What Makes Firms Innovative?

The Role of External Social Networks and Internal Knowledge Capabilities for Innovation Success

Bernhard Moos

2015

Dedicated to my family

Foreword by Prof. Dr. Tim Weitzel

Peter Drucker was fond of saying that "*Innovation is the specific instrument of entrepreneurship...the act that endows resources with a new capacity to create wealth.*" But, to borrow the title of this thesis, what makes firms innovative?

Dr. Bernhard Moos takes a network perspective to tackle this eternal question. The network metaphor is widespread and probably among the most used images of the past century. Research on innovation *diffusion* networks, for instance in the marketing sciences or Information Systems literature, has become quite mature (e.g., Rogers 2003; Weitzel et al. 2003). But creating sustainable firm-level innovativeness remains a tough theoretical and managerial challenge. There is no scarcity of observations that a firm's innovativeness is related to the business network it is embedded in. The Economist writes that "*Procter & Gamble tries to get half of its innovations from outside its own labs. Microsoft works closely with a network of 750,000 small companies around the world.*" (Economist 2009). Yet transcending the multitude of singular observations into an embracing theoretical understanding that allows to suggest systematic innovation governance approaches and derive managerial interventions makes this book such a captivating read.

Embracing the extant literature on innovation and knowledge management, the theoretical core of the analysis is an explicit theoretical model of the interplay of the external network, operationalized as a firm's social capital, and its internal knowledge capabilities, operationalized as a firm's absorptive capacity. To the delight of Henry Ford, who was skeptical to rely on customers alone when looking for innovation ("*If I had asked my customers what they wanted, they would have said faster horses*"), Dr. Moos looks for the sources of innovativeness in a firm's network neighborhood that consists of vertical (customers and suppliers), horizontal (trade associations) and lateral partners (R&D partners) and also individual-level accidental relationships (friendship communities). This is a challenging endeavor. But Dr. Moos succeeds in developing a theoretically and empirically convincing innovativeness model that is both intellectually challenging and managerially useful. Among others, he can show that, indeed, innovativeness is contagious (Moos et al. forthcoming), that besides customers R&D partners in particular can be valuable sources of different types of knowledge and how Knowledge Management Systems support innovativeness (Moos et al. 2013).

Gary Hamel remarked that "*(m)ost of us understand that innovation is enormously important. It's the only insurance against irrelevance. It's the only guarantee of long-term customer loyalty. It's the only strategy for out-performing a dismal economy.*" This book is a must-read for anyone interested in innovation research and how a firm can keep on

innovating to design the future. After all, none other than Gene Roddenberry suggested "*It isn't all over; everything has not been invented; the human adventure is just beginning.*"

Prof. Dr. Tim Weitzel

(Bamberg, March 2015)

References

Economist (2009). Global Heroes. http://www.economist.com/specialreports/displaystory.cfm?story_id=13216025, Mar 12th 2009.

Moos, B., Beimborn, D., Wagner, H.-T., and Weitzel, T. (2013). The Role of Knowledge Management Systems for Innovation: An Absorptive Capacity Perspective. *International Journal of Innovation Management*, 17(05), 1350019.

Moos, B., Wagner, H.-T., Beimborn, D., and Weitzel, T. (forthcoming). The Contagious Power of Innovativeness: How Different Corporate Partners Contribute to a Firm's Knowledge. *International Journal of Innovation Management.*

Rogers E.M. (2003). Diffusion of innovations. Simon & Schuster Ltd: London.

Weitzel, T., Wendt, O., von Westarp, F., and König, W. (2003). Network Effects and Diffusion Theory - Extending Economic Network Analysis. *The International Journal of IT Standards & Standardization Research*, 1(2), pp. 1-21.

Foreword by Prof. Dr. Heinz-Theo Wagner

Innovation is a topic that gains significant interest in academia and practice alike. Innovation is crucial in most industries and seen as a distinguishing driver of firms' growth, competitiveness, and organizational survival. Innovation is therefore a relevant object for strategic considerations including internationalization of research and development, and open innovation. Correspondingly, expenditure for innovation-related activities such as research and development accounts for large parts of the investment budget of firms. These investments are related to the high expectations and hopes regarding the value innovation activities are supposed to deliver. Consequently, researchers have investigated the antecedents, nature, and effects of innovation and produce an increasing number of publications in top journals. Key insights over decades of innovation research reveal that a firm's knowledge stock as well as a firm's ability to manage knowledge are at the heart of innovation and are seen as strategic resources.

But, despite decades of academic research and acknowledging the importance of knowledge and its exchange and recombination for most companies, the sources of innovation success is the subject of debate and controversy in theory and practice for many years now. In this respect, the connection between networks and a firm's innovative capabilities plays a central role in research and has been addressed by a number of studies. However, our understanding how a firm might benefit from its external network is limited. In particular, mainly one open issue can be identified: the unclear interplay of external networks and firm-internal capabilities and their differential effect on innovation success.

Reflecting this challenge, the thesis of Dr. Bernhard Moos aims at theoretically evaluating and empirically validating what makes a firm innovative. Corresponding to the challenging task of his thesis, Dr. Bernhard Moos analyzes recent research on networks, knowledge and the ability to manage knowledge. The author builds his work on an original combination of the absorptive capacity and social capital theory, applied at an organizational level of analysis and focusing on the interactions between a focal firm and its network. This approach has found only slight attention in most parts of the literature so far. The procedure makes it evident which factors in which constellation contribute to the innovativeness of firms and to the acquisition of market advantages. To validate the relationship between the various factors and innovativeness, an empirical study among Germany's top 2,500 manufacturing companies was conducted.

This unique combination enables Dr. Bernhard Moos, and from now on also the scientific community, to more clearly understand the interplay of firm-internal knowledge ca-

pabilities and a firm's external network. The work captivates by its methodologically elaborate and clear structure that fully meets the requirements of current research literature and by the sound analysis of a large number of evaluated literature contributions. Furthermore, the quality of collected data, the test of numerous hypotheses, and the combination of model building and a survey within this cumulative dissertation is exceptionally remarkable, contributing to an improved understanding of a firm's innovativeness and offering great building blocks for further research to the scientific community.

The research results of Dr. Bernhard Moos provide a solid fundament to a more sophisticated understanding of the transmission process from firm-internal knowledge capabilities and external networks to innovation success. This dissertation is a must read for anyone who is interested in the innovativeness of firms as it identifies the interplay of internal and external factors and its influence on innovation success, and provides valuable concepts of how to manage the innovation arena.

Prof. Dr. Heinz-Theo Wagner

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Zusammenfassung

Innovationen, verstanden als eine einzigartige und superiore Kombination von Wissen, verschaffen einem innovierenden Unternehmen einen Vorsprung gegenüber dessen Wettbewerbern (Schumpeter 1934) und tragen somit zum Fortbestehen eines Unternehmens am Markt durch dessen evolutionäre Fitness bei (Crossan and Apaydin 2010). Folglich ist das kontinuierliche Innovieren für den Markterfolg eines Unternehmens unabdingbar (Schumpeter 1934), wobei diesem zur Schaffung von Innovationen drei Strategien zur Verfügung stehen: Reine unternehmensinterne Forschung und Entwicklung, reiner Bezug von externen Technologien oder eine Kombination beider Strategien (Cassiman and Veugelers 2006). Speziell letztere erweist sich als erfolgversprechendste Strategie (Cassiman and Veugelers 2006). Dies liegt mitunter an dem heutigen hoch kompetitiven Wettbewerbsumfeld und an dem hohen Technologiegrad der Produkte und Prozesse eines Unternehmens, so dass das unternehmensintern vorhandene Wissen zur Schaffung von Innovationen meist nicht ausreicht und somit um unternehmensexternes Wissen ergänzt werden muss (Berchicci 2013; Cassiman and Veugelers 2006). Dementsprechend hat in jüngster Vergangenheit innerhalb der Unternehmen ein Wandel von einer monolithischen Struktur der reinen unternehmensinternen Forschung und Entwicklung hin zu einer offenen Struktur stattgefunden, welche es Unternehmen erlaubt, externe Wissensquellen aktiv in den Innovationsprozess mit einzubinden (Berchicci 2013). Diese Vorgehensweise zur Schaffung von Innovationen wird als Open Innovation bezeichnet und geht auf Chesbrough (2003) zurück.

Während sich die ersten Arbeiten zu Open Innovation und interorganisationalem Wissenstransfer primär auf den reinen Wissensaustausch konzentrierten, fordern jüngere Arbeiten eine weiter gefasste Perspektive, welche die unternehmensinterne Integration und Transformation des extern erworbenen Wissens zur Schaffung von Innovationen berücksichtigt (Easterby-Smith *et al.* 2008). Der zu Grunde liegende Gedanke, welcher auch gleichzeitig eine Leithypothese dieser Arbeit ist, ist der, dass ein Unternehmen nur mit Hilfe von unternehmensinternen Wissensverarbeitungsfähigkeiten in der Lage ist, von seinem Netzwerk verstanden als Quelle für innovationsrelevantes Wissen zu profitieren (Fosfuri and Tribo 2008; Salge *et al.* 2012). Diese internen Fähigkeiten wurden aber bislang nur unzureichend betrachtet (Huizingh 2011), so dass der Ruf nach deren theoretischen und empirischen Untersuchung vermehrt aufkam (Lichtenthaler 2011). Diese Dissertation nimmt sich diesem Ruf an und untersucht neben der detaillierten Betrachtung von interorganisationalen Netzwerken und unternehmensinternen Wissensverarbeitungsfähigkeiten auch deren wechselseitige Beziehung zur Generierung von Innovationserfolg. Entsprechend werden drei konkrete Forschungsziele verfolgt:

- **Interorganisationale Netzwerke**: Wie beeinflusst ein mehrere Partnertypen umfassendes interorganisationales Netzwerk den unternehmerischen Wissensstand?
- **Unternehmensinterne Wissensverarbeitungsfähigkeiten**: Wie und in welchem Ausmaß tragen unternehmensinterne Wissensverarbeitungsfähigkeiten zur Generierung von Innovationserfolg bei?
- **Zusammenspiel beider Faktoren**: Wie spielen interorganisationale Netzwerke und unternehmensinterne Wissensverarbeitungsfähigkeiten zur Generierung von Innovationserfolg zusammen?

Zur Beantwortung dieser Forschungsfragen werden acht meist veröffentlichte Artikel unter Verwendung eines empirisch-quantitativen Ansatzes herangezogen. Das Fundament für diesen Ansatz stellt eine Literaturrecherche dar, welche den bisherigen Stand des Wissens zur fragebogen-basierten Vermessung der Innovationsfähigkeit eines Unternehmens zusammenführt. Mit Hilfe dieser Erkenntnisse wurden Daten von 229 Unternehmen des deutschen produzierenden Gewerbes erhoben. Auf Grundlage dieser Daten wurden anschließend die unterschiedlichen Forschungsfragen unter Zuhilfenahme verschiedener theoretischer Konzepte, wie der Sozialkapitaltheorie (Nahapiet and Ghoshal 1998) oder den Konzepten der Aufnahme- und Umsetzungsfähigkeit – der sog. „Absorptive Capacity" (Cohen and Levinthal 1990) – sowie unter Verwendung von quantitativen Methoden insbesondere der Regressionsanalyse und der Strukturgleichungsmodellierung untersucht.

Besonders von Bedeutung für eine detaillierte Betrachtung des Effekts eines interorganisationalen Netzwerks auf den Wissensstand eines Unternehmens ist die Differenzierung des Netzwerks in verschiedene Partnertypen sowie die des Wissensstands in verschiedene Wissensdomänen. Ein Unternehmensnetzwerk umfasst dabei die Partnertypen *Kunden, Lieferanten, Entwicklungspartner, Verbände/Arbeitskreise* und – als individuelle, persönliche Verbindung verstanden - *außerberufliche Netzwerke der Mitarbeiter*. Die individuellen Beziehungen des Unternehmens werden dabei mithilfe der Sozialkapitaltheorie formal vermessen, was ein theoretischer Kern und Beitrag der vorliegenden Arbeit ist. Ferner wird der Wissensstand von den Wissensarten *Marktwissen, Technologiewissen, organisatorisches Wissen, Prozess- und Produktwissen* abhängig gemacht. Auf Basis dieser beiden Differenzierungen lassen sich detailliertere Aussagen im Vergleich zu bisherigen Arbeiten über den Beitrag externer Partner zum Wissensstand eines Unternehmens treffen, wobei dieser Beitrag nicht nur an der Beziehungsgüte zu den externen Partnern, sondern auch an der Innovativität der Partner ausgemacht wird.

Hinsichtlich der unternehmensinternen Wissensverarbeitungsfähigkeiten betrachtet diese Arbeit die Aufnahmefähigkeit (externes Wissen der Partner dem eigenen hinzufügen können) und Umsetzungsfähigkeit (den Wissenstand aus internem und externem

Wissen tatsächlich umsetzen können) sowie den Einsatz von Wissensmanagementsystemen und die Ausübung einer Innovation-Governance in Form von gezielten Managementmaßnahmen. Die Ergebnisse belegen, dass alle drei Wissensverarbeitungsfähigkeiten einen wesentlichen Beitrag zum Innovationserfolg eines Unternehmens leisten. Speziell werden bisherige Forschungsarbeiten durch die Identifikation von Innovation-Governance und von Wissensmanagementsystemen als Treiber für Aufnahme- und Umsetzungsfähigkeit sowie durch das Aufzeigen der mediierenden Wirkung von Aufnahme- und Umsetzungsfähigkeit als Erklärung für den Einfluss von Wissensmanagementsystemen auf den Innovationserfolg erweitert.

Durch die gleichzeitige Betrachtung von interorganisationalen Netzwerken und unternehmensinternen Wissensverarbeitungsfähigkeiten zeigt die Arbeit deren Wechselwirkung zur Generierung von Innovationserfolg auf. So decken die Analysen auf, dass für die Wissensakquise von externen Partnern die Aufnahmefähigkeit eines Unternehmens unerlässlich ist, wohingegen der Einsatz von Wissensmanagementsystemen zur Verarbeitung des akquirierten Wissens vorteilhaft, aber auch nachteilhaft ist – in Abhängigkeit der Wissensquelle und der Domäne des akquirierten Wissens. Folglich kommt die Dissertation der bereits erwähnten Aufforderung bisheriger Arbeiten, nämlich einer Bereitstellung eines holistischen Models des interorganisationalen Wissenstransfers durch die Berücksichtigung der unternehmensinternen Wissensverarbeitungsfähigkeiten zur Integration des extern akquirierten Wissens, nach.

Die im Rahmen dieser Arbeit gewonnen Erkenntnisse tragen dabei auf vielfältige Weise zum Stand der Forschung bei. So werden theoretische und empirische Erklärungen für den Einfluss von interorganisationalen Netzwerken und unternehmensinternen Wissensverarbeitungsfähigkeiten sowie deren Zusammenspiel zur Generierung von Innovationserfolg dargestellt. Ferner wird ein Messmodell für die unternehmerische Innovationsfähigkeit vorgestellt. Dadurch erweitert diese Arbeit die Erkenntnisse auf den Gebieten der Forschung zu Aufnahme- und Umsetzungsfähigkeit, zu Open Innovation und zu Sozialkapital und Informationstechnologie im Innovationskontext.

Gleichermaßen bieten die Erkenntnisse Implikationen für die Praxis. Mit Blick auf die interorganisationalen Netzwerke lassen sich auf Basis der empirischen Ergebnisse konkrete Empfehlungen hinsichtlich der Partnerselektion ableiten. Darüber hinaus wird eine solide Grundlage für gezielte strategische Investitionen zum Aufbau von unternehmensinternen Wissensverarbeitungsfähigkeiten bereitgestellt. Beide Aspekte zusammen liefern der Praxis ein vollständiges Bild bezüglich der Generierung von Innovationserfolg unter Zuhilfenahme von externen Partnern und der internen Integration des erworbenen Wissens und helfen somit, die beabsichtigten Innovationsziele eines jeden Unternehmens zu erreichen.

Literaturverzeichnis

Berchicci, L. (2013). Towards an Open R&D System: Internal R&D Investment, External Knowledge Acquisition and Innovative Performance. *Research Policy*, 42(1), 117-127.

Cassiman, B. and Veugelers, R. (2006). In Search of Complementarity in Innovation Strategy: Internal R&D and External Knowledge Acquisition. *Management Science*, 52(1), 68-82.

Chesbrough, H. (2003). Open Innovation: The New Imperative for Creating and Profiting from Technology, Harvard Business School Press: Boston.

Cohen, W.M. and Levinthal, D.A. (1990). Absorptive Capacity: A New Perspective on Learning & Innovation. *Administrative Science Quarterly*, 35(1), 128-152.

Crossan, M.M. and Apaydin, M. (2010). A Multi-Dimensional Framework of Organizational Innovation: A Systematic Review of the Literature. *Journal of Management Studies*, 47(6), 1154-1191.

Easterby-Smith, M., Lyles, M.A., and Tsang, E.W.K. (2008). Inter-Organizational Knowledge Transfer: Current Themes and Future Prospects. *Journal of Management Studies*, 45(4), 677-690.

Fosfuri, A. and Tribo, J.A. (2008). Exploring the Antecedents of Potential Absorptive Capacity and It's Impact on Innovation Performance. *Omega*, 36(2), 173-187.

Huizingh, E.K.R.E. (2011). Open Innovation: State of the Art and Future Perspectives. *Technovation*, 31(1), 2-9.

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

Nahapiet, J. and Ghoshal, S. (1998). Social Capital, Intellectual Capital, and the Organizational Advantage. *Academy of Management Review*, 23(2), 242-266.

Salge, T.O., Farchi, T., Bohné, T.M., and Piening, E.P. (2012). Harnessing the Value of Open Innovation: The Moderating Role of Innovation Management. *International Journal of Innovation Management*, 16(03), 1240005.

Schumpeter, J.A. (1934). Theory of Economic Development, Harvard University Press: Cambridge, MA.

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INTRODUCTORY PAPER

What Makes Firms Innovative?

The Role of External Social Networks and Internal Knowledge Capabilities for Innovation Success

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1.   Introduction

1.1   Motivation and Objective of the Thesis

For decades research has consistently shown that innovation is an important driving force enabling firms to compete successfully (Schumpeter 1934) and is seen as one out of two basic functions of any business enterprise (Drucker 1955). Especially in today's dynamic economic environment, innovation is "widely recognized as being critical to the growth and competitiveness of organizations" (Baer 2012, p. 1102; compare also Crossan and Apaydin 2010) because innovation "in the form of a unique and superior combination of firm resources may introduce 'creative destruction' to the competitive landscape and bring considerable benefits to the innovating firm (Schumpeter 1934)" (He and Wang 2009, p. 920).

Accordingly, the overall research question this thesis addresses is: *What makes a firm innovative, or what ensures the respective success of its innovation?*

Innovation success is about the commercialization of a firm's innovation efforts (Joshi *et al.* 2010) and results from "the successful implementation of creative ideas, tasks, or procedures" (Cummings and Kiesler 2003, p. 297), i.e. the successful launch or adoption of new products/services or processes. Thereby, new products/services or processes can be of a radical or incremental nature. Radical innovations are mostly the result of applying new knowledge to develop completely new products/services or processes (Cardinal 2001) whereas incremental innovations refer to further developments of already existing products/services or processes by reconfiguring existing knowledge (Henderson and Clark 1990). Hence, a key insight over the years of innovation research is that the knowledge held by a firm – its knowledge stock – and especially what He and Wang (2009, p. 920) calls "innovative knowledge assets" as well as the capabilities to manage it – its knowledge capabilities – are the main driving forces of companies' innovation success (Hult *et al.* 2004) offering them the opportunity to increase their performance (Grant 1996b; Kogut and Zander 1992). Consequently, the knowledge stock and firm-internal knowledge capabilities due to their novel, tacit, and firm-specific character (He and Wang 2009), have become strategic resources (Alavi and Leidner 2001). Thus the exchange and combination of knowledge representing the core of innovative activities have become a central tenet of innovation research (e.g. Easterby-Smith *et al.* 2008; Henderson and Clark 1990).

Accordingly, this knowledge stock has been widely recognized in research (e.g. Kogut and Zander 1992; Spender and Grant 1996) and particularly in innovation research (e.g. Miller *et al.* 2007; Smith *et al.* 2005; Thornhill 2006), in which several different knowledge domains which each affect innovation success in different ways have been

identified (Li *et al.* 2011). Recent studies focus simultaneously on the domain of market and technological knowledge in the context of innovations (e.g., Lichtenthaler 2009; Maurer *et al.* 2011) to complement the established roles of each domain in response to De Luca and Atuahene-Gima (2007), who found a focus on market knowledge alone to be insufficient. Following Li et al.'s (2011, p. 167) call for research to "explore various types of knowledge on innovation" (compare also Easterby-Smith *et al.* 2008) and taking into account that "the simultaneous consideration of different types of knowledge in the context of inter-firm innovation collaboration has not yet received proper conceptual or empirical elaboration" (Sammarra and Biggiero 2008, p. 801), this thesis distinguishes between market and technological knowledge while also including the domain of product knowledge (knowledge employees have about the product landscape of their own organization), managerial knowledge (Sammarra and Biggiero 2008) in terms of the domains of organizational knowledge (knowledge about the organizational structure, functions, and organizational forms) and process knowledge (knowledge about the management and design of business processes).

Each knowledge domain of a company's knowledge stock can be increased by creating knowledge within the firm or by acquiring knowledge from outside (Amelingmeyer 2004; Cassiman and Veugelers 2006). In particular the latter plays an important role for companies. Taking into account the complexity of today's technology which drives economic performance, the "mythic image of the brilliant lone inventor" is not sustainable anymore (Rycroft and Kash 1999, p. 1) or, in other words, "few firms appear able to innovate alone" (de Jong and Freel 2010, p. 47). Instead companies open themselves and establish networks by setting up relationships to other companies instrumentally (Greve *et al.* 2010) such as inbound open innovation[1] (Lichtenthaler 2011) to acquire the knowledge which is not available firm internally but required for establishing innovations (Cassiman and Veugelers 2006). Hence the different external partners representing a company's network reflect what Bahemia and Squire (2010) call the 'breadth dimension of inbound open innovation' by building a 'pool of knowledge' with which knowledge is exchanged to achieve the goal of ensuring innovation success. This thesis follows Lane et al.'s (2006) call to investigate the "knowledge environment" of companies (i.e., knowledge produced by corporate and non-corporate sources) by focusing on external partners as sources of knowledge which are differentiated into five types: Customers, suppliers, R&D partners, communities, and friendship communities. In this way Berchicci's (2013) call for the examination of different types of external partners and their relationship with the focal company is addressed.

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[1] Open innovation research makes a distinction between inbound open innovation as an outside-in process in terms of acquisition of firm-external knowledge and outbound open innovation as in inside-out process in terms of the commercialization of technological knowledge to other companies (Lichtenthaler 2011).

While prior innovation research on the outcomes of networks mainly focuses on institutional relationship modes (e.g. Hagedoorn and Duysters 2002; Keil *et al.* 2008; Lee *et al.* 2001) or preferred structures and positions in an inter-organizational (e.g. Bell 2005; Capaldo 2007; Gilsing *et al.* 2008; Roxenhall 2013; Tiwana 2008) as well as in an intra-organizational context (e.g. Rodan and Galunic 2004; Tortoriello and Krackhardt 2010), recent research concludes that it is not sufficient to consider these perspectives for examining networks alone because the existence of trust and reciprocity in networks is not ensured (e.g. Reinholt *et al.* 2011). Therefore, this thesis does not investigate the relationships of a company from the perspective of institutional modes or social network analysis. Instead, and in line with Maurer et al.'s (2011) investigation on an intra-organizational level, this thesis adopts a social capital lens to determine the effect of corporate partners on a firm's knowledge stock and eventually on innovation success, whereby corporate partners and the social capital embedded within the corresponding relationships constitute the inter-organizational social network of a company.

The application of social capital theory to explain how innovation arises has become increasingly common in recent research (Roxenhall 2013), but there is still a dearth of studies analyzing the role of social capital in an open-innovation context (Rass *et al.* 2013). By applying social capital theory, this thesis investigates the depth of the relationship to the external partners from a relational perspective and thus does not just concentrate on the breadth dimension of inbound open innovation as a deficit in prior research (Bahemia and Squire 2010). In particular, and in contrast to Maurer et al. (2011), inter-organizational knowledge transfer as "an interesting domain for further theoretical investigation" (Easterby-Smith *et al.* 2008, p. 677) is examined by scrutinizing the role of firm-external social capital defined "as the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships" (Nahapiet and Ghoshal 1998, p. 243) possessed by a company. Knowledge is one of the resources that can be acquired via inter-organizational social networks whereas firm-external social capital allows a firm to access the knowledge of the corporate partners, thereby facilitating the exchange and combination of knowledge (McFadyen and Cannella 2004) and eventually a firm's innovation success (Padilla-Meléndez *et al.* 2013).

Easterby-Smith et al. (2008, p. 684) argue that research "should not just be focusing on knowledge transfer, but also on the transformation and integration of knowledge into commercial innovation" to get a wider view of inter-organizational knowledge transfer. This is because merely maintaining relationships to external exchange partners is insufficient unless the transferred knowledge is internalized by the focal firm (Hao *et al.* 2011). To employ knowledge as a differentiating factor for competitive advantage it is necessary to keep it updated by reconfiguring it more effectively, faster and more effi-

ciently than direct competitors (Almahamid *et al.* 2010). Accordingly, inter-organizational social networks are only the one side of the coin while the other consists of firm-internal knowledge capabilities which allow a focal company to exploit internal but also newly acquired external knowledge from various corporate partners. Thus, firm-internal knowledge capabilities are critical components of innovation activities (Fosfuri and Tribo 2008) and act as a differentiator in an inbound open-innovation context, separating companies which are able to harvest the benefits of the inter-organization social network from those that are not (Salge *et al.* 2012). Such differentiating factors are particularly under-researched (Huizingh 2011) and theoretical as well empirical investigation into them is still lacking (Lichtenthaler 2011).

Among the firm-internal knowledge capabilities, the most prominent antecedent of innovation is the concept of absorptive capacity, because knowledge to develop an innovation has to be reached partly from outside the firm (Cassiman and Veugelers 2006). According to Zahra and George (2002) absorptive capacity refers to the acquisition of necessary external knowledge and to the assimilation and transformation of this knowledge so that it can be exploited in a business and especially in the innovation process of an organization. Hence, absorptive capacity as the ability to absorb knowledge from outside a firm and apply it to commercial ends (Cohen and Levinthal 1990) has been demonstrated to propel performance and especially innovation success (e.g., Tsai 2001). Since firm performance and innovation success depend on the complementary use of knowledge which is externally acquired but also internally developed (He and Wang 2009; Vekstein 1998), absorptive capacity can be seen as a source of competitive advantage (Zahra and George 2002; Zollo and Winter 2002). However, the role of absorptive capacity especially in knowledge distributed environments, e.g. social inter-organizational networks, is still an open issue since the research literature on absorptive capacity has not placed sufficient emphasis on this topic (Huang and Rice 2009; Robertson *et al.* 2012).

Beside absorptive capacity this thesis investigates the effects of innovation governance mechanisms and the usage of knowledge management systems as further internal knowledge capabilities of an organization to "synthesize and apply current and acquired knowledge" (Kogut and Zander 1992, p. 384). Innovation governance mechanisms can be distinguished between mechanisms geared to system and coordination capabilities (van Den Bosch *et al.* 1999). The former focus on organizational structures, policies, and procedures and are designed to guide the innovation process of a firm to make it more systematic and efficient, while the latter refers "to lateral ways of coordination" (van Den Bosch *et al.* 1999, p. 556) across the "[firm-internal] 'network' of the organisation" (Cuellar and Gallivan 2006, p. 1125) to enhance knowledge absorption. Adopting Pavlou and El Sawy's (2006) understanding, KMS can be defined as an "IT-based sys-

tem developed to support and enhance the organizational processes of knowledge creation, storage/ retrieval, transfer, and application" (Alavi and Leidner 2001, p. 114). By incorporating innovation governance mechanisms and the use of knowledge management systems not only is their contribution to innovation success examined but also their interplay with absorptive capacity. Thereby, recent calls for further research in this area are addressed. Lane et al. (2006) point out that only a small group of studies has looked into the organizational antecedents of absorptive capacity within firms (compare also Easterby-Smith *et al.* 2008; van Wijk *et al.* 2008). Furthermore, the effect of organizational antecedents on different dimensions of absorptive capacity has not been empirically tested (Volberda *et al.* 2010). In their recent literature review Roberts et al. highlighted the fact that only a few studies investigate the relationship between information technology (IT) and absorptive capacity, concluding that "we know little regarding how IT impacts the identification, assimilation, transformation, and application of external knowledge" (Roberts *et al.* 2012, p. 639).

One weakness of research on inter-organizational knowledge transfer and thereby on innovation research is that with a few exceptions researchers do not focus simultaneously "on the relationship between the source and the recipient, the recipient itself, the source itself or the type of knowledge being transferred" (Pérez-Nordtvedt *et al.* 2008, p. 715).The latter aspect is of particular importance in the context of inter-firm innovation collaboration but "has not yet received proper conceptual or empirical elaboration" (Sammarra and Biggiero 2008, p. 801). By scrutinizing the relationship to external corporate partners from a social capital perspective and by distinguishing different knowledge domains and different external partners, this thesis overcomes this weakness by simultaneously incorporating characteristics of knowledge sources and recipients as well as attributes of the transferred knowledge. Furthermore, by combining the concept of firm-internal knowledge capabilities with inter-organizational networks this thesis provides a more comprehensive picture of inter-organizational knowledge transfer and thus of innovation success (compare on an intra-organizational level: Maurer *et al.* 2011; Tsai 2001). Accordingly, the weakness of previous studies in failing to explore the influence of firm-external and firm-internal factors simultaneously to account for innovation success (Chen *et al.* 2009; Zaheer and Bell 2005) is addressed by this thesis[2]

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[2] Works relevant to this thesis are studies by Azadegan et al. (2008), Chen et al. (2009), Hervas-Oliver's and Albors-Garrigos'(2009), Huang and Rice (2009), Koch and Strotman (2008), Slage et al. (2012), Zaheer and Bell (2005) as well as Zheng et al. (2011). However, these studies unlike the current thesis either do not scrutinize the interplay of absorptive capacity and inter-organizational knowledge transfer or do not take into account the multidimensional nature of absorptive capacity as defined by Zahra and George (2002). Furthermore, studies simultaneously including external and firm-internal factors are limited to or rooted in different contexts of expatriate-subsidiary-relationships (Chang *et al.* 2012), international joint ventures (Lane *et al.* 2001), supply chains (Malhotra *et al.* 2005) or start-up companies (Lee *et al.* 2001). Additionally, studies focus on the effect of absorptive capacity on firms' collaborations (de Jong and Freel 2010; Muscio 2007) or on how environmental turbulence effects absorptive capacity (Lichtenthaler 2009) which is not the focus of this thesis.

and has been identified as "a fruitful avenue for future research" (Baer 2012, p. 1116; compare also Faems *et al.* 2010). In particular, the controversial topic and still open question of absorptive capacity's role[3] in constituting innovation success (Huang and Rice 2009; Robertson *et al.* 2012) is examined in detail by applying the conceptualization of Zahra and Gorge (2002).

In summary, this thesis addresses the following overarching research objectives:

- **Inter-organizational social networks (research objective A)**: What is the differential impact of inter-organizational social networks comprising various different corporate partners on the knowledge stock of a company?
- **Firm-internal knowledge capabilities (research objective B)**: How and to what extent do internal knowledge capabilities contribute to innovation success?
- **Interplay of both factors (research objective C)**: How do both inter-organizational social networks and internal knowledge capabilities interact and thereby affect innovation success?

