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Feed the Machine - An Empirical Investigation of the Impact of Openness in Innovation on IT Entrepreneurship

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Complete Research

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In the future, if businesses want to innovate, IT will have to play a substantial role. Furthermore, innovating with IT will most likely imply opening up the innovation channel and collaborating with various kinds of external partners, as digital platforms and eco-systems involving various actors arise. According to prior research, emphasizing external innovation collaboration bears the risk of inhibiting internal innovation. As the ability to innovate with IT becomes a key differential factor in almost every industry, business managers – especially in non-IT firms – must cultivate the entrepreneurial role of their IT departments and the respective employees. Therefore, the question arises of how the focus on external innovation sources and the emphasis on internal innovativeness of IT professionals relate to each other. Prior research has generated conflicting results on this issue. With our large-scale (n = 354) empirical analysis, we provide evidence that firm openness fosters the entrepreneurial behavior of IT professionals. Furthermore, this impact is mediated by the absorptive capacity of the IT unit. Consequently, as our model shows, valuable external knowledge can be integrated for internal innovation purposes, thus driving both IT professionals' willingness to act entrepreneurially as well as their perceived ability to do so.

Keywords: Open Innovation, Absorptive Capacity, Corporate Entrepreneurship, Innovation Management.

Introduction

Due to the increasing pervasiveness of information technology (IT) in everyday life (Yoo, 2010), more and more industries must take IT into account when considering innovation. As Nambisan (2013) points out, "Digital technologies are being embedded into an ever-increasing range of products and services—from cars and toys to household appliances and medical devices—thereby expanding the role and relevance of IT in any innovation" (Nambisan, 2013, p. 216). Stemming from this elaborated role, IT departments today face completely different expectations than they did a decade ago. For corporate IT, it is no longer sufficient to simply increase the efficiency of existing business processes by, e.g., automating manual work practices (Melville et al., 2004). Moreover, it is insufficient for IT to merely be aligned with business strategy (Henderson and Venkatraman, 1993); instead, corporate IT must now contribute to a firm's innovation processes.

However, this new and important role is far from easy to fulfill for most IT departments, especially in non-IT industries. IT departments have a history of being a support function whose goals are, in the best case, derived from the business strategy (Guillemette and Paré, 2012). Now, in many industries the tables have turned as firms have begun implementing digital business strategies (Bharadwaj et al., 2013). This demands a changed set of skills, competences, and resources for the IT function. Thus, in the digital age the role of IT in innovation has changed from being a simple operand resource, i.e., an innovation enabler, to being an operant resource that triggers innovation processes and outcomes that rely on digital platforms and multiple players in the innovation ecosystems (Nambisan, 2013). One way of coping with these challenges would be to support the entrepreneurship of IT professionals (Watts and Henderson,

2006). Innovative business ideas from IT employees that are implemented within the firm are a desirable outcome in a world where IT increasingly penetrates business or even becomes the business.

However, not only has the importance of innovations in IT changed but the logic of innovation processes is also shifting (Yoo et al., 2012). Although IT departments have historically been responsible for managing and executing the potential of IT for the business, in the digital age they are increasingly challenged to keep pace with IT developments stemming from fields of knowledge distant from their area of expertise. As the phenomenon of consumerization demonstrates, corporate IT is in danger of being bypassed if it does not meet the increased expectations of managers, employees, or customers, which result from private consumer IT usage (Gregory et al., 2014). IT units are surrounded by pervasive IT that originate from areas distant from their core knowledge base but invade the business environment. In the digital age, ecosystems emerge that involve increases in both collaboration and competition (Henningsson and Hedman, 2014; El Sawy and Pereira, 2013; Yoo et al., 2010). To create innovations in such an interconnected environment, IT departments must open up their innovation channels by getting in touch with technology partners, customers, competitors, etc. (Yoo et al., 2012). Nevertheless, openness in IT innovation does not guarantee that opportunities will be recognized and realized by corporate IT. They must be able to effectively acquire, interpret, and exploit the external knowledge – a capability referred to as absorptive capacity.

Prior research has "largely ignored the connections between internal and external innovation" (Faems et al., 2010, p. 793). However, it has also indicated possible tensions resulting from external innovation collaboration as it might hinder the ability to identify and develop innovations internally (Xu et al., 2013). While the importance of absorptive capacity for, e.g., firm performance, has been proven in general several times, there is still a lack of understanding concerning its effects on internal innovativeness (West and Bogers, 2014) – particularly the relationship between internal innovations and collaboration with the external environment. Research has produced conflicting results on these issues, finding both substitutionary and complementary effects of absorptive capacity on internal innovativeness (West and Bogers, 2014). One could argue that absorptive capacity drives external innovation sourcing, thus reducing resources available for internal innovations. On the other hand, however, the enhanced knowledge transfer from external sources to the company, driven by absorptive capacity, might generate ideas for internal innovations.

Thus, a dilemma arises from the need to open up and collaborate in IT innovation while avoiding the danger of inhibiting internal innovativeness. Though this predicament may have long existed, it becomes crucial when IT gains in importance and IT innovations are basically business innovations. As IT competence becomes a key differentiator in competition, strategic disadvantages emerge if the needed competence lies outside the firm boundaries. In this paper, we therefore aim to provide insights into the following research question: *What is the influence of openness and absorptive capacity on IT entrepreneurship?*

In answering this question, we attempt to shed light on the black box of how the increased openness of the firm in innovation initiatives and the IT department's ability to absorb external knowledge influences the individual entrepreneurial behavior of IT professionals. In order to do so, we built a comprehensive model that attempts to bridge the gaps among the organizational, IT-unit, and individual layer and conducted a large-scale (n = 354) empirical investigation to examine the specific relationships.

The remainder of the paper is organized as follows. First, we lay out our theoretical foundation by drawing from prior research on new challenges for the IT function as well as the concepts of absorptive capacity, open innovation, and IT entrepreneurship. Afterwards, we develop our hypothesis and explain the methodological approach taken. Finally, we present and discuss our results and derive important implications for business practice and future research.

1 Theoretical Background

1.1 Challenges for corporate IT in the digital age and IT entrepreneurship

As described by Bharadwaj et al. (2013), the role of the IT function is currently undergoing a fundamental change. While IT has historically been considered a business function, or an internal service provider (Queiroz and Coltman, 2014) intended to support given business objectives (Guillemette and Paré, 2012), its role has been increasing in importance. Instead of aligning IT to business strategy, digital business strategy, i.e., an "organizational strategy formulated and executed by leveraging digital resources to create differential value" (Bharadwaj et al., 2013, p. 472), is on the rise. El-Sawy and Pereira (2013) describe the changing role of IT from being a business tool – an enabler of business processes – to a state in which it is inseparably connected with the business itself. As Bucherer et al. (2012) report from a recent case study, "Employees from the IT department suddenly had to deal with customers instead of focusing on internal process optimization" (Bucherer et al., 2012, p. 193).

Consequently, although innovation has always been an important task for IT departments (Merali et al., 2012), it will become even more important in the digital age as IT innovations are business (service/product and business model) innovations. However, while corporate IT functions in the past were used to drive innovations more or less on their own, innovation ecosystems broaden in the digital space (Bharadwaj et al., 2013). With the diffusion of digital platforms, interorganizational collaboration on shared architectures increases (El-Sawy and Pereira, 2013). Yoo et al. (2012) describe future IT innovations as distributed in nature and point out that "[n]ot only are innovations increasingly moving toward the periphery of an organization, but the distributed innovation spurred by pervasive digital technology increases the heterogeneity of knowledge resources needed in order to innovate" (Yoo et al., 2012, p. 1401). However, the emerging ecosystems are not free from tensions, as collaboration partners often are competitors at the same time (Henningsson and Hedman, 2014).

