DOES AN INDEPENDENT ORGANIZATIONAL INNOVATION FUNCTION PREDICT NPD PERFORMANCE? – UNCOVERING THE CAUSAL CHAIN

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ABSTRACT

Currently, firms increasingly establish independent innovation departments in an attempt to foster their innovative performance. However, it is still unclear if and how an innovation management department impacts firms' ability to develop new products and introduce them into the market. In this paper, we shed light on this issue by developing and testing a theoretical model that depicts the causal chain from the existence of an independent innovation department to an organization's NPD performance. The results of our empirical study provide various important insights. In essence, the existence of an independent innovation department in the firm helps in increasing NPD performance, but only via a limited number of causal paths. First, an independent innovation department fosters effective evaluation and selection of product ideas which in turn leads to higher NPD performance via innovation process effectiveness. Second, an independent innovation department improves innovation project coordination leading to higher NPD performance via innovation process efficiency. Whereas innovation culture and openness to external knowledge also foster innovation process effectiveness and NPD performance, neither is increased by the presence of an innovation department. In sum, an innovation department is beneficial, but far from being a "magic bullet" that firms may exclusively rely on in fostering their innovative performance.

Key words: Innovation Management, Innovation Department, Organizational Structure

INTRODUCTION

A firm's capability to innovate is a crucial factor in determining its future competitive success (McDermott & O'Connor, 2002). The increasingly globalized nature of most markets as well as blurring industry frontiers furthermore lead to more fast paced and intensified competition, so that firms need to be able to frequently and continuously develop and introduce new products and services (Enkel & Gassmann, 2010; Gassmann & Enkel, 2006). In order to elevate organizational product and service innovation from a state of mere randomness to an at least partially projectable process, firms need to systemize their innovation efforts and install innovation management as a permanent firm function (O'Connor & DeMartino, 2006). One important element in doing so is the implementation of new or modification of existing organizational structures. The link between organizational structure and innovative performance has already been discussed in early managerial research (Burns & Stalker, 1961). Following this, several different structural arrangements for organizing innovation have been discussed in innovation literature over time (Benner & Tushman, 2003). Among those, establishing an independent organizational function in the form of an innovation department is option that is increasingly used by firms and discussed in research

(Jagersma & van Grop, 2003; O'Connor & DeMartino, 2006). Such an independent innovation department allows firms to coordinate resources across innovation initiatives and hinder innovation to be cannibalized by day-to-day operations (Blindebach-Driessen & van den Ende, 2014).

Notwithstanding this obvious practical importance and timeliness of the topic, hitherto research considerably lacks insight on if and how an innovation management department impacts firms' ability to develop new products and introduce them into the market (O'Connor, 2012). Moreover, the majority of the small stream of existing empirical research takes the perspective of an independent innovation function as a form of structural ambidexterity (Blindebach-Driessen & van den Ende, 2014; Raisch *et al.*, 2009). In spite of the undoubtful importance of ambidexterity in realizing firms' innovative performance, we argue that the existence of an independent innovation department might positively impact other factors explaining product and service innovation success. In this paper, we hence shed light on the relation between the existence of an innovation department and an organization's performance concerning product development by outlining a model that aims to depict the corresponding causal chain in more detail than in the works before.

More specifically, we propose a theoretical model which integrates function and process perspectives on organizational innovation management. In line with previous considerations on the topic (O'Connor, 2012), we argue that the existence of an independent innovation department per se will not foster innovation performance. Rather, this department is likely to set the frame for the effective and efficient processing of innovation initiatives by stimulating the emergence of innovation-enhancing behaviours and thought frames in the organization (Barczak *et al.*, 2009; Cooper *et al.*, 2004). More concretely, we draw on literature on the specific tasks of innovation departments (Labitzke *et al.*, 2014; O'Connor & DeMartino, 2006) in order to determine five factors on the organizational level that are likely to be fostered by the existence of an independent innovation function: 1) innovation-friendly culture, 2) effective idea evaluation and selection, 3) independence of innovation initiatives from daily business, 4) openness to external knowledge, and 5) innovation project coordination. These five factors will positively impact the effectiveness and efficiency of a firm's innovation processes, which in turn are likely to increase the success of its new products in the market. In sum, we thus propose a 2-step mediation model spanning a causal chain from the existence of an innovation department over the five innovation-enhancing factors to innovation process effectiveness and efficiency finally resulting in firms' NPD performance.

ORGANIZING INNOVATION AND NEW PRODUCT DEVELOPMENT

Due to its importance for ensuring competitiveness in the long-term, firms strive to manage innovation, i.e. to plan, influence and monitor according activities and outcomes (Burns & Stalker, 1961). In doing so, firms try to systematically eliminate the randomness associated with the creation and implementation of new products and services (Cheng & Van de Ven, 1996). Instead of chaotic and uncoordinated activities, innovation management thus strives to implement procedures, systems and structures that help in producing innovation outputs on a regular basis (Olson *et al.*, 2001). Thereby, the organization of innovation includes two task levels which both are of high importance: the management of single initiatives and projects as well as of the firm's innovativeness as a whole (Dougherty, 1999). As both tasks feed into each other, also the main means of organization, innovation processes and innovation departments are likely to be intertwined in predicting firms' innovation outcome.