To scrutinize these three research objectives this dissertation is comprised of eight articles which are connected to the following detailed research questions.

A literature review builds the starting point to outline the concept of innovativeness. In particular the use of the concept in quantitative research is considered by developing a measurement model which is applied in the subsequent analyses. Thereby, PAPER I answers the following research question:

> RQ1: How to measure innovativeness? (PAPER I)

According to the first research objective the impact of inter-organizational social networks is examined by differentiating between the effect of relationship aspects and corporate partner characteristics on the innovation-critical factor of knowledge.

> RQ2: What is the differential impact of social capital related to different types of exchange partners on various types of knowledge? (PAPER II)

> RQ3: What is the differential impact of corporate partner types' innovativeness on a focal company's knowledge stock? (PAPER III)

Next, the second research objective is addressed by demonstrating the effect of firm-internal knowledge capabilities on innovation-critical factors and eventually on innova-

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[3] Prior studies treated absorptive capacity as a mediator (e.g. Francalanci and Morabito 2008; Liao *et al.* 2007; Liao *et al.* 2010) as well as a moderator (e.g. Azadegan *et al.* 2008; Berchicci 2013; Chang *et al.* 2012; Escribano *et al.* 2009; Rothaermel and Alexandre 2009; Tsai 2001; Wang and Han 2011; Xiong and Bharadwaj 2011) to explain a firm's business and innovation performance. Thereby, excepting Wang and Hen (2011) the multidimensional nature of absorptive capacity as defined by Zahra and George (2002) has not been analyzed in detail or even considered.

tion success. Therefore, not only are the pure effects examined but the dependencies of the different firm-internal knowledge capabilities are illustrated by examining the interplay of innovation governance mechanisms and the use of knowledge management systems with absorptive capacity.

RQ4: What is the impact of innovation governance mechanisms and knowledge management practices on knowledge stock, absorptive capacity and innovation success? (PAPER IV)

RQ5: How do knowledge management systems contribute to innovation success? (PAPER V)

RQ6: How are information systems, organizational mechanisms and control modes related to absorptive capacity and innovation success? (PAPER VI)

Finally, both research themes are synthesized to draw a comprehensive picture of how innovation success can be constituted from an inter-organizational social network's and firm-internal knowledge capabilities' perspective.

RQ7: How and to what extent does a firm's external social capital (i.e., its relationship with external partners) contribute to its innovation success? (PAPER VII)

RQ8: What is the differential impact of using KMS for managing different types of acquired knowledge from various types of exchange partners? (PAPER VIII)

Figure 1 gives an overview of the research objectives of this thesis.
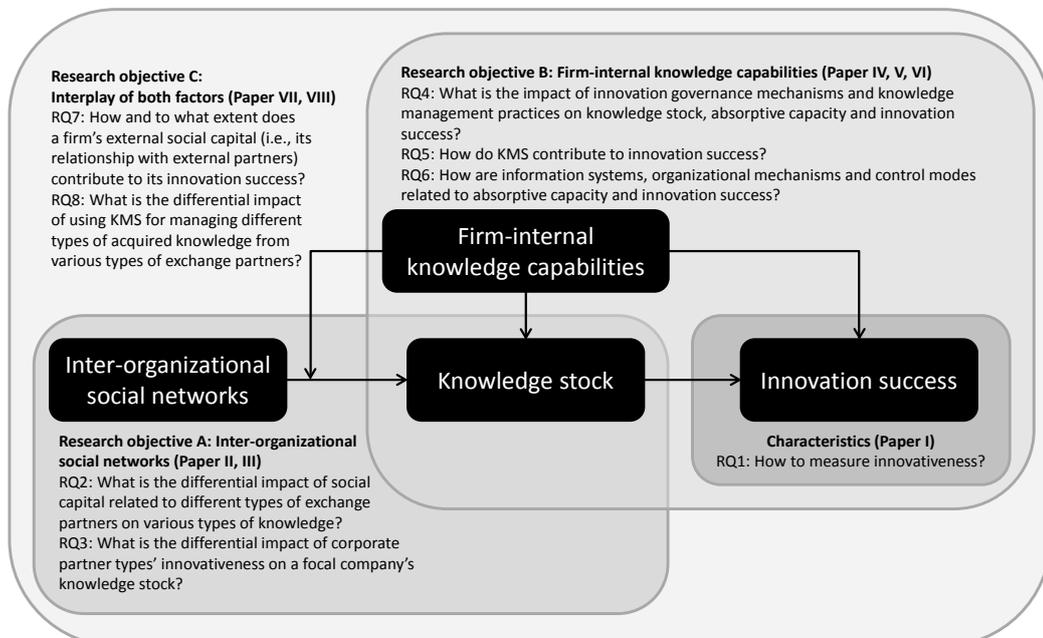
Figure 1: Research questions of the dissertation

The answers to these questions provide a multi-conceptual explanation of how an inter-organizational social network consisting of different corporate partner types and firm-internal knowledge capabilities combine to influence the success of innovations. The introduction of social capital theory to inbound-open-innovation research in combination with the differentiation of the various external partners offers particularly valuable insights through the simultaneous consideration of the depth and breadth dimension of open innovation. Furthermore, social capital theory is supported and extended by explaining how social capital and intellectual capital represented by knowledge stocks are related to each other. Additionally, insight into firm-internal knowledge capabilities as a differentiator for benefiting from open innovation is gained by examining the role of innovation governance mechanisms and the use of knowledge management systems as intra-organizational antecedents of ACAP. Finally, this thesis synthesizes previously adopted measurement instruments of innovativeness to provide a consistent model for future empirical research.

Through the differentiation of various corporate partner types and different knowledge domains practical implications are derived. The thesis develops a order of preference for corporate partners and so provides guidelines allowing organizations to invest systematically into their network of knowledge exchange partners depending on the knowledge domain. Accordingly, resource allocation to external relationships should consider knowledge contribution as an additional manageable object. Furthermore, the use of knowledge management systems and the application of innovation governance mechanisms as well as the deployment of ACAP within the innovation process are justified, implying that management should strategically invest in firm-internal knowledge capabilities to increase them and thus the firm's potential for innovation success by improving benefits from inbound open innovation.

1.2   Structure of the Thesis

The cumulative thesis comprises of eight papers which mainly apply social capital theory to examine inter-organizational networks and the theoretical concept of ACAP as one firm-internal knowledge capability. Beside the method of a literature review, the papers deploy quantitative methods in terms of group comparisons, regression analyses and structural equation modeling based on survey data collected from the 2,500 largest firms in the German manufacturing industry (according to the SIC-Codes 3011-3999 and to the revenue of 2007).

The first part of the thesis establishes the basis for the application of quantitative methods by conceptualizing the concept of innovativeness and developing a corresponding measurement instrument (PAPER I) which is used in the majority of the subsequent papers. The second part of the thesis presents the empirical results and can be split into

three sections corresponding to the aforementioned research objectives. First, the research questions regarding the impact of inter-organizational social networks on the knowledge stock of the focal company are answered by focusing on relational (PAPER II) as well as corporate partner characteristics (PAPER III). Second, empirical results are presented regarding the effect of firm-internal knowledge capabilities on innovation-critical factors and eventually on innovation success (PAPER IV and PAPER V). PAPER VI takes on a special position since it presents a conceptual work drawing on the results of PAPER IV and PAPER V. Finally, the third section focuses on the interplay of both inter-organizational social networks and firm-internal knowledge capabilities to draw a comprehensive picture of how innovation success can be constituted (PAPER VII and PAPER VIII). The overall structure of the thesis is presented in Figure 2 which illustrates the relatedness of the eight papers.

By testing the research models statistically to answer the research questions, this thesis adopts a positivist research perspective that assumes that "reality is objectively given and can be described by measureable properties, which are independent of the observer (researcher) and his or her instruments" (Myers 2013, p. 38). Thereby, the social world is treated "as if it were the natural world, adopting a 'realistic' approach to ontology [and] is backed up by a 'positivist' epistemology, relatively 'deterministic' views of human nature and the use of 'nomothetic' methodologies" (Burrell and Morgan 1979, p. 5). Survey research was chosen as a nomothetic methodology for collecting people's perceptions about reality (Meredith *et al.* 1989). Accordingly and in line with Orlikowski and Baroudi (1991, p. 5) this thesis can be classified as positivist since the criteria of "formal propositions, quantifiable measures of variables, hypothesis testing, and the drawing of inferences about a phenomenon from a representative sample to a stated population" are fulfilled (compare also Klein and Myers 1999).

The next chapter of this introductory paper (section 2) presents the most important theoretical concepts and related research followed by an overview of the applied methodologies and data used in this thesis (section 3). Section 4 summarizes the main results of each paper of this thesis, while their overall contribution to theory and their managerial implications are synthesized in section 5. Finally, the limitations of the overall thesis are discussed (section 6) and opportunities for further research are provided (section 7). The introductory paper closes with a short conclusion (section 8).
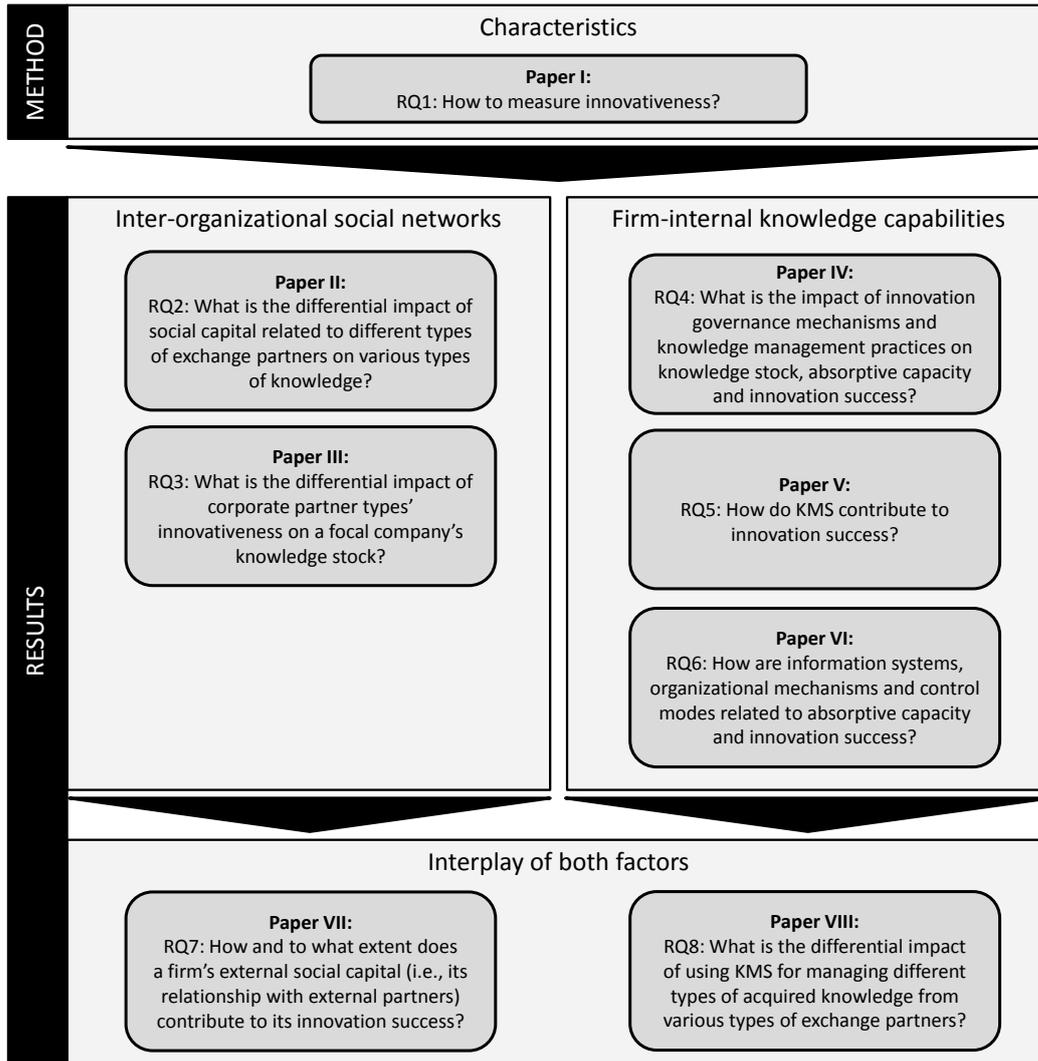
Figure 2: Structure of the thesis

2.   Theoretical Foundation and Related Research

As the different papers of this thesis draw on various related research fields and theoretical foundations only the most important ones are presented in this section. First, the concept of innovation as the ultimate depending variable in this thesis is introduced. Second, the role of knowledge and in particular the role played by the knowledge stock of an organization in prompting innovation is illustrated. Third, the role of inter-organizational social networks and finally the role of firm-internal knowledge capabilities are discussed in an open-innovation context.

2.1 The Concept of Innovation

From an individual perspective, innovation improves standards of living and creates a better quality of life (Gopalakrishnan and Damanpour 1997). From an organizational

perspective, innovations are seen as essential because they play a vital role in the prosperity and growth of firms (Schumpeter 1934) by "enhancing and sustaining the high performance of firms [and by] building industrial competitiveness" (Gopalakrishnan and Damanpour 1997, p. 15). In particular, long-term growth has been associated with the ability to innovate (Szymanski *et al.* 2007). Innovation is thus an important driver for the prosperity and growth of entire economies (Gopalakrishnan and Damanpour 1997; Schumpeter 1934). Unfortunately no common definition of innovation exists[4] (Varis and Littunen 2010); instead its definition depends on three dimensions which should be employed by researchers in all fields to conceptualize innovation (Gopalakrishnan and Damanpour 1997). These are: Level of analysis , stage of innovation, and type of innovation[5] (Gopalakrishnan and Damanpour 1997).

Level of analysis. Innovation research mainly differentiates between four levels: Industry, organization, organizational sub-units, and the innovation itself (Gopalakrishnan and Damanpour 1997). On an organizational level, studies can either take an outcome or a process approach (Gopalakrishnan and Damanpour 1997) which is in line with the differentiation between innovation as an outcome or as a process, as recognized by Crossan and Apaydin (2010). Research rooted in the outcome approach aims to explain organizational innovation by identifying characteristics that distinguish innovative from non-innovative organizations based on their context and their structural and behavioral characterisitcs (Gopalakrishnan and Damanpour 1997), while research embedded in the process approach looks to describe a wide class of events and sequences related to the innovation process (Gopalakrishnan and Damanpour 1997). In line with the argument that the "role of innovation as an outcome is both necessary and sufficient for a successful exploitation of an idea, whereas that of innovation as a process is only necessary but not sufficient" (Crossan and Apaydin 2010, p. 1169), this thesis adopts an outcome approach on an organizational level.

Stages of innovation. Innovation as an outcome results from the innovation process (Crossan and Apaydin 2010) which can be initiated in an organization in two different ways which are comprised of various stages: Innovation generation vs. innovation adoption (Damanpour and Wischnevsky 2006; Gopalakrishnan and Damanpour 1997). The former approach defines innovation as "a new product, service, or technology created by the organization for the market" (Damanpour and Wischnevsky 2006, p. 275) with the innovation process consisting of two phases: Invention and exploitation (Damanpour and Wischnevsky 2006). Accordingly, organizations are characterized by introducing

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[4] Even the terms "creativity", "knowledge", or "change" are used as substitutes for the term "innovation" (Crossan and Apaydin 2010).

[5] In a recent literature review, Crossan and Apaydin (2010) found that in 44% of the 525 reviewed articles innovation was defined in a general way which did not take into account the different types of innovation.

"products, services, or technologies that are new to the market (Dougherty and Hardy 1996; Hitt *et al.* 1996)" (Damanpour and Wischnevsky 2006, p. 272) and are called innovative-generating organizations (Damanpour and Wischnevsky 2006). In contrast, innovation seen from the latter perspective can be understood as "a product, service, or technology assimilated by the organization and used by its members for the first time" (Damanpour and Wischnevsky 2006, p. 275) while comprising the processes of initiation and implementation (Damanpour and Wischnevsky 2006). Hence, innovation-adopting organizations assimilate "products, services, or technologies that are new to the adopting organization (Klein and Sorra 1996; Meyer and Goes 1988)" (Damanpour and Wischnevsky 2006, p. 272). If an organization both generates and adopts innovation at a high level it is labeled an innovative organization (Damanpour and Wischnevsky 2006), and is the focus of this thesis.

Type of innovation. This dimension of innovation is the most comprehensive and contains three sets of contrasting types of innovation: Product vs. process; technical vs. administrative, and radical vs. incremental (Damanpour 1991; Damanpour 1992; Gopalakrishnan and Damanpour 1997) [6]. The first set concerns the object which is generated or changed by the innovation (Varis and Littunen 2010) or what Crossan and Apaydin (2010) call the form of innovation. Process innovations are "new elements introduced into an organization's production or service operations—input materials, task specifications, work and information flow mechanisms, and equipment used to produce a product or render a service" (Damanpour 1991, p. 561) while, in contrast, product innovations are "new products or services introduced to meet an external user or market need" (Damanpour 1991, p. 561)[7]. The second set of innovation type concerns the organizational focus, meaning "the aspect of the organization to which the innovation is most related" (Wolfe 1994, p. 419). Administrative innovations involve "organizational structure and administrative processes; they are indirectly related to the basic work activities of an organization and are more directly related to its management (Damanpour and Evan 1984; Kimberly and Evanisko 1981; Knight 1967)" (Damanpour 1991, p. 560f.) since they do not "provide a new product or a new service, but […] indirectly influence the introduction of products or services or the process of producing them (Kimberly and Evanisko 1981)" (Damanpour *et al.* 1989, p. 588), for example, the "introduction of a new management system, administrative process, or staff development programs" (Damanpour *et al.* 1989, p. 588). Technical innovations pertain to products,

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[6] The term "type of innovation" is used differently in the literature. While Crossan and Apaydin (2010) limit the term to differentiate between administrative and technical innovations, Damanpour and colleagues (Damanpour 1991; Damanpour 1992; Gopalakrishnan and Damanpour 1997) use the term to distinguish between the three sets of innovation mentioned here. This thesis follows the latter approach.

[7] The distinction between products and services is called the category of innovation by Hauser et al. (2002), but is not considered further in this thesis.

services, and production process technology (Damanpour 1991). These are "related to basic work activities and can concern either products or processes (Damanpour and Evan 1984; Knight 1967)" (Damanpour 1991, p. 560), for example, the "adoption of a new idea pertaining to a new product or a new service, or the introduction of new elements in an organization's production process or service operations" (Damanpour *et al.* 1989, p. 588). Finally, the third set concerns the radical nature or newness of the innovation[8] (Varis and Littunen 2010) which can be defined as "the extent to which an innovation represents technological change and thus implies new behaviours for organizational subsystems and/or members" (Wolfe 1994, p. 419). Crossan and Apaydin (2010) label this set as the magnitude of innovation. From an innovation adoption perspective, radical innovations produce "fundamental changes in the activities of an organization and represent clear departures from existing practices" (Damanpour 1991, p. 561), while from an innovation generation perspective, radical innovations are mostly achieved by applying new knowledge to develop completely new products/services or processes (Henderson and Clark 1990). In contrast incremental innovations result "in little departure from existing practices (Dewar and Dutton 1986; Ettlie *et al.* 1984)." (Damanpour 1991, p. 561) (innovation adoption perspective) and results from the reconfiguration of existing knowledge to enhance already existing products/services or processes (Henderson and Clark 1990) (innovation generation perspective). Radical or incremental innovations respectively, are often associated with technology-push or market-pull innovations (Darroch and McNaughton 2002) and can either be a product or a process innovation (de Propris 2002). This thesis does not distinguish between the different sets of types of innovation. However the differentiation is important for understanding how innovation success and innovativeness are constituted.

In summary, this thesis defines innovation on an organizational level in a very general manner "as the successful implementation of creative ideas, tasks, or procedures" (Cummings and Kiesler 2003, p. 297) independent of its type and initiation (generation vs. adoption). Accordingly, innovation success is about the commercialization of a firm's innovation efforts (Joshi et al. 2010) regarding all types of innovations, and correspondents to market success based on product/service or process launches as well as to the

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[8] Radicalness or newness of innovations is often associated with three categories of newness: New to the firm new to the market or, new to the industry. These categories are called the referent dimension of innovation (Crossan and Apaydin 2010). Since the referent and the magnitude dimension are clearly related to each other (Crossan and Apaydin 2010), the referent dimension is not considered further in the thesis. Furthermore it must be considered that the radicalness or newness of an innovation is distinct from its disruptiveness (Govindarajan and Kopalle 2006). Disruptive innovations at their time of introduction attract the customer segment of niches (Govindarajan and Kopalle 2006). "Disruptive technologies […] introduce a different performance package from mainstream technologies and are inferior to mainstream technologies along the dimensions of performance that are most important to mainstream customers. As such, in their early development they only serve niche segments that value their non-standard performance attributes. Subsequently, further development raises the disruptive technology's performance on the focal mainstream attributes to a level sufficient to satisfy mainstream customers" (Adner 2002, p. 668).

success resulting from adopting new product/services or processes to achieve competitive advantages. In contrast innovativeness can be understood as the ability of a firm to continuously generate and adopt innovations of all types (Bell 2005; Subramaniam and Youndt 2005; Subramanian and Nilakanta 1996; Zaheer and Bell 2005). Figure 3 visualizes this thesis' understanding of innovation and how innovativeness, innovation and innovation success are related to each other.
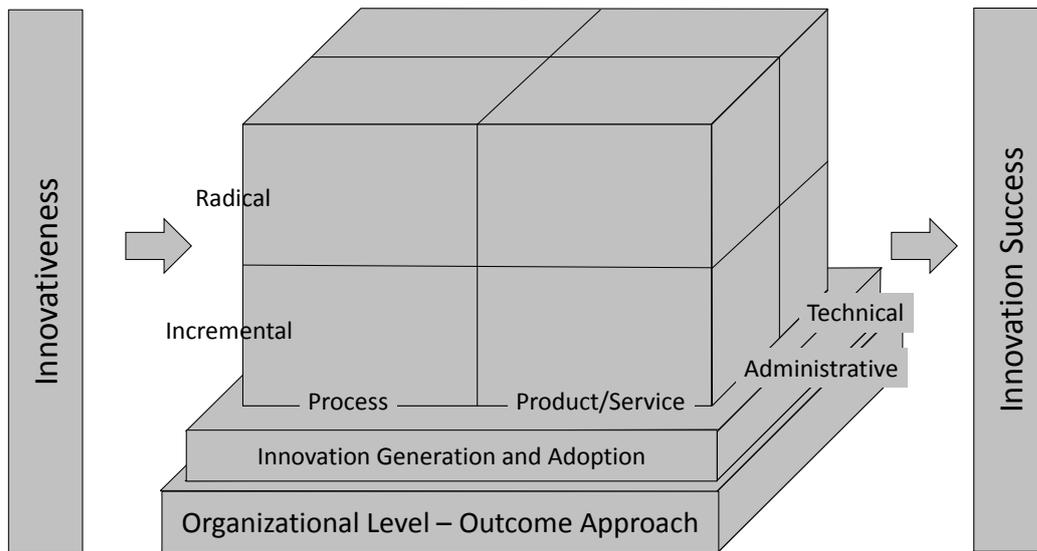
Figure 3: Definition of innovation

2.2 The Role of Knowledge for Innovation Success

As outlined in the previous section, innovations can be differentiated into three sets of types in relation to the object of change (product/service vs. process), the radicalness of the innovation (incremental vs. radical), and the organizational focus of the innovation (administrative vs. technical). Establishing an innovation, regardless of its nature, is reliant on knowledge exchange and combination which build the core of the innovation process (Schumpeter 1934). Radical innovations are mostly attended by applying new knowledge to develop completely new products/services or processes whereas incremental ones result from the reconfiguration of existing knowledge to enhance already existing products/services or processes (Henderson and Clark 1990) independently of their organizational focus. Accordingly, the knowledge held by an organization enables and drives innovation success (Subramaniam and Youndt 2005). Several studies have empirically demonstrated a positive link between firms' knowledge and innovativeness or innovation success respectively (e.g., Bell and Zaheer 2007; Tsai and Ghoshal 1998; van Wijk *et al.* 2008) leading to the conclusion that "knowledge has emerged as the most strategically-significant resource of the firm" (Grant 1996a, p. 375). For example, the knowledge acquired from customers and suppliers is positively associated with in-

novations (Bell and Zaheer 2007). Furthermore, "increased knowledge can relate to the introduction of a novel manifestation resulting in an innovation" (Chen and Edgington 2005, p. 285). The basic notion of this perspective is that the ability to produce innovations is based on superior access to and the integration of a range of specialized knowledge that are put to use and which produce new products/services or processes (Grant 1996a).

Knowledge is comprised of "framed experience, values, contextual information, and expert insight that together build a framework for evaluating and incorporating new experiences and information" (Davenport and Prusak 1998, p. 5). Experience, or what Kogut and Zander (1992) call know-how, "is the accumulated practical skill or expertise that allows one to do something smoothly and efficiently" (von Hippel 1988, p. 8) while information "implies knowing what something means […] which can be transmitted without loss of integrity once the syntactical rules required for deciphering it are known" (Kogut and Zander 1992, p. 386). Therefore, knowledge reflects an entity's capacity to act effectively (Ahmed *et al.* 2002). In line with the differentiation of knowledge into information and know-how by Kogut and Zander(1992), Nonaka (1994) distinguishes between explicit and tacit knowledge. Explicit knowledge is codifiable while tacit knowledge is not and is therefore difficult to express. Accordingly, explicit knowledge can be documented and articulated and thus easily transferred between organizations while the transfer of tacit knowledge usually requires demonstration instead of description (Nonaka 1994; Nonaka and Takeuchi 1995).

In a strict sense, knowledge is developed only by individuals (Nonaka and Takeuchi 1995). In general, organizations cannot develop knowledge without their employees or individuals (Nonaka and Takeuchi 1995). Accordingly, organizations facilitate creative individuals or procure contexts for them to generate new knowledge (Nonaka and Takeuchi 1995). In this sense, organizational knowledge creation "should be understood as a process that 'organizationally' amplifies the knowledge created by individuals and crystallizes it as a part of the knowledge network of the organization" (Nonaka and Takeuchi 1995, p. 59). Accordingly, organizational knowledge is not only constituted by the knowledge held by its employees in terms of their competences, capabilities, and motivation, nor by its departments in terms of shared understandings, stories, and languages; organizational knowledge also resides in organizational routines, processes, practices, and norms (Crossan *et al.* 1999; Davenport and Prusak 1998; Vera and Crossan 2004). In other words "organizational knowledge is the set of collective understandings embedded in a firm, which enable it to put its resources to particular uses" (Tsoukas and Vladimirou 2001, p. 981) and represents a firm's knowledge assets or its knowledge stock (Haas and Hansen 2005) which in turn helps firms to gain and sustain competitive advantages (Bharadwaj 2000). Organizational knowledge, or the knowledge

stock respectively, is the result of knowledge combination and exchange (Kogut and Zander 1992) and comprises of the two forms: Organizational explicit and organizational tacit knowledge. The former is about codified knowledge (Alavi and Leidner 2001), or what Spender (1996) calls objectified knowledge (e.g., established standards and practices), and "represents the shared corpus of knowledge" (Nahapiet and Ghoshal 1998, p. 247). The tacit form, which Spender (1996) calls "collective knowledge", "resides in the tacit experiences and enactment of the collective" and is a form of "shared knowledge [that have] been defined as 'routines' by Nelson and Winter (1982)" (Nahapiet and Ghoshal 1998, p. 247). The knowledge stock of an organization that is shared among the employees and collectively held can be understood as its intellectual capital since intellectual capital represents "the knowledge and knowing capability of a social collectivity [an organization]" (Nahapiet and Ghoshal 1998, p. 245). Accordingly, the terms 'knowledge stock', 'organizational knowledge', and 'intellectual capital' are used interchangeably in the papers in this thesis[9], while the introductory paper prefers knowledge stock.

The knowledge stock of an organization can be categorized into domains – related fields of knowledge (Cohen and Levinthal 1990). The literature suggests several categories of knowledge that are vital for innovation success and highlights two in particular: Market and technological knowledge (Lichtenthaler 2009; Maurer *et al.* 2011). Beside these two domains the concept of knowledge stock used in this thesis additionally comprises of the domains of organizational, process and product knowledge. A detailed description of each domain of the knowledge stock follows:

- Market knowledge is externally oriented and can be seen as environment-oriented knowledge (Laine and Laine 2012) which is in turn defined as "organized and structured information on the market" (Sammarra and Biggiero 2008, p. 805). It is comprised of knowledge about the firm's external environment, i.e. knowledge about factor and product markets. Thereby, market knowledge not only covers knowledge about the environment in which the firm is actually involved but it also include knowledge about those environments which might be attractive for the firm in the future. Additionally, market knowledge encompasses knowledge about competitors and customers (de Luca and Atuahene-Gima 2007), suppliers (Gold *et al.* 2001), partners (Nakayama 2003), about the overall industry (Tippins and Sohi 2003), as well as about market knowledge in general (Yli-Renko *et al.* 2001).

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[9] PAPER V uses the term 'organizational knowledge' and PAPER VII uses the term 'intellectual capital' to cover the domains of market and technological knowledge. The usage of the term 'organizational knowledge' in PAPER V should not be mistaken for the usage of the term in the other papers to describe knowledge about the organizational structure, functions, and organizational forms as one domain of the knowledge stock.

- Technological knowledge is largely internally oriented and can be seen as firm-internal knowledge (Laine and Laine 2012) that mostly deals with the technological competence of an organization (Ko *et al.* 2005) and with the ability to recognize new technologies and practices (Ashrafi *et al.* 2006) in order to optimize or innovate production processes, business processes, products and services. Major conceptualizations of this in the literature are IT knowledge (Bassellier *et al.* 2001; Reich and Kaarst-Brown 2003) and state-of-the-art technical practices (Matusik and Heeley 2005) or, in an innovation context, the "know-how and competences necessary to the process and execution of product and process development [including] scientific knowledge as well as applied and experimental knowledge (Howells *et al.* 2003)" (Sammarra and Biggiero 2008, p. 805).

- Process knowledge "refers to competences and know-how necessary to efficiently and effectively coordinate and supervise organizational resources and processes" (Sammarra and Biggiero 2008, p. 805) or in other words to the management and design of internal business processes (Bassellier and Benbasat 2004). Thus it is related to the structuring of operations, procedures, and workflows. Process knowledge represents the operational and applied knowledge (e.g. business process re-engineering and total quality management) of what Sammarra and Biggiero (2008) calls managerial knowledge.

- Organizational knowledge includes knowledge about organizational structure, functions, and organizational forms (e.g., matrix organization). It includes sourcing (Hult *et al.* 2007) as well as strategic and networking aspects in particular (Sammarra and Biggiero 2008). Organizational knowledge corresponds to the more abstract and complex knowledge of managerial knowledge since "it implies the capability to integrate and coordinate specialized knowledge (including market and technological knowledge) across organizational functions, departments and products" (Sammarra and Biggiero 2008, p. 805).

- Product knowledge refers to the extent of knowledge employees have about the product landscape of their own organization and is comprised of knowledge about products of other business units. It includes knowledge about handling problems, (alternative) application domains, but also (alternative) materials and (alternative) construction principles that are (might be) applied to the firm's products. This domain has not been discussed frequently in the literature but

case studies carried out prior to this thesis [10] have indicated its importance for developing innovations, especially incremental ones.