The increasing penetration of digital technologies into everyday life (Yoo, 2010) brings along another challenge that has been discussed under the theme of consumerization (Gregory et al., 2014). Initial research on this emerging topic has explicitly described the tensions for IT functions resulting from employees bringing consumer technologies and their related expectations to the workplace (Ruch and Gregory, 2014). The consumerization of IT turns the direction of innovation upside down as new technologies emerge from the private space (Niehaves et al., 2012). Hence, corporate IT faces competition from very different areas and is in danger of being left behind if it cannot manage to meet the transferred expectations (Gregory et al., 2014). Business managers might then bypass their own IT function and instead collaborate with external partners (Niehaves et al., 2012). This reliance on external partners is particularly dangerous when IT becomes a key aspect in business innovation.

In sum, these developments lead to a specific profile for corporate IT when it comes to innovation. It must be able to open up and collaborate with external partners while also having the ability to acquire and integrate knowledge from dispersed areas, apply it to its own contexts, and contribute to business innovations in order to avoid being bypassed by outside players. In order to address these challenges, corporate entrepreneurship, i.e., "an organizational process for transforming individual ideas into collective actions through the management of uncertainties" (Chung and Gibbons 1997), carried out by the IT function is a promising avenue, as it has been reported to enhance innovation performance in its respective contexts (e.g., Burgelman, 1983; Covin and Slevin, 1991). As the definition of corporate entrepreneurship above already indicated, recent research on the topic has identified the specific importance of the individuals operating in the "machine rooms" for the initiation of entrepreneurial actions (Kuratko and Audresch, 2009). When focusing on IT innovations, this machine room is the IT department with the respective IT professionals working within.

Much research has found a positive influence of IT on entrepreneurship (e.g., Armstrong et al., 2002; Jalava and Pohjola, 2001; Kim, 2002; Oulton, 2002; Parham et al., 2001; Van der Wiel, 2001; Vu, 2004). Furthermore, the driving and inhibiting organizational factors (e.g., Leidner et al., 2010; Watts and Henderson, 2006; Floyd and Lane, 2000) as well as the influence of intrinsic and extrinsic motivations on

entrepreneurial behavior (e.g., Kruep et al., 2014; Carsrud and Brännback, 2011; Edelman et al., 2010) have been investigated. However, to the best of our knowledge, what is missing to date is empirical evidence on the impact of firm openness and external innovation collaboration on the internal innovativeness of IT departments and individual entrepreneurship of IT employees. Employing this perspective is important because "employee innovation behavior has been predicted by factors at the organizational, the job, and the individual levels, but research reflecting these three perspectives has not been examined for relative and interactive effects" (Kinnamon and Fabian, 2010, p.3).

1.2 Open innovation and absorptive capacity

Since its introduction by Chesbrough (2003), the concept of open innovation has initiated substantial related research (Dahlander and Gann, 2010). According to Lichtenthaler (2011), "Open innovation is defined as systematically performing knowledge exploration, retention, and exploitation inside and outside an organization's boundaries throughout the innovation process" (Lichtenthaler, 2011, p. 77). When focusing on the influence of open innovation on the internal development of business innovations, the inbound open innovation types, i.e., sourcing knowledge, ideas, or inventions from the external environment (Dahlander and Gann, 2010), are of particular relevance. They manifest themselves – e.g., in a search behavior – when it comes to innovation initiatives that include various external sources of knowledge and increased collaboration with external partners (e.g., Laursen and Salter, 2006). This broadened access to external knowledge is reported to have positive impacts on the performance of both the innovation process and its outcome (e.g., Davey et al., 2010). Nevertheless, it is a complicated endeavor to identify and transport valuable external knowledge to the organization, especially from distant sources, and make mindful use of it (Salge et al., 2012). After analyzing literature on open innovation, West and Bogers (2014) derive a four-phase process model of firms leveraging external sources of innovation. The first phase focuses on the search for and acquisition of external knowledge. In the second phase the acquired external knowledge is integrated into the focal firm. Afterward, in phase three, the integrated knowledge becomes commercialized into, e.g., new business models. In parallel to these three phases, there is a fourth one dealing with interactions among the respective partners and including aspects such as co-creation, reciprocal information exchange, and participation in innovation ecosystems (West and Bogers, 2014). It becomes apparent that the integration phase is a key bottleneck to profiting from external knowledge. The concept of absorptive capacity is an instance of this phase and has been described as contributing to the success of open innovation (e.g., Newey, 2010) by enabling firms to "capitalize on external sources of innovations" (West and Bogers, 2014, p. 821).

Cohen and Levinthal (1990) define absorptive capacity as the "ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends" (Cohen and Levinthal, 1990, p. 128). This concept has further been described as building upon knowledge gathered in the past (Zahra and George, 2002). Because of this path dependency, absorptive capacity has often been conceptualized as an asset, i.e., a stock of knowledge gathered in the past. However, in their guidelines concerning absorptive capacity in IS research, Roberts et al. (2012) recommend viewing it as a capability because then the process of knowledge absorption can be captured as well (Roberts et al., 2012). Prior research has defined several kinds of absorptive capacity according to, e.g., the respective field of knowledge that is to be addressed, (e.g., Newey, 2010; Weigelt and Sarkar, 2012) or different phases in the innovation process (e.g., Lichtenthaler and Lichtenthaler, 2009). Furthermore, Zahra and George (2002) describe two subsets of absorptive capacity: "Potential capacity comprises knowledge acquisition and assimilation capabilities, and realized capacity centers on knowledge transformation and exploitation" (Zahra and George, 2002, p. 185). Concerning the relation of organizational factors and absorptive capacity, Jansen et al. (2005) have shown that cross-functional interfaces, participation in decision making, and job rotation increase potential, while connectedness and socialization tactics improve realized absorptive capacity.

According to Lane et al. (2006), absorptive capacity generates two types of output: knowledge outputs and commercial outputs. While knowledge outputs encompass, e.g., technical or scientific knowledge,

commercial outputs comprise new products, services, business models, or patents. Both output types influence firm performance and, due to the path dependency of the construct, a firm's future absorptive capacity (Lane et al., 2006). Prior research is relatively consistent regarding the impact of absorptive capacity on performance: "Absorptive capacity amplifies the benefits of external innovation sourcing both on innovativeness and on financial performance" (West and Bogers, 2014, p. 821).

However, although open innovation and absorptive capacity have been reported to positively influence outcome measures, their impacts on internal innovativeness are not well understood (West and Bogers, 2014). When Chesbrough (2003) introduced the concept of open innovation, it included the assumption that openness in innovation processes would spur internal innovations by delivering valuable insights and knowledge (Faems et al., 2010). Since then, however, this connection has not been subject to much research. Existing work on the issue has produced conflicting results. While Faems et al. (2010) find a positive impact of the diversity of technology alliances a firm pursues on its internal innovation efforts, West and Bogers (2014) state, "Adopting an inbound open innovation strategy could allow financially conscious managers to use it as an excuse to cut internal innovation resources, subject to the need to maintain enough absorptive capacity to evaluate and integrate external innovations" (West and Bogers, 2014, p. 822). Thus, an emphasis on external innovation collaboration may hinder internal departments or employee's willingness to be innovative on their own.

