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Hiring, Developing, and Organizing Individual Employees for New Product Development versus Product-related Service Innovation

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Abstract

This study examines how manufacturing firms should organize their human resources by maximizing the value of individual employees for different forms of innovations. In particular, it examines the hiring, developing, and structural organization of human resources for optimizing different innovation outcomes. An analysis of 335 survey responses of the multi-topic and multi-country European Manufacturing Survey (EMS) results in a number of interesting findings. First and foremost, although there are commonalities in organizing employees in flexible team arrangements for new product development versus product-related service innovations, there are also important differences between these. In particular, whilst the educational level of employees has a significant and positive effect on new product development success, hiring highly educated individuals has a significant and negative effect on new product-related service development success. At the same time, while investing in individual training programmes is beneficial for new-product related services, such programmes have no impact on new product development. Combining our findings on these differences, it seems that in order to maximize the value of human resource hiring and developing practices for new product development success; organizations will find it more beneficial to invest predominantly in employees with the highest possible educational level, whilst for product-related service innovations; employees with more general skills should be hired. For the latter case, these employees? individual careers must be developed internally once hired. The paper therefore carries important implication for the innovation management literature and related human resource practices at different organizational levels.

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Introduction

> *All the evidence we have indicates that the growth of the firm is connected with the attempts of a particular group of human beings to do something; nothing is gained and much is lost if this fact is not explicitly recognized (Penrose & Pitelis, 2009: 2)*

Innovation is a key strategic driver of firm growth across industries around the globe (GE Global Innovation Barameter, 2011). The ability to consistently generate, implement, and market new products and services provides a competitive advantage, where the role of knowledge and human capital by individual employees as productive input is paramount for innovation outcomes (Foss, 2007 and Birdi et. al. 2014). As knowledge is first and foremost embedded in and put to use by individual employees (Barney, 1991; Cohen, 1990), hiring, developing, and organizing individual employees should be core practices unfolded by innovation management.

Surprisingly, however, there is little research-based evidence and only scarce managerial implications on the role of human resource hiring (Gebauer, Krempl, Fleisch, & T., 2008b), human resource development (Sheehan, Garavan, & Carbery, 2013), and the structural organization of human resources for innovation outcomes (Martínez-Sánchez, Pérez-Pérez, De-Luis-Carnicer, & Vela-Jiménez, 2006).

This paper argues in line with Fueller, Hutter, Hautz, and Matzler (2014) that the potential of organizing to utilize the individual employees as key knowledge sources for new product and service success is at least as important as externally driven innovation endeavours like e.g. open innovation, but remains comparably neglected in the innovation management literature. Due to its increasing importance at all levels of the organization, innovation has become a key priority for a significant portion of the organization's workforce (Hunter, Cushenbery, & Friedrich, 2012). However, adding to the challenge of how to best recruit, develop, and allocate suitable employees for innovation, there is little guidance in the innovation literature on whether human resource practices differ depending on the type of innovation the organization aims to develop. For instance, whilst there are substantial insights into organizing groups of employees for innovation success in general (Gupta, Raj, & Wilemon, 1985; Gupta, Tesluk, & Taylor, 2007), it is far less clear how organizations should hire, develop, and organize individuals in order to maximize their contributions to different types of innovations, such as new product developments versus product-related service innovations accompanying the portfolio of their products.

New product developments differ from product-related service developments in several important ways: Whilst new product development focuses on changes to the product characteristics, product-related service innovations involve also changes to the delivery process and client interface (Jong, Bruins, Dolfsma, & Meijaard, 2005). Product-related services are increasingly being used by manufacturing organizations as a strategic factor in competition for several reasons (Gebauer et al., 2008b). This particular type of service is seen as a means of product differentiation that can strengthen the firm's market position.

Furthermore, the inclusion of more and better targeted services in the range offered by a firm can increase customer satisfaction and bind customers more closely to the product portfolio (Lenfle & Midler, 2009). Product-related services may also be seen as an essential component in an integrated package of products designed to meet all the requirements of demanding customers. Hence, they cannot always be separately identified as add-on services but must be seen as an integral building block in a package designed to cover all and diverse customer needs (Stille, 2003).

Although evidence is largely missing on the role of human resource development for innovation as argued by Sheehan et al. (2013); (Sung & Choi, 2014a) and despite the theoretical importance human resources have for organizational performance, their value-adding nature for different types of innovation outcomes remain largely un-researched. This study therefore examines how manufacturing firms should organize their human resources by maximizing the value of individual employees' knowledge capabilities for different forms of innovations. In particular, we analyse the hiring, developing, and structural organization of human resources that optimize different innovation outcomes. This article formulates the overall research question accordingly: *How can firms organize their human resources for innovation performance?*