Figure 4 visualizes the conceptualization of the knowledge stock of an organization.
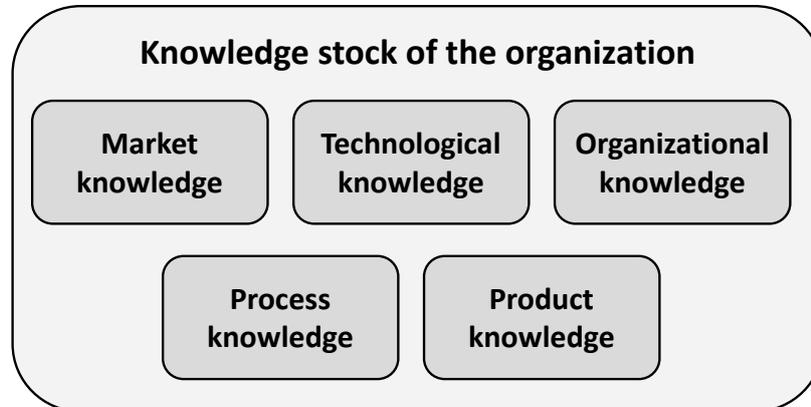
Figure 4: Knowledge stock of the organization

As mentioned previously innovations can be defined as a novel combination of knowledge. Since it is not known which knowledge combinations are desirable, a wider and deeper pool of knowledge increases the number of possible combinations and thereby facilitates the quantity and the potential radicalness of innovations (Laine and Laine 2012) as well as the ability to compete and enhance a firm's survival (Berchicci 2013). Accordingly, the efficiency of a firm in integrating and combining knowledge can be seen as one of the most important indicators for innovation success or market success respectively, where the amount of different knowledge domains which are integrated into a firm drive its potential to outperform competitors (Salge *et al.* 2012; Sammarra and Biggiero 2008).

2.3 The Role of Inter-organizational Social Networks for Knowledge Stock and Innovation Success

To invest in innovation activities organizations can choose between three strategies. Organizations can invest in internal research and development (R&D) – the 'make only' strategy -, they can invest in the acquisition of external technologies – the 'buy only'

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[10] 18 case studies with CEOs, business units, or innovation managers of firms in manufacturing industry were conducted by research colleagues before beginning the survey project and are thus not part of this thesis. The 18 firms were ranked as very innovative in their industries according to the sales volume of new products in relation to total sales. A semi-structured interview guideline was used that covered the company's partners, interactions with these partners, the knowledge domains of partners and the focal company, and innovation outcomes.

strategy[11] -, or they can foster both – the 'make and buy' strategy (Cassiman and Veugelers 2006). Cassiman and Veugelers (2006) come to the conclusion that neither the strategy of 'make only' nor 'buy only' lead to higher innovation performance, but instead this is achieved by investing in the third strategy of 'make and buy'. They conclude that "even the largest innovation-active organizations cannot rely solely on internal sourcing" (Cassiman and Veugelers 2006, p. 68). This is in line with the findings of Berchicci (2013, p. 118) who states that "focusing only on internal R&D and the development of internal capabilities and routines is no longer [in today's environments] sufficient" and this forces organizations to mutate from the "the monolithic structure of an internally closed R&D" to "an open R&D structure by tapping into external sources of knowledge through licensing, alliances and technology agreements (Hagedoorn 1993)".

The main motive for an organization to join alliances or, in general, to tap into collaborations is to acquire knowledge and capabilities from a firm's external partner (Hagedoorn 1993; Mowery *et al.* 1996). Accordingly, collaborations are seen as "important vehicles for learning and knowledge acquisition and it regards this type of learning as an alternative to internal knowledge generation within a company (Almeida *et al.* 2002)" (Becerra *et al.* 2008, p. 692f.). Inter-organizational knowledge transfer is often the "only viable option available to many organizations looking to acquire knowledge" available outside their borders (Pérez-Nordtvedt *et al.* 2008, p. 715). The underlying assumption behind this argument is that "in many industries, firms' competitive advantage [e.g., in terms of innovation success] depends on the ability to use inter-firm collaboration to access essential knowledge and specialized capabilities held by other companies, which are difficult to imitate or acquire through a pure market transaction (Gulati, 1999; McEvily and Marcus, 2005)." (Sammarra and Biggiero 2008, p. 802)".

The firm's external partners therefore function as a repository or as a 'pool of knowledge' with which the focal company can exchange knowledge to achieve the goal of competitive advantages or, in the context of innovations, the conversion of an idea into a successful innovation. Based on Argote and Ingram (2000), inter-organizational knowledge transfer[12] can be defined as "the process through which organizational actors – teams, units, or organizations – exchange, receive and are influenced by the experience and knowledge of others" (van Wijk *et al.* 2008, p. 832) or, in a more general way, as "an event through which one organization learns from the experience of anoth-

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[11] Cassiman and Veugelers (2006) use the terms 'external knowledge acquisition' and 'external technolgy acquisition' synonymously to refer to the strategy of 'buy only'. This thesis adopts the term 'external technlgy acquisition' since the operationalization of the 'buy only' strategy focus only technology acquisition.

[12] The process of knowledge transfer is often labelled in an alternative but related way (van Wijk *et al.* 2008; Wagner and Moos 2014) as knowledge sharing (e.g., Hansen 1999; Tsai 2002), knowledge flows (e.g., Gupta and Govindarajan 2000; Schulz 2001), knowledge acquisition (e.g., Darr *et al.* 1995; Lyles and Salk 1996), knowledge exchange, knowledge dissemination, or knowledge distribution.

er" (Easterby-Smith *et al.* 2008, p. 677). It is in this vein that organizational learning "very often takes place via knowledge transfer from entities outside organizational boundaries (Argote and Ingram 2000; Grant 1996b)"[13] and thus "contributes to an increase in an organization's stock of knowledge" (Pérez-Nordtvedt *et al.* 2008, p. 714). Inter-organizational knowledge transfer is thereby not limited to a specific knowledge domain; instead technological knowledge is exchanged together with market, process and organizational knowledge (managerial knowledge) as well as together with product knowledge (Sammarra and Biggiero 2008). Accordingly, organizational knowledge transfer increases the opportunity of an organization to establish innovations (Powell *et al.* 1996), "as it stimulates the combination of existing and newly acquired knowledge and augments a unit's capacity for making novel linkages and associations (Jansen *et al.* 2005)" (van Wijk *et al.* 2008, p. 836). For example, on the one side a firm can tap into new markets through the transfer of market knowledge by discovering new and/or unfamiliar fields for its product's application (Sammarra and Biggiero 2008), while on the other side a firm can expand existing markets through the transfer of technological and/or product knowledge by creating new and/or further developed products/services. Furthermore, the transfer of organizational and process knowledge which Sammarra and Biggiero (2008) subsume under the term managerial knowledge creates opportunities for establishing process innovations, e.g., through the transfer of best practices operational effectiveness of processes can be increased (Haas 2010). It is through this transfer of a heterogeneous mix of knowledge domains that inter-organizational knowledge transfer becomes a crucial aspect of fostering innovations (Sammarra and Biggiero 2008). Accordingly, prior research consistently associates inter-organizational knowledge transfer with an increased knowledge stock (Pérez-Nordtvedt *et al.* 2008) and thereby with an increased innovativeness of the focal firm (e.g., Berchicci 2013; Easterby-Smith *et al.* 2008; van Wijk *et al.* 2008), or innovation success, (e.g., Yli-Renko *et al.* 2001) respectively, as well as performance in general (e.g., Easterby-Smith *et al.* 2008; Lane *et al.* 2001). In summary, organizations "need to transfer and acquire new knowledge [from their external partners] as they seek to develop new applications

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[13] In essence, organizational interactions are based on interactions between individuals. It is through these interactions that individuals as representatives of organizations transfer knowledge and thereby learn. Accordingly, organizational learning starts at the individual level by receiving knowledge or through the intuition of the individuals. The novel knowledge is then brought to a group level when these individuals interpret and share the new knowledge with their department, project team, or with their working groups (Laine and Laine 2012). The groups in turn bring the knowledge to the organizational level by integrating the knowledge into the organizational knowledge stock. Thereby, the knowledge is institutionalized so that organizational learning takes place. This whole dynamic process which describes learning from the individual via the group to the organizational level (and back) is termed 4I framework (intuiting, interpreting, integrating, and institutionalizing) (Crossan *et al.* 1999; Vera and Crossan 2004). Since this thesis adopts an organizational level as a unit of analysis to scrutinize the effect of firm-external partners on a focal firm in terms of inter-organizational knowledge transfer, the firm-internal learning process through the three different levels is not elaborated on further.

and survive (Henderson and Cockburn 1994; Kogut and Zander 1992)" (van Wijk *et al.* 2008, p. 831).

Active networking is on one of the most effective ways for organizations to practice inter-organizational knowledge transfer since the network provides an interactive platform characterized by a high degree of reciprocity (Huang and Rice 2009). While the contribution of networking to innovation is manifold, most benefits result from the access to external knowledge that the organization actually lacks (Ahuja 2000a; Ahuja 2000b; Keil *et al.* 2008; Kogut 2000; Powell *et al.* 1996) [14]. Hence "part[s] of the value of the firm [its knowledge stock] derives from its participation in a network" (Kogut 2000, p. 405), whereas the network can be seen as a key vehicle through which firms can receive external knowledge (Ahuja 2000a). From this perspective innovations "should be considered 'as a product of a network of actors' (Hakansson 1987, p. 3)" (de Propris 2002, p. 337) since for any of the types of innovations considered in this thesis a "firm's capacity to innovate could greatly improve if they co-operated with other firms over innovation in addition to or instead of investing in [internal] R&D" (de Propris 2002, p. 337). In particular, the greater the breadth of knowledge sources, such as maintaining relationships to a number of diverse external partners, the greater the innovation success (Leiponen and Helfat 2010) due to the amount of new complementary knowledge an organization can combine with its pre-existing internal knowledge stock (Keil *et al.* 2008). Therefore, and in accordance with the literature on inter-organizational cooperation and especially on knowledge transfer, this thesis comprises of the following types of exchange partners which are typical of a firm's network:

- Customers (Chen *et al.* 2009; de Faria *et al.* 2010; Fosfuri and Tribo 2008; Laursen and Salter 2006)
- Suppliers (Chen *et al.* 2009; de Faria *et al.* 2010; Fosfuri and Tribo 2008; Laursen and Salter 2006)
- R&D partners: Commercial R&D service providers (privately owned companies, e.g., engineering companies) (Laursen and Salter 2006) and public research institutions (e.g., universities) (Chen *et al.* 2009; de Faria *et al.* 2010; Fosfuri and Tribo 2008; Laursen and Salter 2006)
- Trade associations, also called communities/professional organizations (Lesser *et al.* 2000): Industry associations and related industry-wide working groups, including both organizations that are linked under a common administrative structure such as holdings (de Faria *et al.* 2010) and organizations without the firm group.

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[14] Other benefits, for example, are the sharing of the 'bundle' of property rights between the network members "including residuals reward rights, last resort control and arbitrage rights" (Grandori 1997, p. 906) or cost savings via risk sharing and resource focusing (Keil *et al.* 2008).

- Friendship communities (Jansen *et al.* 2005; Levin and Cross 2004): Personal contacts of the survey respondent (i.e., a manager responsible for the focal division) with whom professional issues are discussed[15].

Instead of focusing on the institutional relationship modes such as strategic alliances, mergers and acquisitions, venture capitalists, joint ventures, or sponsorship (Hagedoorn and Duysters 2002; Keil *et al.* 2008; Lee *et al.* 2001) or on the network differentiating between direct, indirect, and structural holes (Ahuja 2000a) to scrutinize the effect of different partners on a focal firm's knowledge stock and innovation capabilities, this thesis adopts a relational view (Dyer and Singh 1998) by applying social capital theory. According to Fey and Birkinshaw (2005, p. 602) "social capital theory predicts more learning is likely to occur through partnering [knowledge development through relationships with external partners] than through contracting [knowledge acquisition on a market basis]". Thus this thesis concentrates on the informal part of the relationship, for example, social cohesion rather than on the formal ones, e.g., the contract (Li *et al.* 2008). This is in line with Reagans & McEvily (2003) who demonstrated that the social cohesion associated with a relationship plays a fundamental role in the establishment of knowledge transfer. It also reflects the recognition by Chang et al. (2012, p. 930) "that social ties between knowledge sources and recipients facilitate knowledge transfer (Hansen *et al.* 2005; Tsai and Ghoshal 1998) [especially providing] opportunities for tacit knowledge transfer". Thereby, the network of a company is interpreted as an inter-organizational social network constituted by the focal company, their corporate partners, and the social capital embedded within the corresponding relationships.

The concept of social capital is widely used in research and has been put forth by several researchers, e.g., Coleman (1988, p. 98) who postulates that social capital "consist of some aspect of social structures, and they facilitate certain actions of actors-whether persons or corporate actors-within the structure" and it "is productive, making possible the achievement of certain ends". Coleman (1988) examines obligations and expectations, information channels, and social norms as three forms of social capital. Bourdieu (1986, p. 248f.)[16] stresses that social capital consists of social obligations and defines social capital as "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition – or in other words, to membership in a group – which provides each of its members with the backing of the collectivity-owned capital, a 'cre-

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[15] This type of external partner differs from the others since friendship communities are about relationships between individuals across organizational boundaries exhibiting, for example, mutual affection, advice-seeking, and extensive talks (Bell and Zaheer 2007), but are not rooted in a relationship at a corporate level.

[16] Originally published as Bourdieu (1983).

dential' which entitles them to credit, in the various senses of the word." A widely used definition applied in this thesis was formulated by Nahapiet and Ghoshal (1998) based on the studies by Coleman (1988) and Bourdieu (1986). Nahapiet and Ghoshal (1998, p. 243) refer to social capital as "the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit".

According to Nahapiet and Ghoshal (1998), social capital should be conceptualized using three dimensions which characterize a relationship and are related to inter-organizational knowledge transfer (van Wijk *et al.* 2008): Structural, relational, and cognitive dimension. The prior literature argues that the structural dimension provides channels for gaining and accessing external knowledge while the relational and cognitive dimension are crucial for knowledge transfer through the creation of closure (van Wijk *et al.* 2008) or what Reagans and McEvily (2003) call social cohesion.

The *structural dimension* deals with the existence and strength of relationships between actors and their patterns. One of the most important elements of this dimension is the concept of ties and their strength. Strong ties can be characterized as frequent and direct interaction between actors reflecting a closeness which facilitates the flow of information leading to greater knowledge transfer (Granovetter 1973; van Wijk *et al.* 2008). Furthermore, for the effectiveness of an organization it is beneficial to maintain strong ties to diverse partner types (Burt 1992) in terms of different knowledge domains. This is in line with van Wijk's meta-analytic review showing that "a large number of relations to other firms […] increase the likelihood that relevant knowledge can be accessed" (van Wijk *et al.* 2008, p. 834). Thus the structural dimension of social capital provides relationships in terms of conduits that increase the probability and amount of inter-organizational knowledge transfer regarding potentially useful knowledge, ideas and/or resources (Hansen 1999; Maurer *et al.* 2011; van Wijk *et al.* 2008).

Second, the *relational dimension* of social capital refers to the nature of the relationship (Tsai and Ghoshal 1998) in terms of mutual respect and trust based on the development of relationships over time (Granovetter 1985). Trust "reflects the belief that a partner's word or promise is reliable and that a partner will fulfill its obligations in the relationship" (Inkpen 2000, p. 1027) and is an important aspect for enhancing the efficiency and effectiveness of knowledge transfer (Alavi and Leidner 2001; Levin and Cross 2004). On one side, trust improves the willingness to exchange and integrate knowledge since both exchange partners engaged in the relationship trust other to handle the transferred knowledge carefully (Lane *et al.* 2001; Maurer *et al.* 2011) and do "not take excessive and unilateral advantage of each other, even when the opportunity to do so is available (Sabel 1993)" (Li *et al.* 2008, p. 317). Thus, "trust facilitates knowledge transfer by creating a sense of security that the knowledge in question will

not be exploited beyond what is initially intended (Dhanaraj *et al.* 2004)" (Easterby-Smith *et al.* 2008, p. 680). On the other side trust guides subsequent actions and creates mental maps or models that act as filters for information which leads to an increase of congruency regarding the perception of information (Bhatt and Grover 2005; Galunic and Rodan 1998; Hansen 1999; Nahapiet and Ghoshal 1998). These maps simplify the knowledge transfer process and further foster the subsequent application of the transferred knowledge in terms of reducing time for verification (Maurer *et al.* 2011). Accordingly, prior research indicates that trusted relationships facilitate knowledge transfer (e.g., Lane *et al.* 2001; Szulanski *et al.* 2004) and in particular the transfer of tacit knowledge (e.g., Becerra *et al.* 2008; Dhanaraj *et al.* 2004).

Third, the *cognitive dimension* of social capital deals with shared vocabulary, narratives, interpretations, representations and systems of meaning (Grant 1996a; Kogut and Zander 1992). Similar to the previous pattern, this dimension fosters knowledge transfer by developing a greater understanding of the transferred knowledge through the use of common languages and symbols (Galunic and Rodan 1998; Reagans and McEvily 2003) between knowledge sources and recipients. Common languages and symbols arise in the relationship over time by alleviating barriers to cooperation and by creating a common frame of reference (Nelson and Cooprider 1996) in which knowledge can be integrated (Grant 1996a). Additionally, shared identities, systems, and visions as elements of the cognitive dimension "promote mutual understanding and provide a crucial bonding mechanism that helps different actors [of a relationship] to integrate knowledge [and therefore] are likely to contribute to organizational knowledge transfer" (compare also Chang *et al.* 2012; and Inkpen and Tsang 2005; van Wijk *et al.* 2008, p. 835). Furthermore, the cognitive dimension supports the integration of the transferred knowledge by increasing the reach and richness of such knowledge through the establishment of perspective-sharing and sense-making (Sambamurthy *et al.* 2003).

In summary, the social capital inherent in the relationships with external partners refers to interactive, close, and trust-based relations which "directly affects the combine-and-exchange process and provides relatively easy access to network resources [external partners]" (McFadyen and Cannella 2004, p. 735). Thus social capital influences the quality of knowledge transfer in terms of successfully understanding and rapidly and economically gaining external knowledge (Pérez-Nordtvedt *et al.* 2008). This in turn impacts on the creation of the knowledge stock of the focal organization (Nahapiet and Ghoshal 1998) and eventually the development of new innovations (Padilla-Meléndez *et al.* 2013). From this perspective and underlined by meta analytical reviews (van Wijk *et al.* 2008; Yi-Wen and Cheng-Chieh 2011) the central proposal of social capital is that

social networks, or relationships, respectively are a valuable resource of a company (Inkpen and Tsang 2005) and provide "the bedrock of innovation" (Wei 2010, p. 151)[17].

Accordingly, social capital has been analyzed at many different levels. At the individual level social capital affects knowledge contributions in electronic networks (McLure Wasko and Faraj 2005), knowledge sharing (Yu *et al.* 2010), and knowledge creation (McFadyen and Cannella 2004)[18], while knowledge integration in digitally enabled teams (Robert *et al.* 2008) or in ERP project teams (Newell *et al.* 2004) as well as knowledge sharing in work teams (Yu *et al.* 2010) or in virtual communities (Chiu *et al.* 2006) is influenced by social capital[19]. At the organizational level social capital enhances knowledge transfer (Maurer *et al.* 2011; Sherif *et al.* 2006; van Wijk *et al.* 2008) and sharing (Widén-Wulff and Ginman 2004) through the formation of intra-organizational linkages (Tsai 2000) and fosters the speed of knowledge transfer within multinational enterprises (Chen and Lovvorn 2011)[20]. Furthermore, social capital improves the competiveness of an organization (Wu 2008) through value creation in terms of knowledge creation (Nahapiet and Ghoshal 1998; Sherif *et al.* 2006; Smedlund 2008) or in terms of product innovations (Tsai and Ghoshal 1998). At the inter-organizational level, the findings of research applying social capital are not as extensive as at the intra-organizational level, e.g., social capital functions as a driver of alliance formation (Chung *et al.* 2000; Walker *et al.* 1997), and impacts on knowledge integration in the context of IT projects (Yang *et al.* 2012), on knowledge transfer (van Wijk *et al.* 2008) as well as on knowledge acquisition and exploitation (Yli-Renko *et al.* 2001)[21]. However, while Inkpen and Tsang (2005) examined theoretically how social capital affects the transfer of knowledge between network members distinguishing among three types of networks (intra-corporate networks, strategic alliances, and industrial districts) and while Fountain (1998) discussed social capital as a key enabler of innovation, recent research

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[17] This circumstance is also reflected in the definition of social capital by Fountain (1998, p. 85) who refers to social capital as the "contribution to institutional effectiveness of all these relationships [to external partners] measured in terms of economic performance and innovative capacity".

[18] Social capital at the individual level further influences human capital (Coleman 1988), managerial performance (Moran 2005), career success (Seibert *et al.* 2001), and creativity (Perry-Smith 2006).

[19] At the group level social capital additionally fosters group effectiveness (Oh *et al.* 2004) while the intra- and extra-industry social capital of teams shape the relationship between entrepreneurial orientation and new venture performance (Stam and Elfring 2008).

[20] Another prominent area of social capital at the organizational level is the effect of entrepreneur's social capital on a new venture's performance (Batjargal 2007; Maurer and Ebers 2006). Furthermore, Xiong and Bharadwaj (2011) scrutinized the effect of social capital of young technology firms on the value of their initial public offering.

[21] Beside these four different levels social capital is further applied to investigate regions. For example, Laursen et al. (2012) show that geographically localized social capital affects the external knowledge acquisition and thus the propensity to innovate.

concludes that there is still a dearth of studies that analyze the role of social capital in an open innovation-context (Rass *et al.* 2013)[22].

By distinguishing between the aforementioned types of external partners and by scrutinizing the relationships between them and the focal firm adopting a social capital lens differentiating the three dimensions, this thesis simultaneously incorporates both the breadth and depth dimension of open innovation. Based on Laursen and Salter (2006)[23], the breadth dimension (compare also Leiponen and Helfat 2010) of inbound open innovation represents the "number of different types of external parties involved in the innovation process" (Bahemia and Squire 2010, p. 609) or in other words "the variety of different collaboration partner types" connected through open innovation practices (Ebersberger *et al.* 2012, p. 7). The depth dimension focuses on the "intensity of collaboration with a certain partner type" (Ebersberger *et al.* 2012, p. 7) whereby intensity can be understood as the "level of cooperation and integration between the focal firm and the different types of external parties" (Bahemia and Squire 2010, p. 611).

Figure 5 visualizes this circumstance by presenting the conceptualization of inter-organizational social networks of a company underlying this thesis.
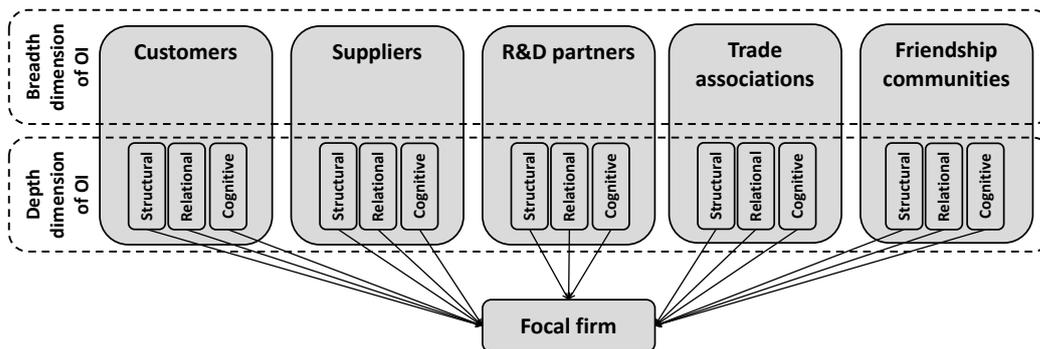
Figure 5: Inter-organizational social network of a company (OI = open innovation)

2.4   The Role of Firm-internal Knowledge Capabilities for Knowledge Stock and Innovation Success

As described above, the exchange of heterogeneous knowledge between a firm and its partners increases its knowledge stock and thereby accelerates the firm's innovation success through the enhancement of the capacity to arrive at novel combinations of

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[22] Notable exceptions are Padilla Meléndez et al. (2013) who focus on the role of social capital in supporting open innovation through knowledge transfer and exchange in the context of SMEs or Rass et al. (2013) who analyze social capital as a mediator between the implementation of open-innovation instruments and firm performance.

[23] Laursen and Salter (2006) introduce the notion of the two dimensions to organize companies' search strategies in an open-innovation context.

knowledge (e.g., Laine and Laine 2012; Salge *et al.* 2012; Sammarra and Biggiero 2008). To have this impact the inflow of knowledge stemming from the different external partners "must be processed before it can become new organizational knowledge, i.e. intellectual capital, and in turn be advantageously used by the firm" (Laine and Laine 2012, p. 239). Otherwise the knowledge remains in a "'raw' form: that is, it is most likely not ready for immediate use by the firm" (Roberts *et al.* 2012, p. 642). In the latter case an organization cannot realize the intended benefits from the external knowledge in question due to problems of assimilation and integration (Pérez-Nordtvedt *et al.* 2008) or due to the absence of innovation-friendly organizational routines, systems, and structures (Zaheer and Bell 2005) since "better resource access alone is insufficient to yield superior performance" (compare also Inkpen 2000; Salge *et al.* 2012, p. 6). But this processing is an often ignored aspect of open-innovation research (Huang and Rice 2009). In this vein, firm internal knowledge capabilities "are of vital importance in the facilitation of innovation effectiveness" (Huang and Rice 2009, p. 201) and are one of the most important aspects responsible for explaining inter-firm disparities in returns from open-innovation activities (Salge *et al.* 2012). This in in line with Sammarra and Biggiero (2008, p. 820) who found that the "key factor for a firm's successful exploitation of innovation opportunities in the context of collaborations [is] the development of dynamic capabilities to access and recombine different types of knowledge". This is partly due to the fact that the pool of knowledge available to a firm dramatically increases with the number of external partners a focal firm maintains relationships with, while the internal knowledge capabilities to manage this pool are not adjusted timely resulting in a gap. Furthermore, strong internal knowledge capabilities allow an organization to select and pursue the most promising relationships with external partners (Rothaermel and Hess 2010). To reduce or even close this gap and to manage the knowledge stock of a firm including already existing as well as newly acquired knowledge, this thesis takes three firm-internal knowledge capabilities into account: Absorptive capacity, usage of knowledge management systems, and innovation governance mechanisms.

2.4.1 The Concept of Absorptive Capacity (ACAP)

The first concept of this thesis applies to absorptive capacity (ACAP) as a firm-specific dynamic capability which is a requirement for systematically and efficiently processing and thereby benefiting from knowledge flows from external partners (e.g. Laine and Laine 2012). The concept of ACAP was first introduced by Cohen and Levinthal (1989) to identify a firm's ability to learn from the environment through processes of identifying, assimilating, and exploiting knowledge. Thereby, ACAP was seen as a by-product of a

firm's R&D efforts (Cohen and Levinthal 1989)[24]. Only one year later, Cohen and Levinthal (1990) revised their original definition and increased the scope of ACAP by taking into account cognitive aspects of the learning process (Camisón and Forés 2010). They subsequently refer to ACAP "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) emphasizing ACAP not only as a by-product of R&D activities and/or manufacturing operations but also as product of prior knowledge and the diversity of expertise of an organization. This definition by Cohen and Levinthal (1990) was extended and refined several times "to move absorptive capacity away from an exclusively R&D focus to a broader dynamic capability perspective" (Lane *et al.* 2006, p. 845), at which these extensions and refinements largely occurred independently (Lane *et al.* 2006).

While Cohen and Levinthal (1990) concentrate on the absolute ACAP of a firm (Dyer and Singh 1998) as a one-way learning process (Lane *et al.* 2006) suggesting that an organization equally learns from all other organizations (Dyer and Singh 1998; Lane and Lubatkin 1998), Dyer and Singh (1998) broaden this perspective by introducing the concept of partner-specific ACAP, focusing on joint learning as a two-way learning process. Partner-specific absorptive capacity "refers to the idea that a firm has developed the ability to recognize and assimilate valuable knowledge from a particular alliance partner" as a "function of (1) the extent to which partners have developed overlapping knowledge bases and (2) the extent to which partners have developed interaction routines that maximize the frequency and intensity of sociotechnical interactions" (Dyer and Singh 1998, p. 665). From this relational perspective, ACAP is viewed as "an iterative process of exchange" leading to "relational rents through knowledge sharing" (Dyer and Singh 1998, p. 666).

At the same time Lane and Lubatkin (2004, p. 461) "reconceptualize the firm-level construct absorptive capacity as a learning dyad-level construct" which is termed relative absorptive capacity. In comparison to Cohen and Levinthal's (1990) understanding of

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[24] Based on Cohen and Levinthal's (1989) notion of the 'two faces of R&D' the concepts of ACAP and R&D capacity can be separated. While R&D capacity refers to firm-internal and especially R&D department-internal knowledge production "defined as a firm's investment in internal R&D to build stock of knowledge" (Berchicci 2013, p. 119), ACAP is about the absorption of external knowledge. However, ACAP and R&D capacity are intertwined and linked (Berchicci 2013) as illustrated by Cassiman and Veugelers (2006, p. 68): "Own internal know-how will increase the marginal return to external knowledge acquisition strategies. This is reminiscent of the notion of 'absorptive capacity'[.] […] At the same time, access to external know-how may leverage the efficiency of internal R&D activities, at least if a firm is willing to accept external ideas and knowledge". Nevertheless, since Cohen and Levinthal (1989) introduced ACAP as a by-product of a firm's R&D efforts, the dominant way to interpret the direction of the relationship between R&D capacity and ACAP is to see the former as enhancing the latter (e.g. Berchicci 2013; Salge *et al.* 2012). Both R&D capacity and ACAP in turn can be seen tor constitute an organization's innovation capabilities in equal measure (Persaud 2005) since innovation capabilities concern "the specific expertise and competence related to the development and introduction of new processes and products [as well as services]" (Hagedoorn and Duysters 2002, p. 168).

ACAP as an ability that firms develop through the accumulation of a knowledge stock over time, Lane and Lubatkin (1998) shifted the unit of analysis to learning dyads consisting of "student firm" and "teacher firm" pairings. By doing so they adopted a one-way learning perspective in comparison to Dyer and Singh (1998), providing evidence that "a student firm's absorptive capacity […] depends upon: (a) the specific type of new knowledge offered by the teacher firm [alliance partner]; (b) the similarity between the student and the teacher firm's compensation practices and organizational structures; and (c) the student firm's familiarity with the teacher firm's set of organizational problems" (Lane and Lubatkin 1998, p. 462).

In this vein van den Bosch et al. (1999) scrutinized the coevolution of a firm's absorptive capacity and its knowledge environment suggesting that Cohen and Levinthal's (1990) implicit positive feedback loop ("an increase in absorptive capacity causes a change in prior related knowledge in such a way that, ceteris paribus, the absorptive capacity increases" (van Den Bosch *et al.* 1999, p. 566)) is "mediated by the environment in which a firm competes and by its success in coping with that environment." (Lane *et al.* 2006, p. 845). In a difference from Dyer and Singh's (1998) focus on the iterative learning process between the focal firm and one external partner, van den Bosch et al. (1999) concentrate on the learning process between the focal firm and its whole environment (Lane *et al.* 2006).