2 Hypothesis Development

In this paper, we aim to examine the influence of firm openness in innovation and the IT department's absorptive capacity on the individual entrepreneurial behavior of IT professionals. Through this approach, we examine how organizational and departmental aspects, as perceived by the individual, influence individual innovation behavior. With this focus, we follow West and Bogers (2014), who maintain that "more research is needed on individuals as sources of innovation" (West and Bogers 2014, p.821). Concerning the literature on open innovation, Salter et al. (2014) identify a void at the individual level, even though individuals are, according to the authors, the ones executing open innovation. However, they "need to be able to take advantage of the knowledge they obtain from external sources" (Salter et al., 2014, p. 88) by organizational circumstances. Moreover, we follow Lane et al. (2006) in the sense that knowledge acquisition and integration at the firm level is complemented by the individuals when it comes to making use of it, especially in innovation: "In short, it is the firm's individual members who add the creativity needed to help the firm uniquely create value from new knowledge" (Lane et al. 2006, p. 854). Figure 1 depicts our research model[1]. In the following, we will develop our hypotheses.

There exist various theories to explain human behavior (Venkatesh et al., 2003; Venkatesh and Brown, 2001). As entrepreneurial behavior is an intentional act, prior research has found intention-based theories to be of superior explanatory value (Krueger et al., 2000). Therefore, we draw on the well-established theory of planned behavior (Ajzen, 1991). This theory aims to explain individual behavior through an individual's intention toward the respective behavior and the "perceived ease or difficulty of performing the behavior" (Ajzen, 1991), a concept referred to as perceived behavior control. Within the frame of reference of our study, this is of particular importance. Individual entrepreneurial behavior, especially within a firm, does not solely depend on the personal intentions of employees to do so; instead, the organizational surroundings, such as the time available and management support, influence the employees' perception of being able to act entrepreneurially. The theory of planned behavior accounts for this aspect with the construct of perceived behavioral control and by doing so extends the theory of reasoned action (Fishbein and Ajzen, 1975). Beside the fact that the theory is "one of the most influential theories in explaining and predicting behavior, and it has been shown to predict a wide range of behaviors" (Pavlou and Fygenson, 2006, p. 117), Kautonen et al. (2013), employing a longitudinal

[1] To keep the illustration comprehensible, we have not depicted the direct effects of external orientation and information exchange on individual entrepreneurial intention and perceived behavioral control. This also applies to Figure 2.

empirical investigation, have proven the theory's significant ability to predict the entrepreneurial behavior of individuals (Kautonen et al., 2013).

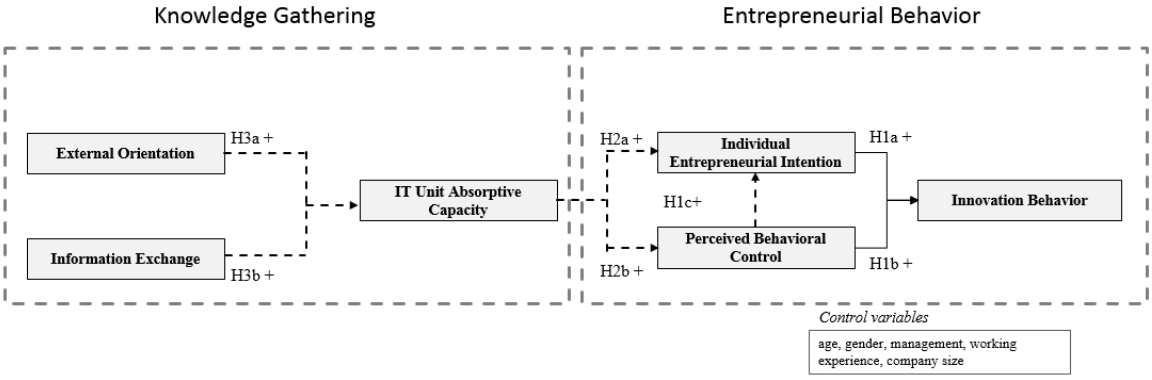

Figure 1. Research model.

In this study, we want to focus on how the factors that influence entrepreneurial behavior – according to theory of planned behavior – are impacted by openness and absorptive capacity as perceived by the individual. Therefore, we abstract from the individual's subjective norm and attitude against entrepreneurial behavior, which, according to theory, only have an indirect effect on the actual behavior (Ajzen, 1991). Following the theory, the innovation behavior of IT professionals should depend on the individual's intention toward pursuing business innovations as well as his or her perception of the available resources and opportunities (Ajzen, 1991). Furthermore, these two influencing factors should be interdependent, as perceived behavioral control influences the individual intention (Ajzen, 1991). Therefore, we propose the hypotheses below:

H1a: Individual entrepreneurial intention positively influences the innovation behavior.

H1b: Perceived behavioral control positively influences the innovation behavior.

H1c: Perceived behavioral control positively influences individual entrepreneurial intention.

As mentioned in the theory section, absorptive capacity describes an organization's ability to leverage external knowledge. Prior research has hinted that an emphasis on external sources of knowledge might diminish internal innovativeness (West and Bogers, 2014; Xu et al., 2013). Transferred to our focus, if an IT unit intensively integrates knowledge from outside the firm, individual employees could be less motivated to act entrepreneurially because they might feel it unnecessary. Moreover, as stated above, if resources are restricted, they might perceive that there are not enough resources to foster their own innovations, due to the activities undertaken to acquire knowledge from external sources,. However, it is not yet clear whether external engagement in innovation supplants or drives internal innovativeness (West and Bogers, 2014). One could also argue that, in contrast, external knowledge spurs the individual innovativeness of IT professionals because it stimulates their creativity, alertness, and opportunity recognition (Sambamurthy et al., 2003). Moreover, external knowledge and ideas can be perceived as an essential resource for identifying, e.g., unserved customer demands. Despite the gap in literature on the relationship of absorptive capacity as an organizational capability and individual behavior (Hotho et al., 2012), empirical evidence suggests that externally sourced knowledge positively influences individual innovativeness (Tortoriello, 2006). As absorptive capacity builds upon previously gathered external knowledge (Lane et al., 2006), a high level of this capability indicates a large stock of externally sourced knowledge, which in turn might foster individual innovativeness. Therefore, we propose the following hypotheses:

H2a: IT unit absorptive capacity positively influences individual entrepreneurial intention.

H2b: IT unit absorptive capacity positively influences perceived behavioral control.

Although we follow Tortoriello (2006) in assuming a positive effect of openness to external sources on internal innovativeness, prior research has found differentiated results on this matter (e.g., Laursen and Salter, 2006), hinting that there might be other factors influencing the actual impact. We suggest that the IT unit's absorptive capacity influences the relationship between firm openness and information exchange as well as the entrepreneurial behavior of IT professionals. The same applies to information exchange with external partners. In doing so, we follow Salter et al. (2014): "Interaction with external parties to access knowledge may require effort to translate and integrate it, and it may be less immediately obvious how it fits with the organization's objectives and expertise" (Salter et al., 2014, p. 82). Due to the importance of absorptive capacity, we investigate its antecedents as well as its mediating effects.