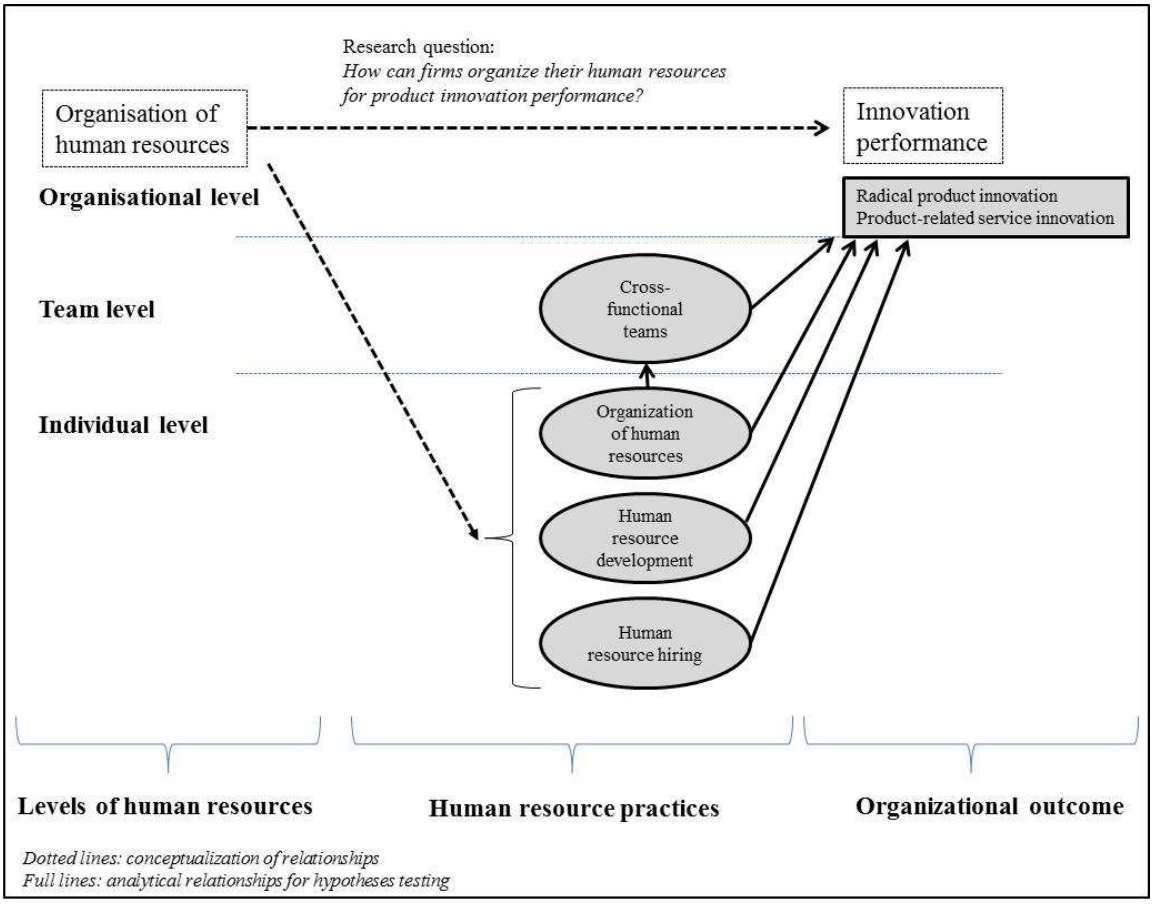

Figure 1: Conceptual and analytical model – Human resource practices for innovation performance (following Coleman, 1990; Foss, 2007)

Although the research question is formulated at the organisational level, we argue that in order to solve this question, an analytical reduction is required that shifts from analysis at a macro-level to exploring this important question at the micro levels of the organization (at the team and individual levels; see Figure 1). A key argument is that at the individual level, human resource hiring practices (i.e. what educational level individual employees ought to have), human resource development (i.e. individual career training programmes), and structural organization of the employees roles and responsibilities (i.e. teleworking – the possibility for individuals to work at home) are all important paths that explain innovation performance. These three relationship paths are explained in the first three hypotheses (H1a, H1b, and H2a). We also posit that the impact of specific ways of structuring employees' responsibilities on innovation is accentuated by cross-functional teamwork (at the team-level) (Hypothesis H2b). Lastly, we argue that specific human resource hiring and human resource developing practices are likely to differ in explaining different types of innovations (H3a and H3b). In line with Foss (2007: 33), we therefore argue that knowledge that resides at the level of the individual is bundled and works directly on (or is integrated through the team level), into organisation level outcomes.

Our analysis of 335 survey responses of the multi-topic and multi-country European Manufacturing Survey (EMS), result in a number of interesting findings. First and foremost, we find that while there are commonalities in organizing employees for new product development versus product-related service innovations, there are also important differences between these. In particular, whilst the educational level of employees has a significant and positive effect on new product development success, hiring highly educated individuals actually has a significant and negative effect on new product-related service development success. Additionally, while investing in individual training programmes is beneficial for new-product related services, such programmes have no impact on new product development. Combining our findings on these differences, it seems that in order to maximize the value of human resource hiring and developing practices for new product development success, organizations will find it more beneficial to invest predominantly in employees with the highest possible educational level, whilst for product-related service innovations; employees with more general skills should be hired. For the latter case, these employees' individual careers must be developed internally once hired.

In terms of commonalities, the results show that for both new product development and new product-related service development, having the freedom to work at home is beneficial for innovation performance. Furthermore, this effect is fully mediated by having these employees work in cross-functional project teams. Put differently, independently of whether a new product or a new product-related service is developed, the impact of teleworking is further substantiated by the extent to which the firm possesses necessary collaborative capabilities. The more collaborative capabilities across different functional units, the higher is the impact of teleworking for innovation.

The paper therefore contributes to the innovation management literature by investigating the differential effects of diverse human resource practices and innovation outcomes. Despite the theoretical importance human resources have for organizational performance as illustrated in

many contributions originating from the theory of Penrose (1959), their value-adding nature for different types of innovation outcomes remain largely un-researched. In particular, this paper contributes to the literature by demonstrating that managers should utilize different practices towards employees to achieve different innovation outcomes, where e.g. hiring highly educated employees is beneficial for radical product innovation, it is detrimental for product-related service innovation. Hence, the desired outcomes although related in nature requires careful consideration and different measures to be achieved. Such findings and managerial considerations are thus far absent from the literature.

Theoretical framework and hypotheses

Hiring and developing individual employees for innovation performance

The increasing role of knowledge as embedded in human capital as productive input is paramount for innovation outcome (Foss, 2007, Birdi et. al. 2014) focusing on individual employees (Barney, 1991; Cohen, 1990) should be apparent, but is largely neglected. It would even follow that hiring, developing and, organizing these employees should be a core focus within the innovation management literature. Therefore, it is surprising to realize that there is little research-based evidence and managerial implications on the role of human resource hiring (Gebauer et al., 2008b; Hunter et al., 2012) and human resource development of individual employees for innovation outcome (Sheehan et al., 2013).

To enhance our understanding of the role of knowledge held by individuals for innovation performance, it is useful to depart in the core of absorptive capacity theory. Absorptive capacity refers to an organizations ability to recognize the value of new information, assimilate it, and apply it for commercial ends (Cohen and Levinthal, 1990: 128). This ability, according to Cohen and Levinthal (1990), is largely a function of the level of prior knowledge that individuals hold, hence linking the organizational level with the individual level (revisit Figure 1). Prior knowledge of an organization encompasses basic skills of the individual employees, a shared language among them, but may also include knowledge of the most recent scientific or technological developments within a given knowledge domain (Cohen and Levinthal, 1990: 128). This definition suggests that individuals with prior knowledge are capable of performing at higher levels for an organization than those lacking this knowledge. This is because possessing prior knowledge enables individuals to better assimilate new knowledge and also increases the individual's ability to overcome complex problems (Cohen & Levinthal, 1990: 130). Put differently, an individual's problem-solving capacity evolves hand-in-hand with the development of individual learning capabilities and must therefore be looked at in relation with each other. Cohen and Levinthal (1990: 131) further point out that if there is uncertainty about the knowledge domains from which potentially useful information may emerge, a diverse background provides a more robust basis for learning because it increases the prospect that incoming information will relate to what is already known.

An individual's educational level reflects both the extent of prior knowledge of an individual (acquired as part of the accumulated learning curve throughout the individual's

studies) as well as the individual's accumulated problem-solving capabilities (acquired as part of the problem-solving learning programs commonly offered in higher degree education (De Corte, 1990)). The educational level is what the individual brings into the employment with an organization and reflects her/his domain-specific knowledge (e.g., Kark & Carmeli, 2009; Oldham & Cummings, 1996; Tierney, Farmer, S.M.). Domain-specific knowledge represents knowledge gained through education, training, or a series of assignments in a particular area of expertise or a combination thereof (Inspired by Scott, Drezner, Rue, & Reyes, 2007). A higher educational level would thus mean that the individual is more likely to have a richer pre-existing knowledge structure in a particular knowledge domain than an individual, who lacks the same or has a lower level of education (McDonough III, 1993).