One important element in organizing innovation is formalization. By formalization, firms aim to standardize, coordinate and control decisions and procedures through clearly specified rules, structures, norms and practices (Bodewes, 2002; Fredrickson, 1986). With this regulatory frame, firms aim at ensuring each discipline and creativity in the process of generating and implementing new ideas, avoiding conflicts among internal and external stakeholders involved as well as reducing uncertainties and turbulences (O'Connor & DeMartino, 2006; Pertusa-Ortega *et al.*, 2010). Apart from steering single innovation initiatives, the formalization of innovation also helps in establishing a sence of significance among an organization's management and workforce (Iwamura & Jog, 1991). Hence, by formalizing organizational innovation firms set up the perspective of innovation as a necessary and pertual field of action rather than a unique and spontaneous incident (O'Connor & DeMartino, 2006). In all, previous research indicates that formalization is indispensable in organizing innovation and turning it into a strategic issue (Okhuysen & Eisenhardt, 2002).

Innovation Processes

Before a product or service innovation is introduced into the market, a number of operative tasks have to be addressed. Typically, an innovation thus runs through different phases, so that there is an innovation process (Olson *et al.*, 2001). In the first phases, opportunities for new products and services are identified and ideas generated and evaluated (Schulz & Hoegl, 2006). Usually, in-depth market and technology analysis is an integral part of this. At the end of this "fuzzy front-end"-phase the innovation team has developed a product or service concept which is used as a basis for further development (Khurana & Rosenthal, 1998). Subsequently, concrete products and services are developed, tested, ramped-up and finally commercialized (Souder & Moenaert, 1992). The early and late phases of the innovation process thereby have very different goals and use different approaches. Whereas openness, creativity and experimentation dominate in early phases, systematic improvement is most important in late phases (O'Connor & Rice, 2013).

In order to ensure a successful completion of an innovation process, management must thus coordinate both phases and juggle the different task and goal foci. The success of this endeavour is displayed by the effectiveness and efficiency of the innovation process. On the one hand, effectiveness is the art of doing the right things, i.e. in the context of product and service innovation to create an outcome that fulfills the aspired performance specifications (Seth & Sisodia, 2002). On the other hand, efficiency is the art of doing things right, hence to reach a certain performance level with the lowest possible usage of ressources (Seth & Sisodia, 2002). In the context of product and service innovation, this thus means to complete the innovation process while meeting time and cost goals (Johnson *et al.*, 2009). Innovation management aims at both optimizing innovation process effectiveness and efficiency in order to foster firms' innovative performance.

Structural Organization of Innovation Management

Innovation literature agrees on the notion that organizational structure influences the innovation capability of a firm as well as the course of innovation processes (Benner & Tushman, 2003). Thereby, organizational structure supports the overall innovation process as well as the specific activities in each phase (Wentz, 2008). Among others, organizational structure may influence the coordination among persons involved in the innovation process and determine their decisional

autonomy. Hence, the choice of an appropriate organizational structure is an important managerial decision with immense impact on product innovation performance (Menguc & Auh 2010).

Notwithstanding the agreement on the importance of formal structure, literature is at variance when it comes to the most suited form of organization for firms' innovation management (Tushman *et al.*, 2010). In general, past research distinguished three major forms of organizational structure: decentral organization on the functional level, temporal organization in projects, or central organization in an own department. Each of the three forms has advantages and disadvantages:

Decentral Organization: Here, the locus of responsibility for an innovation wanders sequentially through a firm's functional departments (Clark & Wheelwright, 1992; Larson & Gobeli, 1988), dependent on the phase in the innovation process (Takeuchi & Nonaka, 1986). Typically, the R&D department will be responsible for the eraly phases, before production and marketing take over. Crossfunctional interaction will be either non-existent or limited (Clark & Wheelwright, 1992). The advantages of this approach lie in specialization and expertise building (Takeuchi & Nonaka, 1986). However, functional departments will likely aim to optimize the outcome of their own process step rather than of the overall innovation outcome. The lack of central coordination often makes rework and iteration necessary so that schedules and budgets might be missed (Larson & Gobeli, 1988). Especially if the complexity of a new product or service is high, decentral organization is ineffective.

Temporal Organization: In this form of organization, members from different departments are assigned project teams dealing with a particular product or service innovation (Edmondson & Nembhard, 2009). This approach aims at using the combined knowledge from the relevant departments and thus providing a broad base of expertise (Dougherty & Tolboom, 2008). Through the involvement of different perspectives and functional backgrounds, interfaces in the innovation process are avoided so that problems might be identified and eliminated early. Compared to the decentral organization, temporal organization thus stands out in terms of cost and time management (Gebert *et al.*, 2006). Still, the integration of different perspectives and expertises might be tough. Hence, the conflict potential in this form of organization is high and the successful advancement of an innovation process could be undermined (Edmondson & Nembhard, 2009). Moreover, team members often have to simultaneously deal with the innovative task and their everyday work which potentially leads to a lack of focus (Majchrzak *et al.*, 2012).

Central Organization: The last structural design option is the establishment of a central independent innovation department (Jagersma & van Grop, 2003). This unit is separated from the organization's core business and is thus not liable to the same sales and profitability goals as the rest of the firm (Christensen & Bower, 1996). In contrast, an independent innovation department follows the goal of developing new product and service offers as well as tapping new business areas (Sharma & Chrisman, 1999). This is achieved by creating an organizational environment in which creativity and experimentation are not endangered to be cannibalized by the needs of the day-to-day business (Hill & Rothaermel, 2003). The innovation department thereby acts as a boundary spanner between the firms' departments in coordinating innovation processes (O'Connor & DeMartino, 2006). Whereas this approach becomes more and more popular in practice, the realization of its potential benefits is often problematic (Kelley, 2009). In particular, the acceptance of the independent unit's work might be low in the rest of the organization and the implementation of the innovation department's outputs in daily business might be impeded (McDermott & O'Connor, 2002).