Following the four-phase model of open innovation by West and Bogers (2014), absorptive capacity represents the integration of externally sourced knowledge into the focal firm. This phase is in turn influenced by the obtaining and interaction phases. To keep our model simple, we operationalized each phase with one construct: external orientation (Zahra et al., 2004) for the obtaining phase and information exchange (Rai et al., 2012) for interaction phase. Concerning the former, prior research has explained that firms source ideas from the external environment by collaborating with various stakeholders, such as customers, suppliers, competitors, or universities (West and Bogers, 2014). These learning relationships, according to the process model of Lane et al. (2006), influence the capability of absorptive capacity. Moreover, due to the path dependency of the product, each outcome of learning from external sources, i.e., the knowledge gathered, influences absorptive capacity in turn. Concerning information exchange, Love et al. (2014) maintain that openness to external knowledge sources in innovation processes includes reciprocal information processing. The authors demonstrate through their empirical investigation that these exchange experiences, however, have the potential to not only benefit the innovation process but also create a learning effect on the ability to profit from external linkages for future innovation processes (Love et al., 2014), thus driving absorptive capacity. Therefore, we propose the following hypotheses[2]:

H3a: External orientation positively influences IT unit absorptive capacity.

H3b: Information exchange positively influences IT unit absorptive capacity.

M1: IT unit absorptive capacity at least partially mediates the positive effects of external orientation on individual entrepreneurial intention.

M2: IT unit absorptive capacity at least partially mediates the positive effects of external orientation on perceived behavioral control.

M3: IT unit absorptive capacity at least partially mediates the positive effects of information exchange on individual entrepreneurial intention.

M4: IT unit absorptive capacity at least partially mediates the positive effects of information exchange on perceived behavioral control.

3 Research Design and Method

3.1 Data-collection procedure and sample

We started an online survey, conducted in both German and English, in February 2014 to test our research model. The survey in English was developed, and an independent translator translated the German version. To establish conceptual consistency, another translator then translated it back to English. We collaborated with a panel provider that hosted a panel with workers at an IT department in non-IT firms in the UK and Germany. The initial sample consisted of 526 participants, with 372 completing the

[2] To decrease complexity, we have not separately added hypotheses on the direct effects of external orientation and information exchange on individual entrepreneurial intention and perceived behavioral control as these are already included in M1-M4.

survey (71%). We had to remove 18 of these because of implausibly short handling times. Table 1 provides the demographics of our sample.

Total Sample	***n* = 354**	**Percentage**
Gender		
Male	245	69%
Female	109	31%
Age		
19–25	43	12,1%
26–35	153	43,2%
36–45	88	24,9%
46–55	50	14,1%
56–65	19	5,4%
66 and over	1	0,3%
Management		
Yes	310	88%
No	44	12%
Working Experience		
< 2 years	20	6%
3–5 years	53	15%
6–10 years	94	27%
11–15 years	63	18%
16–20 years	46	13%
> 20 years	78	22%
Company size		
< 50	42	12%
50–99	39	11%
100–499	86	24%
500–999	75	21%
1.000–2.499	46	13%
2.500–9.999	33	9%
>10.000	33	9%

Table 1. Sample demographics.

3.2 Measurement of constructs

We used standard psychometric scale-development procedures. Our study consists of validated scales when possible, and we adapted some scales to our research context. In a first step, we evaluated our scales based on the feedback from practitioners and scholars in the area of corporate entrepreneurship and motivation research. Following their recommendations, we removed some of the items to ensure the face and content validity of the scales (Hardesty and Bearden, 2004; Moore and Benbasat, 1991). To evaluate and enhance our reflective measures, we also conducted two pilot studies (n = 23). After the second study, the reliability of scales suggested that our survey was ready for a larger study (Brown and Venkatesh, 2005). All items were evaluated using a seven-point Likert scale with the anchors "strongly disagree" (1) and "strongly agree" (7). The psychometric properties and final items are presented in Table 2.

Construct (Source)	**Items**	**Factor Loading**
Perceived Behavioral Control (Bamberg, 1999)	If I wanted to, I would be able to develop innovative business ideas.	.880***
	I have the necessary abilities to develop innovative business ideas.	.885***

	Developing innovative business ideas is easy to me.	.860***
IT Unit Absorptive Capacity (Pavlou and El Sawy, 2006)	Identify and acquire internal (e.g., within the department) and external (e.g., market) knowledge.	.862***
	Developing new knowledge or insights that have the potential to influence new products or services development.	.874***
	Effective routines to identify, value, and assimilate new information and knowledge.	.830***
	Transforming existing information into new knowledge.	.840***
	Exploitation of internal and external information and knowledge into our applications.	.793***
Information Exchange (Rai et al., 2012)	Our IT-service provider and we provide each other with sufficient information to perform the process.	.877***
	Our IT-service provider and we successfully exchange information with each other.	.882***
	Our IT-service provider and we communicate well with each other and discuss at eye level.	.884***
Individual Entrepreneurial Intention (de Jong, 2011)	If I identify a new business opportunity, I would promote and champion my idea to co-workers and superiors.	.795***
	If I had an idea for innovations, I would try to assess its long-term opportunities and threats for the company.	.837***
	I have always wanted to implement innovations by myself.	.773***
	If I had the opportunity, I would like to develop a product or service on my own (or in a team).	.644***
	I intend to develop innovative ideas in the company's core business and implement them within the company in the future.	.808***
	I think that in the future I will develop innovative ideas in the company's core business and implement them within the company more often.	.841***
External Orientation (Zahra et al., 2004)	My firm tracks changes in its markets on a regular basis.	.860***
	My firm values working with key customers and learning from them.	.870***
	My firm values working with key suppliers and learning from them.	.863***
	My firm values learning from the actions of its competitors.	.898***
Innovation Behavior (Amo and Kolvereid, 2005)	To which extent do you contribute to new product development in the organization where you are employed?	.839***
	To which extent do you contribute to the development of new product-market combinations in the organization where you are employed?	.886***
	To which extent do you contribute to development projects in the organization where you are employed?	.827***
	To which extent do you contribute to the development of new venture ideas in the organization where you are employed?	.880***
	To which extent do you contribute to the development of new markets for the organization where you are employed?	.839***
Note: * p < .05; ** p < .01; *** p < .001;		

Table 2. Scale.

4 Analysis and Results

We used structural equation modeling to validate our research model, employing SmartPLS version 2.0.M3 (Ringle et al., 2005) to apply a component-based partial least squares (PLS) regression. In a first step, we assessed the psychometric properties of the measurement model; afterward we verified our hypotheses using the structural model, following the two-stage procedure by Anderson and Gerbing (1988).

4.1 Assessment of measurement model

Conducting reliability and validity tests according to the guidelines of Gefen and Straub (2005), we assessed our reflective variables. Following Chin (1998), we set the recommended threshold to .707. Table 2 reveals that all but one of our reflective items loaded significantly on their constructs with values higher than the required .707, and none of our items loaded on the construct below the cutoff of .50.

Furthermore, we set the threshold of composite reliability (CR) to the recommended .70 (Gefen and Straub, 2005); all of our constructs exceeded this threshold (see Table 3). The indicator and construct reliability could be tested in a positive way. We assessed convergence validity by examining the constructs' average variances (AVE). Following Bhattacherjee and Premkumar (2004), we set the threshold to .50; each construct was above it. As a final step, we applied the discriminant validity using the criterion of Fornell and Larcker (1981): Discriminant validity is established when any squared correlation between any two items is lower than the corresponding AVE. The independent and dependent variables came from the same respondent. To test for common method bias we performed the marker variable test (Lindell and Whitney, 2001) and Harman's single-factor test (Podsakoff et al., 2003). Both tests indicate that there is no common method bias that could threaten our study's validity.