The most far reaching reconceptualization of ACAP is the one offered by Zahra and George (2002) (Camisón and Forés 2010), who refer to ACAP "as a set of organizational routines and processes by which firms acquire, assimilate, transform, and exploit knowledge to produce a dynamic organizational capability" (Zahra and George 2002, p. 186). Zahra and George (2002) split ACAP into two components: Potential absorptive capacity (PACAP) and realized absorptive capacity (RACAP). Each component comprises of two capabilities constituting the diverse 'life cycle' of knowledge utilization by building upon one other to develop a dynamic organizational capability (Camisón and Forés 2010). PACAP is composed of the two capabilities of acquisition and assimilation of external knowledge while RACAP encompasses the abilities of transformation and exploitation of the available knowledge (Zahra and George 2002). Van den Bosch et al.'s (1999) understanding of ACAP, that a firm's ACAP coevolutes with its environment, corresponds to Zahra and George's (2002) view of PACAP (Lane *et al.* 2006). The acquisition capability of a firm concerns its ability "to identify and acquire externally generated knowledge that is critical to its operations", whereas the assimilation capability "refers to the firm's routines and processes that allow it to analyze, process, interpret, and understand the information obtained from external sources" (Zahra and George 2002, p. 189). The transformation capability "denotes a firm's capability to develop and refine the routines that facilitate combining existing knowledge and the newly acquired and assimi-

lated knowledge" and "is accomplished by adding or deleting knowledge or simply by interpreting the same knowledge in a different manner" (Zahra and George 2002, p. 190). Finally, the fourth ability of a firm, its exploitation capability, "reflects a firm's ability to harvest and incorporate [acquired and transformed] knowledge into its operations" (Zahra and George 2002, p. 190). Typical outcomes of this capability are new products/services or processes (Spender 1996). This is in line with Lane et. al.'s (2006, p. 855) statement that while "Cohen and Levinthal (1990), Lane and Lubatkin (1998), and Van den Bosch et al. (1999) imply that absorptive capacity is a funnel that emphasizes exploratory learning, Zahra and George (2002) depict it as a pipeline based on efficient knowledge exploitation."

Based on a thorough review of the discussed papers (and many more publications on ACAP) and taking into account the process perspective of ACAP emphasized by Cohen and Levinthal (1990), Lane et al. (2006) provide a more detailed definition of ACAP, and interpret it as a three sequential processes connecting each process to a specific type of learning[25]: "Absorptive capacity is a firm's ability to utilize externally held knowledge through three sequential processes: (1) recognizing and understanding potentially valuable new knowledge outside the firm through exploratory learning, (2) assimilating valuable new knowledge through transformative learning, and (3) using the assimilated knowledge to create new knowledge and commercial outputs through exploitative learning" (Lane *et al.* 2006, p. 856). It has to be mentioned that Lane et al. (2006, p. 855) implicitly include transformation capability since transformative learning considers the combination of new knowledge with already "existing knowledge allowing the latter to be used in new ways" (Lane *et al.* 2006, p. 855). Accordingly, the four capabilities observed by Zahra and George (2002) are reflected in Lane et al.'s (2006) interpretation of ACAP (Camisón and Forés 2010). In this vein Todorova and Durisin presented a discussion of the assimilation vs. transformation capability as two different sequential processes and came to the conclusion that assimilation and transformation should be treated as an alternative rather than a sequential process depending on the similarity of the respective

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[25] While Lane et al. (2006) clearly relates ACAP to organizational learning, Bresman (2013) incorporates ACAP as a part of the translation process ("translation of the identified knowledge into a vernacular that speaks to [groups] own context" (p. 36)) of his model of routine change based vicarious group learning. Accordingly, Roberts et al. (2012, p. 628) in their recent literature review come to the conclusion that the relationship between ACAP and organizational learning is still not clear. Roberts et al. (2012) initiated an attempt to differentiate between ACAP and organizational learning on the basis of three characteristics: Construct vs. concept, active vs. passive, and external vs. internal. They see ACAP as a "construct with well-defined assumptions and boundary conditions" while organizational learning refers to "a broad concept that encompasses a variety of processes and constructs" (Roberts *et al.* 2012, p. 630). Furthermore, ACAP must be actively fostered by organizations and focuses exclusively on external knowledge while organizational learning can take place actively or passively spanning internal as well as external knowledge (Roberts *et al.* 2012). This is in line with Camisón and Forés (2010) who distinguish between an external learning capacity, the ACAP, and an internal learning capacity, the internal knowledge creation capacity, as well as with Sun and Anderson (2010, p. 130) who suggest "that absorptive capacity (a dynamic capability) is a concrete example of organizational learning that concerns an organization's relationship with new external knowledge."

external acquired knowledge regarding its fit with existing cognitive structures (Todorova and Durisin 2007). If the acquired knowledge fits very well then it will be assimilated (cognitive structures do not change) else it will be transformed (cognitive structures change). Hence Todorova and Durisin (2007) define ACAP as a firm's capacity to value, acquire, assimilate *or* transform, and exploit external knowledge.

However, this thesis follows the conceptualization of Zahra and George (2002) since the theoretical distinction between PACAP and RACAP seems more valuable for the purpose of this thesis because the continuous renewal of the knowledge stock of an organization through acquisition and assimilation builds the potential for innovation by avoiding competence traps, while the transformation and exploitation of this enhanced knowledge stock is the primary source for the competitive advantages in terms of realizing innovations (Camisón and Forés 2010; Volberda *et al.* 2010). Thus assimilation and transformation capabilities are explicitly separated, "since they depend on processes of a different nature within the organization and are part of different components (PACAP vs. RACAP)" (Camisón and Forés 2010, p. 709). Accordingly, this thesis, in line with previous studies (Malhotra *et al.* 2005; Pavlou and El Sawy 2006) and as suggested by Zahra and George (2002), treats ACAP as a dynamic organizational capability[26] (compare also Camisón and Forés 2010) following Lane et al.'s call that research on ACAP should "move away from a structural perspective of absorptive capacity to a view of it as more of a dynamic capability" (Lane *et al.* 2006, p. 857). In this vein, ACAP is a dynamic capability of the organizational set of dynamic innovation capabilities to innovate or to adopt innovations contributing to competitive advantage (for a discussion of dynamic innovation capabilities, see Crossan and Apaydin (2010)).

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[26] An organizational capability "refers to the ability of an organization to perform a coordinated set of tasks, utilizing organizational resources, for the purpose of achieving a particular end result" (Helfat and Peteraf 2003, p. 999). A dynamic capability in contrast is about a "firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments" (Teece *et al.* 1997, p. 516). Eisenhardt and Martin (2000, p. 1111) echo the same point by defining dynamic capabilities as "specific organizational and strategic processes (e.g., product innovation, strategic decision making, alliancing) by which managers alter their [the firm's] resource base [e.g., the knowledge stock]". Thus, dynamic capabilities refer "to the ability to change or reconfigure existing [resource bases as well as] substantive capabilities" and the "qualifier *dynamic* distinguishes one type of ability (e.g., the substantive ability to develop new services) from another type of ability (e.g., the ability to reform the way the firm develops new services)" (Roberts *et al.* 2012, p. 628). In summary, dynamic capabilities comprise of the improvement and renewal of organizations' resource bases (Ambrosini *et al.* 2009) as well as the regeneration of substantive (i.e., ordinary) capabilities (Roberts *et al.* 2012) and the dynamic capabilities themselves ("change the way the firm changes its resource base") (Ambrosini *et al.* 2009, p. 9). The latter has to be interpreted so that "one type of dynamic capability (e.g., a redeployment capability) may act upon another type of dynamic capability (e.g., an R&D capability), but a dynamic capability generally cannot act upon itself to transform itself" (compare also Ambrosini *et al.* 2009; Helfat and Peteraf 2003, p. 1008).
A third interpretation of ACAP beside seeing it as a capability (predominant theoretical view (Roberts *et al.* 2012) especially in the context of inter-organizational learning (Lane *et al.* 2006)) or a dynamic capability is to treat ACAP as an asset (anything tangible or intangible "an organization owns, controls, or has access to on a semi-permanent basis" (Helfat and Peteraf 2003, p. 999)) (Roberts *et al.* 2012). From this perspective ACAP is conceptualized as the prior knowledge stock of an organization (Roberts *et al.* 2012), a definition which has the disadvantage of neglecting "the processes by which the unit's knowledge base is replenished through the identification, assimilation, transformation, and application of valuable new knowledge" (Roberts *et al.* 2012, p. 628).

In a manner similar to research on social capital, ACAP is flexibly applied at many different levels of analysis (Camisón and Forés 2010) (at the individual level (e.g., Matusik and Heeley 2005), the group level (e.g., Tiwana and McLean 2005), organizational level (e.g., Francalanci and Morabito 2008), and inter-organizational level (e.g., Dyer and Singh 1998)) as well as in many different research fields like information systems research (e.g. Francalanci and Morabito 2008), finance and accounting research (e.g., Xiong and Bharadwaj 2011), and research on adoption (e.g. Gomez and Vargas 2009). However, stemming originally from the research on R&D as mentioned above, most of the studies that apply ACAP are still rooted in the field of innovation research (e.g., Berchicci 2013; Chen *et al.* 2009; Escribano *et al.* 2009; Hervas-Oliver and Albors-Garrigos 2009; Huang and Rice 2009; Koch and Strotmann 2008; Liao *et al.* 2007; Liao *et al.* 2010; Tsai 2001; Wang and Han 2011). Accordingly, research has identified several internal and external antecedents as well as outcomes of ACAP (for a comprehensive overview see Daghfous 2004; Lane *et al.* 2006; Volberda *et al.* 2010). Following only the role of ACAP for reducing or even closing the gap between the firm-external pool of knowledge and firm-internal knowledge capabilities for handling this pool as mentioned at the beginning of this section will be discussed. In this way it will be shown how ACAP supports the management of the enhanced knowledge stock of an organization.

Generally, ACAP produces knowledge outputs (Lane et al. 2006). In detail and in relation to an intra-organizational setting, Gupta and Govindarajan (2000) applied ACAP showing that the accumulation of knowledge across different business units of an organization is positively affected and in turn fosters organizational learning (Cohen and Levinthal 1990; Nahapiet and Ghoshal 1998). Furthermore, ACAP plays an important role for inter-organizational knowledge transfer (e.g., Chang *et al.* 2012; Easterby-Smith *et al.* 2008; van Wijk *et al.* 2008) allowing the capture of "what is known as relational rents that result not from its [firm] own resources but from its ties with external actors (Dyer and Singh 1998)" (Salge *et al.* 2012, p. 4). Thereby, ACAP is a crucial driver for gaining benefit from the firm-external pool of knowledge. Additionally, ACAP depends on prior knowledge collected over time (Cantwell 2002) or, in other words, ACAP is path dependent (Cohen and Levinthal 1990), which helps to manage the firm-external pool of knowledge since the capability to observe and explore the environment as well as the capability to recognize opportunities hinge on prior accumulated knowledge (Cantwell 2002). This is in line with Berchicci's (2013, p. 119) finding that the knowledge stock of a firm allows it "to evaluate and tap into external sources of knowledge" and that firms lacking internal knowledge capabilities are not able to fully acquire and assimilate external knowledge. Due to this path dependency, investments in ACAP might not be followed by direct economic returns from innovation and thus might have a negative im-

pact on the short-term performance of an organization but play a crucial role in realizing benefit from an organization's openness in terms of its networking activities (Huang and Rice 2009). In other words, investments in ACAP "will ensure that firms are more likely to combine internal and external sources of innovation to build a comprehensive innovation strategy instead of benefiting from innovating exclusively" (Huang and Rice 2009, p. 216). To sum up, ACAP positively impacts on innovation (Camisón and Forés 2010; Tsai 2001), or innovation success respectively (Chen *et al.* 2009; Fosfuri and Tribo 2008) as well as the firm's (long-term) performance (Lane *et al.* 2001; Tsai 2001). Thus ACAP represents the final element of open innovation since "innovation outcomes will be elusive in the absence of absorptive capacity, even if valuable technology has been successfully obtained from outside. In analogy, both a sponge and a sieve can 'attract' fluids, but only a sponge, with its strong absorptive nature, can retain fluids for later use" (Huang and Rice 2009, p. 203). For an illustrative example of ACAP see PAPER IV chapter 2 "Absorptive Capacity (ACAP)".

2.4.2 The Usage of Knowledge Management Systems (KMS)

To reduce or even close the gap between the knowledge available to an organization and its internal knowledge capabilities for managing this knowledge as mentioned at the beginning of this section, an organization "requires a well-planned system of knowledge management that enables the firm to excel in technological, market and administrative knowledge creation" (Popadiuk and Choo 2006, p. 302). Thus, the application of knowledge management (KM) is of central importance in helping to maintain the consistency and integrity of the knowledge stock of an organization extended by the external knowledge pool (Stein and Zwass 1995). Furthermore, the application of KM ensures that the knowledge stock is always state-of-the-art (Ashrafi et al. 2006). This can be realized in two ways. KM can focus on the one hand on "knowledge flow and the processes of creation, sharing, and distribution of knowledge" (compare also Argote et al. 2003b), or on the other hand "on building core competencies, understanding the strategic advantage of know-how, and creating intellectual capital" (Alavi and Leidner 2001, p. 110). Thus KM can help manage the newly acquired and already existing knowledge of an organization directly or indirectly through driving other internal knowledge capabilities especially ACAP, as illustrated in the following.

"Knowledge management refers to identifying and leveraging the collective knowledge in an organization to help the organization compete" and it "is purported to increase innovativeness and responsiveness" (Alavi and Leidner 2001, p. 113). Hence KM and innovation management are related to each other (Coombs and Hull 1998). Knowledge management contains a dynamic and continuous set of practices and processes (Alavi and Leidner 2001). The four basic processes of KM cover knowledge creation,

knowledge storage/retrieval, knowledge transfer and knowledge application (Alavi and Leidner 2001), which all contribute to driving organizational learning through collaborative processes and individual reflection (Nonaka 1994). To perform and even increase the efficiency and the effectiveness of these four processes, knowledge management conducts various measures called knowledge management practices. One of the most important practices is to support knowledge management processes through the application of information technologies. Information technologies used for this purpose are labelled knowledge management systems (KMS) [27].

Adopting Pavlou and El Sawy's (2006) definition, a KMS refers to "IT-based system[s] developed to support and enhance" the aforementioned four processes of knowledge management (Alavi and Leidner 2001, p. 114). A KMS facilitates the first process of knowledge creation by storing useful knowledge (Pavlou and El Sawy 2006) acquired from many different sources, e.g., external exchange partners. Furthermore, besides creating knowledge organizations also forget knowledge (Argote *et al.* 2003a; 2003b; Darr *et al.* 1995) meaning that knowledge might be in the organization but is not available for application. In this vein, a KMS, for example, in the form of electronic databases, allows the updating or even deleting of pieces of the knowledge stock of an organization in an effective way (Ashrafi *et al.* 2006) and thus creates what Randall et al. (2001) call organizational memory which prevents knowledge decay (Nakano *et al.* 2013). The second process, information retrieval, is supported by a KMS by simplifying the identification and discovery of knowledge of interest to knowledge consumers within a firm (Ashrafi et al. 2006). Thus a KMS contributes to a more comprehensive understanding of newly acquired knowledge by supporting the connection of this knowledge with already existing ones, i.e., the connection of different pieces of knowledge. The third process of knowledge transfer or distribution within a firm is of central importance for developing innovations since the exchange of knowledge across individuals and organizational units fosters the emergence of new knowledge combinations (e.g., van Wijk *et al.* 2008). A KMS supports the transfer of already existing knowledge but also of newly acquired knowledge (Ashrafi et al. 2006) by providing a conduit for communication and collaboration between producers of knowledge and seekers of knowledge (Pavlou and El Sawy 2006), and thus extends the "individual's reach beyond the formal communication lines [of an organization]" (Alavi and Leidner 2001, p. 121). Finally a KMS facilitates the application of knowledge by simplifying and speeding up access to an organization's knowledge stock (Alavi and Tiwana 2002; Gold et al. 2001) that is stored, for example, in organizational directives (Grant 1996a), providing "a rich pool of 'collectively owned' knowledge from the virtual space" (Sherif *et al.* 2006, p. 796). To sum up, the usage of a

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[27] This thesis deliberately focuses on the usage of KMS because in their meta-analysis Petter et al. (2008) found the contribution of IT on an organizational level is related to the extent of its use.

KMS impacts on the management of acquired knowledge directly and in a positive way by building and administering the organization's stock of knowledge, including structuring external acquired knowledge.

Beside this direct effect the use of a KMS has an indirect effect by driving other internal knowledge capabilities, especially ACAP with its two components of PACAP and RACAP. A KMS assists the identification of knowledge (Denrell et al. 2004) in two ways: (1) by assisting the search for information (e.g., keyword search) and (2) by assisting the detection of internal and external knowledge sources (e.g., project managers, customer) providing information. "Employee knowledge directories" or "intelligent mechanisms built into search and retrieval technologies […] help navigate the knowledge acquisition process in the right direction" (Joshi *et al.* 2010, p. 474). "Examples include finding an expert or a recorded source of knowledge using online directories and searching databases; sharing knowledge and working together in virtual teams; access to information on past projects; and learning about customer needs" (Alavi and Leidner 2001, p. 114). Therefore, a KMS facilitates knowledge acquisition by "enhancing the speed, intensity, and directionality of knowledge identification and selection" (Joshi *et al.* 2010, p. 474). The assimilation of knowledge is facilitated through the usage of a KMS by building and organizing an organization's knowledge stock which allows for the better processing and interpreting of newly acquired knowledge in the light of the already existing knowledge stock (Joshi *et al.* 2010), e.g., regarding the newness and compatibility of the acquired knowledge. Thus a more complete picture of the newly acquired knowledge is provided resulting in a more comprehensive understanding of that knowledge. The transformation capability is supported through the use of a KMS by fostering the combination of already accumulated knowledge over time with newly acquired and assimilated knowledge (Joshi *et al.* 2010; Roberts *et al.* 2012). Furthermore, the use of a KMS provides the means to merge, update, share, categorize, and synthesize these two types of knowledge thus creating new knowledge (Joshi *et al.* 2010). In particularly, the functionality of a KMS to distribute knowledge is of crucial importance since ACAP "depends on the organization's ability to share knowledge and communicate internally" (Lane et al. 2006, p. 838). Finally, the use of a KMS supports exploitation capability through the implementation of the newly generated knowledge into the firm's operations thus creating new products or services whereby "with the aid of IT, individuals who exploit knowledge do not need to comprehend it (Conner and Prahalad 1996), nor do they need to internalize it (Sabherwal and Sabherwal 2005)" (Joshi *et al.* 2010, p. 475). The parts of ACAP attributed to information technology, in this case to the use of KMS, are called the IT-enabled potential absorptive capacity (IT-PACAP) and the IT-enabled realized absorptive capacity (IT-RACAP) in which the IT-enabled transfor-

mation capability is related in particular to a high level of innovativeness (Sabherwal and Sabherwal 2005).

In summary, the KM and especially its use provide an organization with the advantage of managing the knowledge stock as well as newly acquired knowledge both directly and indirectly. Accordingly, innovation literature identifies various forms of KMS, e.g., document management or knowledge mapping systems, which highlight KMS's importance as an innovation management technique (Hidalgo and Albors 2008) which maintains and enhances innovations success (Nakano *et al.* 2013).

2.4.3 Innovation Governance Mechanisms

Finally, this thesis also takes into account innovation governance mechanisms as a firm-internal knowledge capability for organizing newly acquired and already existing knowledge of an organization, on the basis that "knowledge is created, shared, transferred and applied [mostly] via people-based mechanisms rather than technology" (Li *et al.* 2011, p. 157). Accordingly, knowledge communication between the employees of organizations is at the heart of the effect that innovation governance mechanisms have in increasing an organization's "ability to create a competitive advantage and generate new knowledge (Cohen and Levinthal 1990; Polanyi 1962) – which is advantageous for developing innovation (Gold *et al.* 2001; Nonaka 1994)" (Li *et al.* 2011, p. 158)[28]. Furthermore, Cohen and Levinthal (1990, p. 133) found out that "an organization's absorptive capacity is not resident in any single individual but depends on the links across a mosaic of individual capabilities". Thus, and in a manner similar to the use of knowledge management systems, the effect of innovation governance mechanisms is twofold. They can affect the management of an organization's knowledge stock directly or indirectly by fostering other internal knowledge capabilities, especially ACAP. This thesis investigates different innovation governance mechanisms which can be assigned to three types of combinative capabilities identified by van den Bosch et al. (1999). Combinative capabilities as capabilities that "synthesize and apply current and acquired knowledge" are differentiated by van den Bosch et al. (1999, p. 556) into coordination capabilities, systems capabilities, and socialization capabilities. Accordingly, this thesis distinguishes between innovation governance mechanisms geared to coordination, to systems and to socialization capabilities.

"Coordination capabilities enhance knowledge absorption through relations between members of a group", "refer to lateral ways of coordination" and "might be explicitly designed, but may also emerge from a process of interaction" (van Den Bosch *et al.* 1999,

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[28] Li et al. (2011) erroneously refer to Polanyi (1967) instead of Polanyi (1962) and to Andrew et al. (2001) instead of Gold et al. (2001). Regarding latter, Li et al. (2011) permuted the first and last name of the first author.

p. 556). Accordingly, innovation governance mechanisms geared to coordination capabilities encompass organizational structures, policies, and procedures to systematically combine efforts, typically of different organization's units, to organize newly acquired and already existing knowledge. They can be found in written documents but also comprise of commonly known and accepted procedures and rules. These mechanisms enhance the level of knowledge available to a firm and contribute positively to ACAP (van Den Bosch *et al.* 1999) and eventually to the innovation success of an organization since they "bring together different sources of expertise and increase lateral interaction between areas of functional, or component, knowledge" (Jansen *et al.* 2005, p. 1001). Jansen et al. (2005) show in their study that coordination mechanisms in terms of cross-functional interfaces, participation in decision making, and in terms of job rotation positively impact on acquisition and assimilation capability (PACAP) (which is not the case regarding participation in decision making) as well as transformation capability, while not affecting exploitation capability (RACAP). These outcomes underline and extend the results published by van den Bosch et al. (1999) which show that the mechanisms of training and job rotation, natural liaison devices, and participation are related to ACAP since the scope and flexibility of knowledge absorption is high.

The second type of combinative capabilities refers to "systems capabilities in terms of direction, policies, procedures, and manuals [which] are often used to integrate explicit knowledge" (van Den Bosch *et al.* 1999, p. 556). Thus innovations governance mechanisms geared to system capabilities "are more formalized, explicit, and changeable by management" (van Den Bosch *et al.* 1999, p. 556) and can be found in documents such as job instructions. This thesis regards governance mechanisms geared to system capabilities as organizational structures, policies, and procedures designed to guide the innovation process of an organization, fostering its efficiency and repetitiveness by providing channels for communication and common frames of reference. Accordingly, these mechanisms are designed to increase efficiency but also provide guidelines for employees to manage newly acquired and already existing knowledge. While van den Bosch et al. (1999) anticipated that the effect of mechanisms geared to systems capabilities on ACAP would be negative due to low scope and flexibility of knowledge absorption, Jansen et al. (2005) provides a more dedicated picture. They found on the one hand that system capabilities in terms of routinization are negatively associated to acquisition, assimilation, and transformation capability, but on the other hand system capabilities in terms of formalization positively impacts on transformation and exploitation capability (RACAP) and have no effect (more explicitly no negative effect) on acquisition and assimilation capability (PACAP). The assumption of this study is that "well-designed rules and procedures capture prior experiences that may enable employees to search for, and assimilate, new external knowledge" (Jansen *et al.* 2005, p. 1009).

Finally, van den Bosch et al. (1999, p. 557) distinguish between socialization capabili-ties which "refer to the ability of the firm to produce a shared ideology that offers mem-bers an attractive identity as well as collective interpretations of reality" (van Den Bosch *et al.* 1999, p. 557). In line with system capabilities, van den Bosch et al. (1999) argue that socialization capabilities negatively influences ACAP due to the low scope and flex-ibility of knowledge absorption. Again Jansen et al. (2005) provide a more detailed pic-ture of the impact of mechanisms geared to socialization capabilities. While mecha-nisms geared to socialization capabilities in terms of connectedness and socialization tactics positively affect transformation and exploitation capabilities (RACAP), only con-nectedness is associated with a higher assimilation capability (Jansen *et al.* 2005). This is in line with the argument of Cohen and Levinthal (1990, p. 131) who state that "if all actors in the organization share the same specialized language, they will be effective in communicating with one another, but they may not be able to tap into diverse external knowledge sources". However, socialization mechanisms are forwarded to influence ACAP through tacit rules for action that enhance the efficiency of knowledge absorption (van Den Bosch *et al.* 1999) and in particular the integration of knowledge into the or-ganizational knowledge stock (RACAP) (Jansen *et al.* 2005) through the creation of conditions for knowledge exchange and combination (Nahapiet and Ghoshal 1998; Roberts *et al.* 2012; Todorova and Durisin 2007).

Building on the insights of the two studies by van den Bosch et al. (1999) and by Jansen et al. (2005) we conclude that innovation governance mechanisms geared to coordina-tion capabilities ("e.g., lateral communications across the 'network' of the organization"), to systems capabilities ("preprogrammed behaviors (e.g., policies, directions and infor-mation systems in use)"), and to socialization capabilities ("mores, social rituals, and expectations for interaction within a given social milieu") are valuable measures for managing the knowledge stock of an organization and in particular for newly acquired knowledge through the enhancement of the different capabilities of ACAP (citations in brackets: Cuellar and Gallivan 2006, p. 1125).

In summary, to manage the knowledge stock of an organization as well as to transform "raw" external knowledge into knowledge valuable for the organization, this thesis draws on the aforementioned three different firm-internal knowledge capabilities. In this way the gap between the knowledge available to an organization and its internal knowledge capabilities for managing this knowledge is reduced or even closed. Figure 6 illustrates these three capabilities with their various facets.
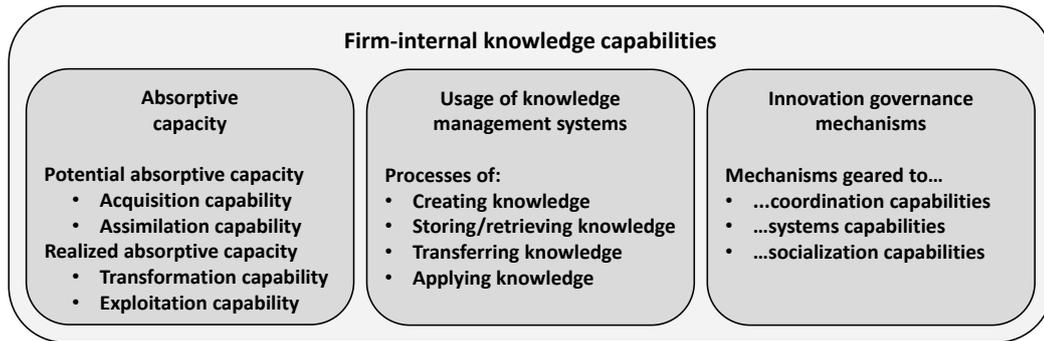
Figure 6: Firm-internal knowledge capabilities

3.   Methodology

To address the various research questions of this thesis a literature review (PAPER I) and a quantitative study adopting a 'realistic' approach to ontology and a positivist research perspective (see section 1.2) have been conducted (PAPER II to PAPER VIII excluding the conceptual PAPER VI). The following subsections describe the two applied methodologies in detail by explaining the different methods of analysis used and by illustrating the setting and procedure of the quantitative study.

3.1   Literature Review

PAPER I of this thesis carries out a literature review in accordance with the general guidelines for reviewing as proposed by Webster and Watson (2002) following a structured five-phase process for the reviewing of literature: (1) definition of review scope, (2) conceptualization of topic, (3) literature search, (4) literature analysis and synthesis, (5) research agenda (e.g., illustrated by vom Brocke *et al.* 2009).

The first process concerns the definition of the scope of the literature review and draws on a taxonomy introduced by Cooper (1988) and extended by Fettke (2006). Table 1 illustrates this taxonomy including their categories and highlights the ones applicable to the review conducted in PAPER I.

The literature review in PAPER I focuses on the applied *research method* in terms of the measurement models for innovativeness while using *natural language* to analyze this literature. Thereby, the goal of creating a coherent perspective on the measurement of innovativeness is *explicitly* described and different measurement models are *integrated* into a *methodological* framework consisting of three different patterns of measurement: Innovation adoption vs. innovation creation, product/service innovation vs. process innovation, and input-oriented vs. output-oriented measurement. The review is performed from a *neutral perspective* based on a *representative sample* of works *explicitly* covering a number of journals of different research domains standing for the field of

innovation research. By taking into account the diverse research domains of information systems, strategic management and marketing literature this review addresses a *broad set of scholars* to reflect the multidisciplinarity of innovation research. Finally, future research is *explicitly* considered in the review by proposing best-practice in how to use measurement models for innovativeness based on identified inconsistencies of usage through the integration of measurement models into the methodological framework.[29]

Table 1: Taxonomy of the literature review on measurement innovativeness (bold = chosen category during the literature review in PAPER I) (based on Cooper (1988) and extended by Fettke (2006))

Characteristic		Categories
Type		**Natural language** / mathematical – statistical
Focus		Research outcomes / **research methods** / theories / practices or applications
Goal	Formulation	**Explicit** / non-explicit
	Content	**Integration** / criticism / identification of central issues
Organization		Historical / conceptual / **methodological**
Perspective		**Neutral representation** / Espousal of position
Coverage	Selection	**Explicit** / non-explicit
	Literature	Exhaustive / exhaustive with selective citation / **representative** / central or pivotal
Audience		Specialized scholars / **general scholars** / practitioners or policy makers / general public
Future research		**Explicit** / non-explicit

The second phase of the literature review process is about the conceptualization of the topic, addressing the claim that "the author of a review article must begin with a topic in need of review and a broad conception of what is known about the topic and potential areas where new knowledge may be needed" (Torraco 2005, p. 359). Accordingly, the review draws on the conceptualization of innovation as developed in chapter 2.1, mainly based on Gopalakrishnan and Damanpour (1997), and classifies the different measurement models according to categories that adopt the lenses of innovation adoption, innovation creation, product/service innovation, process innovation, input-orientation, and output-orientation.

Since innovation research is multidisciplinary the literature search considers works published in selected journals from the fields of information systems, strategic management, and marketing, thus ensuring a representative coverage of the field of innovation research. The focus was on journal articles since these works consist of knowledge validated through the peer-review process before publication and are likely to have a noted impact on the respective field (Crossan and Apaydin 2010; Rowley and Slack 2004).

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[29] Since the primary goal of the performed literature review is the integration of the measurement models used by past research into a methodological framework instead of the criticism of the usage of such models in an inconsistent way, the review focuses on integration rather than on criticism.

Additionally, cited works of potential interest from other journals were investigated by performing a backward search (Webster and Watson 2002).

The fourth phase is about the analysis and synthesis of the investigated literature to account for the characteristics of the literature review (phase 1) as well as the conceptualization of the topic (phase 2). Detailed information about the evaluation and synthesis of the investigated literature used to assemble the review findings in a concept matrix (Webster and Watson 2002) are provided in PAPER I.

The final phase concentrates on the development of a research agenda for future research. This agenda is based directly on the findings of the previous phase and can consist of (1) posing proactive research questions (propositions) which should be answered by future research, (2) developing a taxonomy or other conceptual classification of constructs to lay the foundation for new modes of theorizing, (3) building bases for the creation of a meta-theory through future research, (4) or coming up with alternative models or conceptual frameworks (new interpretations of the review's topic) for future application in research (Torraco 2005). The latter applies to PAPER I by its suggestion of a comprehensive measurement model for innovativeness and by proposing how to use it in future research.