The educational level is relevant in the context of human resource hiring as newly recruited employees add to the knowledge pool of the organization with their prior knowledge they bring in, while the existing knowledge of an organization resides in the employees already working for this organization, (McDonough III, 1993). With a higher educational level, an employee is likely to have gained more substantial learning and problem-solving capabilities, which are key assets for the creation of new products and services (Doz, 1996). It follows that an individual employee with a higher educational level is more prone and proficient in assimilating existing knowledge to new knowledge related to her/his knowledge domain and is thus better able to solve problems due to this increased learning ability (Cohen & Levinthal, 1989; Cohen & Levinthal, 1990) and to support and substantiate innovation outcomes.

New product and service developments take place in environments where there is a substantial amount of uncertainty about the necessary knowledge to be created. The accumulation of knowledge through a high educational level thus also enables the individual to make novel associations and linkages that are not possible without these capabilities (Cohen & Levinthal, 1990). Therefore, a higher educational level is likely to provide the individual with a greater and more detailed understanding of underlying principles and strategies that help solving specific challenges or problems that may pave the way for innovation. Hence, we posit that a higher educational level can uncover causes of potential problems, aid the generation of ideas and support their evaluation, and assist in the implementation of solutions to make ideas work in practice (Birdi, Leach, & Magadley, 2014; Leach, Wall, & Jackson, 2003).

H1a: There is a positive relationship between the educational level of employees and innovation performance.

Although the educational level of an employee obtained via formal training and domain-specific education is a representation of the richness of the employee's knowledge structure within a given knowledge domain, this knowledge may not necessarily be aligned with the desired goals of the employing organization. Therefore, in addition to the knowledge that an employee brings, as part of his educational skills, it is equally important that organizations continuously develop the knowledge, skills, and capabilities of current employees in order to align the employees individual skill sets with the desired outcomes of the organization. Such

development efforts seek to maximize the value of individual skill sets for innovation performance, and should be considered part of human resource development practices. Human resource development practices are defined as the processes of developing and/or unleashing human expertise through organization development and personnel training, and development for the purpose of improving performance (cited in:Weinburger, 1998). When human resource development is targeted at the individual employee (henceforth: individual career development), s/he may be exposed to programs, processes, and assistance, which is provided by the organization to support and enhance his career success within the organization (Ng, Eby, Sorensen, & Feldman, 2005).

Specifically, human resource development can be viewed as integrated training for specific projects or aims, and training more broadly. Training is defined as the systematic acquisition and development of the knowledge, skills, and attitudes required by employees to adequately perform a task or job or to improve performance in the job environment (Tharenou, Saks, & Moore, 2007: 252). Individual career development also benefits the individual. For instance, employees that are exposed to training that is experienced as valuable becomes more motivated to learn (Kuvaas, Buch, & Dysvik, 2012). Since, the development of an employee's competences commonly leads to on-the-job learning and improved problem-solving capabilities this may further the employee's chances of promotion and recognition.

Since an individual's problem-solving capacity evolves hand-in-hand with the development of the individual learning capabilities, any training effort to develop the individual will also increase his potential problem-solving capacity and hence, his ability to successfully engage in innovative projects. The current results from the literature are largely in line with these theoretical arguments as they have shown a positive effect of investments in training (Sung & Choi, 2014b) and of training as a component of bundles of HR practices (Laursen & Foss, 2003; Shipton, West, Dawson, Birdi, & Patterson, 2006), whereas the direct effect of training on innovation performance has yet to be investigated (Tharenou et al., 2007).

H1b: There is a positive relationship between individual career development and innovation performance.

Organizing individual employees tasks for innovation performance

The continuously changing competitive environment and the associated changing requirements facing organizations force management to reconsider how to best hire and develop, but also organize human capability and potential (Song & Xie, 2000). In particular, the organization of creative individuals and the demand for integration of employees across the organisation in innovative efforts requires new ways of working as well as demands additional space and time in order to assign the right employees at the right time for specific projects (Mumford, 2000). In particular, time for research and time for thinking is crucial for employees engaged in creative work, for identifying alternative problem definitions, searching new information, new technologies, and for identifying potential solutions (Bentley & Yoong, 2000; Mumford, 2000). Bentley and Yoong (2000) find that in particular for reflective thinking and research writing time, working in isolation increases productivity and

job satisfaction of the involved employees. In line with these findings, Mumford (2000: 318) stresses that the implementation of flexible work schedules and time management strategies may be crucial mechanisms for management to implement. Two ways of organizing employees for these purposes may facilitate this aim; working in isolated project groups formulated as skunk work and working from home.

Teleworking or allowing employees to work remotely (e.g. at home) (Kowalski & Swanson, 2005) represents an increasingly popular mechanism for flexible work in organizations. Some studies on teleworking focus primarily on the ICT-aspects like availability of personal PC and internet at home (Martínez-Sánchez, Pérez-Pérez, De-Luis-Carnicer, & Vela-Jiménez, 2006) (Bentley & Yoong, 2000). This study focuses on the other dimension of teleworking namely that the employees in question are isolated from extraneous demands (Mumford, 2000), operational procedures, undue disruption, and daily duties. The reason being that access to personal PC's and internet connections can no longer be considered a *good for the privileged*. Teleworking holds several key benefits for the organization; higher individual productivity levels (Standen, Daniels, & Lamond, 1999), reduced absenteeism (Pratt, 1999), and higher creative outcomes (Mumford, 2000). At the same time, employees working remotely have an overall higher level of job satisfaction than non-teleworkers (Igbaria & Guimaraes, 1999), improved employee morale and motivation (Lupton & Haynes, 2000), and an increased commitment to the organization (Igbaraia & Guimaraes, 1999). Surprisingly, despite the many apparent benefits, research on the role of teleworking in organizations remains limited, especially its role in relation to achieving specific organizational objectives like innovation (Martínez-Sánchez et al., 2006).

H2a: There is a positive relationship between teleworking and innovation performance.

Organizing for innovation focusing at the individual level stimulates creative outcome when the individuals work from home to define problems, identify information, and solutions. However, in order for the individual outcomes to benefit the organizational innovation goals, these outcomes must be integrated into the innovative projects of the organisation through knowledge sharing and collaboration (Mumford, 2000). Mumford (2000: 329) stresses two needs for knowledge sharing; either directly among the team members working for a specific project, of which some may have been working from home, and by sharing expertise across projects such that expertise developed on one project can be shared with closely related projects. These needs for knowledge sharing require an organizing form that brings the relevant employees together temporarily and across different projects.