Construct	Range	Mean (STD)	CR	AVE	CA	INB	IEI	PBC	ITAC	EXO	INE
INB	1–7	5.16 (1.24)	.93	.73	.91	**.85**					
IEI	1–7	5.33 (1.21)	.91	.62	.87	.59	**.79**				
PBC	1–7	5.27 (1.12)	.91	.77	.85	.63	.55	**.87**			
ITAC	1–7	5.43 (1.06)	.92	.71	.90	.65	.67	.72	**.84**		
EXO	1–7	5.38 (1.17)	.93	.76	.90	.60	.61	.65	.71	**.87**	
INE	1–7	5.37 (1.24)	.91	.78	.86	.52	.60	.55	.62	.62	**.88**

Note: STD = standard deviation; CR = composite reliability; AVE = average variance extracted; CA = Cronbach's alpha; INB = innovation behavior; IEI = individual entrepreneurial intention; PBC = perceived behavioral control; ITAC = IT unit absorptive capacity; EXO = external orientation; INE = information exchange; bold diagonal elements represent the square root of AVE.

Table 3. Construct correlations.

4.2 Testing the structural model

As pointed out earlier, we used structural equation modeling (PLS) to validate our research model. We applied bootstrapping with a sample of 3,000 to test the significance of the path coefficients. Our model supports the hypothesized positive effects of individual entrepreneurial intention and perceived behavioral control (H1a, H1b) on innovation behavior (see Figure 2[3]). We also found support for the direct effect of IT unit absorptive capacity on individual entrepreneurial intention and perceived behavioral control (H2a, H2b). Our model could also validate the relationship and significant influence of external orientation and information exchange on the IT unit absorptive capacity.

Hypotheses H1a ($\beta = .314$, $p > .001$) and H1b ($\beta = .424$, $p > .001$) were confirmed by the model estimations. Therefore, we can state that individual entrepreneurial intention and perceived behavioral control positively influence the innovation behavior of IT department employees. Hypothesis H1c ($\beta = .352$, $p > .001$) is also statistically supported by our model. Hence, we state that perceived behavioral control positively influences individual entrepreneurial intention. The influence of IT unit absorptive capacity on individual entrepreneurial intention was tested to be significant, supporting H2a ($\beta = .415$, $p > .001$), as was the positive influence on perceived behavioral control, backing H2b ($\beta = .720$, $p > .001$). The statistically significant influence of external orientation and information exchange is also supported by

[3] The coefficients for the direct effects of external orientation and information exchange on individual entrepreneurial intention and perceived behavioral control as well as the mediating effects of IT unit absorptive capacity are presented in Table 4 and were left out of Figure 2 to increase the comprehensibility and reduce the complexity of the figure.

our data. Therefore, we state that external information, H3a (β = .536, p > .001), as well as information exchange, H3b (β = .289, p > .001), positively influence IT absorptive capacity.

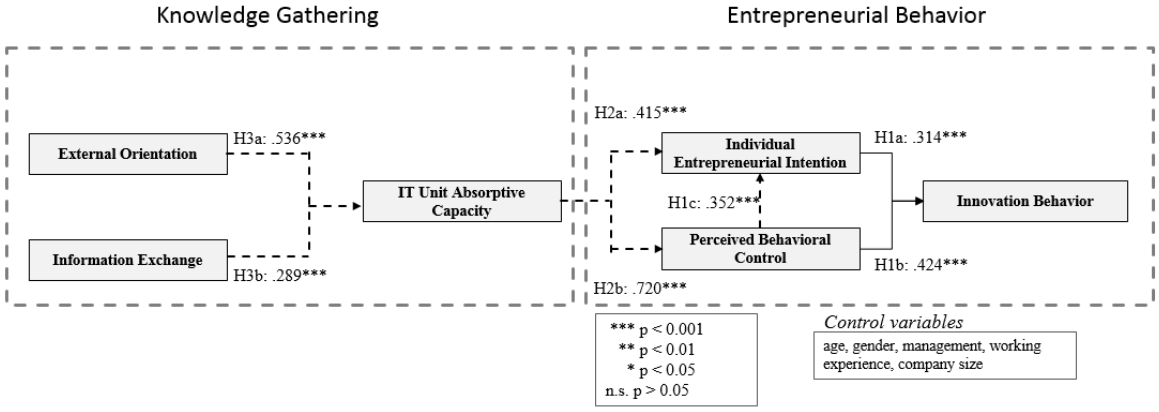

Figure 2. Results.

4.3 Mediation analyses

As also tested our model for the hypothesized mediating effect of IT absorptive capacity. To this end, we followed the procedures of Baron and Kenny (1986), which require the fulfillment of three conditions. To verify the mediating effect, the first condition is that the independent variable (IV) must account for variations in the dependent variable (path c). As a second condition, the variation in the mediator to the dependent variable (path b) must be significant. The final condition is that there must be significant variation in the IV to the mediator (path b). If all three conditions are met and there is a smaller effect of the IV on the dependent variable while checking for the mediation (path c') compared to path c, there is mediation present. To determine whether this mediation is partial or full, we must establish whether path c' is insignificant; we will have a full mediation if path c' is statistically insignificant and otherwise a partial mediation (Baron and Kenny, 1986). To test the significance of the mediation, we performed the Sobel test (Sobel, 1982), checking the indirect effects to assess whether inserting the mediator into the model decreases the IV's effect. We present our results in *Table 4*. Finally, we verified the strength and significance of the indirect effect, following Preacher and Hayes (2004), by bootstrapping the indirect path. All results verify our findings, with p < .001 for the indirect effect of the mediation analysis.

Hypotheses	IV	DV	MV	Model II			Model I	Sobel's Test	Mediation
				a	b	c'	c	Z	
M1	EXO	IEI	ITAC	.714***	.476***	.272***	.612***	6.329 ***	Partial
M2	EXO	PBC	ITAC	.714***	.528***	.269***	.646***	4.197 ***	Partial
M3	INE	IEI	ITAC	.621***	.554***	.189***	.536***	6.746 ***	Partial
M4	INE	PBC	ITAC	.621***	.612***	.174***	.557***	2.418 ***	Partial
Note: IV = independent variable; DV= dependent variable; Model I: without controlling for the mediator (EI); Model II: with controlling for the mediator; Path a: IV -> mediator; Path b: mediator -> DV; Paths c and c': IV-> DV; * p < .05; ** p < .01; *** p < .001.									

Table 4. Mediation analyses.

5 Discussion and Implications

Due to the increasing penetration of IT into everyday life (Yoo, 2010), the role of IT in businesses is changing. When businesses innovate their products, services, or business models, they must deal more and more with IT, no matter the industry to which they belong (Nambisan, 2013). To meet this challenge,

IT departments and their employees must therefore contribute to business innovations. However, the innovation ecosystem has recently been reported to be changing. The emergence of digital eco-systems and platforms creates an innovation climate in which collaboration and co-creation with various external partners and customers – openness – is necessary (El Sawy and Pereira, 2013). This use of external innovation sources, however, has been attributed as having the potential to hinder internal innovativeness. Such a development is extremely dangerous; in times when IT innovations have become a differential factor in competition, it is necessary for firms to keep or develop internal IT-innovation competence to avoid being disrupted from the market. Furthermore, in digital ecosystems, collaboration partners are often also competitors (Henningsson and Hedman, 2014). Sole reliance on the innovative power of external partners is therefore a risky endeavor.

