011), Verona (1999)
Quick implementation of ideas	Time to market	Chen et al. (2005), Kessler and Bierly (2002), Afonso et al. (2008), Lieberman and Montgomery (1988)

Table 3
Component pattern matrix

Latent variable	Item	MSA	F1	F2	F3
NPD_gen_cap	High individual responsibility of employees	.743	.865		
	Creativity of employees	.751	.826		
	Internal cooperation between divisions	.903	.665		
NPD_stim_cap	Internal competition among product ideas	.703		.867	
	Incentive systems	.798		.608	
NPD_impl_cap	Tracking of customer needs	.813			.758
	Quick implementation of ideas	.817			.703
	Quick up-take of novelties from competitors	.748			.691
	Development of new technical solutions	.833			.572

3.5. Data analysis

Subsequent to the previous steps, we applied a three-way multivariate analysis of covariance (MANCOVA) in order to determine effects of managerial innovations on the three dependent variables *NPD_stim_cap*, *NPD_gen_cap*, and *NPD_impl_cap*. The reason why we applied this statistical procedure is that we found moderate correlations between *NPD_stim_cap* and *NPD_gen_cap*, $r = .435$, $p = .000$, *NPD_stim_cap* and *NPD_impl_cap*, $r = .363$, $p = .000$, as well as between *NPD_impl_cap* and *NPD_gen_cap*, $r = .482$, $p = .000$. In contrast to accomplishing individual ANOVAs on each dependent variable, MANCOVA prevented our study from statistical Type I errors (Field, 2013; Meyers, Gamst, & Guarino, 2013; Stiger, Kosinski, Barnhart, & Kleinbaum, 1998). Both control variables *firm_size* and *branch* were included in this procedure as covariates.

4. Results and discussion

As the descriptive statistics in Table 4 show, managerial innovations have been realised by a minority of SMEs. This finding is consistent with those of Garengo and Bernardi (2007), who ascertained that SMEs focus their efforts on operational and technological activities rather than on organisational or managerial problems. As stated by Teece (1980) and Boer and During (2001), managerial innovations are resource intensive. Our observation is thus likely to be related to high efforts for SMEs. The introduction of innovations in organisational procedures was with 35.8% the most common managerial innovations in our sample. Although the descriptive statistics suggest that SMEs do not seem to consider managerial innovations as important contributors to their NPD activities, the results reveal that all SMEs introducing any type of managerial innovation scored on average higher on each of the three NPD capability factors.

Having identified a tendency in the effect of managerial innovation on NPD capability, we will now turn to the results gained by the three-way MANCOVA. These results disclose whether the relationships indicated by the descriptive statistics are significant and in which direction a potential relationship may exist.

Prior to investigating the data for significances with MANCOVA, we ensured that statistical assumptions for this procedure held. On this account, Box's *M* value of 48.053 was not significant, $p = .290$, showing that matrices fulfilled the assumption that there was no significant difference between the covariance matrices (Field, 2013). Second, a non-significant Levene's *F* test

Table 4
Descriptive statistics

			Mean	SD	Total %	Variance
Innovations in organisational procedures	No	NPD_stim_cap	2.3726	.8160	48.9	.6659
		NPD_gen_cap	3.5954	.7436		.5529
		NPD_impl_cap	3.4733	.6496		.4220
	Yes	NPD_stim_cap	2.6824	.7768	35.8	.6034
		NPD_gen_cap	3.7525	.6091		.3710
		NPD_impl_cap	3.6341	.5931		.3518
Innovations in organisational forms	No	NPD_stim_cap	2.3934	.8083	53.4	.6533
		NPD_gen_cap	3.6138	.7523		.5659
		NPD_impl_cap	3.4575	.6711		.4503
	Yes	NPD_stim_cap	2.6820	.8037	31.7	.6460
		NPD_gen_cap	3.7201	.6061		.3673
		NPD_impl_cap	3.6578	.5620		.3158
Innovations in external relations	No	NPD_stim_cap	2.4435	.8022	61.2	.6435
		NPD_gen_cap	3.6198	.7227		.5223
		NPD_impl_cap	3.5013	.6508		.4235
	Yes	NPD_stim_cap	2.6433	.8321	23.1	.6924
		NPD_gen_cap	3.7356	.6337		.4016
		NPD_impl_cap	3.6133	.5919		.3503