We argue that though there might be problems in the first practical implementations of independent innovation departments, this form of structural design in general will be beneficial for a firm's innovative performance. An independent innovation department ensures the permanence of innovation on the organizational agenda and establishes clear roles and responsibilities (Barczak *et al.*, 2009; O'Connor & DeMartino, 2006). Thereby, decision speed and quality, collection and routinization of best practices, and the development of organizational innovation capabilities are major benefits (O'Connor & DeMartino, 2006; O'Connor, 2008).

THE IMPACT OF AN INDEPENDENT INNOVATION DEPARTMENT ON NPD PERFORMANCE

In line with the complex array of activities related to organizational innovation, the task field of an innovation department is rather broad. In particular, reviews of previous literature identified factors concerning organizational culture, leadership, as well as project realization as potentially beneficial for organizations product innovation outcomes (Ernst, 2002). In order to ensure a firm's capability in new product and service development (NPD), an innovation department thus has the task to contribute to an as optimal as possible configuration of these factors (O'Connor & Demartino, 2006). Among the most important and frequently mentioned task fields are the following (O'Connor, 2008):

Innovation Culture: A basic requirement for continuously high innovative performance is the existence of innovation-friendly climate in the organization (Scott & Bruce, 1994). This includes among others a focus on learning and experimentation, a propensity towards risk-taking entrepreneurial behaviour, encouragement unofficial projects, top management support and the availability of internal "venture capital" (Cooper & Kleinschmidt, 1995).

Idea Selection and Evaluation: The selection and evaluation of new ideas for products and services is a further important task. It serves to align innovative activities with the strategic foresight of an organization (Labitzke *et al.*, 2014; O'Connor, 2008). Hence, ideas must be evaluated based on technological and market criteria in order to make a selection in line with a company's goals.

Openness to External Knowledge: The external environment is a valuable source of ideas, expertise and insight on future trends, opportunitites and risks (West & Bogers, 2014). In order to exploit this source, a firm's innovation management must establish contact to external actors such as customers, suppliers, research organizations and others (West & Bogers, 2014). This might allow for detecting technological developments and customer needs which serve as an input for the generation of new concepts and ideas (Labitzke *et al.*, 2014).

Project Independence: There is an inherent conflict potential between daily business and innovation activities, or, as literature on organizational ambidexterity terms it, exploitation and exploration (Raisch *et al.*, 2009). Oftentimes, daily business cannibalizes resources and attention for innovation initiatives (Kessler & Chakrabarti, 1996). Independence of innovation projects in terms of resources, decisions and goals is thus especially for radically new NPD projects an important success factor.

Interproject Coordination: Usually, a firm pursues a portfolio of innovations rather than a single initiative at a time (O'Connor, 2008). This brings with it the necessity of allocating ressources across projects, transferring learning effects from one project to another and ensuring alignment towards overall company goals rather than optimization of single projects' outcome (Bartsch *et al.*, 2013).

We propose that these five factors rather than the existence of an innovation department will determine how effectively and efficiently a firm can execute innovation processes. Still, we also expect a strong positive influence of an independent innovation function on all of the five factors. Hence, in contrast to previous works, we postulate mediated rather than direct effects. In the following, the rational behind these effects will be outlined (see also Figure 1).