3.2 Quantitative Research

Most papers in this thesis (except PAPER I and PAPER VI) draw on a quantitative study to answer the various research questions through the evaluation of different research models that apply data collected in a survey. Survey data used as primary data seems preferable over secondary data such as patent statistics in the context of this thesis, directly responding to He and Wang's (2009, p. 934) call for future research which "might use survey or field data to explore other aspects of innovative knowledge that are not reflected in R&D spending or patent". Thereby, this thesis overcomes "the common problem in patent studies that knowledge transfer and innovation are hard to discriminate, since such studies often use citations to measure either knowledge transfer or the type of innovation pursued" (van Wijk *et al.* 2008, p. 843). Furthermore, with regard to absorptive capacity, survey data allows for an in-depth study by formulating a multidimensional operationalization of ACAP (Camisón and Forés 2010) and thus addresses the increasing criticism of "objective unidimensional measures [which] turn out to be insufficient to capture the richness" of ACAP (Camisón and Forés 2010, p. 708). Finally and in line with Zaheer and Bell's (2005) finding, survey data is advantageous since it captures experts' best assessments of a current aspect such as the innovation success of an organization at the date of the study, while secondary data only reflects the history of that aspect. In the following sections, the development of the questionnaire, the background of the survey and the data collection process are briefly described. After

that the statistical methods used to scrutinize the different research models of this thesis are explained before finally the role of biases is discussed.

3.2.1 Development of the Questionnaire

The questionnaire underlying the survey of this thesis was developed by four experienced researchers following the procedure suggested by Churchill (1979). At the beginning, measurement models from 97 journal articles related to the topics of this thesis (organizational innovativeness, knowledge transfer, SCT, ACAP) were reviewed. From these articles appropriate measurement instruments were assessed regarding content validity and suitability to the thesis's research domain and were extracted predominantly based on one resource for one latent variable building the first draft of the measurement model. This first version of the questionnaire was pre-tested in eight firms (using the think-aloud approach with innovation managers). Based on their feedback several refinements were undertaken in order to eliminate ambiguities and to better adapt the questionnaire to the research domain and to the technical language of the target group. This included modification of the wording of the items to ensure their understandability and the comprehensive nature of the constructs. Additionally, information about the appropriate key informants in companies was collected. This pre-test also indicated that the concept of the knowledge stock with its five different domains was the most sophisticated. Therefore, a card sorting approach (assignment of cards encompassing single items to respective constructs) was carried out using a couple of managers and research colleagues for the five knowledge domains in order to gain higher content and convergent validity. The feedback was used to adjust the measurement model of the five domains by specifically modifying two items regarding wording and by deleting one item. Finally, a second round of six pre-tests was conducted resulting in the final questionnaire as the pre-tests showed consistent answering behavior meaning that no further changes were deemed necessary.

3.2.2 Data Collection

To analyze the various research models of the different papers in this thesis a survey was conducted among the 2,500 largest firms in Germany's manufacturing industry according to the Standard-Industrial-Classification-Codes (SIC-Codes) 3011-3999 and to the records of revenue for 2007. The 2,500 largest companies were chosen over smaller companies because they exhibit characteristics which offer differentiated insights into the various research questions. This firms are characterized by a high level of resources such as financial resources including R&D budgets and skilled employees (Damanpour and Wischnevsky 2006), by technological diversification, by the ability to integrate various innovative activities (Cantwell 2002), by entering into more joint venture agree-

ments with firm-external partners (Dutta and Weiss 1997), and also by engagements in more R&D cooperation (de Faria *et al.* 2010). Furthermore, these firms operating in the manufacturing industry are known for their worldwide presence and partnerships as well as for their continuous success in introducing new offerings due to their innovative knowledge assets, as reflected in patent statistics and their commercial success (He and Wang 2009). In summary, this sample of firms is appropriate for collecting a suffi-cient data set detecting knowledge transfer from a firm's environment (their inter-organizational social networks) as well as detecting applied firm-internal knowledge ca-pabilities.

The survey focused on the most important product division of each firm instead of the entire firm so as to avoid aggregation problems at the organizational level, since organi-zations often exhibit multiple divisions operating in different markets. On the one hand this narrower scope allows a precise detection of the relevance of their different knowledge domains, the role of the external relationships they maintain, and the internal knowledge capabilities applied by that specific division. On the other hand focusing only on the most important product division may bias the collected data resulting in only the highly innovative product divisions being considered since the 'most important' is asso-ciated with 'most innovative' or 'most successful' by the organizations. Case studies conducted before the survey started however (see footnote 10 on page 20) indicated that this was not the case, and that 'most important' was commonly associated with 'largest' by the organizations and thus revealed nothing about the innovation activities of the product division.

The survey was carried out in multiple steps. In the first step, each organization was contacted by phone in order to locate the manager responsible for the most important product division of the firm and thus also responsible for the innovation activities or, if such a position existed, the innovation manager, i.e., the person in charge of the inno-vation activities within this product division. Again, case studies carried out prior to the survey (see footnote 10 on page 20) indicated that this person had the necessary over-view to evaluate the level of existing knowledge for each domain and was totally familiar with the innovation process as well as with the relationships to the external partners since s/he was responsible for daily business affairs and thus stayed in contact with the partners of the product division. Such a person was identified in 2,160 cases. In the second step the questionnaire was mailed out according to the channel preferred by the identified manager: Postal mails (1575 times), faxes (4 times), and emails (581 times). To increase response rates and following Dennis's suggestion (2003), a reminder was issued four weeks later in the third step for those cases in which the manager had not returned the questionnaire. Finally, two more weeks later, those managers who still had not responded were called a second time and a second reminder was sent out. Addi-

tional measures were used to increase the response rate, such as sending the questionnaire together with a stamp addressed return envelope and a letter indicating the university sponsors, purpose and importance of the study together with an invitation for them to participate in a lottery among the study participants (see Dennis 2003). This whole process ultimately resulted in 229 received questionnaires which are representative of the population of the 2,500 largest organizations operating in Germany's manufacturing industry according to the distribution of revenue in 2007 (Wagner *et al.* 2011).
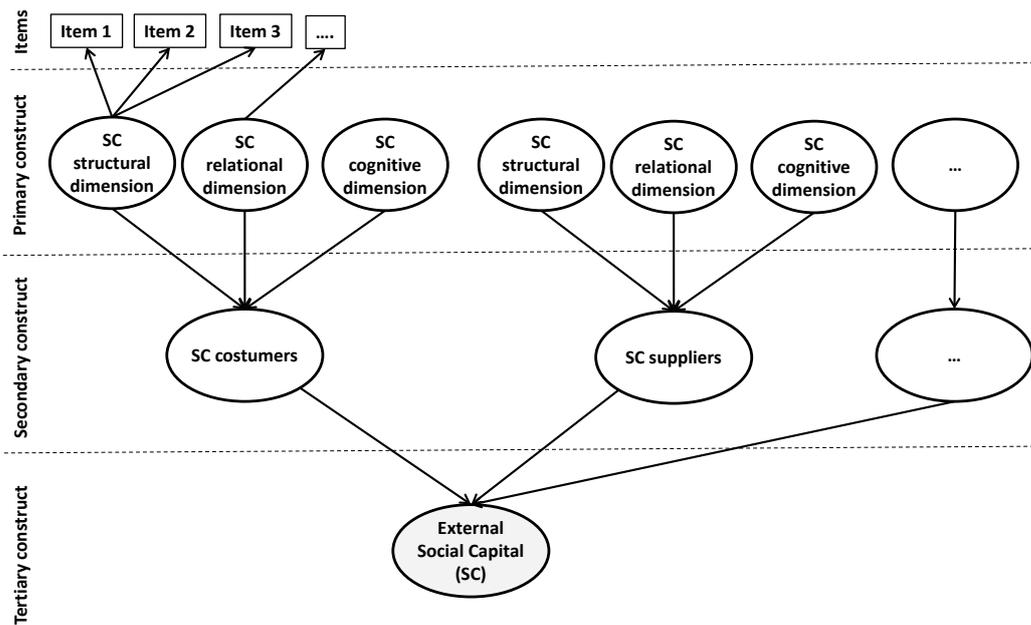
3.2.3 Basics of Quantitative Research

Quantitative research and especially the survey approach rely on the concept of latent variables representing theoretical constructs which cannot be measured directly and thus reflect unobservable constructs. Accordingly, measurement models consisting of observable indicators such as questions or statements from a questionnaire are associated with unobservable latent variables to make them measurable. Examples of latent variables are the four capabilities of ACAP. These capabilities cannot be measured directly but can be made measurable by using a measurement model comprising of various questionnaire items which are rated on a 7-point-Likert-scale, for example, ranging from "fully disagree" to "fully agree". The development of such a best-practice measurement model for the latent variable of innovativeness constitutes the core of PAPER I.

Prior literature distinguishes between two types of measurement model specification: The formative and reflective measurement model (e.g., Bagozzi 2011; Bollen 2011; Chin 1998a; Chin 2010; Jarvis *et al.* 2003). In the case of the former, the direction of causality is from the indicators to the latent variable forming it (Jarvis *et al.* 2003). Hence, Chin (2010) uses the term 'emergent construct' when referring to formative indicators. Dropping or changing an indicator from the measurement model results in a change of content in the latent variable in which the indicators should not be correlated to minimize multicollinearity (Jarvis *et al.* 2003). In the case of reflective measurement models the direction of causality is from the latent variable to the indicator reflecting the latent variable (Jarvis *et al.* 2003). Accordingly, changes in the construct affect the value of the indicators, but dropping an indicator from the measurement model does not alter the meaning of the latent variable in which the indicators should correlate highly with each other (Jarvis *et al.* 2003). In this thesis, the latent variables are made operational using reflective measurement models.

A wide-spread technique for aggregating the indicators of a reflective measurement model to one value representing the latent variable is factor analysis (Bühl 2012). In general this is "a multivariate technique for identifying whether the correlation between a set of observed variables [items of the questionnaire] stem from their relationship to one or more latent variable" (Field 2009, p. 786). In other words factor analysis is a "statisti-

cal approach that can be used to analyze interrelationships among a large number of variables [items] and to explain these variables in terms of their common underlying dimensions (factors) [latent variables]" (Straub *et al.* 2004, p. 425). Two kinds of factor analysis are differentiated between: Explorative factor analysis (EFA) and confirmatory factor analysis (CFA). In short, in an EFA the algorithm determines the number of factors (latent variables) without à priori assumptions by the researcher, while in a CFA the number of factors (latent variables) is set before running the analysis on the basis of a pre-established theory (Hair *et al.* 2009). Accordingly, the goal of a CFA is "to test specific theoretical expectations about the structure of a set of measures" (Straub *et al.* 2004, p. 424). CFA is mainly used in this thesis to calculate latent variable scores by applying principal component analysis (PCA) as one of the most common factor analytic techniques.

Besides first-order constructs comprising of only one latent variable and the corresponding measurement model, higher order constructs consisting of two or more latent variable are commonly used in quantitative research. Higher-order constructs at the initial level are called second-order constructs which "consist of a higher order LV [latent variable] that is modeled as causally impacting a number of first order LVs (i.e., standard LVs with measured indicators)" (Chin 1998a, p. x). Accordingly, second order latent variables are not directly connected to measured items. Such an analysis can be seen as "akin to a confirmatory factor analysis, but at a higher level of abstraction where the indicators are actually latent variables" (Chin 1998a, p. x). Since formative and reflective measurement models exist, four types of second-order constructs can be constructed: Reflective first-order and reflective second-order (type I); reflective first-order and formative second-order (type II); formative first-order and reflective second-order (type III); and formative first-order and formative- second-order (type IV) (Jarvis *et al.* 2003). Chin (2010) calls type I a molecular model and type II a molar model. For example, firm-external social capital associated with each type of partner was operationalized as a second-order construct by capturing the three different dimensions of social capital (first-order constructs) as introduced in the previous section by adopting the type II model (PAPER II and PAPER VIII). Type II was chosen based on theoretical considerations since social capital theory identifies three dimensions (see section 2.3) as building the social capital inherent in a relationship. The social capital of the whole network spanning all types of external partners was measured as the superset of the organization's relationship to the external partners and thus represents a respective third-order latent variable or tertiary construct (Wetzels *et al.* 2009) (PAPER VII). Figure 7 visualizes the measurement of the firm-external social capital as a tertiary construct.

Figure 7: Tertiary construct of the firm-external social capital (SC)

Besides the measurement model representing the relationship of the latent variables with their indicators, quantitative research considers the structural model as referring to a "set of one or more dependence relationships linking the model constructs [latent variables]" (Straub 1989)[30]. Accordingly, the structural model is concerned with the representation of the hypothesized causal relationships. These causal relationships between two or more latent variables can be of a different nature whereby the following are of interest for this thesis: Direct and indirect relationships in terms of moderation and mediation (Frazier *et al.* 2004; Henseler and Fassott 2010; Jaccard and Turrisi 2003). A direct causal relationship exists if a direct path from a latent variable X to Y is hypothesized. A moderation effect assumes that a moderator variable [Z] exists which "affects the direction and/or strength of the relation between an independent or predictor variable [X] and a dependent or criterion variable [Y]" (Baron and Kenny 1986, p. 1174). A mediation variable [M] (also referred to as an intervening variable (MacKinnon *et al.* 2002; Mathieu *et al.* 2008)) represents the mechanism through which a latent variable [X] influences another one [Y] (Baron and Kenny 1986). In the case of partial mediation the relationship between the X and Y decreases by a nontrivial amount while in the case of full mediation the relationship between X and Y even becomes insignificant after adding the mediator [M] (Baron and Kenny 1986; MacKinnon *et al.* 2002; Shrout and Bolger 2002). Thus "moderator variables specify when certain effects will hold, [whereas] mediators speak to how or why such effects occur" (Baron and Kenny 1986, p. 1176).

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[30] Instead of either the measurement model or structural model, the terms outer and inner model are used interchangeably in the research, while Henseler et al. (2009) remark that the former pairing is mostly used in the context of CBSEM and the latter in the context of PLS (compare section 3.2.5.3).
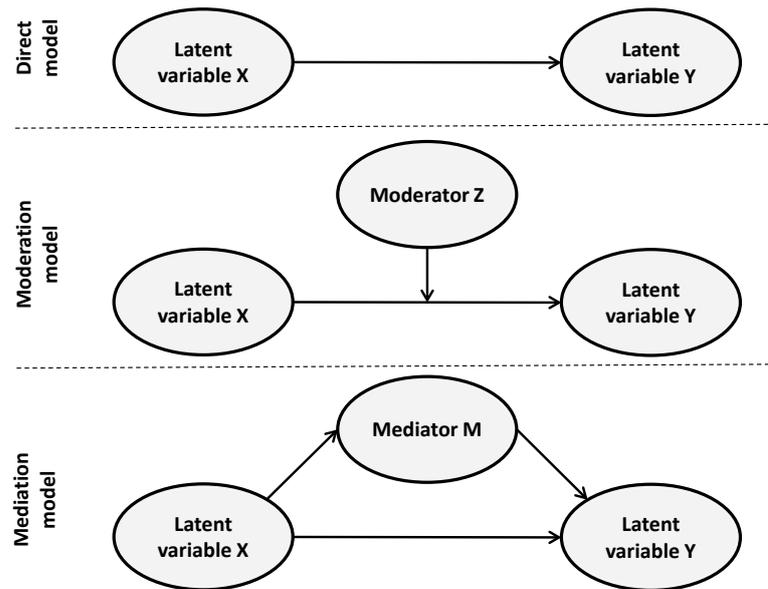
Figure 8: Diagrams of direct, moderator, and mediator effects (based on Baron and Kenny 1986; Frazier *et al.* 2004; Henseler and Fassott 2010; Jaccard and Turrisi 2003).

While PAPER II, PAPER III, and PAPER IV are concerned with direct effects, PAPER V and PAPER VII scrutinize mediation effects while PAPER VIII takes moderation effects into account. In the following subsections the methodological approaches used to analyze the different research models in this thesis regarding their measurement and structural model considering the various causal relationships are explained.

3.2.4 Evaluation of the Measurement Model

As mentioned previously, this thesis operationalizes the latent variables by using reflective measurement models. Accordingly, in what follows criterions for evaluating such models regarding their reliability and validity are provided based mainly on the works by Hair et al. (2011), (2012), Henseler et al. (2009), and Götz et al. (2010).

Reliability can be checked on the indicator level and the construct level. Indicator reliability "specifies which part of an indicator's variance can be explained by the underlying latent variable. A common threshold criterion is that more than 50% of an indicator's variance should be explained by the latent construct" (Götz *et al.* 2010, p. 694). To fulfill this requirement the indicator loadings should be higher than 0.707 (squared value of 0.5) (Carmines and R.A. 1979; Hulland 1999). Construct reliability, also called internal consistency reliability, focuses on the requirement that the indicators assigned to the same construct reveal a strong mutual association (Götz *et al.* 2010). Criterions for construct reliability are that composite reliability should be higher than 0.7 (Nunnally 1978) and that Cronbach's Alpha should be above 0.7 (Hair *et al.* 2009).

The assessment of the validity involves the evaluation of both the content and construct validities comprising of convergent and discriminant validity. Content validity "reveals to what extent a measurement model's variables belong to the domain of the construct" (Götz *et al.* 2010, p. 694). Content validity is ensured in this thesis by taking indicators from preceding research as well as by carrying out a pre-tests and the card-sorting approach as described in section 3.2.1. Convergent validity "signifies that a set of indicators represents one and the same underlying construct, which can be demonstrated through their unidimensionality" (Henseler *et al.* 2009, p. 299). To assess convergent validity the average variance extracted (AVE) can be used which should be higher than 0.5 (Chin 1998b; Götz *et al.* 2010)[31]. Discriminant validity is defined "as the dissimilarity in a measurement tool's [model's] measurement of different constructs" (Götz *et al.* 2010, p. 696) and is examined in two ways. First the Fornell–Larcker criterion (Fornell and Lacker 1981) is checked which postulates that "the AVE of each latent construct should [be] higher than the construct's highest squared correlation with any other latent construct" (Hair *et al.* 2011, p. 145). Second the cross-loadings of the indicators are examined claiming that all indicators are in accordance with the required high loadings for their associated constructs, while having low loadings for the other constructs (Chin 1998b).

Figure 9 illustrates the different reliability and validity criterions and their requirements for the assessment of reflective measurement models.
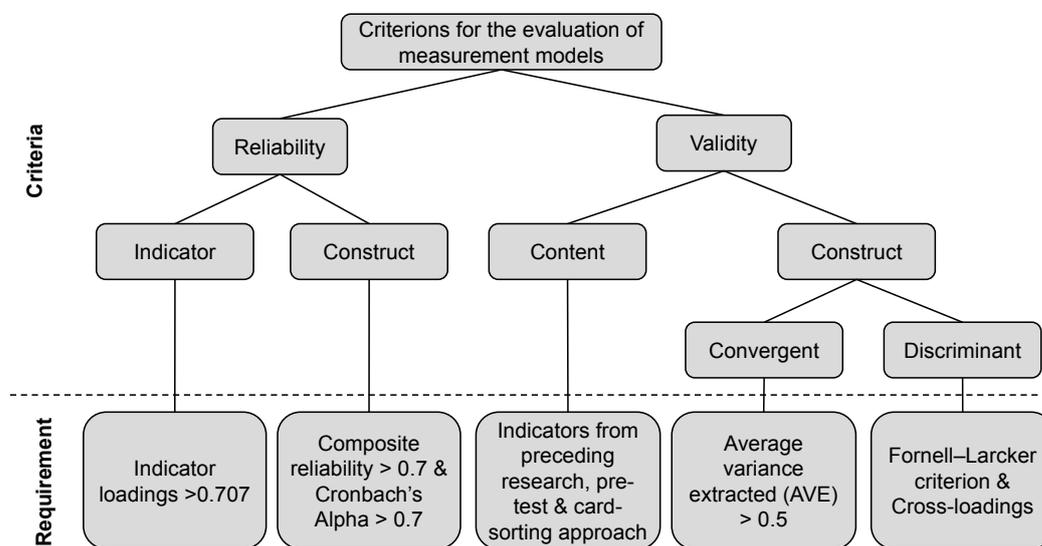
Figure 9: Criterions for the evaluation of the measurement model and their requirements (based on Götz *et al.* 2010; Hair *et al.* 2011; Hair *et al.* 2012; Henseler *et al.* 2009)

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[31] Beside the AVE construct reliability in terms of composite reliability can also be applied for assessing convergent validity (Hair *et al.* 2009).

3.2.5 Evaluation of the Structural Model

For the analysis of the different research models in this thesis in relation to the various types of causal relationships (direct, mediation, and moderation relationships), this thesis applies three different methods, namely group comparisons, regression analysis, and Structural Equation Modeling (SEM). The application of each method is explained in detail in the following.

3.2.5.1 Group comparison

A first and rather rudimentary way to analyze a direct effect of a latent variable [X] on another one [Y] is by applying the technique of group comparisons (PAPER IV). For this purpose the items of a latent variable are aggregated to a single construct score by using factor analysis (principal component analysis) as mentioned above. Based on this score two samples (groups) are created by splitting the latent variable [X] into one sample characterized by high scores and one by low scores, e.g., the mean of the scores can be used as a split value. In the case of a single item construct (PAPER IV) measured on a 7-point Likert scale, the data can be split at the middle of the scale while omitting the center. These two created independent samples can be compared regarding differences in the parameters of the latent variable Y to detect the direct effects of the latent variable X. This thesis applies three types of group comparisons according to their assumption as outlined in the following: Independent t-test, Welsh test, and Mann-Whitney test.

The independent t-test belongs to the group of parametric tests that require that the sampling distribution is normally distributed and that homogeneity of variance in the two samples built is ensured (Field 2009). The first requirement is checked by applying the Kolmogorov-Smirnov test, while to verify the second Levene's test is used (Field 2009). In the case of non-normal distributed samples, the Mann-Whitney test as the non-parametric equivalent of the independent t-test can be deployed since its restrictions regarding the distribution of the sample are less than those of the parametric counterpart (Field 2009). In the case of normally distributed samples that do not fulfill the requirement of homogeneity of variance, the Welch test is conducted as a parametric test (Field 2009). The Welch test is not explicitly mentioned in PAPER IV but was carried out and thus considered when reporting the results. Figure 10 visualizes the application of the three different types of group comparison according to the requirements described.
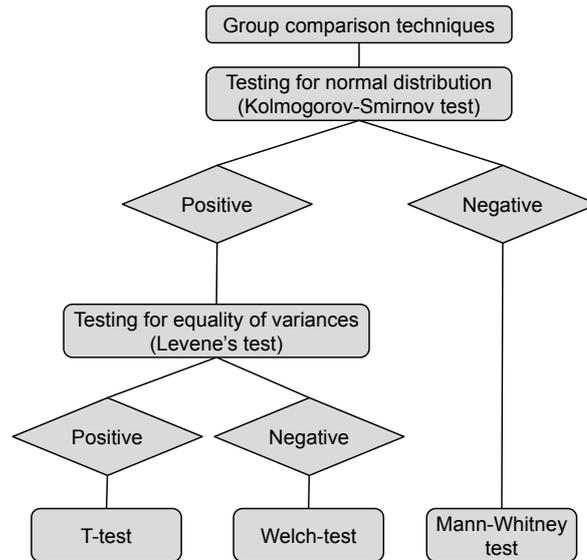
Figure 10: Application of group comparisons according to their requirements

3.2.5.2 Regression Analysis

A second type of data analysis technique applied in this thesis is regression analysis as a first generation technique of multivariate analysis (Chin 1998a; Gefen *et al.* 2000). Regression analysis is limited to only one layer of the relationships between independent and dependent variables, as is the case in PAPER III and PAPER VIII, and requires two unrelated analyses (Gefen *et al.* 2000, p. 4): "(1) examining how items load on the constructs via factor analysis, and then, (2) a separate examination of the hypothesized paths." Thus the first part verifies the measurement model for the second part of analyzing the structural model (Straub *et al.* 2004). PAPER III follows this approach while PAPER VIII applies confirmatory factor analysis only to underline the quality of the measurement model. In the case of the latter, the items are aggregated to a construct score of a latent variable by calculating the mean as an easily replicable method across studies (Lu and Ramamurthy 2011) and because a moderation test is carried out as described in the following.

PAPER VIII carries out a moderation analysis by conducting the product-term-approach running regressions with the product of the sums[32]. This approach is identified by Goodhue et al. (2007) as superior to the product-term-approach running partial least squares with product indicators due to its greater statistical power. This is in line with the finding of Frazier et al. (2004) that regression analyses is the most preferable method for examining moderation effects. Relying on the body of research on interaction ef-

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[32] For a detailed overview of different approaches for assessing moderation effects (product-term approach, two-stage approach, and group comparison approach) the reader is encouraged to consult the articles by Henseler and Chin (2010), Henseler and Fassott (2010), Goodhue et al. (2007), Eberl (2010), and Henseler et al. (2009).

fects in regression analysis (Aiken and West 1991; Cohen *et al.* 2003; Frazier *et al.* 2004; Jaccard and Turrisi 2003), this approach requires three steps. Following Goodhue et al.'s (2007) recommendation, PAPER VIII built the latent variable scores of the independent [X] and moderator variable [Z] by calculating the average of the items[33]. Furthermore the independent and moderator variables were standardized thus reducing multicollinearity problems among them and allowing for an easier interpretation of the resulting regression coefficients. Finally, the product of the standardized independent and moderator variables were calculated and called the interaction term representing the moderation effect.

3.2.5.3 Structural Equation Modeling

Finally, this thesis applies structural equation modeling (SEM) as the second generation of multivariate analysis allowing researchers "to perform path analytic modeling with latent variables" (Chin 1998a, p. vii). SEM-based procedures "involves generalizations and extensions of first-generation procedures [and thus] have substantial advantages over first-generation techniques such as principal components analysis, factor analysis, discriminant analysis, or multiple regression" (Chin 1998a, p. vii). One unique advantage of SEM over linear regression is "that SEM allows the creation and estimation of models with multiple dependent variables and their interconnections at the same time" (Gefen *et al.* 2011, p. iv) making it more "suited for the mathematical modeling of complex processes to serve both theory (Bollen 1989) and practice (Dubin 1976)" (Gefen *et al.* 2000, p. 4). In particular, the "greater flexibility that a researcher has for the interplay between theory and data" (Chin 1998b, p. vii) in comparison to regression analysis makes SEM the preferred method for mediation tests since multiple predictors and outcome variables as well as mediators can be included (Frazier *et al.* 2004; Preacher and Hayes 2008). Therefore, SEM is most suitable for application in PAPER II, PAPER V, and PAPER VII. Another advantage of SEM is "the combined analysis of the measurement and the structural model enable[ing] measurement errors of the observed variables to be analyzed as an integral part of the model, and factor analysis to be combined in one operation with the hypotheses testing" (Gefen *et al.* 2000, p. 5), different to the two-step approach of regression analysis described above. This simultaneous assessment allows SEM to "analyze many stages of independent and dependent variables […] into one unified model" resulting in "a better estimation of both measurement and structural relationships" (Gefen *et al.* 2011, p. iv). This advantage is even backed up in the definition of SEM as a "multivariate technique combining aspects of multiple regression (examining dependence relationships) and factor analysis (repre-

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[33] The product of the sums approach similarly considers the average instead of the sum without consequences for the statistical power of the moderation test (Goodhue *et al.* 2007).

senting unmeasured concepts with multiple variables) to estimate a series of interrelated dependence relationships simultaneously" (Straub *et al.* 2004, p. 426).

Two prominent types of SEM, which differ in their approach and objectives, are used in IS research: Partial Least Squares (PLS) and Covariance-Based Structural Equation Modeling (CBSEM) (e.g., Gefen *et al.* 2011). While PLS is variance-based and prediction-oriented, CBSEM is covariance-based and parameter-oriented (Henseler *et al.* 2009). Thus PLS is well suited for exploratory research while CBSEM emphasizes confirmatory research (Gefen *et al.* 2011; Hair *et al.* 2011; Henseler *et al.* 2009). This is one of the main reasons why this thesis adopts the type of PLS since the research models contain previously untested relationships and thus exhibit an exploratory element (PAPER II, PAPER V, and PAPER VII). Another argument is that here some of the latent variables show slight but significant deviations from a normal distribution which is appropriate for the distribution-free approach of PLS but which would violate the assumption of normally distributed latent variables of CBSEM (Gefen *et al.* 2011; Hair *et al.* 2011; Hair *et al.* 2012). Furthermore, formative measurement creates problems in CBSEM (Gefen *et al.* 2011; Hair *et al.* 2011; Hair *et al.* 2012) and thus CBSEM is limited to second-order molecular constructs (type I) (Chin 2010) while this thesis operationalized social capital as a molar (type II) second order construct. Finally, the operationalization of social capital as a tertiary construct, as mentioned previously, increaes the model complexity raising handling problems when applying CBSEM in terms of sample size (Gefen *et al.* 2011; Hair *et al.* 2011; Hair *et al.* 2012).

SEM is very helpful for assessing mediation effects by carrying out the causal step approach popularized by Baron and Kenny (1986) characterized by its two requirements. First the relationship between the latent variable X and Y must be significant without the consideration of the mediator variable, and second for partial mediation this relationship between X and Y must decrease by a nontrivial amount or for full mediation even become insignificant after adding the mediator variable (Baron and Kenny 1986; Frazier *et al.* 2004; MacKinnon *et al.* 2002; Shrout and Bolger 2002). Since the causal step approach "only establish[es] conditions for mediation rather than [providing] a statistical test of the indirect [mediation] effect" (MacKinnon *et al.* 2002, p. 87) further tests have to be carried out to assess the significance of the mediation. MacKinnon et al. (2002) provides an overview of different methods and beside the causal step approach identifies two more categories: The difference in coefficient approach and the product of coefficient approach. The latter group comprises of the Sobel and Aroian tests which are most commonly used in research (Shrout and Bolger 2002). Taking into account that both tests mostly reach identical outcomes for sample sizes larger than 50 (MacKinnon *et al.* 1995), and following the recommendation by Baron and Kenny (1986), this thesis applies the Aroian test. Recent research indicates that newer approaches like boot-

strapping without any assumptions regarding the sampling distribution are superior to this test (Hayes 2009; Preacher and Hayes 2008) representing a more sophisticated test for the mediation effects which can be easily performed (Mathieu *et al.* 2008). Accordingly, this thesis also carries out the bootstrap approach following the recommendation of Shrout and Bolger (2002) [34].

3.2.6 Accounting for Possible Biases

Beside the common reliability and validity checks of the measurement models (see section 3.2.4) this thesis also accounts for possible bias in terms of non-response and common method bias (CMB). At its core non-response bias deals with the drawback that "persons who respond differ substantially from those who do not" (Armstrong and Overton 1977, p. 396). In order to rule out non-response bias this thesis applies wave and archival analysis techniques (Rogelberg and Stanton 2007; Sivo *et al.* 2006). Regarding the former, the answers given by early respondents (initial dispatch of the survey, first wave) and those who replied after a reminder call or a subsequently sent questionnaire (second wave) are compared. The underlying assumption of this method is that late respondents share similarities with non-respondents, i.e., organizations which have not participated in the survey (Armstrong and Overton 1977, p. 396), since "the respondents in different waves not only reflect temporal differences but also their psychological behaviors" (Sivo *et al.* 2006, p. 363). This approach is typically applied in articles published in leading journals (e.g. Compeau 1995; Kearns and Lederer 2004). Regarding the archival analysis technique a comparison was made of the demographics at an organizational level in terms of revenue and number of employees in those firms that answered with those that did not (Sivo *et al.* 2006). For both techniques the Mann-Whitney test was applied to compare the corresponding groups and found no significant difference. Thus the data of this thesis can be deemed as not prone to non-response bias.