for *NPD_stim_cap*, $F(7, 538) = .691, p = .679$, and for *NPD_impl_cap*, $F(7, 538) = 1.958, p = .059$ revealed that the assumption of equality of error variances were satisfied for these two dependent variables. However, Levene's *F* test also indicated issues for *NPD_gen_cap*, $F(7, 538) = 2.106, p = .041$. Scrutinising the standard deviations (see Table 4) exposed that the largest standard deviation was less than four times the size of the smallest, implying that robust results for the MANCOVA could also be expected for *NPD_gen_cap* (Howell, 2007). With respect to the Central Limit Theorem and our large sample size, we assumed normally distributed data (Field, 2013). Finally, due to the integration of two covariates in our analysis, we tested the assumption for homogeneity of regression slopes. We found no significant interactions between either the covariate *firm_size* and *innovations in organisational procedures* or *innovations in organisational forms* or between the covariate *branch* and both independent variables. We thus supposed that both covariates strengthened the statistical meaning of the present analysis.

The intercept model was statistically significant on an alpha level of .05 (McKillup, 2006), which demonstrates that managerial innovations were related to NPD capabilities after controlling for the effects of *firm_size* and *branch*, $\Lambda_{\text{Pillai}} = .617, F(3, 534) = 287.275, p = .000$, partial $\eta^2 = .617$. Furthermore, the results in Table 5 prove that the only effect of covariates rested upon the relationship of *firm_size* and *NPD_stim_cap*, $F(1, 536) = 5.727, p = .017$. Of the three independent variables, *innovations in organisational procedures*, $\Lambda_{\text{Pillai}} = .023, F(3, 534) = 4.275$, partial $\eta^2 = .023, p = .005$, and *innovations in organisational forms*, $\Lambda_{\text{Pillai}} = .017, F(3, 534) = 3.003$, partial $\eta^2 = .017, p = .030$, were statistically significant. These results point to significant differences in NPD capabilities between firms employing these types of managerial innovation and firms not applying these measures. All model statistics are presented in Table 5.

In order to gain a deeper understanding of specific relations between dependent and independent variables, we employed one-way ANCOVAs on each dependent variable (see Table 6). By doing so, we found that *innovations in organisational procedures* had statistically significant effects on *NPD_gen_cap*, $F(1, 536) = 3.916, \eta^2 = .007, p = .048$, and *NPD_stim_cap*, $F(1, 536) = 12.477, \eta^2 = .023, p = .000$. In addition, *innovations in organisational forms* had statistically significant effects on *NPD_stim_cap*, $F(1, 536) = 4.949, \eta^2 = .009, p = .027$, and *NPD_impl_cap*, $F(1, 536) = 6.246, \eta^2 = .012, p = .013$. It can be seen that the effect size of *innovations in organisational forms* on *NPD_stim_cap*, partial $\eta^2 = .009$, was lower than the effect size of *innovations in organisational procedures* on *NPD_stim_cap*, partial $\eta^2 = .023$, implying a higher meaning of *innovations in organisational procedures* for NPD stimulation capabilities. Contrastingly, no statistically significant effects of *innovations in external relations* could be identified in the model, Pillai's trace = .001, $F(1, 534) = .104$, partial $\eta^2 = .001, p = .958$.

Finally, investigating the direction of the relationship between significant relationships, we juxtaposed the main effects using pairwise comparisons with Bonferroni correction (see Table 7). As the results illustrate, firms employing *innovations in organisational procedures* had statistically significant higher mean scores on *NPD_gen_cap* and *NPD_stim_cap* than firms not applying these measures. Moreover, firms implementing *innovations in organisational forms* scored significantly higher on *NPD_stim_cap* and *NPD_impl_cap*.