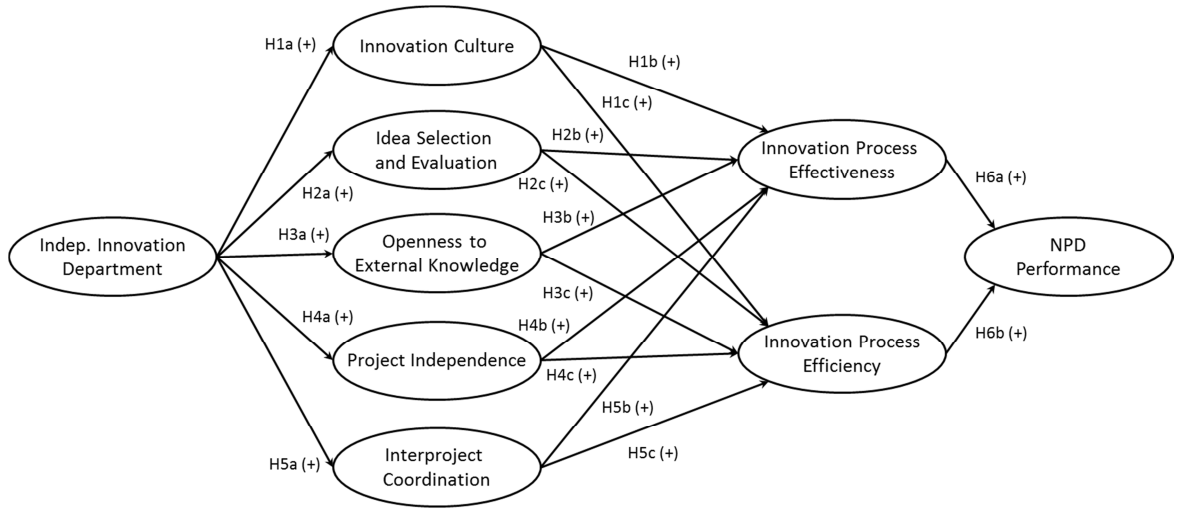

Figure 1: Hypothesis Framework

Innovation Culture

Innovation culture is widely seen as one of the strongest and most valid predictors of innovative behaviors in the firm (Scott & Bruce, 1994). An organizational innovative culture leads employees and managers to create a mindset which is aware of and open to oopportunities stemming from improvements and novelties. This benefits both innovation process effectiveness and efficiency. On the one hand, an innovation-friendly culture allows for employees to actively conduct broad search for knowledge, create new ideas, discuss them with others and experiment with potential applications without having to fear blame and rejection (Tellis et al., 2009). Thisin turn enlarges the opportunities for knowledge creation in firms, enlarges the pool of ideas available as well as the probability of finding adequate solution to fulfill customer needs (Cooper *et al.*, 2004). On the other hand, innovation culture can enable employees to see the big picture, motivate them towards putting higher effort in innovation endeavours and thus push on completing product and service developments faster and more efficiently (Menon & Lukas, 2004). This notion is further supported by the results of empirical studies (Cankurtaran *et al.*, 2013) so that innovation process efficiency is likely to be fostered by innovation culture.

The existence of an innovation department helps in establishing an innovative organizational culture by influencing the creation of structural, procedural and cognitive artefacts that reflect just that innovation-friendly mindset (Leonardi, 2011). By establishing an independent function for innovation management, a firm thus both signals the desirability and strategic importance of innovation to the rest of the firm and creates a central contact point which might help other departments in installing innovation-friendly norms, rules, procedures and values (Blindenbach-Driessen & van den Ende,

2014). As a consequence, we assume that an innovation department is an important factor in creating an innovative culture which in turn favors the performance of NPD processes.

H1a: The existence of an independent innovation department will positively influence the emergence of an innovation-friendly culture.

H1b: The effect of an independent innovation department on innovation process effectiveness will be mediated by the existence of an innovation-friendly culture.

H1c: The effect of an independent innovation department on innovation process efficiency will be mediated by the existence of an innovation-friendly culture.

Idea Selection and Evaluation

Idea selection and evaluation are important determinants of innovative performance. Due to resource limitations, no firm can pursue all of its product ideas so that decisions on investment and implementation need to be made. The more this decision validly reflects potential and feasibility of ideas, the higher the effectiveness and efficiency of innovation processes should be (Cooper, 1992). Concerning effectiveness, during systematic idea selection and evaluation firms analyze relevant technological, market-related, financial or strategic factors influencing he potential success of a product or service concept (Tzokas *et al.*, 2004). Thereby, they are likely to reach a more valid prediction of an ideas market potential. Hence, innovation process effectiveness is fostered. Concerning efficiency, an appropriate evaluation and selection of ideas allows a firm to separate valuable from invaluable ideas. Consequentially, the former may be supported by a larger share of resources and thus be developed faster whereas failures are minimized (Thomke & Bell, 2001).

The innovation department contributes to a more systematic idea selection and evaluation by providing information on the technological, market and regulatory environment. Trend, environment and scenario analysis have traditionally been seen as and still are a main task field of innovation management (Heidenberger & Stummer, 1999). The so gained knowledge on the external environment should be combined with insight on internal strategies and operations in order to feed into idea evaluation and selection. Also here, innovation departments can take an important role in collecting valuable information across firm departments (Labitzke et al., 2014).

H2a: The existence of an independent innovation department will positively influence the systematic idea evaluation and selection.

H2b: The effect of an independent innovation department on innovation process effectiveness will be mediated by systematic idea evaluation and selection.

H2c: The effect of an independent innovation department on innovation process efficiency will be mediated by systematic idea evaluation and selection.

Openness to External Knowledge

At least since the creation of the concept “open innovation”, external knowledge is seen as an important input in organizational innovation (Chesbrough *et al.*, 2006). In the case of innovation process effectiveness, the acquisition and application of external knowledge in product and service innovation initiatives has several potential benefits. First, firms will have access to a broader

knowledge base enabling opportunities for creativity and knowledge combination (Enkel & Gassmann, 2010). Second, external knowledge might allow for departing from the status quo to a much higher degree than internal skills, so that the output of product innovation might be more novel (Cohen *et al.*, 2002). Third and finally, the incorporation of external information helps firms to align their product innovation efforts to the needs of their environment. As a consequence, openness to external knowledge will minimize the probability of developing irrelevant products and services (Brettel & Cleven, 2011). In the case of innovation process efficiency, access to external knowledge and skills might be more flexible and less costly than the in-house development of these resources. Instead of reinventing the wheel, innovation initiatives can resort to existing expertise and solutions leading to large potentials for cost and time savings (Kessler & Chakrabati, 1996).

The innovation department may serve as an agent linking a firm towards its external stakeholders. It can establish contact with research institutes, universities, trade associations, customers, suppliers and competitors, among others. By institutionalizing the innovation department as such an "external star", external knowledge acquisition will most likely be fostered (Wheelan *et al.*, 2010). Besides this, an independent innovation function might also overtake tasks of an "internal star" in translating and disseminating external knowledge within the own firm. By embracing such a gatekeeping role (De Brentani & Reid, 2012), the innovation department will thus be likely to foster the acquisition and application of external knowledge in a firms innovation processes.

H3a: The existence of an independent innovation department will positively influence openness to external knowledge.