Common method variance (CMV), or CMB respectively, can be defined as a "systematic error variance shared among variables measured with and introduced as a function of the same method and/or source" (Richardson *et al.* 2009, p. 763) presenting a major threat to studies' validity (Sharma *et al.* 2009). This thesis checks for CMB in two ways using an a priori questionnaire design and post-hoc statistical analyses. Regarding the former aspect the questionnaire was designed in three different versions with a varying

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[34] For detailed instructions on how to perform the Aroian test and the bootstrap approach the reader is encouraged to consult the articles by Frazier et al. (2004), by Hayes (2009), by MacKinnon et al. (2002), by Shrout and Bolger (2002), and by Preacher and Hayes (2004; 2008).

order of items[35] and further different scale formats for the various constructs were used. While the a priori techniques try to avoid CMB, the post-hoc statistical methods can be applied to assess whether and to what extent CMB affects the data. The post-hoc methods used in this thesis comprise of the Harman single factor test (Podsakoff *et al.* 2003), the usage of theoretical unrelated marker variables applying the 'confirmatory factor analysis marker technique' (Lindell and Whitney 2001; Richardson *et al.* 2009; Williams *et al.* 2010), and the calculation of inter-rater agreements regarding the select-ed constructs by collecting data from a secondary source in terms of the managers of the marketing division of the participating firms[36]. The latter method directly addresses recent calls in the literature to use multiple respondents to provide inter-rater agree-ments (e.g., van Wijk *et al.* 2008) which further establish the reliability and validity of the selected constructs and alleviate their subjectivity thus avoiding the so-called single-response bias.

4.   Main Results

This section presents the main results of each paper in this cumulative thesis including a short description of the papers, and thus provides answers to the research questions of the three research objectives as introduced at the beginning of this paper. PAPER I establishes the starting point for understanding the concept of innovativeness. PAPER II and PAPER III refers to the question of the differential impact of inter-organizational so-cial networks comprising various different corporate partners on the knowledge stock of a company. PAPER IV, PAPER V, and PAPER VI are concerned with the research question of how and to what extent internal knowledge capabilities contribute to innova-tion success. Finally, PAPER VII and PAPER VIII answer the question of how both in-ter-organizational social networks and internal knowledge capabilities interact and thereby affect innovation success.

4.1   Paper I[37]

The first paper of this thesis presents a literature review which was conducted in ac-cordance with the general guidelines for reviewing proposed by Webster and Watson (2002) and which can be characterized as described in section 3.1. The review aims to

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[35] This approach further allows for the testing of whether survey fatigue appears in the data (compare PAPER II).

[36] For a detailed description of this follow-up survey please consult PAPER V section 5.3 and PAPER VII sec-tion 5.3. This secondary survey covers 67 received questionnaires since the sample was limited to the participating firms of the original survey (n=229).

[37] Moos, B., Beimborn, D., Wagner, H.-T., and Weitzel, T. (2010). Suggestions for Measuring Organizational Innovativeness: A Review. 43th Hawaii International Conference on System Sciences (HICSS), Kauai (HI), USA, 1-10.

develop an alternative and comprehensive measurement model for use in future re-
search by answering the question:

RQ1: How to measure innovativeness?

To answer this question, 56 articles comprising of the research fields of information sys-
tems, strategic management, and marketing were reviewed in-depth regarding their
measurement models. Thereby, a comprehensive overview of the various ways to
measure innovativeness is synthesized by integrating the models into three identified
patterns of measurement: Innovation adoption vs. innovation creation, product/service
innovation vs. process innovation, and input-oriented vs. output-oriented measurement.
Input-orientated measurement models focus on the resources a firm is assigning to the
innovation activities, e.g., R&D infrastructure encouraging employees to be progressive,
forward looking and creative (Rubera and Kirca 2012). Output-orientated measurement
models concentrate on the outcome of the innovation activities, e.g., the amount of new
products or services launched to the market (for a description of the other two pattern
see section 2.1) (Rubera and Kirca 2012). This pattern is of particular interest since it
reveals the major weakness of prior measurement models in terms of their inconsistent
simultaneous use of input- and output-oriented measurement items within the same
measurement model independently of the theoretical role of innovativeness in the caus-
al model (exogenous, endogenous, mediator, or moderator). To tackle this issue
PAPER I makes a suggestion for using measurement models for innovativeness in fu-
ture research. Given the manifold theoretical relationships between the measurable
proxies (input and output or innovativeness) and the latent construct itself (innovative-
ness) the best solution would be to use both proxy measures as two framing dimen-
sions of innovativeness, with a causal link between them in an empirically testable
causal model (compare Figure 11).
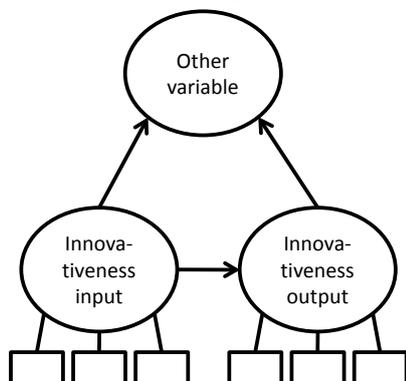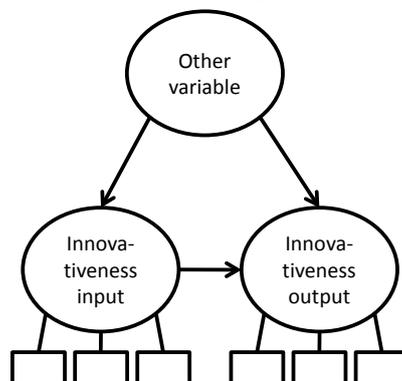
Figure 11: Suggested use of innovativeness measures in causal models

Taking into account the often limited space of questionnaires in quantitative research a
second-best solution is provided in terms of using input-oriented measures if the innova-

tiveness construct has an endogenous role within the theoretical model, and to use output-oriented measures if the innovativeness construct has an exogenous role (compare Figure 12).
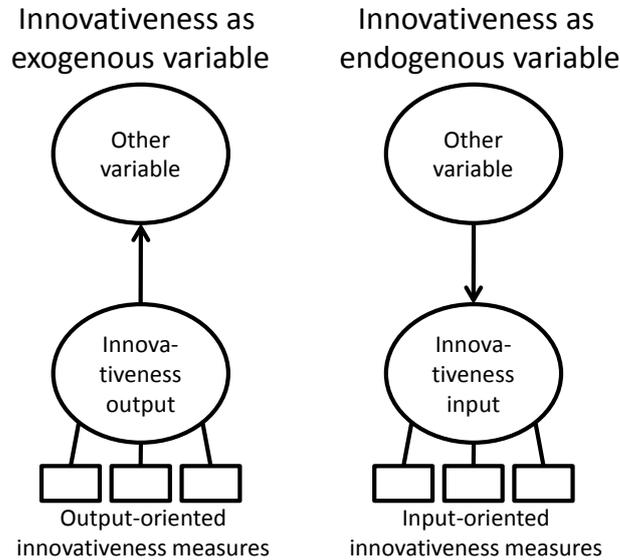
Figure 12: Suggested use of innovativeness measures in causal models (second-best solution)

Finally a concrete measurement model in terms of item formulation is provided for both forms of measurement on a firm level taking into account that input-oriented measurement models should capture the "efforts made toward innovation" and that output-oriented measures should focus on capturing the "consequences of innovation activities visible to consumers" (Rubera and Kirca 2012, p. 137). Through this differentiation and since the suggested output-oriented measurement includes the commercialization of innovation, which is a crucial part of innovation success, the provided measurement model overcomes the flawed performance of previous studies that use input as a proxy for output (Huang and Rice 2009). Moreover, the output-oriented measurement model of *innovativeness* can also be used as a proxy for *innovation success* as it is done in the PAPER IV, PAPER V, and PAPER VII of this thesis and can serve for future studies as a standard measure of innovative output, something which currently does not exist (Huang and Rice 2009).

4.2 Paper II[38]

The first paper regarding the research objective focusing on inter-organizational networks analyzes the impact of social capital inherent in the organizational relationships to

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[38] Moos, B., Wagner, H.-T., Beimborn, D., and Weitzel, T. (2012). Whom to Ask for What Knowledge? A Comparison of Exchange Partners and Their Impact on Knowledge Types. 45th Hawaii International Conference on System Science, Maui (HI), USA, 3806-3815.

external partners on the various knowledge domains of the knowledge stock. Thereby, PAPER II responds directly to an issue identified by recent research. Inter-firm knowledge transfer literature predominantly tends to ignore the domain of transferred knowledge so that "literature on innovation networks reveals little of to what extent different types of knowledge are exchanged and combined by collaborating firms to foster innovation" (Sammarra and Biggiero 2008, p. 800) .Accordingly, the relationships between an organization and its external partners involved in innovation activities merits further inquiry (Berchicci 2013). Thereby, the examination of different configurations of partners understood as external knowledge providers is of interest to scrutinize the information benefits of obtaining external knowledge from them (Haas 2010). To address this issue, PAPER II asks the question:

RQ2: What is the differential impact of social capital related to different types of exchange partners on various types of knowledge?

To answer this question PAPER II focuses on five different knowledge domains representing the knowledge stock as described in section 2.2 and applies social capital theory to investigate the effects of the various external partners as illustrated in section 2.3. Figure 13 visualizes the corresponding research model which is tested using the Partial Least Squares' approach (see section 3.2.5.3).
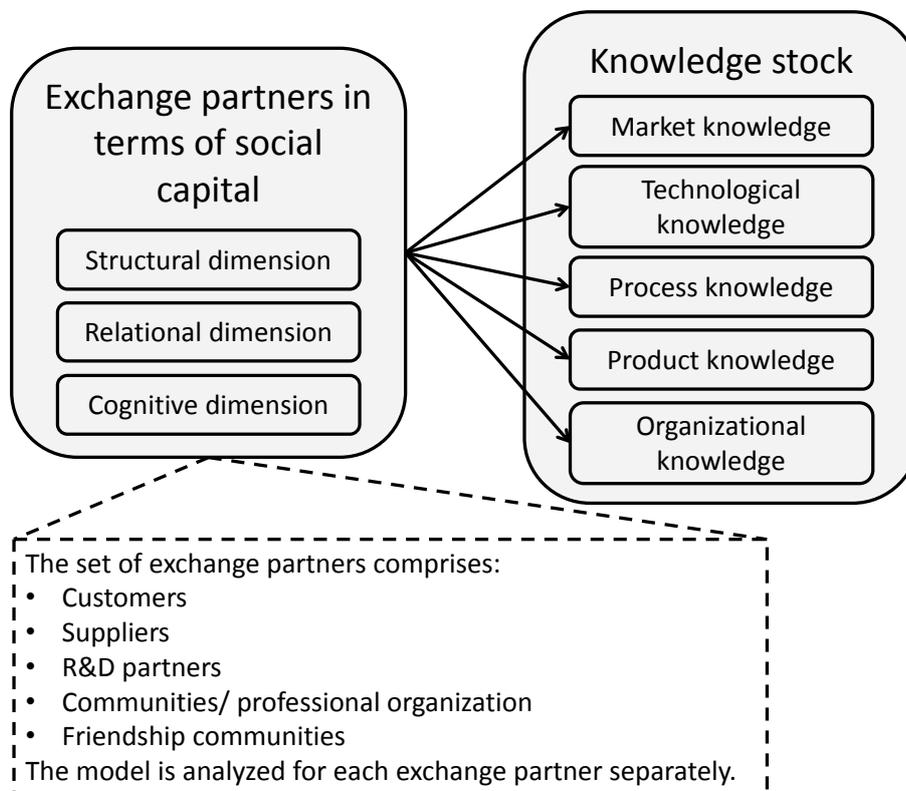
Figure 13: Research model for investigating the relationship of external partners

The results show the importance of the different types of exchange partners regarding each type of knowledge in detail:

- All types of partners contribute to most of the different knowledge types and thus help to enhance the knowledge stock of a firm (exceptions are: friendship communities regarding organizational and technological knowledge and communities/ professional organizations regarding product knowledge).

- Regarding *market knowledge* the customers are the most important partners, adding significantly more to the firm's knowledge than the other exchange partners.

- In terms of *product knowledge* customers also contribute the most but cannot set themselves apart from other exchange partners. Since the effect of the other partners does not differ much, PAPER II concludes that all exchange partners are equally important for this type of knowledge.

- For *organizational knowledge* the most important exchange partners are R&D partners and customers both of whom contribute more than the other exchange partners.

- Concerning *process and technological knowledge* the results show the same pattern, namely that customers play the most important role for both types of knowledge followed by the R&D partner and that these two types of exchange partners are significantly different from other exchange partners.

Summarizing the results reveal that beside the expected importance of customers for the different knowledge domains, R&D partners contribute in a similar manner to the enhancement of the knowledge stock of an organization.

4.3 Paper III[39]

Considering an inter-firm network to be constituted by nodes and relationships between the nodes, PAPER II provides insights into the effect of dyadic relationships between the focal firm and its external partners on knowledge transfer in an innovation context. These insights are very valuable as they shed light on the characteristics of relationships and networks formed when organizations interact to render effects. PAPER III in contrast looks into characteristics of the nodes themselves, i.e. the innovativeness of the external partners. The investigation of characteristics of corporate partners in the

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[39] Moos, B., Wagner, H.-T., Beimborn, D., and Weitzel, T. (forthcoming). The Contagious Power of Innovativeness: How Different Corporate Partners Contribute to a Firm's Knowledge. International Journal of Innovation Management.
This publication is based upon a previous paper presented at the Academy of Management Conference 2012 in Boston: Wagner, H.-T., Moos, B., Beimborn, D., and Weitzel, T. (2012). The Contagious Power of Innovativeness: A Comparison of Different Types of Firm Partners. Academy of Management: Annual meeting, Boston (MA), USA.

context of innovation is seen as a fruitful avenue of research (Berchicci 2013) but virtually no study looks into characteristics of the nodes themselves (a notable exception is Zaheer and Bell 2005) or their effect on innovation-critical factors such as knowledge (a notable exception is Pérez-Nordtvedt *et al.* 2008). Thus, the research question of PAPER III is:

RQ3: What is the differential impact of corporate partner types' innovativeness on a focal company's knowledge stock?

In accordance with PAPER II, five different types of knowledge and five different external partners are distinguished in order to scrutinize the innovativeness of the partners on each knowledge type in detail. To hypothesize and thus explain the differential effects of the various partners these partners are grouped into two categories: Axial and lateral partners. Axial partners are related to the focal firm in a vertical (customers and suppliers) or horizontal way (trade associations) (compare Atallah 2002; de Faria *et al.* 2010; Porter 1985) whereas lateral partners comprise planned (R&D partners) and accidental relationships (friendship communities)[40].
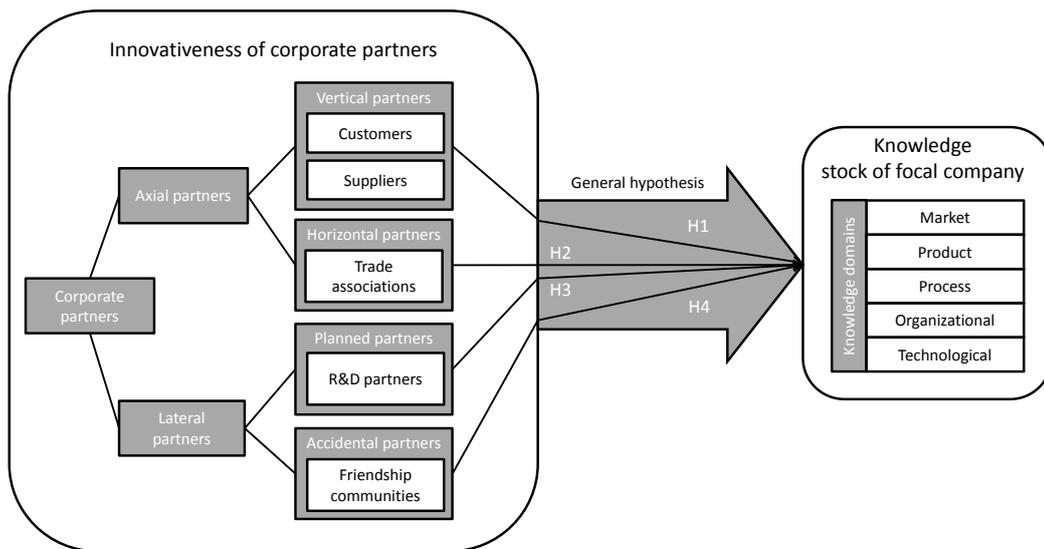
Figure 14: Research model for investigating the innovativeness of external partners

Regression analysis was applied, as described in section 3.2.5.2, to verify the hypotheses. To ensure comparability across corporate partner types, the analysis was conducted using a sample representing 147 organizations, each maintaining relationships to all the considered partner types. To underline the results and to detect additional insights

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[40] R&D partners are often deployed to support specific R&D projects because the necessary knowledge for the development of new products/services or processes is not available within the focal firm and thus presents planned relationships. In contrast friendship communities are usually not designed for exchanging innovation-relevant knowledge, but nevertheless 'accidentally' can contribute to it. For detailed information about the categorization please consult PAPER III.

the analysis was also carried out with the maximum sample size for each combination of partner type and knowledge domain. Figure 15 summarizes the results of PAPER III.
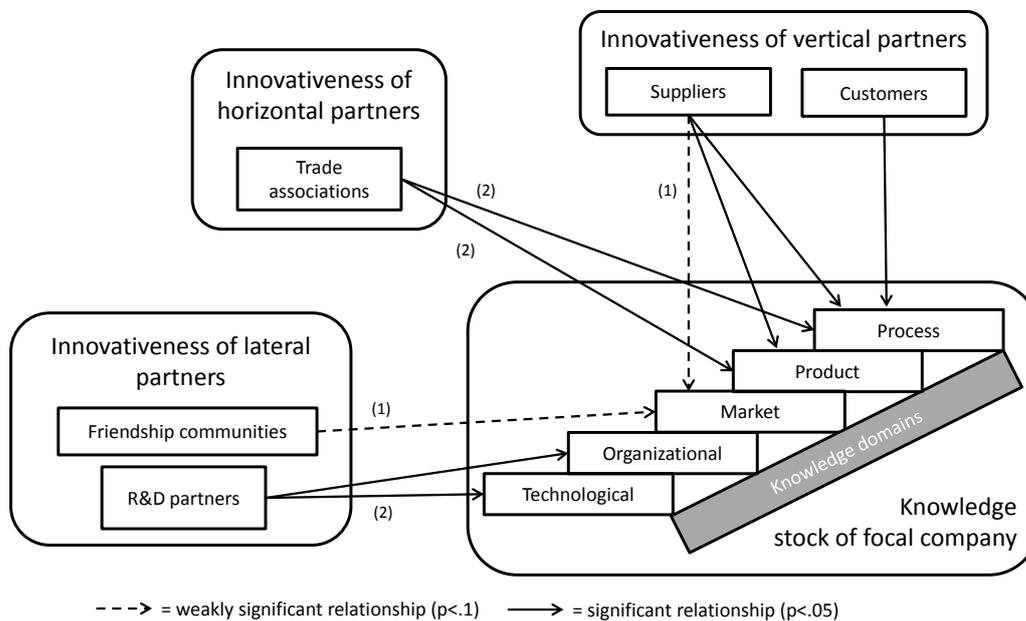
Figure 15: Summary of results ((1) = effect only detected applying the sample of n=147; (2) = effect only detected applying the maximum sample size; no index = effect is present in both samples)

Based on these results, PAPER III concludes that the innovativeness of *vertical* partners, i.e. customers and suppliers, is related to a firm's market knowledge, product knowledge, and, in particular, process knowledge. The innovativeness of *horizontal* partners in contrast is largely negligible (effects only detected applying the maximum sample size). *Lateral* partners' innovativeness, particularly, the innovativeness of R&D partners, is conducive to technological knowledge, and even more to organizational knowledge while the innovativeness of friendship communities is weakly related to market knowledge. In essence the results suggest that the innovativeness of a firm's partners positively yet diversely influences its various knowledge stocks.

4.4 Paper IV[41]

The first paper of the research objective of firm-internal knowledge capabilities examines the role of innovation governance mechanisms and knowledge management practices as antecedents of the innovation success, of the knowledge stock, and of the absorptive capacity of an organization. Firm-internal antecedents of ACAP in particular have only been examined in a few studies focusing on organizational structures (van

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[41] Moos, B., Wagner, H.-T., Beimborn, D., and Weitzel, T. (2011). The Role of Innovation Governance and Knowledge Management for Innovation Success. 44th Hawaii International Conference on System Sciences, Kauai (HI), USA, 1-10.

Den Bosch *et al.* 1999) or organizational policies (Lane and Lubatkin 1998; Lane *et al.* 2001). Accordingly, Lane et al. (2006) propose that research on firm-internal antecedents of ACAP is required and van Wijk et al. (2008) more precisely calls for the investigation of combinative capabilities as drivers to increase the efficiency and the effectiveness of an organization's ACAP. To address this issue PAPER IV examines different innovations governance mechanisms which can be assigned to different types of combinative capabilities (see section 2.4) and thus extends the studies by van den Bosch et al. (1999) and Jansen (2005). In a similar vein, to the best of my knowledge there are no studies investigating the effect of knowledge management on ACAP. As mentioned in section 2.4 knowledge management comprising of different knowledge management practices not only impacts on the management of knowledge directly by building and administering the organization's stock of knowledge but also has an indirect effect by driving other internal knowledge capabilities, especially ACAP. Excepting a few theoretical statements regarding what the effect of knowledge management might be on ACAP (compare Lane *et al.* 2006, p. 858), studies explicitly addressing this topic were not found. Accordingly, PAPER IV investigates the effect of innovation governance mechanisms and knowledge management practices on ACAP but also on the knowledge stock and innovation success, and asks the following question:

RQ4: What is the impact of innovation governance mechanisms and knowledge management practices on knowledge stock, absorptive capacity and innovation success?
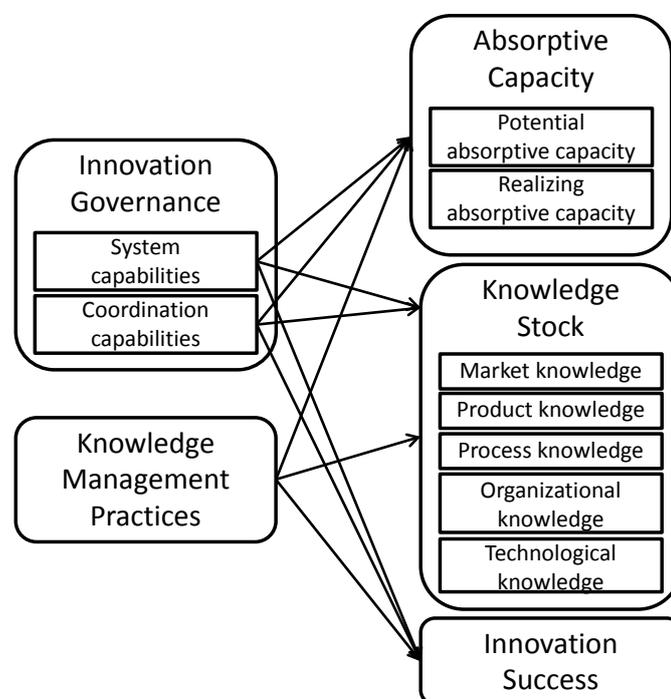
Figure 16: Research model investigating the effects of innovation governance mechanisms and knowledge management practices

Group comparisons (see section 3.2.5.1) were conducted for the analysis of the research model visualized in Figure 16 showing that innovation governance geared to system and coordination capabilities significantly contributes to a firm's innovation success, to its absorptive capacity and to its knowledge stock, except regarding the combination of product knowledge and innovation governance mechanisms geared to system capabilities. Additionally, the analysis shows that knowledge management practices have a similar impact on the dependent constructs to innovation governance whereas the role of knowledge management practices are less important regarding the usage of the knowledge stock in terms of exploitation as a component of realized absorptive capacity.

4.5 Paper V[42]

In line with Lane et al.'s (2006) statement that research on firm-internal antecedents of ACAP is necessary, Volberda et al. (2010) provide an integrative framework of ACAP and show that intra-organizational antecedents of ACAP have not received too much attention so far. Hence, they identify intra-organizational antecedents as a field for further research. In this respect Roberts et al. (1982, p. 639) conclude that "the role of IT as a storage mechanism for knowledge assets is relatively well-established (Alavi and Leidner 2001; Stein and Zwass 1995), we know little regarding how IT impacts the identification, assimilation, transformation, and application of external knowledge [i.e. ACAP]." PAPER V is among the first to address this issue following Roberts et al (2012, p. 639) suggestions that "IS researchers should adequately conceptualize and describe the relationship between IT and absorptive capacity" and that "researchers should conduct holistic investigations of the relationship between IT and absorptive capacity." Both aspects are ensured by differentiating ACAP into PACAP and RACAP and by modeling these two components as mediators for the relationships between knowledge management systems and organizational knowledge, or innovation success, respectively asking the following question:

RQ5: How do knowledge management systems contribute to innovation success?

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[42] Moos, B., Beimborn, D., Wagner, H.-T., and Weitzel, T. (2013). The Role of Knowledge Management Systems for Innovation: An Absorptive Capacity Perspective. International Journal of Innovation Management, 17(05), 1350019.
This publication is based upon a previous paper presented at the European Conference on Information System 2011 in Helsinki: Moos, B., Beimborn, D., Wagner, H.-T., and Weitzel, T. (2011). Knowledge Management Systems, Absorptive Capacity, and Innovation Success. 19th European Conference on Information System (ECIS), Helsinki, Finland, Paper 145.

H2: Mediation through PACAP   **H3: Mediation through RACAP**
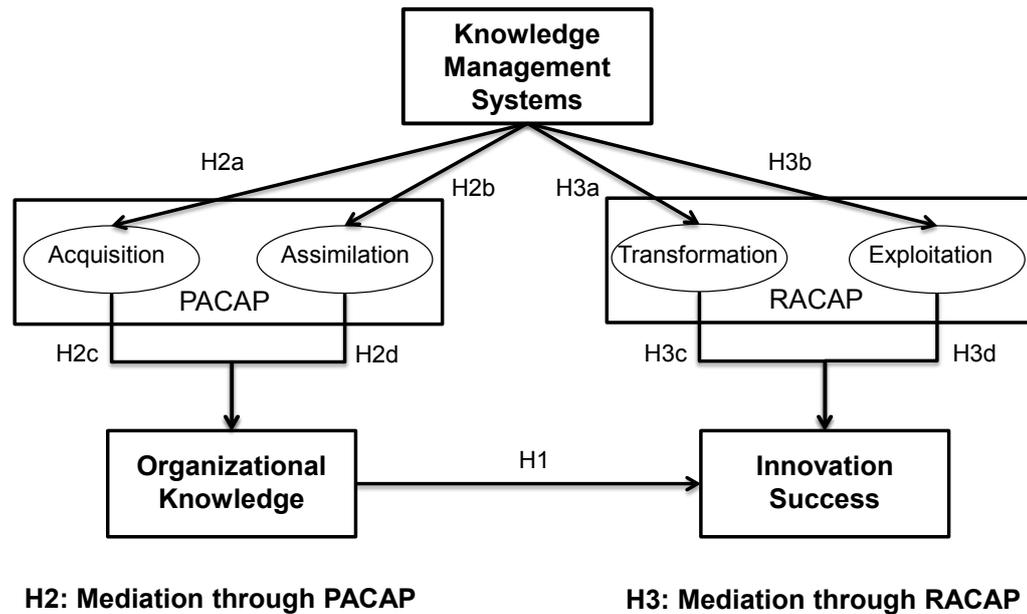
Figure 17: Research Model for examining knowledge management systems' impact on organizational knowledge and innovation success[43]

The model illustrated in Figure 17 was evaluated applying the Partial Least Squares' approach (see section 3.2.5.3) based on data from 222 organizations. When scrutinizing the results and differentiating ACAP into its components the results show that a KMS impacts PACAP with its two capabilities of acquisition and assimilation as well as RACAP with the two components of transformation and exploitation capability and thus drive organizational knowledge and innovation success. In detail, the results reveal that the single capabilities of ACAP are differentially affected. Whereas the highest impact was identified on transformation capability, the lowest was found on exploitation capability. Additionally, organizational knowledge comprising of the two domains of market and technological knowledge (compare footnote 43) is driven by PACAP, except the missing effect of acquisition on market knowledge. Innovation success is driven by RACAP through the exploitation capability, but not through transformation capability. Finally, for the effect of the organizational knowledge the results show that market knowledge has no effect on innovation success while technological knowledge contributes a lot more. In conclusion, we can confirm that ACAP, comprising of PACAP and RACAP, fully mediates the effect of KMS on innovation success by actively framing and catalyzing the formation of organizational knowledge and by supporting the routines of an innovation process in the form of making knowledge available in a structured way.

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[43] The term 'organizational knowledge' is used in PAPER V to cover the knowledge domains of market and technological knowledge and should not be mistaken for the usage of the term in the other papers to describe knowledge about the organizational structure, functions, and organizational forms as one domain of the knowledge stock.

4.6 Paper VI[44]

Based on the insights of PAPER IV and PAPER V PAPER VI as a conceptual paper proposes a research model (see Figure 18) that further contributes to the discussion of intra- organizational antecedents of ACAP and eventually to innovation success by asking the following question:

RQ6: How are information systems, organizational mechanisms and control modes related to absorptive capacity and innovation success?
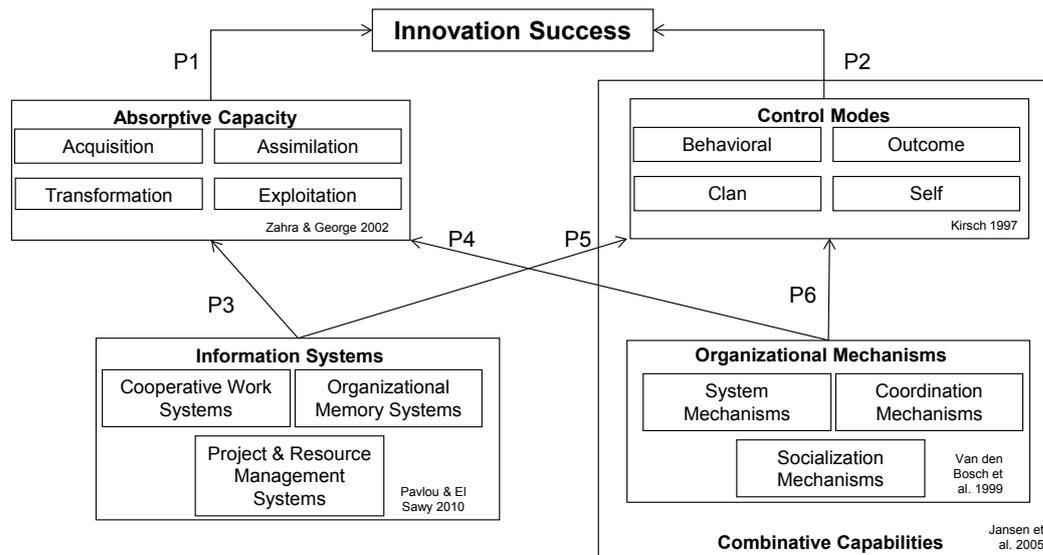
Figure 18: Conceptual research model

Therefore, not only are knowledge management systems, in this paper referred to as organizational memory systems (ORMS)[45], considered but also cooperative work systems (CWS) and project and resource management systems (PRMS) are taken into account to provide a differentiated picture of the hitherto unexamined relationship between information systems (IS) and ACAP (Roberts *et al.* 2012). CWS refer to systems enabling real-time communication across time and space and coordinate collaboration among employees (Pavlou and El Sawy 2010) such as presentation systems, file-synchronization software, and portals (Tarafdar and Gordon 2007) whereas PRMS relates to tools supporting processes like resource allocation, task assignment, and scheduling as well as documenting and evaluating progress at milestones (Pavlou and El Sawy 2010; Tarafdar and Gordon 2007).