The research question in this study sought to determine whether managerial innovations could help SMEs to improve their NPD capabilities. Our results indicate a relationship between managerial innovations and NPD capabilities of SMEs. Thus, we can underline the argument that different innovation types (technical vs. managerial innovations) are not mutually exclusive to each other and that they need to be implemented jointly (Damanpour & Evan, 1984). However, we must also call into question the findings of Damanpour (1987), who observed that technical innovations depend more on organisational characteristics than on administrative innovations.

We can confirm Hypothesis 1 that *innovations in organisational procedures* have a positive effect on the NPD capabilities of SMEs. More specifically, we found positive impacts on *NPD stimulation* and *generation capability*. The results suggest that *innovations in organisational procedures* preliminary have beneficial effects on NPD capabilities that are relevant for the first stages of NPD processes. In other words, when it comes to NPD implementation, chances are that new organisational procedures may fail to have their desired effect. A possible explanation for this is that *innovations in organisational procedures* could be strongly knowledge related. This implies that to initiate ideas, these innovations serve well. Once an idea has been generated, however, the organisation's structure that determines roles and responsibilities to finalise the innovative product may play a more important role for SMEs.

The second finding was that *innovations in organisational forms* had positive impacts on both *NPD stimulation* and *implementation capabilities*. There is therefore support for our Hypothesis 2. Nevertheless, as indicated by the effect sizes, *innovations in organisational procedures* may be more important for *stimulation capabilities*, and we found no promoting effect on *NPD generation*

Table 5
Model statistics

Statistic		Values	Sig.
Pillai's trace	<i>intercept</i>	$\Lambda_{\text{Pillai}} = .617, F(3, 534) = 287.275$, partial $\eta^2 = .617$.000
	<i>innovations in organisational procedures</i>	$\Lambda_{\text{Pillai}} = .023, F(3, 534) = 4.275$, partial $\eta^2 = .023$.005
	<i>innovations in organisational forms</i>	$\Lambda_{\text{Pillai}} = .017, F(3, 534) = 3.003$, partial $\eta^2 = .017$.030
	<i>innovations in external relations</i>	$\Lambda_{\text{Pillai}} = .001, F(3, 534) = .104$, partial $\eta^2 = .001$.958
Box's M		48.053	.290
Levene's F	<i>NPD_stim_cap</i>	$F(7, 538) = .691$.679
	<i>NPD_impl_cap</i>	$F(7, 538) = 1.958$.059
	<i>NPD_gen_cap</i>	$F(7, 538) = 2.106$.041

Table 6
Tests of between-subjects effects

Source		Type III sum of squares	df	Mean square	F	Sig.	Partial η ²
Corrected model	NPD_stim_cap	24.834 ^a	9	2.759	4.406	.000	.069
	NPD_gen_cap	6.265 ^b	9	.696	1.461	.159	.024
	NPD_impl_cap	9.335 ^c	9	1.037	2.700	.004	.043
Intercept	NPD_stim_cap	136.227	1	136.227	217.533	.000	.289
	NPD_gen_cap	295.870	1	295.870	621.070	.000	.537
	NPD_impl_cap	242.238	1	242.238	630.631	.000	.541
Branch	NPD_stim_cap	.650	1	.650	1.038	.309	.002
	NPD_gen_cap	.485	1	.485	1.017	.314	.002
	NPD_impl_cap	.906	1	.906	2.359	.125	.004
Firm_size	NPD_stim_cap	3.587	1	3.587	5.727	.017	.011
	NPD_gen_cap	.167	1	.167	.351	.554	.001
	NPD_impl_cap	.674	1	.674	1.754	.186	.003
Innovations in organisational procedures	NPD_stim_cap	7.814	1	7.814	12.477	.000	.023
	NPD_gen_cap	1.865	1	1.865	3.916	.048	.007
	NPD_impl_cap	1.023	1	1.023	2.664	.103	.005
Innovations in organisational forms	NPD_stim_cap	3.099	1	3.099	4.949	.027	.009
	NPD_gen_cap	.434	1	.434	.912	.340	.002
	NPD_impl_cap	2.399	1	2.399	6.246	.013	.012
Innovations in external relations	NPD_stim_cap	.120	1	.120	.191	.662	.000
	NPD_gen_cap	.102	1	.102	.215	.643	.000
	NPD_impl_cap	.004	1	.004	.010	.922	.000

^a R² = .069 (adjusted R² = .053).