H3b: The effect of an independent innovation department on innovation process effectiveness will be mediated by openness to external knowledge.

H3c: The effect of an independent innovation department on innovation process efficiency will be mediated by openness to external knowledge.

Project Independence

Innovation success might be fostered by granting innovation initiatives a certain degree of autonomy and independence from operative business. This is due to the fact that the generation and implementation of product and service innovations entails a range of tasks which drastically differ from day-to-day business in terms of complexity and routinization (O'Connor, 2008). Innovation projects independence first helps in increasing innovation process effectiveness (Gupta *et al.*, 2006). For instance, higher levels of independence and autonomy allow for a focus on new customers and business fields, experimentation and flexibility in reacting to changing requirements (Blindenbach-Driessen & van den Ende, 2014). Second, also innovation process efficiency should benefit from independent innovation initiatives. Thereby, independence and autonomy enable focus on the innovative task at hand (Kessler & Chakrabati, 1996). This focus eliminates stagnations and supports a speedier finalization of new product and service development.

An innovation department might help in protecting innovation initiatives from being canibalized by daily business but also in creating fruitful links between both domains. The innovation function serves as a patron for product and service innovation projects and is able to enforce different rules and norms concerning new product development which differ from those in the rest of the

organization. It thus supports the establishment of autonomy for organizational innovation (Barczak *et al.*, 2009) so that the independence of innovation projects from operations will be fostered.

H4a: The existence of an independent innovation department will positively influence innovation projects' independence from daily business.

H4b: The effect of an independent innovation department on innovation process effectiveness will be mediated by innovation projects' independence from daily business.

H4c: The effect of an independent innovation department on innovation process efficiency will be mediated by innovation projects' independence from daily business.

Interproject Coordination

Finally, innovation process effectiveness and efficiency are likely to be positively influenced by an overarching coordination between different product and service innovation projects. On the one hand, interproject coordination enhances process effectiveness by aligning different initiatives towards competitive goals and creating a sense of interdependence (O'Connor, 2008). As a consequence projects are more likely to feed into each other and contribute more significantly to organizational value creation. On the other hand, lack of interproject coordination will almost necessarily lead to rework, resource inefficiencies and interproject conflicts (Labitzke *et al.*, 2014). The reverse conclusion from this is, that better interproject coordination will enable firms to keep cost and time needs lower and thus foster innovation process efficiency.

The coordination of organizational innovation activities is key task of an innovation department and thus a direct potential benefit stemming from the establishment of an independent innovation function. By central bundling of decisions, responsibilities and competences in one department is likely to increase the alignment of innovation activities to strategic goals, the goal-oriented allocation of resources and the transfer of best practices from initiative to initiative (O'Connor & DeMartino, 2006). In all, the existence of an independent innovation department creates a central contact point which takes superordinate role and enables better interproject coordination.

H5a: The existence of an independent innovation department will positively influence interproject coordination.

H5b: The effect of an independent innovation department on innovation process effectiveness will be mediated by interproject coordination.

H5c: The effect of an independent innovation department on innovation process efficiency will be mediated by interproject coordination.

NPD Performance

The more effective a firm's innovation processes, the more likely a firm will be able to commercialize new products and services as well as generate revenues and profits superior to competition. Both the quantity and quality of innovation process outcomes feed into this increase of performance. Research has shown that successful innovators often play a numbers game by introducing a range of new products and thus spreading the risk of non-acceptance by the market (Deschamps & Nayak, 1992). An effective innovation process that creates an adequate quantity of output helps here and

increases the likelihood of a firm to land a hit. However, quantity alone cannot explain NPD success. Effective innovation processes are able to produce new products and service that offer new levels and dimensions of performance (Montoya-Weiss & Calantone, 1994). The higher performance levels enable a firm to better address customers needs and creating demand and revenue. In sum, innovation process effectiveness will enhance the performance of new products in the market.

Moreover, also process efficiency might yield high returns on new products in the market. A fast innovation process is a clear competitive advantage and helps firms to exploit advantages of pioneering and conquer market shares and an innovative brand image before competitors can react (Goktan & Miles, 2011). Moreover, process efficiency enhances the profits made from product and service innovations by lowering costs of development (Cankurtaran *et al.*, 2013). Especially in highly competitive market environments, this cost efficiency might allow firms to offer new products at lower prices than rival companies (Kim & Atuahene-Gima, 2010). Also this might help in gaining market shares with new products so that NPD performance is positively influenced by efficiency.

H6a: Innovation process effectiveness will positively influence firms' NPD performance.

H6b: Innovation process efficiency will positively influence firms' NPD performance.

RESEARCH METHODOLOGY

We test the hypothesized model based on a quantitative survey with a sample of 1,100 innovation managers, product managers and R&D managers. These come from different industrial contexts (such as automotive, energy, IT, banking, biotechnology, or engineering, among others) as well as different countries (such as Germany, Switzerland, USA, France, China, and Sweden, among others).