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[44] Moos, B., Wagner, H.-T., Beimborn, D., and Weitzel, T. (2013). Innovation Success and Absorptive Capacity: The Combined Influence of Information Systems and Combinative Capabilities - A Theoretical Model. 19th Americas Conference on Information Systems (AMCIS), Chicago (IL), USA, 1-7.

[45] In their publication Pavlou and El Sawy (2010) use the term "organizational memory systems" but refer to this category of systems in their previous work (Pavlou and El Sawy 2006) as "knowledge management systems". Since we apply the categorization of information systems as illustrated in Pavlou and El Sawy (2010) we switched to "organizational memory systems" accordingly in comparison to PAPER V.

Since "IS exert their influence on the firm through complementary relationships with other firm assets and capabilities" (Wade and Hulland 2004, p. 109) the concept of combinative capabilities as introduced in section 2.4 is considered again (labelled as organization mechanisms) but enhanced by control modes (Jansen *et al.* 2005) based on the differentiation by Kirsch (1997). Behavioral control is concerned with articulated rules and procedures which lead to desired outcomes (Kirsch 1997) whereas outcome control refers to the regulation and control of desired outcomes (Cardinal 2001; Kirsch 1997) both belonging to the group of formal control. Informal control comprises clan and self-control (Kirsch 1997). The former is related to the promulgation and implementation of common beliefs, values, and philosophies within a clan (Kirsch 1997) while the latter in contrast exists on an individual level and is about setting personal goals including self-monitoring, self-reward, and self-sanctioning.

In summary PAPER VI comprises of six propositions:

- P1: ACAP positively influences the innovation success of an organization.
- P2: Combinative capabilities in terms of formal control modes exhibit a curvilinear relationship to innovation success of an organization and combinative capabilities in terms of informal control modes positively contributes to innovation success of an organization.
- P3: Information systems in terms of PRMS, ORMS, and CWS positively contribute to ACAP.
- P4: Combinative capabilities in terms of organizational mechanisms positively influence ACAP.
- P5: Information systems in terms of PRMS, ORMS, and CWS positively influence the different control modes.
- P6: Organizational mechanisms positively contribute to the different control modes.

By examining these propositions empirically it is anticipated that PAPER VI will contribute to our understanding of the influencing factors of ACAP and thus of achieving innovation success by highlighting which combination of IS type and organizational mechanism will have an effect on which component of ACAP and thus eventually on innovation success.

4.7 Paper VII[46]

The first paper of the research objective focusing on both inter-organizational social networks and firm-internal knowledge capabilities provides an integrative innovation success model. Only a few studies investigate social capital inherent in a firm's external relationships in terms of its effect on knowledge transfer between members of strategic alliances (Inkpen and Tsang 2005). While the contributions of these studies provides valuable insights on effects of firm-external social capital, they are limited in terms of not differentiating between specific partner types and in terms of focusing on specific coordination forms such as strategic alliances. Additionally, existing studies neglect the role of different types of knowledge in knowledge transfer (Pérez-Nordtvedt *et al.* 2008; Sammarra and Biggiero 2008) as mentioned previously, and only a few studies investigate organization-level outcomes such as, in particular, innovativeness (for one of these few studies, see Laursen et al. (2012)). Finally, van Wijk et al. (2008, p. 844) claim that "future research may investigate antecedents of absorptive capacity such as depth [application as social capital] and breadth of knowledge sources [differentiation of partners types]" (compare Figure 5 on page 28). In line with Sammarra and Biggiero's theoretical framework, PAPER VII "stresses that inter- and intra-organizational interactions are both crucial to favour the acquisition of heterogeneous knowledge" (2008, p. 844) by developing an innovation success model that integrates firm-external social capital and a firm's internal capabilities to absorb knowledge from the different external partners. Accordingly, this paper is guided by the following research question:

RQ7: How and to what extent does a firm's external social capital (i.e., relationship with external partners) contribute to its innovation success?

PAPER VII conceptualizes PACAP in its enacted version, called enacted PACAP, as a second-order construct while external social capital is treated as a tertiary construct as illustrated in Figure 7 on page 48. Applying the Partial Least Squares' approach (see section 3.2.5.3) based on data from 153 organizations the results show that firm-external social capital is a significant contributor to intellectual capital and that intellectual capital is a substantial determinant of innovation success, but only in terms of technological knowledge and not in terms of market knowledge. Furthermore, it becomes clear that technological knowledge is driven more by external sources than market knowledge and that enacted PACAP is a partial mediator between firm-external social capital and intellectual capital. Thus external social capital acts as an antecedent of PACAP. Finally, PAPER VII offers the interesting insight that firm-external social capital shows strong and highly significant total effects on all endogenous variables thus sup-

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[46] Wagner, H.-T., Beimborn, D., Moos, B., and Weitzel, T. What Makes a Firm Innovative? A Social Capital Perspective on Ex-ternal Partners and Internal Knowledge Capabilities.

porting the basic argument of this paper and of the thesis as a whole that firm-external social capital is a relevant contributor to a firm's intellectual capital and to its innovation success.
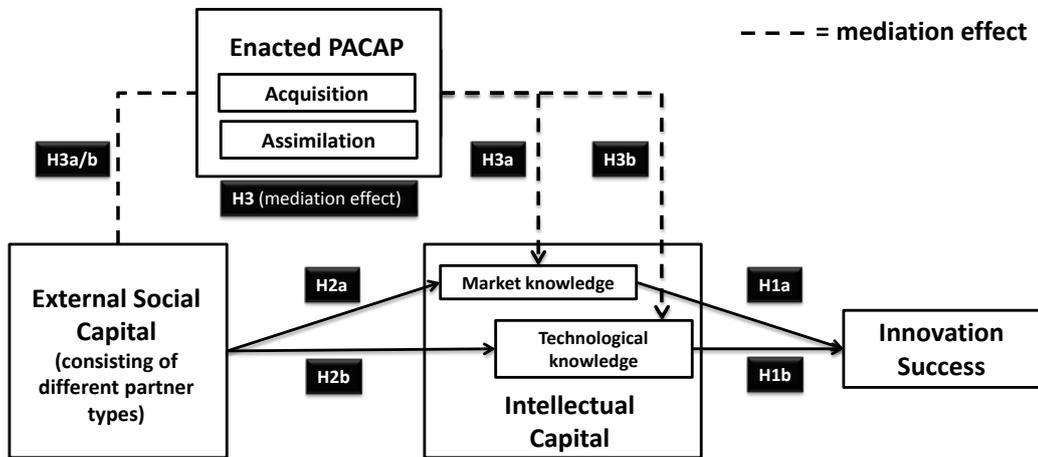
Figure 19: Research model for analyzing the interplay between inter-organizational social networks and firm-internal knowledge capabilities for innovation success

4.8 Paper VIII[47]

Focusing on the research field of knowledge, researchers have identified various types of exchange partners (e.g., Laursen and Salter 2006) and have analyzed their influence on innovation (de Faria *et al.* 2010). Other studies examined the effect of different knowledge domains (e.g., Maurer *et al.* 2011) or knowledge management systems on firm performance (e.g., Kuoching *et al.* 2004). However, the question of how a KMS affects the management of acquired knowledge, spanning different domains from various exchange partners, still remains open although its answer is of importance in order for strategic investments in KMS to improve benefits from the external partners of an organization. Based on the insights of PAPER II and PAPER V and following the argument regarding knowledge management systems provided in section 2.4, PAPER VIII asks the following question:

RQ8: What is the differential impact of using KMS for managing different types of acquired knowledge from various types of exchange partners?

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[47] Moos, B. (2013). Managing Acquired Knowledge from Different Network Partners: The Role of Knowledge Management Systems. 11th International Conference on Wirtschaftsinformatik, Leipzig, GER, 737-751. (Best Paper Nomination)
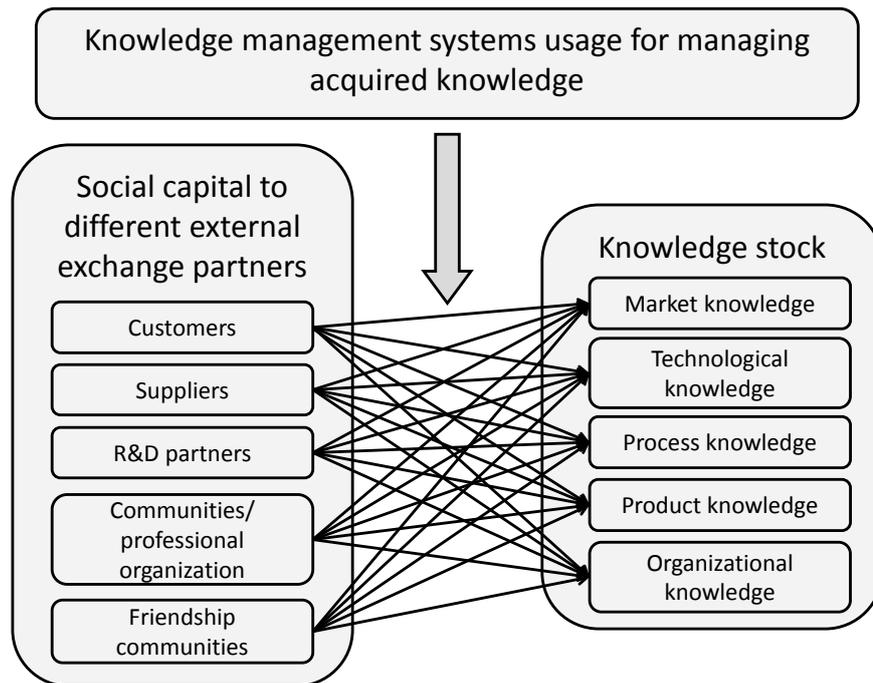
Figure 20: Research model investigating the effect of knowledge management systems for managing acquired knowledge

As in PAPER II and PAPER III a differentiation is made between five different types of external partners and five different knowledge domains. By conducting regression analysis, as described in section 3.2.5.2, the results demonstrate that for the management of acquired process knowledge from R&D partners as well as for technological knowledge from customers, the use of KMS shows a significant negative effect while for managing organizational and technological knowledge from R&D partners the use of KMS seems to be obstructive. In contrast the use of KMS is beneficial for the management of acquired market, organizational, and process knowledge (in this case significantly) from communities as well as for managing organizational, technological, and process knowledge acquired from friendship communities. For most of the other combinations of knowledge domain and partner type the use of KMS supports the management of acquired knowledge while this effect is not significant (e.g., customer and product knowledge) or the use of KMS does not seem to matter for the management of acquired knowledge (e.g., suppliers regarding market knowledge). Additionally, the use of KMS is significantly positively related to the management of the already existing knowledge stock of a firm, excluding the domain of product knowledge.

In summary, PAPER VIII provides detailed insights into the use of knowledge management systems for managing external acquired knowledge by highlighting for which combination of knowledge domain and external partner type the application of KMS is beneficial or obstructive.

5.   Contributions and Implications

Based on the results presented in the previous section, the current section summarizes the contribution to theory (5.1) as well as the managerial implications (5.2) revealed by this thesis. Both subsections are structured along the three overall research objectives guiding this thesis. Since research objective C synthesizes the other two research objectives A and B, the two papers addressing objective C (PAPER VII and PAPER VIII) contribute to all three objectives. Thus, PAPER VII and PAPER VIII are also considered when discussing the contributions and implications of the objectives of inter-organizational social networks (A) and of firm-internal knowledge capabilities (B).

5.1 Contributions to Theory

***Inter-organizational social networks (research objective A):** What is the differential impact of inter-organizational social networks comprising various different corporate partners on the knowledge stock of a company?*

This thesis distinguishes between five different types of external partners (customers, suppliers, R&D partners, trade associations also called communities/professional organizations, and friendship communities) and five different knowledge domains (market, technological, organizational, process, and product knowledge). Through this differentiation and its simultaneous consideration, which have not yet received proper conceptual or empirical elaboration (Berchicci 2013; Sammarra and Biggiero 2008), this thesis increases our understanding of how and to what extent inter-organizational social networks impacts the knowledge stock of a company. While PAPER II, PAPER VII, and PAPER VIII concentrate on the relationship with the various partners, PAPER III reveals that not only relationships with partners but also their properties – partner innovativeness – are important for a company's knowledge stock. This detailed and hitherto unresearched area directly extends the investigation into inter-firm innovation collaboration and inbound open innovation by revealing in detail which external partner should be consulted for which knowledge domain in order to gain access to the necessary knowledge an organization is actually lacking.

Next, this thesis contributes to the research field of open innovation by incorporating social capital theory. Since a dearth of studies exist analyzing the role of social capital in an open-innovation context (Rass *et al.* 2013), PAPER II, PAPER VII, and PAPER VIII are among the first to empirically examine the effects of the various external partners from a social capital perspective, thus responding to the observation that "inadequate efforts have been made to synthesize the way in which different components of social capital dynamically influence innovation" (Wei 2010, p. 151). Thereby, insights relevant to the debate over the simultaneous analysis of the breadth and depth of inbound open

innovation are provided since the relationships to the different external partners are scrutinized from a relational perspective by adopting a social capital lens. Furthermore, the application of social capital theory advances existing research on inter-organizational knowledge transfer as "an interesting domain for further theoretical investigation" (Easterby-Smith *et al.* 2008, p. 677) by adding link characteristics, conceptualized as social capital, to the hitherto investigated knowledge characteristics and thus empirically showing the profound strength of this relational effect.

Table 2: Theoretical contribution of research objective (A) on inter-organizational social networks

Research objective A	Contribution to
  What is the differential impact of inter-organizational social networks comprising various different corporate partners on the knowledge stock of a company?	Inbound open innovation: • Extension of knowledge about the impact of inter-organizational social networks on the knowledge stock of a company from both a relational view and a partner characteristics view based on the distinction between five different types of external partners and five different knowledge domains. • Simultaneous consideration of the breadth (set of external partners) and depth dimension (degree of social capital along three dimensions inherent in the relationships) of inbound open innovation. • Introduction of social capital theory to open-innovation research. Inter-organizational knowledge transfer: • Link characteristics, conceptualized as social capital, are added to the previously investigated knowledge characteristics and the profound strength of this relational effect is shown empirically.

***Firm-internal knowledge capabilities (research objective B)**: How and to what extent do internal knowledge capabilities contribute to innovation success?*

This thesis investigates how and to what extent absorptive capacity, the usage of knowledge management systems, and the application of innovation governance mechanisms as firm-internal knowledge capabilities contribute to innovation success. PAPER VII and PAPER VIII augment our knowledge about firm-internal knowledge capabilities as differentiators, separating companies which are able to harvest the benefits of the inter-organizational social network from those that are not (Salge *et al.* 2012) and thus directly contribute to open-innovation research since these factors are under-researched (Huizingh 2011) and their theoretical as well as empirical investigation is still lacking (Lichtenthaler 2011). PAPER VII demonstrates the enacting of PACAP as the routine or 'pump' to transfer and absorb external knowledge to enhance the knowledge stock of

the organization and eventually to increase innovation success. PAPER VII demonstrates the role of the usage knowledge management systems to manage newly acquired knowledge to keep the knowledge stock of the organization up to date ensuring that knowledge can be employed as a differentiating factor for competitive advantage.

PAPER IV to PAPER VI not only contribute to the debate about firm-internal knowledge capabilities as differentiators in the inbound open-innovation context but also to the fertile research objective of information technology and innovation. This research objective tends towards the question of "how and when IT-based tools and applications enhance the likelihood of innovation success" (Nambisan *et al.* 2014, p. 1). This thesis reveals that the use of knowledge management systems is positively related to innovation success (PAPER IV) showing that this relationship is mediated by absorptive capacity (PAPER V). Beside knowledge management systems, the use of cooperative work systems (CWS) and project and resource management systems (PRMS) as sources for absorptive capacity and eventually for innovation success is conceptualized (PAPER VI).

Additionally, this thesis not only examines the contribution of innovation governance mechanisms and the use of knowledge management systems for innovation success but it also scrutinizes their interplay with absorptive capacity (PAPER IV to PAPER VI) by looking in detail into organizational antecedents of absorptive capacity within a firm. This follows Camisón and Forés's (2010, p. 714) claim that "further studies clearly need to take into account contingencies that can affect both PACAP and RACAP models, such as […] organizational circumstances". On the one hand PAPER IV and PAPER VI extend previous studies regarding innovation governance mechanisms as firm-internal drivers of ACAP (Jansen *et al.* 2005; van Den Bosch *et al.* 1999). PAPER IV investigates different practical management measures, including measuring innovation success or having a structured idea management which can be assigned to innovation governance mechanisms according to different types of combinative capabilities (van Den Bosch *et al.* 1999) (see section 2.4). Whereas PAPER VI enhances the concept of combinative capabilities by control modes (Jansen *et al.* 2005) based on the differentiation by Kirsch (1997) (behavioral, outcome, clan, and self-control). On the other hand, PAPER IV to PAPER VI are the first works to conceptualize and empirically evaluate the use of knowledge management systems as firm-internal antecedents of ACAP. Through the differentiation of absorptive capacity into its two components of potential and realized absorptive capacity, detailed insights into the impact of knowledge managements systems on ACAP could be gained. PAPER IV and PAPER V show that a KMS impacts PACAP (capabilities of acquisition and assimilation) as well as RACAP (transformation and exploitation capabilities), with the highest impact on transformation and the lowest effect on exploitation. Related to KMS, PAPER VI provides a conceptual extension to-

wards the impact of cooperative work systems (CWS) and project and resource man-agement systems (PRMS) on absorptive capacity. Finally, external social capital inher-ent in a firm's external relationships as another influencing factor of potential ACAP is identified (PAPER VII). In summary, this thesis offers valuable theoretical and empirical insights in the under-researched field of antecedents of ACAP (Easterby-Smith *et al.* 2008; Lane *et al.* 2006; Roberts *et al.* 2012; van Wijk *et al.* 2008; Volberda *et al.* 2010).

Another contribution to the field of ACAP is the substantiation of the current controversy over the theoretical distinction between PACAP and RACAP (compare section 2.4) by theoretically and empirically illustrating their mediating impact between inter-organizational social networks and firm-internal knowledge capabilities in terms of KMS on the knowledge stock of an organization and on innovation success. It is shown that PACAP mediates the relationship between inter-organizational networks and the knowledge stock of an organization (PAPER VII) as well as the relationship between KMS and the knowledge stock of an organization (PAPER V), while RACAP act as a mediator between KMS and innovation success (PAPER V).

Table 3: Theoretical contribution of research objective (B) on firm-internal knowledge capabilities

Research objective B	Contribution to
How and to what extent do internal knowledge capabilities contribute to innovation success?	Inbound open innovation: • Theoretical conceptualization of and empirical evidence for the role of absorptive capacity, the usage of KMS, and the application of innovation governance mechanisms as firm-internal knowledge capabilities for increasing innovation success in an open-innovation context. Information technology and innovation: • Extension of knowledge about the role of knowledge management systems for innovation success. Absorptive capacity: • Establishment of innovation governance mechanisms and the usage of knowledge management systems as firm-internal drivers of absorptive capacity. • Substantiation of the theoretical distinction between PACAP and RACAP.

Interplay of both factors (research objective C)*: How do both inter-organizational so-cial networks and internal knowledge capabilities interact and thereby affect innovation success?*

Beside the aforementioned contributions of PAPER VII and PAPER VIII to the research objectives of inter-organizational social networks and firm-internal knowledge capabili-ties, these two papers provide additional insights since they synthesize both objectives.

Through this integrated view these papers overcome the weakness of previous studies that explore the influence of firm-external and firm-internal factors separately (Chen *et al.* 2009; Faems *et al.* 2010; Zaheer and Bell 2005) and instead deliver a multi-conceptual innovation perspective revealing the complex interactions between external and internal innovation activities, which in turn enhance innovation research and especially open-innovation research. In particular, PAPER VII and PAPER VIII add to findings in previous studies regarding the payoff from open innovation by exposing how discrepancies in the return from inter-organizational social networks can be attributed in part to differences in firm-internal knowledge capabilities and thus responds to the recognition that "explaining such discrepancies […] remains one of the most pressing research needs in the area of open innovation" (Salge *et al.* 2012, p. 2). Enacted PACAP is identified as an important lever for higher benefits from external partners by demonstrating that enacted potential absorptive capacity mediates the relationship between the external partners of an organization and the firm-internal knowledge stock (PAPER VII). Thus this thesis increases our understanding of the controversial topic and still open question of absorptive capacity's role in constituting innovation success (Huang and Rice 2009; Robertson *et al.* 2012) and adds theoretically to social capital theory by explaining how social and intellectual capital are related through enacted PACAP. Furthermore, the use of knowledge management systems to manage newly acquired knowledge as another important lever for benefiting from external partners is identified. This is achieved by showing combinations of types of external partners (suppliers, customers etc.) and knowledge domains (market, technological, organizational, process, and product knowledge) for which the use of such systems is beneficial or obstructive (PAPER VIII).

By scrutinizing the relationship to external corporate partners from a social capital perspective, distinguishing between different knowledge domains and external partners, while incorporating firm-internal knowledge capabilities, PAPER VII and PAPER VIII focus simultaneously on the knowledge source and recipient, on the relationship among them and on the knowledge domain transferred between them, as claimed by Pérez-Nordtvedt et al. (2008). Thereby this thesis offers a contribution to inter-organizational knowledge transfer research by demonstrating a holistic view that includes firm-internal integration of the externally acquired knowledge to foster innovation, which is explicitly identified as a field of future research by Sammarra and Biggiero (2008). This thesis focuses on enacted PACAP as a firm-internal knowledge capability for integration of externally acquired knowledge (PAPER VII), but also concentrates on the use of KMS as another firm-internal capability for managing externally acquired knowledge (PAPER VIII).

Table 4: Theoretical contribution of research objective (C) on interplay of both factors

Research objective C	Contribution to
  How do both inter-organizational social networks and internal knowledge capabilities interact and thereby affect innovation success?	**Inbound open innovation:** • Simultaneous consideration of inter-organizational social networks and firm-internal knowledge capabilities for constituting innovation success revealing enacted potential absorptive capacity and the usage of knowledge management systems as important levers for higher benefits from external partners. **Inter-organizational knowledge transfer:** • Provision of a holistic model of knowledge transfer including the firm-internal integration of the external acquired knowledge to foster innovation. **Absorptive capacity:** • Clarification of the controversially discussed and still open question of the absorptive capacity's role for constituting innovation success. **Social Capital Theory:** • Theoretical explanation of how social capital and intellectual capital represented by the knowledge stock are related through enacted PACAP.

5.2   Contributions to Practice

Inter-organizational social networks (research objective A): What is the differential impact of inter-organizational social networks comprising various different corporate partners on the knowledge stock of a company?

Knowing which type of exchange partner contributes to which domain of knowledge is crucial for assessing the contribution to a firm's knowledge creation and thus allowing it to invest thoroughly in networks from a knowledge management perspective. This thesis provides important insights that allow management to invest systematically into its network of exchange partners depending on the knowledge type by revealing detailed indications of which types of partner are conducive to which knowledge domain, resulting in a preference order of the different external partners according to their impact on the corresponding knowledge type (PAPER II, PAPER III, PAPER VII, and PAPER VIII). This priority queue is extremely useful for the directed development and management of relationships to external partners since – compared to previous research – it provides richer information and thus allows concrete suggestions to be made regarding the selection of partners. Thereby, an active management of the partner network and of the focal company's boundary spanning activities is enabled. Thus this thesis supports strategic decisions regarding partner selection and development. To make the best possible

contribution, PAPER II, PAPER VII, and PAPER VIII concentrate on the relationships to external partners in contrast to PAPER III's focus on the innovativeness of the external partners. Hence these papers create a new awareness of a previously hidden influential factor for a firm's knowledge stock and eventual innovation success. In summary, management should consider knowledge contribution as an additional manageable object when resources are allocated to external relationships.

Firm-internal knowledge capabilities (research objective B)*: How and to what extent do internal knowledge capabilities contribute to innovation success?*

This thesis investigates knowledge management systems and innovation governance mechanisms comprising of several mechanisms that managers can implement directly. PAPER IV provides very detailed managerial implications and concludes that the most important innovation governance mechanisms are: Measuring the innovation success, using tools for monitoring the innovation process, and having a structured idea management. Additionally, mechanisms geared to system capabilities are identified as 'must have' mechanisms while coordination capabilities are more relevant for differentiating a firm in terms of innovation success. Furthermore, this thesis shows that management should strategically invest in knowledge management systems and corresponding processes (PAPER V), i.e. ACAP, to increase their firm's potential for innovation success. In sum this thesis provides evidence that comprehensive and differentiated innovation governance as well as a dedicated knowledge management system serving the different steps of the innovation process are advantageous for firms and thus offer a solid ground for strategic investments.

Interplay of both factors (research objective C)*: How do both inter-organizational social networks and internal knowledge capabilities interact and thereby affect innovation success?*

This thesis aims to better understand the transmission from the pure opportunity to access new firm-external knowledge through firm-internal capabilities to enhance the knowledge stock and eventually increase innovation success. Thus PAPER VII and PAPER VIII focus on the "transformative efficiency and effectiveness once the knowledge reaches the focal organization" as an often ignored aspect of the open-innovation approach (Huang and Rice IJIM 2009, S. 201). Therefore, social capital to the external partner is seen as a channel for exchanging knowledge (Hansen 1999) while enacted PACAP is necessary for absorbing the knowledge via those channels to the firm (PAPER VII). The analysis reveals that management should foster the development of enacted PACAP by investing in knowledge accumulation of the firm to ensure that more effective use is made of external knowledge. Furthermore, organizations should invest in relationship building with external sources as this fosters internally en-

acted PACAP, providing the organizations with more valuable knowledge, and eventually increasing innovation success. This thesis also looks at the management of externally acquired knowledge through the use of knowledge management systems. By connecting both aspects of 'external exchange partners' and 'internal KMS', PAPER VIII provides guidelines for organizations to invest systematically into their network of exchange partners and into the use of KMS by indicating for which combination of external partner and knowledge domain the use of KMS for managing acquired knowledge is beneficial or detrimental. In essence, PAPER VII and PAPER VIII are about the improvement in benefits from inbound open innovation by offering managers a comprehensive picture, from access to external knowledge to innovation success, with the help of firm-internal capabilities so that managers can pro-actively fine-tune their open-innovation activities.

Table 5 summarizes the managerial implications of this thesis according to the three different research objectives.

Table 5: Summary of the managerial implications

Research objectives	Managerial implications
Research objective A: What is the differential impact of inter-organizational social networks comprising various different corporate partners on the knowledge stock of a company?	• Creation of a priority queue of external partners according to their contribution to a firm's knowledge stock allowing strategic decisions regarding partner selection and development. • Establishment of knowledge contribution as an additional management objective when resources are allocated to external relationships.
Research objective B: How and to what extent do internal knowledge capabilities contribute to innovation success?	• Creation of a solid ground for strategic investments in firm-internal knowledge capabilities in terms of knowledge management systems, innovation governance mechanisms, and absorptive capacity. • Revelation of the role of the three firm-internal knowledge capabilities for innovation success and their interplay, providing starting points for increasing the firm's innovativeness.
Research objective C: How do both inter-organizational social networks and internal knowledge capabilities interact and thereby affect innovation success?	• Illustration of the open-innovation process from the accessing of new firm-external knowledge to increasing innovation success with the help of firm-internal capabilities – allowing managers to pro-actively fine-tune their open-innovation activities. • Establishment of potential absorptive capacity and the use of knowledge management systems as levers for higher benefits from external partners allowing managers to deliberately invest in open-innovation efforts.

6.   Limitations

For the interpretation of the results of the thesis some limitations have to be considered according to the applied methodology.

The literature review conducted in PAPER I only covers the selected major journals from information systems, strategic management, and marketing literature. To extend the set of articles cited, works of potential interest were investigated (backward search). Thus the articles under investigation cover a representative sample (compare section 3.1) but are limited to this set, not taking into account other works published in conferences proceedings or books and not performing a forward search, i.e., the most recent insights in the field of measuring innovativeness might not be included. However, to the best of my knowledge recent literature does not show any major advancement.

Since PAPER II to PAPER VIII (excepting the conceptual PAPER VI) all follow an empirical approach, they also share the same limitations due to the joint data collection method and study setting.

One of the major weaknesses of survey-based studies is that the data for analysis might be biased in terms of single-response and/or common method bias. The former was reduced by directly addressing the manager of the respective marketing division for the innovation success variable through a follow-up survey (compare section 3.2.6) and further by augmenting the survey with a set of case studies (compare footnote 10 on page 20) that allowed us to balance the view of the manager in charge (original survey respondent) with the views of other managers (participants of the case studies) where we did not find great deviations in the assessment. To account for the existence of common method bias several methods recommended by the previous literature were conducted (compare section 3.2.6) which did not show that common method bias was a major threat to our data. Thus no substantial effects on the results of this thesis are expected but due to some disadvantages of the common method bias tests (see Podsakoff *et al.* 2003), common method bias cannot be completely excluded. Hence, common method bias is a potential limitation of the thesis.

Another limitation relates to the aspect of the generalizability of the findings. Since the survey was limited to the 2,500 largest firms in Germany's manufacturing industry, the generalizability of the results is also limited to this population of one specific industry in one country (Lee and Baskerville 2003; Seddon and Scheepers 2012). It also needs to be recognized that this restriction can also be seen as an advantage as the robustness of the interpretation of the results is strengthened since the findings are not influenced by contingency factors dependent on the country and industry. However, taking into account that the exchange and combination of knowledge representing the core of innovative activities and the manufacturing performance are influenced by national as well as organizational culture (Bock *et al.* 2005; Chow *et al.* 2000; Griffith *et al.* 2006; Naor *et al.* 2010), the effect of inter-organizational social networks on the knowledge stock and eventually on the innovation success may differ when investigating other industries and/or countries. Another influencing factor might be the governance system of the

country. Munari et al. (2010) show that widely-held organizations operating in the United Kingdom invest less in R&D in comparison to organizations operating in continental European countries due to the greater pressure that exists for the reduction of R&D in market-based governance systems.

Finally, the application of social capital theory in a survey-based study to investigate the effects of external partners restricted the structure of the network to a star. Thus only the focal organization, its external partners and the corresponding ties are considered but not the relationships between the external partners and the relationship of the partners to third parties. Accordingly, methods of social network analysis, e.g., centrality measures or the analysis of cliques, could not be conducted (Alba 1973; Freeman 1978/79; Mokken 1979). Furthermore, other concepts such as Simmelian ties[48] which have been identified as important for generating innovations in an intra-organizational context (Tortoriello *et al.* 2012) could not be adopted to the inter-organizational context of this thesis and thus are not taken into account. Additionally, the relationships to a type of external partner, e.g., customers, constitute the most important set of partners of this type, not considering the duration of each relationship or the different sizes of the several partners. Hence, the relationship as set out in this thesis aggregates many different relationships to several partners of a specific type to one tie.