In this paper, we conducted a survey with 354 employees of IT departments in non-IT firms to investigate how openness toward the external environment and the absorptive capacity of the IT unit, both as perceived by the individual, influence the innovativeness of IT professionals. Our findings indicate that openness toward the external environment, i.e., customers, suppliers, competitors, and reciprocal information exchange with partners, has a positive and significant influence on the IT unit's absorptive capacity. This is in line with prior research on the antecedents of absorptive capacity (Lane et al., 2006). Bidirectional learning from external sources increases not only the knowledge stock but also the capability to transform the external knowledge for the firm's own commercial purposes. As the mediation analysis (see *Table 4*) indicates, information exchange and the external orientation are partially mediated by the IT unit's absorptive capacity. This hints at the particular importance of absorptive capacity when dealing with external sources in the innovation process. While in general open innovation has been found to have positive effects on innovation outcomes in recent works (e.g., Davey et al., 2010), its impact on internal innovativeness was rather unclear in prior literature (e.g., Laursen and Salter, 2006). Our findings indicate, in line with Chesbrough (2003), that the external knowledge accessed by openness fosters innovations from internal departments and employees. The more developed a department's absorptive capacity is, the more this seems to be true for the respective department – IT in our case. The mediating effect indicates that access to external knowledge is just one part of the story. Particularly when this knowledge comes from diverse and distant sources and is thus fundamentally different – as is increasingly the case for digital innovations (Yoo et al., 2012) – the ability to integrate, translate, and learn from it becomes essential to profiting from open innovation (Salter et al., 2014). Absorptive capacity by itself was found to positively influence both individual entrepreneurial intention as well as perceived behavioral control. Hence, IT professionals are motivated to act in an entrepreneurial way and feel an increased ability to do so if there is a high level of absorptive capacity in the IT department. This might be explained as follows: Entrepreneurial behavior of employees is a creative process whereby knowledge from external sources must be integrated with the individual's creative ideas to actually induce business innovations (Lane et al., 2006; Sambamurthy et al., 2003). The openness of the organization increases the knowledge inflow, which in turn is amplified or receives an "added value" through absorptive capacity. When this valuable and enhanced knowledge reaches the employee, he or she feels empowered to act in an entrepreneurial way because his perception of market opportunities is increased. Consequently, the employee might sense increased prospects for acting entrepreneurially and an enhanced probability of being successful with it. As suggested by prior literature (Ajzen, 1991), we found individual intention and perceived behavioral control to positively influence actual individual behavior. Our findings also support the positive influence of perceived behavioral control on the individual's intention. Nevertheless, our findings indicate that there could be additional factors to consider when it comes to entrepreneurial behavior, such as the incentives a firm employs to motivate IT entrepreneurial behavior (see Kruep et al., 2014).

In sum, we can negate a negative impact of external orientation on internal innovativeness (West and Bogers, 2014) – at least for our context. On the contrary, external information and knowledge seem to fuel the innovativeness of the employees or "feed the internal innovation machine", especially if the IT unit has developed a high level of absorptive capacity. Thus, we provide more clarity to the relationship between external and internal sources of innovation. Moreover, our study has important implications for

the information systems research community. We are among the first to investigate the influence of firm openness on internal IT innovations. As described in the background section, openness will be an essential part of future digital innovation ecosystems. However, as prior research has revealed, this aspect may also have negative consequences on internal innovativeness. With our research we reveal an important contingency when it comes to profiting from openness: the absorptive capacity of the IT department. However, future research should also investigate the influence of other organizational and individual factors on the ability to bridge the gap between external and internal innovation. Furthermore, the impact of different approaches to digital business strategy (Bharadwaj et al., 2013) on the innovation activities of IT departments is of particular interest.

Our study has also implications for practitioners. If business managers want to spur IT innovations, opening up the innovation channel is a good idea. They should support interaction with diverse stakeholders. Moreover, they should support reciprocal information exchange. However, the aim of openness should always be to benefit internal innovativeness because it is the source of future profits. Therefore, it is not enough to just be open; to achieve the best possible effects on the innovativeness of IT departments and their employees, they should foster the department's absorptive capacity.

6 Limitations

This paper provides insights into the importance of external knowledge within the firm's internal innovation process. However, we must mention some limitations. First, the study was conducted in Western Europe. Therefore, cultural impacts from other regions are not considered in this study. As pointed out by prior research (e.g., Lee and Peterson, 2000), regional and cultural factors (e.g., power distance, uncertainty avoidance) influence entrepreneurial orientation. Moreover, the sample includes a large proportion of respondents in the age range of 26 to 45. These sample characteristics may reduce the generalizability of our findings. To address this limitation, further research should validate our findings in other cultural areas and with a sample balanced across all ages. We further encourage researchers to find moderating effects on the knowledge-gathering process, thus extending our model. Here, especially in innovation contexts, the role of cross-functional integration mechanisms (e.g., Jansen et al., 2005) should be further investigated, which would help practitioners support their employees in this area. Second, as prior literature suggests (e.g., West and Bogers, 2014), there would have been several other possibilities for the operationalization of the obtaining and interaction phases of open innovation. As described above, we chose one specific construct for each phase to keep the model simple. Here, future research could investigate the influence of other constructs and thus test the reliability of our findings.

7 Conclusion

In the future, if businesses innovate, IT will play a substantial role. Furthermore, innovating with IT will most likely imply opening up the innovation channel and collaborating with various kinds of external partners as digital platforms and ecosystems arise. According to prior research, emphasizing external innovation collaboration bears the risk of inhibiting internal innovations. Business managers are thus confronted with a dilemma: On the one hand, they must collaborate with external partners on IT innovations; on the other hand, they need to build the entrepreneurial role of their IT departments and their respective employees. Therefore, the question arises of how the focus on external innovation sources and the emphasis on the internal innovativeness of IT professionals relate to each other. With our empirical analysis, we provide evidence that openness fosters the entrepreneurial behavior of IT workers. However, this impact is amplified by the absorptive capacity of the IT unit. With this capability, valuable external knowledge can be integrated, thus driving both IS professionals' motivation to act entrepreneurially and their perceived ability to do so. Our study therefore implies that managers should support openness to gather external knowledge from various sources and foster the absorptive capacity of the respective IT unit to be best prepared for future challenges in IT innovation.

References

Ajzen, I. (1991). "The theory of planned behavior." *Organizational Behavior and Human Decision Processes* 50 (2), 179-211.

Amo, L. W. and L. Kolvereid (2005). "Organizational Strategy, Individual Personality and Innovation Behavior." *Journal of Enterprising Culture* 13 (1), 7-19.

Anderson, J. C. and D. W. Gerbing (1988). "Structural equation modeling in practice: A review and recommended two-step approach." *Psychological Bulletin* 103 (3), 411-423.

Armstrong, P., Harchaoui, T., Jackson, C. and F. Tarkhani (2002). "A Comparison of Canada-US Economic Growth in the Information Age, 1981-2000: The Importance of Investment in Information and Communication Technologies." *Economic Research Paper Series, Statistics Canada.*

Bamberg, S. (1999). "Umweltschonendes Verhalten–eine Frage der Moral oder der richtigen Anreize." *Zeitschrift für Sozialpsychologie* 30 (1), 57-76.