Data Collection

The sample of 1,100 respondents was randomly drawn from member search results on the career platforms Xing and LinkedIn. The used search term was the following: "(Product OR Service) AND (Research OR Development OR Innovation) AND Management". The 1,100 selected persons were contacted via personal message on the career platform and asked if they were willing to participate in the survey. If there was agreement, we sent the link for the questionnaire via e-mail. In all, 124 completed questionnaires were obtained yielding a satisfactory response rate of 11.3 percent. We took several measures to ensure biases resulting from this collection procedure to be low. First, we ensured that the respondents were knowledgeable on the research topic and thus actually represent key informants (Kumar *et al.*, 1993). We did this by adding questions on position, task field and involvement in innovation processes to the questionnaire. Second, we tested for nonresponse bias by compaing early respondents and late respondents (Armstrong & Overton, 1977). We did not find any statistically significant differences for any research and control variable ($p < .05$). Third and finally, we controlled for common-method bias by conducting Harman's one-factor test using a principal components VARIMAX rotation factor analysis (Podsakoff *et al.*, 2003). Results did not indicate noticeable signs for common-method bias to be a problem.

Research Variables

All research variables were measured on reflective scales via seven point Likert rating. The selection and wording of items was based on a detailed literature review and refined during in-depth

discussions between the involved researchers, academic colleagues not involved in the project as well as three practitioners from industry. The dependent variable NPD performance was measured based on four items (Zahra & Covin, 1993). In samples like ours, in which reporting standards vary between firms and industries, such self-report measures of innovation are commonly seen as reliable alternative to "hard" numbers. Exemplary items included were: "New products or services make a large portion of our revenue", "The introduced innovations helped us to gain market share".

Table 1: Measurement Reliability

Construct	Cronbach's α	Composite Rel.	Factor Loadings	AVE
Innovation Department	1.000	1.000	1.000	1.000
Innovation Culture	0.782	0.858	0.692 - 0.853	0.607
Idea Selection and Evaluation	0.794	0.867	0.720 - 0.864	0.620
Openness to External Knowledge	0.815	0.879	0.729 - 0.831	0.646
Project Independence	0.784	0.875	0.758 - 0.873	0.702
Interproject Coordination	0.832	0.888	0.758 - 0.875	0.666
Innovation Process Effectiveness	0.832	0.900	0.830 - 0.907	0.749
Innovation Process Efficiency	0.863	0.907	0.833 - 0.878	0.708
NPD Performance	0.875	0.915	0.774 - 0.885	0.730

Independent and mediating variables were measured similarly. Innovation process effectiveness was measured via three items (e.g. "We are able to develop products so they deliver unique advantages for our customers", "We are able to regularly introduce new products or services") (Zahra & Covin, 1993) whereas innovation process efficiency was measured via four items (e.g. "Our process from idea generation to launch is faster than the one of our competitors", "Our process from idea generation to launch is more cost-effective than the one of our competitors") (Lynn *et al.*, 1999). Our measure for innovation culture used four items (e.g. "Employees with new ideas for products or services are supported in our company", "Our company is highly oriented towards its future existence") (Tellis *et al.*, 2009), idea selection and evaluation used four items (e.g. "New ideas are reviewed early in the process regarding market potential and are then selected accordingly", "New ideas are reviewed early in the process regarding technical feasibility and are then selected accordingly") (Martinsuo & Poskela, 2011), openness to external knowledge used four items (e.g. "We actively look in other industries for ideas and solutions", "We involve customers and suppliers in the development of innovations") (Brettel & Cleven, 2011), project independence used three items (e.g. "The innovation process is not affected by other daily tasks", "During the innovation process, participants can make decisions without the agreement of the top-management") (Tellis *et al.*, 2009), and interproject coordination used four items (e.g. "The innovation process is led by an identifiable person or group", "The different activities are well coordinated") (Hoegl *et al.*, 2004). Finally, the existence of an independent innovation department was measured by asking respondents the question "Who is primarily responsible for innovation activities and the innovation process in your company?" with the answer categories "(1) Department for innovation management", "(2) Separate company division for innovation management", "(3) Collaboration of several departments", "(4) Innovation management is supervised by R&D or marketing department", "(5) Others" (Blindenbach-Driessen & van den Ende, 2014). Existence of an innovation department was assigned (binary value "1" in the analysis) if respondents chose category (1) or (2).

We used several control variables in the analysis to ensure the validity of obtained results. First, innovation literature indicates regional and country-specific differences that might influence the outcomes of innovation processes (Anokhin & Wincent, 2012). As the majority of our responses came from German firms (around 80 percent), we used a binary indicator distinguishing between German firm (1) and non-German firm (0). Second, firm size may generate resource slack available to firms innovation endeavours, but also decrease flexibility of resource allocation (Allocca & Kessler, 2006). We therefore categorized firms in small (< 50 employees), middle (< 500 employees) and large companies (> 500 employees) and used the outcome as control variable for firm size. Finally, industry factors may influence firms innovative activites respectively outcomes (Dolfsma & van der Gelde, 2014). Hence, we used dummy variables for the industries the sample firms operated in.

The analysis of the measurement model indicated good levels of reliability and validity. Each Cronbach's α, composite reliability, factor loadings and average variance extracted (AVE) were meeting the common quality criteria (see Table 1) (Bagozzi & Yi 1988; Hulland, 1999). Also, we tested for discriminant validity by analyzing the Fornell/Larcker criterion (Fornell & Larcker, 1981). As Table 2 shows, AVE is in each case larger than then the quadratic cross-factor correlation.