One such organizing form is the skunk work model, which brings individuals or smaller working groups – often temporary or informal ones – within an organization together to work on a specific project to identify potential disruptive technical or product challenges (Ma, 2002: 527-528). As part of this work model, a selective set of individual employees are purposely isolated from the influence of the rest of the organization by providing employees with autonomy, independence, and resources to think and develop outside the organization's objectives in order to stimulate radical innovation in projects with high risk and high potential failure rates (Ma, 2002), even though these may challenge the existing business models and

business orientation (O'Conner & Rice, 2013). On the other hand, cross-functional teams are applied more broadly for organizational performance and for product development efforts more specifically.

In cross-functional teams, employees from different functional areas collaborate to integrate different insights and disciplines and to support knowledge sharing from their individual efforts for a mutual project goal (Chen, 2007), which can facilitate the product development process. Hence, cross-functional teams facilitate integration of multiple sources of information and perspectives (see for instance Gebauer, Krempl, Fleisch, & Friedli, 2008a for product-related service innovation), inclusion of concerns from different areas of the company, and may even foresee future downstream challenges in e.g. market development perspectives (McDonough, 2000). The cross-functional teams therefore lead to reduced cycle time of new product development projects, creation of new knowledge, and dissemination of organizational learning to other projects (Denison, Hart, & Kahn, 1996). Consequently, we argue that cross-functional teams facilitate the integration of insights coming from diverse employees that have developed insights and findings from home via teleworking or from their work place. Hence, in order to maximize the value of the inputs from teleworking for innovation outcomes, these employees should be assigned to temporary cross-functional teams, as it is through these teams that new ideas and knowledge are shared among different experts and colleagues for achieving the organizational objectives like new products and services.

Interestingly, although the implementation of cross-functional teams is widely touted in the innovation literature for their undisputed benefits to new product and product-related service innovation (Gebauer et al., 2008a; Griffin, 1997; Griffin & Hauser, 1996; McDonough, 2000), the value of cross-functional teams for integration of employees that are *also* teleworking for innovation purposes, remain un-researched in the empirical literature. One notable exception is Chen (2007), who investigates the mediating effect of the cross-functional team interaction on new product development. Therefore, although cross-functional teams may in themselves have a significant effect on innovation performance, we suggest that the positive effect of teleworking on innovation outcome (*Hypothesis H1b*) is further accentuated by the utilization of cross-functional teams.

H2b): The positive relationship between teleworking and innovation performance is mediated by temporary cross-functional teams.

Hiring and developing individual employees for innovation performance in new product development versus product-related service innovation

Extensions of physical products with service content (also known as service infusion, Lay, Copani, Jäger, & Biege, 2010) have become increasingly attractive for manufacturing firms to enhance the product value, product experience, and innovativeness for customers (Lenfle & Midler, 2009). However, the overall degree of service infusion is still low due to slow processes and the companies being unable to extract the expected benefits (Lay et al., 2010: 716). Product-related service innovations are defined as offerings not previously available to

a firm's customers, resulting from additions to or substantial changes in the service concept (Menor, Mohan, & Sampson, 2002). These may seek to ensure proper functioning of a new or existing product, provide additional usage possibilities, provide additional product support features, offer growth opportunities, and enable customers to utilize all available product features (Cohen, Agrawal, & Agrawal, 2006). Typical examples of these service innovations (see Lay, Schroeter, & Biege, 2009 for a literature review on types of PRS) are new or largely adjusted product installation, after-sales product inspection, training, and any type of repair and product maintenance services (Lay et al., 2009; Mathieu, 2001). Product-related service innovations are either integrated, where they are developed simultaneously with a new product *development* or they are separated where the innovation of the product-related service takes place in the process of the *usage* of an existing product (Gebauer et al., 2008b). Therefore, product-related service innovations may also differ in their antecedents, appearance, as well as evolution compared to new product developments (Gebauer et al., 2008a).

We argue that the nature of these differences also reflect in the requirement of appropriate educational levels of the individual employees that are involved in these two types of innovation processes. In particular, the development of new products necessitates that the employees have profound insights in specific technologies and particular skill sets in relation to research and development (Olivia & Kallenberg, 2003). Hence, the employees need a deep understanding of specific technological knowledge domains that relates to the product development or part of the product that the individual is involved in. On the other hand, for the development of a product-related service innovation, employees need to possess knowledge structures that are much broader, encompassing wider aspects than merely related to the final product including additional knowledge domains like market development, business economics (Gebauer et al., 2008b), and activities related to delivery of the product and after-sales services. This implies that the knowledge required for the development of product-related service innovations is, in general, much less focused on particular technologies (Cooper & Brentani, 1991; Jong et al., 2005). Summarizing, new product development processes require depth of particular knowledge domains, but may suffice with specific product-related technological knowledge, whereas product-related service innovations necessitate breadth across different knowledge disciplines and integration of these knowledge aspects across domains.

H3a): The relationship between the educational level of employees and innovation performance is stronger for new product development than product-related services.

As the knowledge required for the development of product-related service innovations is expected to be less focused on particular technologies or other fixed assets (Cooper & Brentani, 1991; Jong et al., 2005), the organization needs to master the integration of knowledge on the technical features and structures of the physical product with insights on customer demands and needs, and combine these with identified business opportunities. For successful implementation of product-related service innovations, these integrative capabilities must be developed and can only be acquired via simultaneous in-depth

understanding of the physical product and all related product features and service components matched against the customer needs.

The product and product-related service knowledge is something that the employee cannot acquire through prior education, rather it is continuously acquired through on-the job learning and specific training programs implemented by the organization. In particular, training that is organized by the organization can be specifically tailored towards the organizational goals and identified challenges. This type of training therefore empowers the individual employee and creates commitment toward the organizational goals in general and the particular tasks at hand in specific (Erhardt, Miller, Freeman, & Hom, 2011).

Considering that employees engaged with developing new services need less specialized, domain-specific knowledge, one would assume that new-product related services require less organizational investments (Olivia & Kallenberg, 2003). Traditional types of new-product related services in manufacturing firms include installed base services, product training, inspection, spare parts, trouble shooting, hotline, and other basic repair and maintenance services (Mathieu, 2001; Olivia & Kallenberg, 2003). As new-product related services in manufacturing are expected to be easier to imitate than the products themselves this may stimulate the organization to invest more on a continuous basis into these services to achieve sustainable service performance (Gebauer et al., 2008b). Following this line of logic, an explicit human resource strategy, which focuses on related investments in personnel career development of frontline service employees and co-workers should exercise a larger influence on the success of new product-related services than new products. Doing so is expected to ensure that the service component of a new product is constantly renewed, changed, and updated.

Building on a different argument, although traditionally the interaction between service workers and customers can be partly to completely scripted, most case studies on employees in service-related roles across multiple industries found that these individuals had to deploy a blend of emotional, cognitive, technical, and time management skills to quickly solve customer problems (Gatta, 2002; Hampson & Junor, 2005). Therefore, case studies and employer surveys alike find that employees in most services roles are recruited predominantly based on their aesthetic and social skills, creativity, and adaptability and are trained in managerial, technical, and product skills throughout their careers (Hilton, 2008). Hence, for product-related service innovations it is more important that the organization invest in training and career development as compared to product development.