Baron, R. M. and D. A. Kenny (1986). "The moderator-mediator variable distinction in social psychological research: Conceptual, strategic and statistical considerations." *Journal of Personality and Social Psychology* 510 (6), 1173-1182.

Bharadwaj, A., El Sawy, O. A., Pavlou, P. A. and N. Venkatraman (2013). "Digital business strategy: toward a next generation of insights." *MIS Quarterly* 37 (2), 471-482.

Bhattacherjee, A. and G. Premkumar (2004). "Understanding changes in belief and attitude toward information technology usage: A theoretical model and longitudinal test." *MIS quarterly* 28 (2), 229-254.

Brown, S. A. and V. Venkatesh (2005). "Model of adoption of technology in households: A baseline model test and extension incorporating household life cycle." *MIS Quarterly* 29 (3), 399-426.

Bucherer, E., Eisert, U. and O. Gassmann (2012). "Towards systematic business model innovation: Lessons from product innovation management." *Creativity and Innovation Management* 21 (2), 183-198.

Burgelman, R. A. (1983). "Corporate entrepreneurship and strategic management: Insights from a process study." *Management Science* 29 (12), 1349-1364.

Carsrud, A., and M. Brännback (2011). "Entrepreneurial Motivations: What Do We Still Need to Know?" *Journal of Small Business Management* 49 (1), 9–26

Chesbrough, H. W. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Boston: Harvard Business Press.

Chin, W. W. (1998). "The partial least squares approach for structural equation modeling." *Modern Methods for Business Research*. London: Psychology Press.

Chung, L. H. and P. T. Gibbons (1997). "Corporate entrepreneurship: The roles of ideology and social capital." *Group and Organization Management* 22 (1), 10-30.

Cohen, W. M. and D. A. Levinthal (1990). Absorptive capacity: a new perspective on learning and innovation. *Administrative science quarterly* 35 (1), 128-152.

Covin, J. G., and D. P. Slevin (1991). "A conceptual model of entrepreneurship as firm behavior." *Entrepreneurship theory and practice* 16 (1), 7-25.

Dahlander, L. and D. M. Gann (2010). "How open is innovation?" *Research Policy* 39 (6), 699-709.

Davey, S. M., Brennan, M., Meenan, B. J. and R. McAdam (2010). "The Health of Innovation: Why Open Business Models Can Benefit the Healthcare Sector." *Irish Journal Of Management* 30 (1), 21-40.

De Jong, J. P. J., Parker, S. K., Wennekers, S. and C. Wu (2011). "Corporate entrepreneurship at the individual level: Measurement and determinants." *EIM Research Reports*. Zoetermeer: EIM.

Edelman, L. F., Brush, C. G., Manolova, T. S. and P. G. Greene (2010). "Start-up Motivations and Growth Intentions of Minority Nascent Entrepreneurs." *Journal Of Small Business Management* 48 (2), 174-196.

El Sawy, O.A. and F. Pereira (2013). "Digital Business Models: Review and Synthesis." In: *Business Modelling in the Dynamic Digital Space, SpringerBriefs in Digital Spaces*, pp. 13-20.

Faems, D., de Visser, M., Andries, P. and B. van Looy (2010). "Technology Alliance Portfolios and Financial Performance: Value-Enhancing and Cost-Increasing Effects of Open Innovation." *Journal Of Product Innovation Management* 27 (6), 785-796.

Fishbein, M. and I. Ajzen (1975). *Belief, attitude, intention, and behavior: An introduction to theory and research.* Ontario: Addison-Wesley Pub. Co.

Floyd, S.W. and P. J. Lane. (2000). "Strategizing throughout the organization: Managing strategic renewal and strategic role conflict." *Academy of Management Review* 25 (1), 154–177.

Fornell, C. and D. F. Larcker (1981). "Structural Equation Models With Unobservable Variables and Measurement Errors." *Journal of Marketing Research* 18 (2), 39-50.

Gefen, D. and D. Straub (2005). "A Practical Guide to Factorial Validity Using PLS-Graph: Tutorial and Annotated Example." *Communications of the Association for Information Systems* 16 (1), 91-109.

Gregory, R.W., Ruch, T.J., Kaganer, E. and O. Henfridsson (2014) "Toward Everyone's IT: A Study of Consumerization at GlobalBankCorp." In: Proceedings of the *74th Annual Meeting of the Academy of Management.*

Guillemette, M. G. and G. Paré (2012). "Toward a new theory of the contribution of the IT function in organizations." *MIS Quarterly* 36 (2), 529-551.

Hardesty, D.M. and W. O. Bearden (2004). "The Use of Expert Judges in Scale Development: Implications for Improving Face Validity of Measures of Unobservable Constructs." *Journal of Business Research* 57 (2), 98-107.

Henderson, J. C. and N. Venkatraman (1993). "Strategic Alignment: Leveraging Information Technology for Transforming Organizations." *IBM Systems Journal* 32 (1), 4-16.

Henningsson, S. and J. Hedman (2014). "Transformation of Digital Ecosystems: The Case of Digital Payments." *Information and Communication Technology* 84 (7), 46-55.

Hotho, J. J., Becker-Ritterspach, F. and A. Saka-Helmhout (2012). "Enriching Absorptive Capacity through Social Interaction." *British Journal Of Management* 23 (3), 383-401.

Jalava, J. and M. Pohjola (2001). "Economic Growth in the New Economy: Evidence from Advanced Economies." *Information Economics and Policy* 14 (2), 189-210.

Jansen, J. J., Van Den Bosch, F. A., and H. W. Volberda (2005). "Managing potential and realized absorptive capacity: how do organizational antecedents matter?" *Academy of Management Journal 48* (6), 999-1015.

Kautonen, T., Van Gelderen, M. and E. T. Tornikoski (2013). "Predicting entrepreneurial behaviour: a test of the theory of planned behaviour." *Applied Economics 45* (6), 697-707.

Kim, S. (2002). *The Digital Economy and the Role of Government: Information Technology and Economic Performance in Korea*. White Paper, Program on Information Resources Policy. Harvard University.

Kinnamon, E. and F. Fabian (2010). *A Model of Employee Innovation Behavior: When Organizational Initiatives Do Not Add Up*. Academy of Management, Montreal, Canada.

Krueger Jr, N. F., Reilly, M. D. and A. L. Carsrud (2000). "Competing models of entrepreneurial intentions." *Journal of business venturing 15* (5), 411-432.

Kruep, H., Kranz, J. and L. M. Kolbe (2014). "It's not for the money; it's the motives – The mediating role of endogenous motivations on IT employees' entrepreneurial behavior.". In: *Proceedings of the International Conference on Information Systems (ICIS)*, Auckland, New Zealand.

Kuratko, D. F. and D. B. Audretsch (2009). "Strategic entrepreneurship: exploring different perspectives of an emerging concept." *Entrepreneurship Theory and Practice* 33 (1), 1-17.

Lane, P. J., Koka, B. R. and S. Pathak (2006). "The reification of absorptive capacity: A critical review and rejuvenation of the construct." *Academy Of Management Review* 31 (4), 833-863.

Laursen, K. and A. Salter (2006). "Open for innovation: the role of openness in explaining innovation performance among UK manufacturing firms." *Strategic Management Journal* 27 (2), 131-150.

Lee, S. M., and S. J. Peterson (2000). "Culture, entrepreneurial orientation, and global competitiveness." *Journal of world business* 35 (4), 401-416.