^b R² = .024 (adjusted R² = .008).

^c R² = .043 (adjusted R² = .027).

capabilities. This result may be explained by the fact that divisional changes, job rotation, or other labour-oriented modifications could be foundations for NPD implementation. Scholars often describe the first phases of NPD as fuzzy front-end. The term fuzzy refers to uncertainty and high dynamics (Chang, Chen, & Wey, 2007; Kim & Wilemon, 2002). It is conceivable that habit changes through *innovations in organisational procedures* may contribute more to these activities since most of the final development goals are unclear at this stage. It seems to be more important at this point to gain all information and ideas by unstructured means in contrast to finding ways to improve the workplace organisation to speed up prototype development for example. However, when it comes to NPD implementation, our results suggest that the changes required to support these activities should be more focused on structural changes in the work setting that become crucial to finalise the product as efficiently as possible. Indeed, there is a growing amount of literature analysing the effects of structural changes in the workplace on NPDs (Martínez-Sánchez, Vela-Jiménez, Pérez-Pérez, & de-Luis-Carnicer, 2008; Scott & Bruce, 1994). Rework and waiting times are typical issues that occur in NPD processes (Haque & James-Moore, 2004; Liker & Morgan, 2006). Appointing the right employees at the right place could improve information flows to avoid these problems.

Naveh et al. (2006) showed in a study among 885 organisations which implemented the ISO 9000 standard that managerial innovations will not contribute to innovations under all circumstances. We support this finding since one unanticipated result of our study was that we found no significant effects of *innovations in external relations* on NPD capabilities of SMEs. On this account, we must reject Hypothesis 3 that *innovations in external relations* support NPD capabilities of SMEs. This could be due to the fact that prevalent relations of SMEs are sufficiently established and do not call for any changes. Assuming this, *innovations in external relations* may consume resources that could be better utilised elsewhere. Since *innovations in external relations* seem to play a minor role for SMEs' general NPD capabilities, the results reinforce the two-fold classification of managerial innovations in (a) *innovations in organisational procedures* and (b) *innovations in organisational forms* (Damanpour & Aravind, 2012).

The situation is quite different when the two-tier differentiation of NPD capabilities (Hortinha et al., 2011; Teece et al., 1997; Zaltman et al., 1973) is considered: we argue that this two-stage classification neglects the differences between NPD capabilities

Table 7
Pairwise comparisons with Bonferroni correction

Independent variable	Dependent variable	Mean difference ^a	SE	Sig.	95% confidence interval for difference	
					Lower bound	Upper bound
Innovations in organisational procedures	NPD_gen_cap	.151*	.076	.048	.001	.300
	NPD_stim_cap	.308*	.087	.000	.137	.480
Innovations in organisational forms	NPD_stim_cap	.193*	.087	.027	.023	.363
	NPD_impl_cap	.169*	.068	.013	.036	.303

^a Values were calculated as the mean difference of firms applying the specific independent variable and firms not applying the specific independent variable; positive values indicate positive effects of independent variables

required to stimulate ideas and those which contribute to the idea development. Based on the results of the PCA, we can thus extend Teece et al.'s (1997) two-tier distinction by a third category: NPD stimulation capability. In fact, this three-tier distinction takes into account that authors emphasised the crucial role of reward systems (Herrmann et al., 2006; Kesting & Parm Ulhøi, 2010; Koc, 2007) and motivating competition among employees (Birkinshaw, 2001; Cummings & Oldham, 1997; Ekvall, 1996) as contributing factors to innovations.