RESULTS

We chose a partial-least-squares structural equation modelling (PLS-SEM) approach for the statistic test of our research hypotheses. In general, there are two available options for analyzing, the covariance-based CB-SEM and the variance-based PLS-SEM. Our choice of the latter was due to several reasons. First, PLS-SEM is suited also for rather small *n* below 250 observations (here *n* = 124) (Hair *et al.*, 2012). Second, PLS-SEM is especially effective in exploratory studies as well as in representing complex mediation models (Hair *et al.*, 2012). Our model both contains a larger number of independent mediating variables and several postulated direct and indirect effects so that PLS-SEM seems a reasonable selection. Third and finally, PLS-SEM is useful in examining potential success factors for organizational outcomes and has been applied this way in a range of studies (Albers, 2010). In this study, we used the software SmartPLS 3 (Ringle *et al.*, 2015).

PLS-SEM Results

Our results indicate that the existence of an independent innovation department clearly has on a number of, but not all innovation-enhancing factors examined in the context of this study (see Table 3). In particular the existence of an independent innovation function positively influences idea selection and evaluation, project independence and interproject coordination. Hence, H2a, H4a and H5a are supported. In contrast, neither innovation culture nor openness to external knowledge are impacted by an innovation department. Therefore, H1a and H3a are rejected.

Concerning the outcome dimensions it is evident that the five factors predicted to support organizational innovation have quite different impact on innovation process effectiveness and efficiency. First, innovation culture positively and significantly influences both effectiveness and efficiency. Second, idea evaluation and selection is positively related to innovation process effectiveness but not efficiency. Third, for openness to external knowledge the same pattern applies, i.e. there is a significant positive impact on effectiveness but no significant impact on efficiency. Fourth, project independence surprisingly neither increases innovation process effectiveness nor efficiency. Fifth, interproject coordination has a positive impact on both dimensions of innovation

process performance. Finally, both innovation process effectiveness and efficiency have a positive effect on NPD performance at which the effect of effectiveness is clearly the larger one. In all, the hypothesized model explains large shares of the variance of innovation process effectiveness (R^2 = 0.577), innovation process efficiency (R^2 = 0.460) and NPD performance (R^2 = 0.347).

Table 2: Discriminant Validity

	1	2	3	4	5	6	7	8	9
1. Innovation department	**1.00**								
2. Innovation Culture	0.02	**0.61**							
3. Idea Selection and Evaluation	0.06	0.42	**0.62**						
4. Openness to External Knowledge	0.01	0.40	0.36	**0.65**					
5. Project Independence	0.12	0.20	0.25	0.19	**0.70**				
6. Interproject Coordination	0.12	0.12	0.37	0.10	0.28	**0.67**			
7. Innovation Process Effectiveness	0.01	0.47	0.44	0.35	0.21	0.22	**0.75**		
8. Innovation Process Efficiency	0.12	0.19	0.27	0.12	0.24	0.39	0.35	**0.71**	
9. NPD Performance	0.01	0.25	0.18	0.13	0.14	0.14	0.30	0.24	**0.73**

Table 3: PLS-SEM Results

Hypothesis	Path coefficient	*p*-value	Result
H1a: Innovation Department → Innovation Culture	0.124	0.190	Rejected
H2a: Innovation Department → Idea Selection and Evaluation	**0.252**	**0.003**	**Supported**
H3a: Innovation Department → Openness to Ext. Knowledge	0.123	0.192	Rejected
H4a: Innovation Department → Project Independence	**0.342**	**0.000**	**Supported**
H5a: Innovation Department → Interproject Coordination	**0.341**	**0.000**	**Supported**
H1b: Innovation Culture → Innovation Process Effectiveness	**0.370**	**0.000**	**Supported**
H1c: Innovation Culture → Innovation Process Efficiency	**0.186**	**0.095**	**Supported**
H2b: Idea Sel. and Eval.→ Innovation Process Effectiveness	**0.220**	**0.032**	**Supported**
H2c: Idea Sel. and Eval. → Innovation Process Efficiency	0.052	0.617	Rejected
H3b: Openness Ext. Knowl. → Innovation Process Effectiveness	**0.170**	**0.043**	**Supported**
H3c: Openness Ext. Knowl. → Innovation Process Efficiency	0.001	0.990	Rejected
H4b: Proj. Independence → Innovation Process Effectiveness	0.045	0.581	Rejected
H4c: Proj. Independence → Innovation Process Efficiency	0.137	0.151	Rejected
H5b: Interproject Coord. → Innovation Process Effectiveness	**0.120**	**0.097**	**Supported**
H5c: Interproject Coord. → Innovation Process Efficiency	**0.456**	**0.000**	**Supported**
H6a: Innovation Process Effectiveness → NPD Performance	**0.400**	**0.001**	**Supported**
H6b: Innovation Process Efficiency → NPD Performance	**0.257**	**0.003**	**Supported**

As innovation culture, idea selection and evaluation, openness to external knowledge, project independence and interproject coordination are postulated to have mediation effects on the relation between the extistence of an innovation department on innovative performance, the significance of the mediation effects must be examined. Following Lowry and Gaskin (2014) we apply a two step procedure in doing so. In the first step, the direct effect of the innovation department on innovation process effectiveness and efficiency is estimated. In the second step, the mediators are included in the model and the significance of mediation effects is calculated in a Sobel test. The significance thereby is calculated with the following formula (Eggert *et al.*, 2005):

$$z = \frac{b_{ab} \times b_{bc}}{\sqrt{b_{ab}^2 \times SE_{bc}^2 + b_{bc}^2 \times SE_{ab}^2}}$$

$b_{ab} =$ path coefficient from the exogenous variable to the mediator
$b_{bc} =$ path coefficient from the mediator to the endogenous variable
$SE_{ab} =$ standard error of path coefficient from the exogenous variable to the mediator
$SE_{bc} =$ standard error of path coefficient from the mediator to the endogenous variable

This procedure yields the following results. Leaving out the mediating variables, the existence of an independent innovation department has a positive impact on innovation process efficiency (β = 0.353, p = 0.000), but not on innovation process effectiveness (β = 0.108, p = 0.365). When mediation variables are included, both path coefficients decrease largely (effectiveness: β = -0.103, p = 0.087; efficiency: β = 0.116, p = 0.090). Hence, partial mediation is evident (Baron & Kenny, 1986). The Sobel test results indicate that concerning innovation process effectiveness, the mediation paths over idea selection and interproject coordination are significant, whereas for efficiency the path over interproject coordination is significant.