H3b): The relationship between individual career development and innovation performance is stronger for new product-related service innovation than new product development.

Working remotely as part of temporary cross-functional teams has been found to lead to innovation success for both new product innovation as well as product related service innovations (Gebauer et al., 2008b). We thus do not assume differences across innovation

contexts for the relationship between teleworking, cross-functional teams and innovation performance.

DATA AND METHOD

The analyses are based on the multi-topic and multi-country European Manufacturing Survey (EMS). EMS is a European joint survey project carried out in 12 European countries, Turkey and Russia. The current paper is based on EMS data from Denmark that were collected in 2009 (April through June) using a web survey tool. The survey is constructed with a core set of questions that are used by all countries, and an additional set of self-selected questions can be added by the single countries. In Denmark, for instance, the efforts as response to the financial crisis were added as additional variables. The Danish manufacturing firms are particularly interesting to investigate because Danish employees are exposed to relatively flexible work conditions with high individual autonomy, which reflects core aspects of our theoretical framework.

The population of firms was delimited to manufacturing companies (NACE 15 to 37) with more than 20 employees (N=3068). The company names and addresses were drawn in February 2009 from a database building on national statistical information. To identify the relevant respondent in each firm, they were contacted by telephone. During the phone call, we retrieved the respondents accept of participation and subsequently their personal email addresses. The phoners were instructed to identify the person responsible for production activities (i.e. production manager, production director or executive production officer of the plant). In case this person could not be reached, the switchboard was asked to provide the email address of the correct respondent, and if this could not be provided, a general company email was requested.

From the phone contacts, 1291 email addresses were retrieved to which we sent a personalized link to the electronic survey. In total, three e-mail reminders were sent to the respondents, approximately 14 days apart. The final response rate (n=335) calculated on the population is 10.9% (335/3068), and of the number of accepts to receive the survey, the response rate is 25.9% (335/1291), both of which are acceptable given the complexity of the questionnaire. The sample has been tested for representativeness using sector, region and size (size was calculated on both the number of employees and turnover in last year of accounting) and no significant differences were identified indicating that the study is representative of the population of firms in the Danish manufacturing industries.

Selection of variables – dependent variables

Radical product innovation (*RadPInno*)

The hypothese are formulated to enable a comparision of the development of new products to the development of product-related services. In the following, we therefore use two dependent variables; the first is a CIS-type question on products that are no only new to the factory, but also **new to the market** (yes/no). The respondent is asked this question relating

to the period from 2006-2008. 29.3% of the firms have introduced a radically new product in the period from 2006-2008.

Product-related service innovation (*PRS_Inno*)

The second dependent variable is a similarly structured question, but on the introduction of a product-related service innovation in the period from 2006-2008 that was completely new to the factory or contained significant improvements. The share of firms that have introduced new product-related services is 29.3%. The shares of firms that either introduce radically new products or product-related services are therefore similar.

Selection of variables – independent variables

As the main independent variables, we use highly skilled employees, individual career development, and teleworking.

Skill level of the employees (HighSkill)

The Danish educational system requires that graduate programs are research-based in the content, wheras for instance diploma degrees are not subject to this requirement. Hence, we argue that employees with graduate and PhD-degrees hold a high level of domain-specific knowledge obtained during the education, but they may also hold more broad knowledge obtained during exercises in applying and discussing the domain-specific knowledge e.g. in project work or through interactions in class. In the survey, the respondent is asked for the share of employees that hold a graduate degree or PhD; hold a diploma or bachelor degree; are skilled professionals or employees with upper secondary education; are unskilled, or apprentices. We focus on the graduate degree or PhD and find that the minority of firms employ individuals with such degrees (69.6% does not have employees with such degrees). In fact, the range of employees with graduate or Phd- degrees goes from 0 to 40%. The upper 10% percentile covers firms with 10-40% of the employees holding such degrees, and are hence highly knowledge-intensive. As the distribution of firms is highly left-skewed, we include this variable as a dummy variable (1= employees with graduate or PhD degrees; 0=no).

Individual career development (IndCDev)

The measure for individual career development is an item, which asks for the use of personnel training programmmes as a special function in human resources. First the respondent is asked to answer yes/no, and if yes, the extent of used potential (low/medium/high) is requested. We then code the variable (*IndCDev*) as value 0 if not used, value 1 for low degree of used potential, 2 for medium degree of used potential, and 3 for high degree of used potential. The variable ranges from 0 to 3, where 65.7% of the firms do not invest in employee career development, whereas 8.7% of the firms use this measure to upgrade employee knowledge and skills to a high degree. The mean for the variable is 0.74, hence a fairly low extent of used potential, on average. The correlation table (see appendix A) demonstrates that indvidual career development is correlated with radical innovation and product-related service innovation at levels 0.18 and 0.16 (both significant at 0.00% level). In

Denmark, the law requests that managers in firms carry out regular individual appraisal interviews and follow up on these in the subsequent year. The format may vary, but often the interviews are in the form of dialogue emphasising personal development. For instance, it is not allowed to discuss salary and other financial or holiday benefits. These regular individual appraisal interviews can be considered facilitating mechanisms for bringing the training of individuals and more broadly the individual career development into action within the firm regardless of size and industry.

Teleworking (TeleWork)

Teleworking represents one way of flexible structuring of the work day for the employees. The variable is represented in the survey as the posibility for employees to work at home (teleworking). First, the respondent is asked to answer yes/no, and if yes, the extent of used potential (low/medium/high) is requested. We then code the variable (*TeleWork*) as value 0 if not used, value 1 for low degree of used potential, 2 for medium degree of used potential, and 3 for high degree of used potential. The variable ranges from 0 to 3, where 45.4% of the firms do not invest in teleworking, whereas 8.7% of the firms use this measure to implement flexibility in the structure of the employees work. The mean for the variable is 1.00, hence representing a fairly low extent of used potential, on average. The correlation table (see appendix A) demonstrates that teleworking is correlated with radical innovation and product-related service development at levels 0.24 and 0.22 (both at 0.00% level).

Cross functional teams (CFTeams)

The implementation of cross-functional teams is a way to gather relevant employees for knowledge sharing and learning related e.g. to concrete development projects. In the survey, we inquire whether the factory uses temporary cross-functional teams (yes/no), if the respondent answers yes, he is then asked for the extent of used potential (low, medium, high). We then code the variable (*CFTeams*) as value 0 if not used, value 1 for low degree of used potential, 2 for medium degree of used potential, and 3 for high degree of used potential. The variable ranges from 0 to 3, where 53.7% of the firms have not implemented cross-functional teams, whereas 10.4% of the firms use these teams extensively. The mean for the variable is 0.94, hence a fairly low extent of used potential, on average. The cross-functional teams construct is used in the analysis as the potential mediator. The correlation table (see appendix A) demonstrates that the use of cross-functional teams is correlated with radical product innovation and product-related service innovation at levels 0.23 and 0.22 (both at 0.00% level).