Leidner, D. E., Preston, D. and D. Chen (2010). "An examination of the antecedents and consequences of organizational IT innovation in hospitals." *Journal of Strategic Information Systems* 19 (3), 154–170.

Lichtenthaler, U. and E. Lichtenthaler (2009). "A Capability-Based Framework for Open Innovation: Complementing Absorptive Capacity." *Journal Of Management Studies 46* (8), 1315-1338.

Lichtenthaler, U. (2011). "Open Innovation: Past Research, Current Debates, and Future Directions." *Academy Of Management Perspectives* 25 (1), 75-93.

Lindell, M. K. and D. J. Whitney (2001). "Accounting for common method variance in cross-sectional research designs." *Journal of Applied Psychology* 86 (1), 114-121.

Love, J. H., Roper, S. and P. Vahter (2014). "Learning from openness: The dynamics of breadth in external innovation linkages." *Strategic Management Journal* 35 (11), 1703-1716.

Merali, Y., Papadopoulos, T. and T. Nadkarni (2012). "Information systems strategy: Past, present, future?" *The Journal of Strategic Information Systems* 21 (2), 125-153.

Melville, N., Kraemer, K. and V. Gurbaxani (2004). "Information technology and organizational performance: an integrative model of it business value." *MIS Quarterly* 28 (2), 283-322.

Moore, G. C. and I. Benbasat (1991). "Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation." *Information Systems Research* 2 (3), 192-222.

Nambisan, S. (2013). "Information Technology and Product/Service Innovation: A Brief Assessment and Some Suggestions for Future Research." *Journal Of The Association For Information Systems* 14 (4), 215-226.

Newey, L. (2010). Wearing different hats: how absorptive capacity differs in open innovation. *International Journal of Innovation Management* 14 (4), 703-731.

Niehaves, B., Köffer, S. and K. Ortbach (2012). "IT Consumerization – A Theory and Practice Review."In: *Proceedings of the Eighteenth Americas Conference on Information Systems*. Seattle, Washington.

Oulton, N. (2002). "ICT and Productivity Growth in the UK." *Oxford Review of Economic Policy* 18 (3), 363-379.

Parham, D., Roberts, P. and H. Sun (2001). "Information Technology and Australia's Productivity Surge." Staff Research Paper, *Productivity Commission*, Aus Info, Canberra, Australia.

Pavlou, P. A., and M. Fygenson (2006). "Understanding and predicting electronic commerce adoption: An extension of the theory of planned behavior". *MIS Quarterly* 30 (1), 115-143.

Pavlou, P. A., and O. A. El Sawy (2006). "From IT leveraging competence to competitive advantage in turbulent environments: The case of new product development." *Information Systems Research*, 17 (3), 198-227.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y. and N. P. Podsakoff, (2003). "Common method biases in behavioral research: A critical review of the literature and recommended remedies." *Journal of Applied Psychology* 88 (5), 879-903.

Preacher, K. J. and A. F. Hayes (2004). "SPSS and SAS procedures for estimating indirect effects in simple mediation models." *Behavior Research Methods, Instruments, & Computers* 36 (4), 717 – 731

Queiroz, M and T. Coltman (2014). "Reorienting the Information Systems Function to Support Increasing Levels of Business Service." In: *Proceedings of the Thirty Fifth International Conference on Information Systems (ICIS)*, Auckland, New Zealand.

Rai, A., Pavlou, P. A., Im, G. and S. Du (2012). "Interfirm IT Capability Profiles and Communications for Cocreating Relational Value: Evidence from the Logistics Industry." *MIS Quarterly* 36 (1), 233-A5.

Ringle, C. M., Wende, S. and A. Will (2005). *Smartpls*. Hamburg: SmartPLS.

Roberts, N., Galluch, P. S., Dinger, M. and V. Grover (2012). "Absorptive Capacity and Information Systems Research: Review, Synthesis, and Directions for Future Research." *MIS Quarterly* 36 (2), 625-A6.

Ruch, T.J.and R. W. Gregory (2014). "Consumerization of IT – Where is the Theory?" In: Proceedings of *the 18th Pacific Asia Conference on Information Systems (PACIS*). Chengdu, China.

Salge, T. O., Bohné, T. M., Farchi, T. and E. P. Piening (2012). "Harnessing the value of open innovation: the moderating role of innovation management." *International Journal of Innovation Management* 16 (3), 1-26.

Salter, A., Criscuolo, P. and A. J. Ter Wal (2014). "Coping with Open Innovation: Responding to the Challenges of External Engagement in R&D." *California Management Review*, *56* (2), 77-94.

Sambamurthy, V., Bharadwaj, A. and V. Grover (2003). "Shaping Agility through Digital Options: Reconceptualizing the Role of Information Technology in Contemporary Firms." *MIS Quarterly* 27 (2), 237-263.

Sobel, M. (1982). "Asymptotic intervals for indirect effects in structural equation models." *Sociological methodology* 13, 290-312.

Tortoriello, M. (2006). "The social underpinnings of absorptive capacity: external knowledge, social networks, and individual innovativeness." *Academy Of Management Annual Meeting Proceedings*.

Van der Wiel, H. (2001). *Does ICT Boost Dutch Productivity Growth?* Den Haag: CPB Netherlands Bureau for Economic Policy Analysis.

Venkatesh, V. and S. A. Brown (2001). "A longitudinal investigation of personal computers in homes: Adoption determinants and emerging challenges." *MIS Quarterly* 25 (1), 71-102.

Venkatesh, V., Morris, M. G., Davis, G. B. and F. D. Davis, (2003). "User acceptance of information technology: toward a unified view." *MIS Quarterly* 27 (3), 425-478.

Vu, K. (2004). *Measuring the Impact of ICT on Economic Growth: An International Comparative Perspective.* Program on Technology and Economic Policy, Kenney School of Government. Harvard University.

Watts, S. and J. C. Henderson (2006). "Innovative IT climates: CIO perspectives." *Journal of Strategic Information Systems* 15 (2), 125-151.

Weigelt, C. and M. B. Sarkar (2012). "Performance implications of outsourcing for technological innovations: managing the efficiency and adaptability trade-off." *Strategic Management Journal* 33 (2), 189-216.

West, J. and M. Bogers (2014). "Leveraging External Sources of Innovation: A Review of Research on Open Innovation." *Journal Of Product Innovation Management* 31 (4), 814-831.

Xu, S., Wu, F. and E. Cavusgil (2013). "Complements or Substitutes? Internal Technological Strength, Competitor Alliance Participation, and Innovation Development Complements or Substitutes? Internal Technological Strength, Competitor Alliance Participation, and Innovation Development." *Journal Of Product Innovation Management* 30 (4), 750-762.

Yoo, Y. (2010). "Computing in everyday life: a call for research on experiential computing." *MIS Quarterly* 34 (2), 213-231.

Yoo, Y., Boland Jr., R. J., Lyytinen, K., and A. Majchrzak (2012). "Organizing for Innovation in the Digitized World." *Organization Science 23* (5), 1398-1408.

Zahra, S. A. and G. George (2002). "Absorptive capacity: A review, reconceptualization, and extension." *Academy of management review* 27 (2), 185-203.

Zahra, S. A., Hayton, J. C. and C. Salvato (2004). "Entrepreneurship in family vs. non-family firms: A resource-based analysis of the effect of organizational culture." *Entrepreneurship Theory and Practice* 28 (4), 363–381.