Table 4: Analysis of Mediation Effects

Mediation Path	*z*-value	*p*-value	Result
Innovation Department → Innovation Culture → Innovation Process Effectiveness	1.299	0.194	Non-significant
Innovation Department → Idea Selection and Evaluation → Innovation Process Effectiveness	**1.851**	**0.064**	**Significant**
Innovation Department → Openness to Ext. Knowledge → Innovation Process Effectiveness	0.942	0.346	Non-significant
Innovation Department → Project Independence → Innovation Process Effectiveness	0.883	0.377	Non-significant
Innovation Department → Interproject Coordination → Innovation Process Effectiveness	**1.765**	**0.078**	**Significant**
Innovation Department → Innovation Culture → Innovation Process Efficiency	1.115	0.265	Non-significant
Innovation Department → Idea Selection and Evaluation → Innovation Process Efficiency	0.112	0.911	Non-significant
Innovation Department → Openness to Ext. Knowledge → Innovation Process Efficiency	0.995	0.320	Non-significant
Innovation Department → Project Independence → Innovation Process Efficiency	0.772	0.440	Non-significant
Innovation Department → Interproject Coordination → Innovation Process Efficiency	**3.641**	**0.000**	**Significant**

DISCUSSION

The results of this work yield several important contributions to research on innovation management and new product development. First and foremost, it provides empirical evidence for the notion that the impact of an independent innovation department on a firm's innovative performance is an indirect rather than a direct one. Thereby, three different causal paths proved to be significant. In the first two paths, innovation process effectiveness is increased as the existence of an innovation department fosters systematic idea selection and evaluation as well as an overarching coordination of innovation initiatives. In the third path, innovation process efficiency is enhanced by

better interproject coordination enabled bythe existence of an innovation department. In sum, these results indicate that the benefit of an independent innovation department mainly lies in a better execution of idea screening and coordination, two of the main tasks identified by previous literature (O'Connor, 2008).

Second, however, the results also show that there are innovation-enhancing factors which are not positively influenced by the existence of an independent innovation department. On the one hand, innovation culture has a significant positive effect on both innovation process effectiveness and efficiency. Still, the presence of an innovation department seems to be unable to adequately foster an innovation-friendly culture. Organizational culture is a complex and layered concept (Leonardi, 2011) might thus be rather emerging than implemented. The mere existence of organizational structures centralizing responsibilities concerning innovation does not seem to be alone sufficient for cultural change. On the other hand, also openness to external knowledge is likely to benefit innovation process effectiveness (though not efficiency). Also here however, innovation departments do not seem to be beneficial. This is even more surprising as in contrast to the complex and fuzzy task of cultural change, external information acquisition and dissemination is widely seen and formalized as a core task of innovation departments (Blindenbach-Driessen & van den Ende, 2014). This result might give a hint to the notion that informal communication might have a larger impact on open innovation than formal responsibilities (De Brentani & Reid, 2012). Still, this surprising result should be further examined in future works. In sum, the establishment of an innovation department is far from being a "magical bullet" concerning innovation performance.

Third, also the effects of the five factors assumed to be innovation-enhancing should be discussed in more detail. The most definite finding here is that among these five factors, some seem to predominantly enhance the effectiveness of innovation processes (in specific, innovation culture, idea selection and evaluation, openness to external knowledge) whereas others seem to priorly increase innovation process efficiency (in specific, interproject coordination). Though these distinct effects might partially intuitive, they also strengthen the conceptualization of effectiveness and efficiency to be clearly different dimensions of performance. In order to obtain valid findings, future research should thus distinguish these two concepts both theoretically and empirically. Another finding is that while positively influenced by the existence of an innovation department, the independence of innovation initiatives from day-to-day business has no significant effect on effectiveness and efficiency. Based on our empirical data, an interpretation of this effect is somewhat speculative. Drawing on previous literature, there might well be circumstances under which project independence is beneficial for innovative performance as well as under which it is not (Hoegl *et al.*, 2004). Future research should thus incorporate according context factors in theory development and testing.

There are several limitations in our research that we want to discuss here in order to provide starting points for further research validating our findings. First, this study relied on self-report measures. Though this was necessary to ensure anonymity of repondents, it would be preferable if future studies triangulated their findings with objective indicators. Second, our survey is cross-sectional so that reverse causality is a potential issue. A longitudinal study to validate our findings is thus desirable. Third and finally, concerning the developed theory, we only compared between the existence of a central innovation department as well as the lack of it. This might be overly

reductionistic in that also other forms of organization (i.e. decentral staff positions) can benefit organizational innovation. Hence, there is a need for further differentiating between the structural aspects of organizing product innovation. With this study, we aim to inspire future works on the topic and provide the ground for further theoretical and practical discussions.

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