Selection of variables – control variables

Age of the firm (LnAge)

The age of the firm is calculated for 2009 using the year of establishment. The mean age of the firms is 37.4 years, in the range from one to 190 years. In general, the distribution is skewed towards younger firms (left-skewed). The upper 10% percentile includes firms aging from 76 to 190 years. In order to ensure a more appropriate distribution for analytical

purposes, we calculate the Ln of the age, which ensures and appropriate distribution (skewness = -0,71; kurtosis =0.49).

Firms in low tech industries (lowtech)

A categorisation of the industrial sectors based on NACE codes and subsequent coding according to the EUROSTAT categories (low, medium, high tech) resulted in the following categorisation of the firms[1].

	Frequency	Percent	Cumulative percent
High tech industries	30	9.0	9.0
Medium tech industries	205	61.2	70.1
Low tech industries	100	29.9	100.0
Total	335	100.0	

Table 1: Industrial categorisation of firms (EUROSTAT)

As can be seen from the table 1, there are very few firms from high tech industries, whereas the majority of the firms are from medium tech industries. We have therefore coded the dummy for industries as low tech (=1 if firms are from low tech industries; 0=medium and high tech).

Producer of finished goods for end users (Enduse)

We are further interested in the type of goods that the factory produces since it may cause some differences in the type of activity they prioritise (innovation of products versus innovation of product-related services). In the survey, we ask for the factory's main line of products and as can be seen from table 2, the respondents are distributed fairly evenly across the five types

	Frequency	Percent	Cumulative percent
Producer of finished goods (end user)	68	20.3	20.5
Producer of finished goods (for industry/business)	87	26.0	46.7
System supplier	49	14.6	61.4
Supplier of parts/components	83	24.8	86.4
Contract manufacturer	45	13.4	100.0

[1] For the exact distribution of NACE codes please see: http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/Annexes/htec_esms_an3.pdf

Missing	3	0.9	
Total	335	100.0	

Table 2: Producer of end user goods or supplier

In terms of the dependent variables, we primarily consider the producer of finished goods for end users to be distinct from the other four types, which are all oriented towards the industrial business market. Hence, we code a dummy for producer of finished goods for end users (*enduse*). This variable represents 20.3 % of the firms in the sample. We also checked the producer of finished goods together with the system suppliers, suppliers of parts and components as one variable (*indbus*), but this variable turned out insignificant for both product-related service innovation and for radical product innovation. We therefore omitted this variable from the analysis.

Reaction to financial crisis (FinCrisisRD and FinCrisisPers)

The data were collected in Spring 2009, around 6 months after the financial crisis really was experienced in Europe and also in Denmark. We therefore wanted to control for the effect of the financial crisis on the decisions made by the managers of Danish manufacturing firms. This is to control for the risk that the particularities captured with the survey refer to the crisis rather than specific strategic decisions. In particular, we find that the focus of this paper on personnel development and skills and investements in R&D are particularly relevant to control for.

The data reveals that 79.4% of the firms had changed their efforts on rationalising personnel costs and 38.8% had changed their efforts in R&D as a direct reaction to the crisis. In general, 61.8% of the firms had changed their efforts in one way or the other as a direct response to the crisis. Hence, we can safely conclude that the financial crisis was important and had effects on the firms decisions.

	Yes (%)	No (%)	Missing
Efforts in R&D	130 (38.8%)	199 (59.4%)	6 (1.8%)
Efforts in rationalising personnel cost	266 (79.4%)	63 (18.8%)	6 (1.8%)
Efforts in general	207 (61.8%)	122 (36.4%)	6 (1.8%)

Table 3: Efforts as a response to the financial crisis

We therefore coded two dummies for those firms that reacted as a direct response to the financial crisis in terms of rationalising personnel cost (*FinCrisPers*) and another dummy for those firms that reacted as a direct response to the financial crisis in terms of changing their efforts in R&D (*FinCrisisRD).*

Omitted variables

Traditionally, articles in the literature include a control variable for firm size. The dataset includes the number of employees (in 2008), but the number of missings is high (56 cases missing = 16.7 %) and the variable is therefore excluded. Furthermore, dedicated resources for R&D as well as the intensity of such investments in R&D are important for innovation outcomes. The share of people in R&D is highly correlated with the variable for highly skilled employees at respectively 0.32. Hence, in the regression models, we exclude R&D intensity simultanously with the *highskill* due to the introduction of multicollinarity.

Analyses and method

As both of the dependent variables are binary (yes/no), we applied a binary logistic regression model to test for the hypothesised effects. For the mediation test, we used the *PROCESS* macro for SPSS as developed by Hayes[2] and described in detail in Hayes (2013) and in Zhao et. al. (2010). The test of mediation effects in regression analysis has been much debated, but many still use the original test by Baron and Kenny (1986). The most important debated aspects are: the importance of maintaining or reducing the main effect, once the mediator is included in the analysis, and the type of test needed for mediation to be established. We follow the suggestions of Preacher and Hayes (2004) and discussed in Zhao et. al. (2010) by implementing a bootstrap approach. For the bootstrap approach, we use 1000 samples to establish the confidence intervals for the indirect effect of the independent variable on innovation performance. Furthermore, we introduce the control variables as covariates when testing for the effects on innovation performance. Mediation is established if the calculated bootstrap confidence interval (95%) does <u>not</u> include 0. This signifies that axb (the coefficients of the independent on the mediator (a) and the mediator on the outcome (b)) is significant. To further support the significant mediation, we also present the Sobel z-test for mediation. If we can establish mediation, we then move on to classify the type of mediation effect (see Zhao et. al, 2010: figure 2, p. 201). The starting point is the significance of axb, followed by the second step, which is to establish the level of significance of path c (the independent variable on the outcome) [3]. If the mediated effect (axb) and the direct effect (c) both exist and point in the same direction, there is complementary mediation, but if the mediated effect (axb) and the direct effect (c) both exist and point in opposite directions the mediation is competitive.

Sensitivity check

For analysis of the sensitivity of the results to choice of variables, we further checked the third possible dependent variable, namely the standard CIS-question; has the firm introduced products since 2006, that were completely **new to the factory** or incorporated major technical changes. Theoretically, the two measures corresponds to a definition of innovation that is based on the relative novelty of the final products (as opposed to a definition of novelty as absolute) (Anderson, Potočnik, & Zhou, 2014). The share of firms introducing

[2] To see further details on the macro, we refer to the designated homepage: http://www.processmacro.org/
[3] For presentation of the remaining three mediation dimensions as discussed in the paper, please consult Zhao et. al. (2010: 200-202).

incremental innovations is 50.4% and hence there is, as expected, a decrease in firms that introduce products new to market compared to new to the factory.