5. Conclusion and implications

Investigating the effects of managerial innovation on NPD capabilities of SMEs was the main goal of the current study. Reviewing the recent literature on managerial innovation and revealing the roots of NPD capabilities in the theory laid the foundations of our research. Based on these insights, we divided managerial innovations into *innovations in organisational procedures*, *innovations in organisational forms*, and *innovations in external relations*. Nine items that derived from the literature measured NPD capabilities. We applied principal component analysis to reduce the items to three constructs that described NPD capabilities of SMEs best. In this regard, we identified the factors *NPD stimulation capability*, *NPD generation capability*, and *NPD implementation capability*. Overall, the results exposed that

- a) Innovations in organisational procedures have a positive effect on the NPD stimulation capabilities and NPD generation capabilities of SMEs.
- b) Innovations in organisational forms have a positive effect on the NPD stimulation capabilities and NPD implementation capabilities of SMEs.
- c) Innovations in external relations have no significant effect on the NPD capabilities of SMEs.

This study has gone some way toward enhancing our understanding of the relatively little investigated field of managerial innovations. Moreover, the analysis of SMEs' NPD capabilities undertaken here has extended our knowledge of how SMEs can improve their NPDs further. In contrast to previous studies that focused on SMEs' capability improvements by external means, our paper demonstrated that SMEs can actively reinforce their NPD capabilities by implementing the right changes in their organisations.

Regarding implications, this study strengthens the idea that managerial innovations make important contributions to the NPD capabilities of SMEs. As outlined at the beginning of this paper, NPD capabilities are embedded in theories on organisational learning and dynamic capabilities. Our results also enhance the understanding of the relationship between managerial innovations and these theoretical frameworks. What is more, we found no support that SMEs' NPD capabilities can benefit from *innovations in external relations*. This result challenges the idea that managerial innovation could be helpful per se for SMEs. Our research suggests that NPD capabilities rely on three dimensions: *NPD stimulation capability*, *NPD generation capability*, and *NPD implementation capability*. First, this classification substantiates the general two-tier distinction of NPD capabilities established by other scholars. Second, we propose that this classification should be extended by an upstream NPD capability, which is related to NPD stimulation.

Besides these theoretical implications, our findings also have important implications for the operational practice of SMEs. Referring to our results, we can arguably assume that managerial innovations are for the most part important for SMEs to improve their NPD capabilities. However, in order to ensure positive effects of managerial innovations, SMEs should focus on *innovations in organisational procedures* and *innovations in organisational forms*. Our results help SMEs to prioritise their managerial innovations: the best bet for SMEs aiming at improving capabilities that are important for the first phases of NPD are changes in their organisational procedures. These firms should actively rethink their information exchanges and long-established habits to find ways how modifications in these fields could simplify daily work. On the other hand, firms gearing toward advances in the final phases of NPD should concentrate internal changes on their general work organisation. The mere relocation of individual employees between firm sites could already help a firm improve its implementation capabilities. By contrast, building up new types of external relations will probably not support the NPD capabilities of SMEs. For these firms, this in practice means that efforts to implement changes in external relations could be – at least with regard to their NPD capabilities – wasted resources. Considering the widespread resource scarcity in SMEs, this is an essential finding, enabling managers to anticipate the impacts of organisational changes on NPDs.

The key limitation of this essay is based on the fact that we restricted the analysis to four innovative industries. Thus, the findings may not apply to all SMEs. Second, we employed nine items in three factors to analyse the impact of managerial innovations on NPD capabilities. Even though we fulfilled all statistical assumptions required to use this procedure, more items could have increased the total variance explained. We therefore suggest that future studies should build upon the three NPD capabilities identified and reinforce them by using additional items. Finally, the differentiation of managerial innovation remained a rather superordinate classification. While we separated managerial innovations into three different types, future analyses would benefit from breakdowns that are more detailed.

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