We then analyzed the entire model for the CIS-question (new to the factory). The independent variables show similar results although there are minor differences in the levels of significance, whereas there are smaller differences on the two control variables: production for endusers and low tech industries (not significant here, whereas significant for products that are new to the market). Hence, the results for new to the factory innovation are distinct for radical innovation (new to the market) in case of firms in low tech and those that produce for endusers. However, the main results hold for this alternative innovation measure.

A further comment relates to the two dependent variables. As the theoretical section outlines, product-related services are seen as integral parts of the overall product to be delivered to the customer. Hence, one may speculate critically, whether the two dependent variables in fact do investigate separate aspects or are in fact part of a larger whole "the product"? To investigate this, we calculate the correlations among the dependent variables (see table 4). As expected, the correlation between radical and incremental innovation is fairly high (r=0.64), whereas the correlation among radical innovation and product-related service innovation is much lower (r=0.14). Therefore, the two dependent variables are not independent, but clearly distinct phenomena that warrants individual analysis.

		Radical product innovation (new to the market)	Incremental product innovation (new to the factory)	New product-related services
Radical product innovation (new to the market)	Pearson Correlation	1	,637***	,144**
	Sig. (2-tailed)		,000	,009
Incremental product innovation (new to the factory)	Pearson Correlation		1	,139*
	Sig. (2-tailed)			,012
New product-related services	Pearson Correlation			1
	Sig. (2-tailed)			

*** Correlation is significant at the 0.01 level (2-tailed)

** Correlation is significant at the 0.05 level (2-tailed).

Table 4: Correlations of dependent variables

As a contrast to the use of the high skills being graduate and PhD candidates, we further tested the effect of **any** tertiary education (diploma, bachelor, graduate or PhD). Only 30.4% of the firms have employees with graduate or PhD degrees (mean = 2.16%), whereas 71.7% of the firms have employees with diploma or bachelor degrees (mean = 8.17%) and a range from 0 to 60%. Hence, more firms employ people with diploma and bachelor degrees. To verify the results of the high skills, we developed a similar dummy to *highskill*, namely a dummy for diploma, bachelor, graduate or PhD degrees (mean = 0.71). The results of this sensitivity check is further commented on in the results section.

Results

The most important drivers of radical product innovation are teleworking (confirming *hypothesis H2a* at significance level 0.01) and highly skilled employees (confirming *hypothesis H1a* at significance level 0.05).

	Model A ***Radical product innovation***			**Model B** ***Product-related service innovation***		
	Unstd. coef.	Level of significance		Unstd. coef.	Level of significance	
Constant	-1.900	0.002		-2.649	0.002	
LnAge	0.041	0.789		0.033	0.839	
Low tech	-0.718	0.038	**	-0.324	0.366	
EndUse	1.042	0.003	***	0.073	0.852	
FinCrisisRD	-0.096	0.738		0.315	0.291	
FinCrisisPers	-0.353	0.307		0.486	0.245	
IndCDev	0.178	0.165		0.228	0.096	*
TeleWork	0.415	0.002	***	0.344	0.015	**
HighSkill	0.584	0.045	**	-0.712	0.039	**
CFTeams (mediator)	0.321	0.011	**	0.367	0.007	***
N		313			310	
Model fit – Nagelkerke		0.194			0.146	
Model fit – Cox & Snell		0.136			0.094	

***: significant at 0.01; **: significant at 0.05; *: significant at 0.1

Table 5: Logistic regression for radical product innovation and product-related service innovation (without mediation)

Similarly, the mediator, cross-functional teams is significantly related to the radical product innovation (at level 0.05). Furthermore, the results do not lend support to *hypothesis H1b* as

we cannot establish a significant relationship between individual career development and radical product innovation. On the other hand, for product-related service innovation, the results do show that there is a significant relationship between individual career development (confirming *hypothesis H1b* at significance level 0.1). Hence, the evidence for hypothesis 1b deserves further discussion (see below). Furthermore, the results also lend support to *hypothesis H2a* as teleworking is signficantly related to product-related service innovation. Hence, the *hypothesis H2a* is supported for both innovation outcomes. Finally, for the test of *hypothesis 1a* for product-related service innovation, the results indicate suprisingly that highly skilled employees have a significant and negative effect on the product-related service innovation. To investigate this finding further we carried out the sensitivity check as explained early by adding other educations at the tertiary level (table 6).

	Highly skilled	Tertiary education
Innovation – new to the market	+ (**)	+ (*)
Innovation – new to the factory	+ (***)	+ (***)
Product-related service innovation	- (**)	- (*)

***: significant at 0.01; **: significant at 0.05; *: significant at 0.1

Table6: Sensitivity check of tertiary education on innovation outcome

The results show that both highly skilled personnel, but also employees with lower degrees from university educations have a significantly and negative relationship with innovation outcome, when the outcome is product-related service innovation, although the effect is of less significance for lower levels of tertiary education than for higher levels. The positive effects of highly skilled employees on new product development are also found for employees with tertiary education, but here also with less significance than higher levels of university education.

As described in the method section, the bootstrap approach is used to identify possible mediation (table 7). We find full support for *hypothesis 2b* as cross-functional project teams mediate both the relationship between teleworking and radical product innovation and product-related service innovation (confirming *hypothesis H2b* at significance level 0.05 for both outcomes). In both cases, the mediation is a complementary mediation indicating that although teleworking is related to innovation outcome this effect can be further accentuated by also implementing temporary cross-functional teams although it is not a pre-condition since the indirect effect does not take out the main effect.

The interpretation of the results for *hypotheses 3a and 3b* follow deductively from the previous analyses. For hypothesis 3a, we find that the educational level was positively and significantly correlated with radical product innovation, whereas the educational level was negatively and significantly related to product-related service innovation.

	Radical product innovation	Product-related service innovation
(a) TeleWork -> CFTeams	0.234 (0.000/***)	0.248 (0.000/***)
(b) CFTeams -> Inno Performance	0.321 (0.011/**)	0.367 (0.007/***)
(c) TeleWork -> Inno Performance	0.415 (0.016/**)	0.344 (0.015/**)
(axb) – Indirect effect of TeleWork on Inno Performance	0.075	0.091
Confidence interval (95%)	(0.015 : 0.164)	(0.019 : 0.196)
Sobel test	0.036 (**)	0.025 (**)
Conclusion	Complementary mediation	Complementary mediation

***: significant at 0.01; **: significant at 0.05; *: significant at 0.1

Table7: Bootstrap results for mediation effect

Hence, we find that *hypothesis 3a* is supported by the results. Further, for hypothesis 3b, the previous results demonstrated that individual career development was insignificantly related to radical product innovation, whereas it was positive and signficantly related to product-related service innovation, which lends support to *hypothesis 3b*.

DISCUSSION AND CONCLUSION

This study took on the challenge of linking human resource hiring, developing and organizing practices for a maximization of individual employee's educational levels towards different innovation outcomes. While there are commonalities in maximizing employees' skills for new product development and product-related service innovation, there are also key differences between these two innovative outcomes. In particular, whilst the educational level of employees has a significant and positive effect on new product development success, hiring highly educated individuals actually has a significant and negative effect on product-related service innovation. Second, although investing in individual training programmes is beneficial for product-related service innovation, such programmes have no impact on new product development outcome. Consequently, the value-adding human resource hiring and developing strategies differ significantly for product-related service versus new product innovations.

In particular, in order to maximize new product development success, organizations should invest predominantly in employees with the highest possible educational level rather than investing organizational resources to develop skills later on. Oppositely, for successful product-related service innovation, employees with lower educational levels should be hired and their skills be developed by the organization in the form of personalized training programs.

The positive effect, highly educated employees have on new product development success is in line with a body of literature that has shown a link between domain-specific expertise and new product success (Hunter et al., 2012). New product development teams are usually comprised of individuals that each have specified skills and knowledge that they contribute to the larger product (Madhavan & Grover, 1998). Increasing levels of educational skills developed through postgraduate and Doctorate degrees are commonly associated with higher levels of applied domain-specific specific expertise due to the field explicit nature of such degrees. Therefore, with increasing levels of applied domain-specific knowledge gained through their education, individuals are more capable of generating more innovative ideas in relation to technical products and product features and to implement these ideas (Madhavan & Grover, 1998; Polanyi, 1975) (Vincent et al., 2002). Also, with higher educational skills, individuals inherit a higher amount of content-specific embedded knowledge, which is the amount of particular knowledge stored within each person (Nonaka, 1994). It would follow that combining this knowledge of highly skilled individuals leads to a larger pool of product-specific knowledge, which in turn leads to more creative, novel products. Hence, rather than spending organizational resources in enlarging individual knowledge through training programs, for new product development success, it is most beneficial to hire individuals at the highest possible educational level. Based on the review of this paper, we invite future research to investigate the findings of this study on innovative outcomes to further substantiate our results.

For managers, it is important to notice that human resource hiring and development for new product development, requires allocation of resources predominantly for recruitment of employees with the highest possible education as an alternative to developing and training individuals. On the one hand, managers must recruit employees with appropriate knowledge levels, but must also ensure a sufficient basis of knowledge within the firm to enable the knowledge of the newly hired to become productive for the specific organizational goals and challenges. Cohen and Levinthal (1990: 135) explain that to integrate new complex, tacit, and sophisticated technological knowledge successfully into an organization's existing activities, the firm must possess an existing internal staff consisting of technologists and scientists, who are both competent in their fields and are familiar with the organization's idiosyncratic needs, organizational procedures, routines, complementary capabilities, and extramural relationships.

If we turn towards the product-related service innovation outcome, the negative relationship warrants further explanation. We have argued that for product-related service innovations, individuals require a breadth of knowledge across several different knowledge disciplines such as knowledge about all key product features of new and existing products, product delivery details, marketing and sales-, and an array of after-sales service knowledge (Jong et al., 2005). Highly specialized knowledge in the form of a postgraduate or doctorate degree may thus hinder rather than benefit the diverse demands for product-related service innovations. Contrary to the findings of Gebauer et al. (2008), who recognize the need for market and business competence, but who do not find a significant effect of training or education on product-related service innovation, our findings show that organizations should

invest in further developing skills of individuals during their employment rather than investing in highly educated individuals out-front.

The results further suggest that for both new product development and product-related service innovation, having the freedom to work at home via telework is beneficial for innovation performance. Furthermore, this effect is fully mediated by having these employees work in temporary cross-functional project teams. Put differently, independently of whether a new product or a product-related service innovation is developed, the impact of teleworking on innovation outcomes is positive and is further substantiated by the extent to which the firm possesses necessary collaborative capabilities. Interestingly, despite the compelling empirical evidence in relation to the benefits of cross-functional teams for innovation success (Kahn, 1996; Moenaert, Souder, De Meyer, & Deschoolmeester, 1994; Schleimer & Shulman, 2011), the innovation literature has thus far not produced any empirical validations as to their beneficial role for teleworkers (Martínez-Sánchez et al., 2006). Considering the nature of skunk work teams, the temporary nature may be a useful starting point for the successful integration of teleworkers into cross-functional teams, which will increase the likelihood that the outcomes become more radical compared to existing market alternatives. Comparative to the popular "time for creativity model" where a certain percentage of creative employees work time is dedicated to innovative projects (as seen in e.g. 3M and Google to name more popular and known examples), one could easily imagine that these models of flexible work arrangements could be combined, but are currently not investigated in the literature, and is proposed for further research. We therefore suggest a wider empirical validation of skunk works, teleworking and cross-functional teams for innovative outcomes.

Increasingly, knowledge-based economies demand heightened flexibility of individuals to accommodate work tasks in a virtual space covering global businesses across time zones. For these global businesses, flexible work arrangements such as teleworking present the future of organizational structures (Kowalski & Swanson, 2005). However, the existing innovation management literature predominantly examines the role of cross-functional teams in relation to inter-departmental/cross-functional collaboration that are co-located, yet rarely in relation to remotely located teleworkers engaged in the same cross-functional project teams. Most innovation studies assume that cross-functional team members within an organization are co-located. However, when we consider that these individuals are all working in separate spaces (perhaps even separate time zones), future research may want to examine whether such teams face different types of coordination mechanisms and challenges.

Even though the existing literature reports a continuous increase in the number and complexity of product-related service innovations, the negative effect of educational level on performance could be one explanation for the lack of existing studies to link PRS to positive financial performance (Lay et al., 2010). Since product-related service innovation has received such little attention compared to new product development, our findings in relation to human resource training are valuable and show that this form of human resource strategy is useful for this particular type of innovation outcome. Evidently further research focusing on training for innovation outcome for new product development and especially product-related service innovation is needed.

Our results lead us to imagine the emergence of new managerial paradoxes from focusing on recruiting, hiring and organizing individual efforts for organizational outcomes though team constellations, but this remains to be seen from additional research efforts. In particular, we highlight the need to develop more fine-grained measures of the individual career development measures, of the organization of individual employees in different structures e.g. by comparing cross-functional team structures with skunk work approaches to organization of innovative efforts, and for investigating the temporal perspectives of hiring highly educated employees e.g. by investigating the extent of time needed before they positively support specific organizational goals. We suggest an investigation of investments with a long-term perspective in employees with tertiary educations to develop the knowledge base bottom up and then enlarge and deepen the knowledge base of the organization gradually. The findings of the test of tertiary education (see table 6) support that such investments also pay off for innovation outcomes although primarily for innovation outcomes that are new to the factory. Such strategies may therefore support the firm in transforming from being non-innovative towards being product innovative with less radical innovations prior to taking additional steps for radical innovation.

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