7.   Future Research

Future research may draw on the findings of this thesis to provide additional insights that may shed even more light onto the particular research fields of inter-organizational knowledge transfer, open innovation, absorptive capacity, social capital theory, and information systems, as illustrated in the following.

Knowledge transfer in its easiest form takes place between a knowledge seeker and a knowledge source. In this respect this thesis concentrates on the absorptive capacity of a seeker, including the recognition of the value of external knowledge, but neglects the transmission capacity of the source, "the ability of the source to recognize the value of its knowledge for others" (Bresman 2013, p. 54). Accordingly, the simultaneous examination of the absorptive capacity of a seeker and the transmission capacity of the source would be a fruitful avenue for future research since both are related to each other because the "seeker's ability to recognize the value of a source's knowledge is criti-

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[48] The concept of Simmelian ties refers to the idea "that the context in which dyadic relationships are embedded has the potential to substantially change their character and quality. In particular, a tie becomes Simmelian when the parties involved in it are reciprocally connected to one other and each is reciprocally connected to another, third party (Krackhardt 1998). The definition of Simmelian ties closely resembles that of a clique (Dekker 2006); indeed, a perfectly equivalent definition of a Simmelian tie is that it is a tie embedded in a clique" (Tortoriello *et al.* 2012, p. 120)

cally determined by the source's active involvement in assessing the value of its knowledge together with the seeker" (Bresman 2013, p. 54).

Another avenue for further research besides looking at the knowledge transfer capabilities of seekers and sources is to consider the different dimensions of the knowledge transfer construct. Research in this field reveals four underlying dimensions of knowledge transfer: Comprehension ("the extent to which the new knowledge transferred is fully understood by the recipient"), usefulness ("the extent to which such [transferred] knowledge was relevant and salient to organizational success")[49], speed ("'how rapidly [the recipient] acquires new insights and skills' (Zahra *et al.* 2000, p. 926)") and economy ("costs and resources associated with the knowledge transfer") (Pérez-Nordtvedt *et al.* 2008, p. 717). These four dimensions can be grouped reflecting knowledge transfer 'effectiveness' (comprehension and usefulness) and the 'efficiency' of the knowledge transfer process (speed and economy) (Pérez-Nordtvedt *et al.* 2008). While effectiveness is initially considered in this thesis in relation to comprehensiveness by taking into account the concept of ACAP (PAPER VII) and use of KMS (PAPER VIII) as well as regarding usefulness by demonstrating the role of externally acquired knowledge for innovation success (PAPER VII), the efficiency of knowledge transfer has so far been neglected. Thus, future research should incorporate the two dimensions of speed and economy of knowledge transfer (compare also van Wijk *et al.* 2008) in an open-innovation context whereas social capital theory seems an appropriate lens to scrutinize these dimensions especially with regard to the speed of knowledge transfer (Chen and Lovvorn 2011).

A third path of future research is to focus on knowledge itself. While this thesis separates knowledge into various knowledge domains, the knowledge transfer literature identifies further characteristics of knowledge embraced by the concept of knowledge ambiguity. Knowledge ambiguity comprises of the tacitness, teachability, complexity, and specificity of the specific knowledge (Becerra *et al.* 2008; van Wijk *et al.* 2008) and "contributes to protecting knowledge from being imitated by rivals [and] has, therefore, been suggested to negatively affect organizational knowledge transfer" (van Wijk *et al.* 2008, p. 833). This corresponds with the knowledge-based view of the firm, suggesting that those parts of the knowledge stock of an organization responsible for value creation and thus for competitive advantages are developed and shared within the firm (Argote and Ingram 2000; Grant 1996b; Kogut and Zander 1993). However "it is important that firms possess the ability to learn from others in order to meet the increasing pace of competition" (Easterby-Smith *et al.* 2008, p. 677). By adding the dimensions of

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[49] Van Wijk et al. (2008, p. 847) call this the quality of knowledge transfer which refers to "whether transferred knowledge generates fresh thinking and provides useful new insights".

knowledge ambiguity, future research should shed light on inter-organizational knowledge transfer by applying the knowledge-based view of the firm and thus contribute to the stream of open-innovation research by answering the question of "how firms achieve the desired level of knowledge ambiguity that enables them to prevent unwanted leakage and promotes purposeful transfer processes" (van Wijk *et al.* 2008, p. 844). For this purpose it would be beneficial if research scrutinized inter- organizational networks on an individual level since organizational interactions are based on interactions between individual people. Such an analysis could result in a 'knowledge transfer governance' balancing knowledge transfer and knowledge protection.

Over the years, the general tenet has become apparent, which also underlies this thesis as well, that absorptive capacity contributes positively to organizational knowledge transfer and to innovation success (e.g., Tsai 2001), but research continuously challenges this positive contribution. As van Wijk et al. (2008) remark, some studies found no evidence for the contribution of ACAP to organizational knowledge transfer and Huang and Rice (2009) even show that investments in ACAP can be negatively related to innovative performance. They argue that it is the path-dependent nature of ACAP which hampers short term innovation success from investments in ACAP but that the long term return might possibly be affected by an increased innovation success. Finally, Stock et al. (2001) report an inverted-U relationship between ACAP and the success of new product development. These conflicting findings can partly be explained by different operationalizations of ACAP. However, future research is needed to extend our knowledge about the role of ACAP and so research on ACAP remains a fertile research stream.

In a similar vein, the relationship between inter-organizational social networks and innovation success may be an inverted u-shaped. Recent research shows that the level of search openness of an organization, or its respective external R&D activities, is curvilinear related (taking an inverted U-shape) to its innovative performance (Berchicci 2013; Salge *et al.* 2012). One reason might by that the "attempt to learn something from a partner may […] end up with having trained a new competitor (Hladik 1988; Khanna *et al.* 1998)" (Becerra *et al.* 2008, p. 693). Regarding social capital, van Wijk et al. (2008) detected positive linear relationships between the dimensions of social capital and organizational knowledge transfer through their meta-analysis but at the same time suggested that these relationships may be curvilinear (compare also Florida *et al.* 2002). In particular, the focus should be on the relational dimension because on the one side trust increases organizational knowledge transfer but on the other side a high level of trust can inhibit knowledge exchange due to the creation of collective blindness (van Wijk *et al.* 2008). Furthermore, a high similarity in mental maps as elements of the relational

dimension hinders novelty (Li *et al.* 2008) and thus affects innovation success in a negative way. Future research should address this issue in more detail.

Regarding social capital there is an additional field for future research. Based on a meta-analysis, van Wijk et al. (2008) conclude that all three dimensions of social capital are positively related to organizational knowledge transfer, although to varying degrees. Their "findings suggest that relational and cognitive capital are crucial network-level determinants for transferring knowledge as they create closure. Alternatively, structural capital appears to be a mechanism to search and gain access to new, diverse knowledge available at other organizations because it creates a brokerage mechanism" (van Wijk *et al.* 2008, p. 845). However, the importance of each dimension of social capital may vary depending on the type of external partner and knowledge domain exchanged, which is something that should be scrutinized in detail by future studies.

Finally, based on the results regarding the relationship between knowledge management systems and absorptive capacity, future research in the field of information systems can empirically test the conceptual model of PAPER VI to highlight which combination of system (organizational memory systems (ORMS), cooperative work systems (CWS), project and resource management systems (PRMS)), and innovation governance mechanisms (mechanisms geared to system, coordination, and socialization capabilities) will have an effect on which respective element of the four capabilities of ACAP.

8. Conclusion

By examining the role of inter-organizational social networks and firm-internal knowledge capabilities this thesis provides a holistic picture and thus advances our knowledge about what makes firms innovative. By analyzing the relationship with external partners from a social capital perspective and by distinguishing different knowledge domains (market, technological, organizational, process, and product knowledge) and different types of external partners (customers, suppliers, R&D partners, trade associations also called communities/professional organizations, and friendship communities) as well as by integrating the concept of firm-internal knowledge capabilities (absorptive capacity, knowledge management systems, innovation governance mechanisms), this thesis offers valuable and detailed insights for gaining and maintaining innovation success. Thereby, this thesis contributes to various research fields, such as social capital theory, open innovation, information systems, and absorptive capacity, and reveals several managerial implications, including for example, better partner selection and development, more dedicated strategic investments in firm-internal knowledge capabilities, and improvements of benefits from inbound open innovation.

9.   References

Adner, R. (2002). When Are Technologies Disruptive? A Demand-Based View of the Emergence of Competition. *Strategic Management Journal*, 23(8), 667-688.

Ahmed, P.K., Lim, K.K., and Loh, A.Y.E. (2002). Learning through Knowledge Management, Butterworth-Heinemann: Oxford, Boston.

Ahuja, G. (2000a). Collaboration Networks, Structural Holes, and Innovation: A Longitudinal Study. *Administrative Science Quarterly*, 45(3), 425-455.

Ahuja, G. (2000b). The Duality of Collaboration: Inducements and Opportunities in the Formation of Interfirm Linkages. *Strategic Management Journal*, 21(3), 317-343.

Aiken, L.S. and West, S.G. (1991). Multiple Regression: Testing and Interpreting Interactions, Sage: Newbury Park.

Alavi, M. and Leidner, D.E. (2001). Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues. *MIS Quarterly*, 25(1), 107-136.

Alavi, M. and Tiwana, A. (2002). Knowledge Integration in Virtual Teams: The Potential Role of Kms. *Journal of the American Society for Information Science and Technology*, 53(12), 1029-1037.

Alba, R.D. (1973). A Graph-Theoretic Definition of a Sociometric Clique. *Journal of Mathematical Sociology*, 3(1), 113-126.

Almahamid, S., Awwad, A., and McAdams, A.C. (2010). Effects of Organizational Agility and Knowledge Sharing on Competitive Advantage: An Empirical Study in Jordan. *International Journal of Management*, 27(3), 387-404.

Almeida, P., Song, J., and Grant, R.M. (2002). Are Firms Superior to Alliances and Markets? An Empirical Test of Cross-Border Knowledge Building. *Organization Science*, 13(2), 147-161.

Ambrosini, V., Bowman, C., and Collier, N. (2009). Dynamic Capabilities: An Exploration of How Firms Renew Their Resource Base. *British Journal of Management*, 20, S9-S24.

Amelingmeyer, J. (2004). Wissensmanagement: Analyse Und Gestaltung Der Wissensbasis Von Unternehmen. 3 edition, Dt. Univ.-Verl.: Wiesbaden.

Argote, L. and Ingram, P. (2000). Knowledge Transfer: A Basis for Competitive Advantage in Firms. *Organizational Behavior and Human Decision Processes*, 82(1), 150-169.

Argote, L., McEvily, B., and Reagans, R. (2003a). Introduction to the Special Issue on Managing Knowledge in Organizations: Creating, Retaining, and Transferring Knowledge. *Management Science*, 49(4), v-viii.

Argote, L., McEvily, B., and Reagans, R. (2003b). Managing Knowledge in Organizations: An Integrative Framework and Review of Emerging Themes. *Management Science*, 49(4), 571-582.

Armstrong, J.S. and Overton, T.S. (1977). Estimating Nonresponse Bias in Mail Surveys. *Journal of Marketing Research*, 14(3), 396-402.

Ashrafi, N., Xu, P., Kuilboer, J.P., and Koehler, W. (2006). Boosting Enterprise Agility Via It Knowledge Management Capabilities. *39th Hawaii International Conference on System Sciences (HICSS)*, Hawaii, USA, 1-9.

Atallah, G. (2002). Vertical R&D Spillovers, Cooperation, Market Structure, and Innovation. *Economics of Innovation and New Technology*, 11(3), 179-209.

Azadegan, A., Dooley, K.J., Carter, P.L., and Carter, J.R. (2008). Supplier Innovativeness and the Role of Interorganizational Learning in Enhancing Manufacturer Capabilities. *Journal of Supply Chain Management*, 44(4), 14-35.

Baer, M. (2012). Putting Creativity to Work: The Implementation of Creative Ideas in Organizations. *Academy of Management Journal*, 55(5), 1102-1119.

Bagozzi, R.P. (2011). Measurement and Meaning in Information Systems and Organizational Research: Methodological and Philosophical Foundations. *MIS Quarterly*, 35(2), 261-292.

Bahemia, H. and Squire, B. (2010). A Contingent Perspective of Open Innovation in New Product Development Projects. *International Journal of Innovation Management*, 14(4), 603-627.

Baron, R.M. and Kenny, D.A. (1986). The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations. *Journal of Personality and Social Psychology*, 51(6), 1173-1182.

Bassellier, G. and Benbasat, I. (2004). Business Competence of Information Technology Professionals: Conceptual Development and Influence on It-Business Partnerships. *MIS Quarterly*, 28(4), 6733-6694.

Bassellier, G., Reich, B.H., and Benbasat, I. (2001). Information Technology Competence of Business Managers: A Definition and Research Model. *Journal of Management Information Systems*, 17(4), 159-182.

Batjargal, B. (2007). Internet Entrepreneurship: Social Capital, Human Capital, and Performance of Internet Ventures in China. *Research Policy*, 36(5), 605-618.

Becerra, M., Lunnan, R., and Huemer, L. (2008). Trustworthiness, Risk, and the Transfer of Tacit and Explicit Knowledge between Alliance Partners. *Journal of Management Studies*, 45(4), 691-713.

Bell, G.G. (2005). Clusters, Networks, and Firm Innovativeness. *Strategic Management Journal*, 26(3), 287-295.

Bell, G.G. and Zaheer, A. (2007). Geography, Networks, and Knowledge Flows. *Organization Science*, 18(6), 955-972.

Berchicci, L. (2013). Towards an Open R&D System: Internal R&D Investment, External Knowledge Acquisition and Innovative Performance. *Research Policy*, 42(1), 117-127.

Bharadwaj, A.S. (2000). A Resource Based Perspective on Information Technology Capability and Firm Performance: An Empirical Investigation. *MIS Quarterly*, 24(1), 169-193.

Bhatt, G.D. and Grover, V. (2005). Types of Information Technology Capabilities and Their Role in Competitive Advantage: An Empirical Study. *Journal of Management Information Systems*, 22(2), 253-277.

Bock, G.-W., Zmud, R.W., Kim, Y.-G., and Lee, J.-N. (2005). Behavioral Intention Formation in Knowledge Sharing: Examining the Roles of Extrinsic Motivators, Social-Psychological Forces, and Organizational Climate. *MIS Quarterly*, 29(1), 87-111.

Bollen, K.A. (1989). Structural Equations with Latent Variables, John Wiley and Sons: New York.

Bollen, K.A. (2011). Evaluating Effect, Composite, and Causal Indicators in Structural Equation Models. *MIS Quarterly*, 35(2), 359-372.

Bourdieu, P. (1983). Ökonomisches Kapital, Kulturelles Kapital, Soziales Kapital. In: *Soziale Ungleichheiten (Soziale Welt Sonderband 2)*. Kreckel, R. (ed.), Otto Schwartz & Co: Goettingen, pp. 183-198.

Bourdieu, P. (1986). The Forms of Capital. In: *Handbook of Theory and Research for the Sociology of Education*. Richardson, J.G. (ed.), Greenwood Press: New York, Westport (Ct.), London, pp. 241-258.

Bresman, H. (2013). Changing Routines: A Process Model of Vicarious Group Learning in Pharmaceutical R&D. *Academy of Management Journal*, 56(1), 35-61.

Bühl, A. (2012). Spss 20 Einführung in Die Moderne Datenanalyse, Pearson: München.

Burrell, G. and Morgan, G. (1979). Sociological Paradigms and Organizational Analysis: Elements of the Sociology of Corporate Life, Ashgate: Burlington.

Burt, R.S. (1992). Structural Holes: The Social Structure of Competition, Harvard University Press: Cambridge (Mass.), London.

Camisón, C. and Forés, B. (2010). Knowledge Absorptive Capacity: New Insights for Its Conceptualization and Measurement. *Journal of Business Research*, 63(7), 707-715.

Cantwell, J.A. (2002). Innovation, Profits and Growth: Schumpeter and Penrose. In: *The Theory of the Growth of the Firm: The Legacy of Edith Penrose*. Pitelis, C.N. (ed.), Oxford University Press: Oxford, pp. 215-248.

Capaldo, A. (2007). Network Structure and Innovation: The Leveraging of a Dual Network as a Distinctive Relational Capability. *Strategic Management Journal*, 28(6), 585-608.

Cardinal, L.B. (2001). Technological Innovation in the Pharmaceutical Industry: The Use of Organizational Control in Managing Research and Development. *Organizational Science*, 12(1), 19-36.

Carmines, E.G. and R.A., Z. (1979). Reliability and Validity Assessment, CA: Sage Publications: Becerly Hills.

Cassiman, B. and Veugelers, R. (2006). In Search of Complementarity in Innovation Strategy: Internal R&D and External Knowledge Acquisition. *Management Science*, 52(1), 68-82.

Chang, Y.-Y., Gong, Y., and Peng, M.W. (2012). Expatriate Knowledge Transfer, Subsidiary Absorptive Capacity, and Subsidiary Performance. *Academy of Management Journal*, 55(4), 927-948.

Chen, A.N.K. and Edgington, T.M. (2005). Assessing Value in Organizational Knowledge Creation: Considerations from Knoweldge Workers. *MIS Quarterly*, 29(2), 279-309.

Chen, J.-S. and Lovvorn, A.S. (2011). The Speed of Knowledge Transfer within Multinational Enterprises: The Role of Social Capital. *International Journal of Commerce & Management*, 21(1), 46-62.

Chen, Y.-S., Lin, M.-J.J., and Chang, C.-H. (2009). The Positive Effects of Relationship Learning and Absorptive Capacity on Innovation Performance and Competitive Advantage in Industrial Markets. *Industrial Marketing Management*, 38(2), 152-158.

Chin, W.W. (1998a). Issues and Opinion on Structural Equation Modeling. *MIS Quarterly*, 22(1)

Chin, W.W. (1998b). The Partial Least Squares Approach for Structural Equation Modelling. In: *Modern Methods for Business Research*. Marcoulides, G.A. (ed.), Lawrence Erlbaum Associates: Mahwah (NJ), U.S., pp. 295-336.

Chin, W.W. (2010). How to Write up and Report Pls Analyses. In: *Handbook of Partial Least Squares: Concepts, Methods and Applications in Marketing and Related Fields*. Esposito Vinzi, V., Chin, W.W., Henseler, J., and Wang, H. (eds.), Springer-Verlag: Berlin, Heidelberg, pp. 655-690.

Chiu, C.-M., Hsu, M.-H., and Wang, E.T.G. (2006). Understanding Knowledge Sharing in Virtual Communities: An Integration of Social Capital and Social Cognitive Theories. *Decision Support Systems*, 42(3), 1872-1888.

Chow, C.W., Deng, F.J., and Ho, J.L. (2000). The Openness of Knowledge Sharing within Organizations: A Comparative Study of the United States and the People's Republic of China. *Journal of Management Accounting Research*, 12(1), 65-95.

Chung, S., Singh, H., and Lee, K. (2000). Complementarity, Status Similarity and Social Capital as Drivers of Alliance Formation. *Strategic Management Journal*, 21(1), 1-22.

Churchill, G.A. (1979). A Paradigm for Developing Better Measures of Marketing Construct's. *Journal of Marketing Research*, XVI, 64-73.

Cohen, J., Cohen, P., West, S.G., and Aiken, L.S. (2003). Applied Multiple Regression Correlation Analysis for the Behavioral Sciences, Lawrence Erlbaum Associates: Mahwah, NJ.

Cohen, W.M. and Levinthal, D.A. (1989). Innovation and Learning: The Two Faces of R & D. *The Economic Journal*, 99(397), 569-596.

Cohen, W.M. and Levinthal, D.A. (1990). Absorptive Capacity: A New Perspective on Learning & Innovation. *Administrative Science Quarterly*, 35(1), 128-152.

Coleman, J.S. (1988). Social Capital in the Creation of Human Capital. *American Journal of Sociology*, 94, 95-120.

Compeau, D. (1995). Computer Self-Efficacy: Development of a Measure and Initial Test. *MIS Quarterly*, 19(2), 189-211.

Conner, K. and Prahalad, C.K. (1996). A Resource-Based Theory of the Firm: Knowledge Versus Opportunism. *Organization Science*, 7(5), 477-501.

Coombs, R. and Hull, R. (1998). Knowledge Management Practices' and Path-Dependency in Innovation. *Research Policy*, 27(3), 237-253.

Cooper, H. (1988). Organizing Knowledge Syntheses: A Taxonomy of Literature Reviews. *Knowledge in Society*, 1(1), 104-126.

Crossan, M.M. and Apaydin, M. (2010). A Multi-Dimensional Framework of Organizational Innovation: A Systematic Review of the Literature. *Journal of Management Studies*, 47(6), 1154-1191.

Crossan, M.M., Lane, H.W., and White, R.E. (1999). An Organizational Learning Framework: From Intuition to Institution. *Academy of Management Review*, 24(3), 522-537.

Cuellar, M.J. and Gallivan, M.J. (2006). A Framework for Ex Ante Project Risk Assessment Based on Absorptive Capacity. *European Journal of Operational Research*, 173(3), 1123-1138.

Cummings, J. and Kiesler, S. (2003). Coordination and Success in Multidisciplinary Scientific Collaborations. *Proceedings of the 24th International Conference on Information Systems (ICIS)*, Seattle, Washington, USA, 296-303.

Daghfous, A. (2004). Absorptive Capacity and the Implementation of Knowledge-Intensive Best Practices. *SAM Advanced Management Journal*, 69(2), 21-27.

Damanpour, F. (1991). Organizational Innovation: A Meta-Analysis of Effects of Determinants and Moderators. *Academy of Management Journal*, 34(3), 555-590.

Damanpour, F. (1992). Organizational Size and Innovation. *Organization Science*, 13(3), 375-402.

Damanpour, F. and Evan, W.M. (1984). Organizational Innovation and Performance: The Problem of "Organizational Lag". *Administrative Science Quarterly*, 29(3), 392-409.

Damanpour, F., Szabat, K.A., and Evan, W.M. (1989). The Relationship between Types of Innovation and Organizational Performance. *Journal of Management Studies*, 26(6), 587-601.

Damanpour, F. and Wischnevsky, J.D. (2006). Research on Innovation in Organizations: Distinguishing Innovation-Generating from Innovation-Adopting Organizations. *Journal of Engineering and Technology Management*, 23, 269-291.

Darr, E.D., Argote, L., and Epple, D. (1995). The Acquisition, Transfer, and Depreciation of Knowledge in Service Organizations: Productivity in Franchises. *Management Science*, 41(11), 1750-1762.

Darroch, J. and McNaughton, R. (2002). Examining the Link between Knowledge Management Practices and Types of Innovation. *Journal of Intellectual Capital*, 3(3), 210-222.

Davenport, T. and Prusak, L. (1998). Working Knowledge, Harvard Business School Press: Boston.

de Faria, P., Lima, F., and Santos, R. (2010). Cooperation in Innovation Activities: The Importance of Partners. *Research Policy*, 39(8), 1082-1092.

de Jong, J.P.J. and Freel, M. (2010). Absorptive Capacity and the Reach of Collaboration in High Technology Small Firms. *Research Policy*, 39(1), 47-54.

de Luca, L.M. and Atuahene-Gima, K. (2007). Market Knowledge Dimensions and Cross-Functional Collaboration: Examining the Different Routes to Product Innovation Performance. *Journal of Marketing*, 71(1), 95-112.

de Propris, L. (2002). Types of Innovation and Inter-Firm Co-Operation. *Entrepreneurship & Regional Development*, 14(4), 337-353.

Dekker, D. (2006). Measures of Simmelian Tie Strength. Simmelian Brokerage, and the Simmelianly Brokered. *Journal of Social Structure*, 7(1), 1-22.

Dennis, J., William J. (2003). Raising Response Rates in Mail Surveys of Small Business Owners: Results of an Experiment. *Journal of Small Business Management*, 41(3), 278-295.

Denrell, J., Arvidsson, N., and Zander, U. (2004). Managing Knowledge in the Dark: An Empirical Study of the Reliability of Capability Evaluations. *Management Science*, 50(11), 1491-1503.

Dewar, R.D. and Dutton, J.E. (1986). The Adoption of Radical and Incremental Innovations: An Empirical Analysis. *Management Science*, 32(11), 1422-1433.

Dhanaraj, C., Lyles, M.A., Steensma, H.K., and Tihanyi, L. (2004). Managing Tacit and Explicit Knowledge Transfer in Ijvs: The Role of Relational Embeddedness and the Impact on Performance. *J Int Bus Stud*, 35(5), 428-442.

Dougherty, D. and Hardy, C. (1996). Sustained Product Innovation in Large, Mature Organizations: Overcoming Innovation-to-Organization Problems. *Academy of Management Journal*, 39(5), 1120-1153.

Drucker, P.F. (1955). The Practice of Management, Harper & Brothers Publishers: New York.

Dubin, R. (1976). Theory Building in Applied Areas. In: *Handbook of Industrial and Organizational Psychology*. Dunnette, M.D. (ed.), Rand McNally College Publishing Co, pp. 17-26.

Dutta, S. and Weiss, A.M. (1997). The Relationship between a Firm' S Level of Technological Innovativeness and Its Pattern of Partnership Agreements. *Management Science*, 43(3), 343-356.

Dyer, J.H. and Singh, H. (1998). The Relational View: Cooperative Strategy and Sources of Interorganizational Competitive Advantage. *Academy of Management Review*, 23(4), 660-679.

Easterby-Smith, M., Lyles, M.A., and Tsang, E.W.K. (2008). Inter-Organizational Knowledge Transfer: Current Themes and Future Prospects. *Journal of Management Studies*, 45(4), 677-690.

Eberl, M. (2010). An Application of Pls in Multi-Group Analysis: The Need for Differentiated Corporate-Level Marketing in the Mobile Communications Industry. In: *Handbook of Partial Least Squares: Concepts, Methods and Applications in Marketing and Related Fields*. Esposito Vinzi, V., Chin, W.W., Henseler, I., and Wang, H. (eds.), Springer-Verlag: Berlin, Heidelberg, pp. 487-514.

Ebersberger, B., Bloch, C., Herstad, S.J., and Van De Velde, E.L.S. (2012). Open Innovation Practices and Their Effect on Innovation Performance. *International Journal of Innovation & Technology Management*, 9(6), -1.

Eisenhardt, K.M. and Martin, J.A. (2000). Dynamic Capabilities: What Are They? *Strategic Management Journal*, 21(10-11), 1105-1121.

Escribano, A., Fosfuri, A., and Tribó, J.A. (2009). Managing External Knowledge Flows: The Moderating Role of Absorptive Capacity. *Research Policy*, 38(1), 96-105.

Ettlie, J.E., Bridges, W.P., and O'Keefe, R.D. (1984). Organization Strategy and Structural Differences for Radical Versus Incremental Innovation. *Management Science*, 30(6), 682-695.

Faems, D., de Visser, M., Andries, P., and van Looy, B. (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.

Fettke, P. (2006). State-of-the-Art Des State-of-the-Art. *WIRTSCHAFTSINFORMATIK*, 48(4), 257-266.

Fey, C.F. and Birkinshaw, J. (2005). External Sources of Knowledge, Governance Mode, and R&D Performance. *Journal of Management*, 31(4), 597-621.

Field, A. (2009). Discovering Statistics Using Spss, Sage: Los Angeles et al.

Florida, R., Cusbing, R., and Gates, G. (2002). When Social Capital Stifles Innovation: Regions Where Social Ties Are Tight May Be the Worst Places for Creative Operations. *Harvard Business Review*, August, 20.

Fornell, C. and Lacker, D.F. (1981). Evaluation Structural Equation Models with Unobservable Variables and Measurement Errors. *Journal of Marketing Research*, 18, 39-50.

Fosfuri, A. and Tribo, J.A. (2008). Exploring the Antecedents of Potential Absorptive Capacity and It's Impact on Innovation Performance. *Omega*, 36(2), 173-187.

Fountain, J.E. (1998). Social Capital: A Key Enabler of Innovation. In: *Investing in Innovation: Towards a Consensus Strategy for Federal Technology Policy That Works*. Branscomb, L.M. and Keller, J. (eds.), MIT Press: Cambridge, pp. 85-111.

Francalanci, C. and Morabito, V. (2008). Is Integration and Business Performance: The Mediation Effect of Organizational Absorptive Capacity in Smes. *Journal of Information Technology*, 23(4), 297-312.

Frazier, P.A., Tix, A.P., and Barron, K.E. (2004). Testing Moderator and Mediator Effects in Counseling Psychology Research. *Journal of Counseling Psychology*, 51(1), 115-134.

Freeman, L.C. (1978/79). Centrality in Social Networks: Conceptual Clarification. *Social Networks*, 1(3), 215-239.

Friend, M., Lucacs, M., and Snowdon, J. European Business Process Outsourcing Forecast and Analysis 2001-2006, IDC, Framingham (MA), USA

Galunic, D.C. and Rodan, S. (1998). Resource Recombinations in the Firm: Knowledge Structures and the Potential for Schumpeterian Innovation. *Strategic Management Journal*, 19(12), 1193-1201.

Gefen, D., Rigdon, E.E., and Straub, D.W. (2011). An Update and Extension to Sem Guidelines for Administrative and Social Science Research. *MIS Quarterly*, 35(2), iii-A7.

Gefen, D., Straub, D.W., and Boudreau, M. (2000). Structural Equation Modeling and Regression: Guidelines for Research Practice. *Communications of the AIS*, 4(7)

Gilsing, V., Nooteboom, B., Vanhaverbeke, W., Duysters, G., and van den Oord, A. (2008). Network Embeddedness and the Exploration of Novel Technologies: Technological Distance, Betweenness Centrality and Density. *Research Policy*, 37(10), 1717-1731.

Gold, A.H., Malhotra, A., and Segars, A.H. (2001). Knowledge Management: An Organizational Capabilities Perspective. *Journal of Management Information Systems*, 18(1), 185-214.

Gomez, J. and Vargas, P. (2009). The Effect of Financial Constraints, Absorptive Capacity and Complementarities on the Adoption of Multiple Process Technologies. *Research Policy*, 38(1), 106-119.

Goodhue, D., Lewis, W., and Thompson, R. (2007). Statistical Power in Analyzing Interaction Effects: Questioning the Advantage of Pls with Product Indicators. *Information Systems Research*, 18(2), 211-227.

Gopalakrishnan, S. and Damanpour, F. (1997). A Review of Innovation Research in Economics, Sociology and Technology Management. *Omega*, 25(1), 15-28.

Götz, O., Liehr-Gobbers, K., and Krafft, M. (2010). Evaluation of Structural Equation Models Using the Partial Least Squares (Pls) Approach. In: *Handbook of Partial Least Squares: Concepts, Methods and Applications*. Vinci, V.E., Chin, W.W., Henseler, J., and Wang, H. (eds.), Heidelberg: Springer: Berlin, pp. 655-690.

Govindarajan, V. and Kopalle, P.K. (2006). Disruptiveness of Innovations: Measurement and an Assessment of Reliability and Validity. *Strategic Management Journal*, 27(2), 189-199.

Grandori, A. (1997). An Organizational Assessment of Interfirm Coordination Modes. *Organization Studies*, 18(6), 897-925.

Granovetter, M. (1973). The Strength of Weak Ties. *American Journal of Sociology*, 78(6), 1360-1380.

Granovetter, M. (1985). Economic Action and Social Structure: The Problem of Embeddedness. *American Journal of Sociology*, 91(3), 481-510.

Grant, R.M. (1996a). Prospering in Dynamically-Competitive Environments: Organizational Capability as Knowledge Integration. *Organization Science*, 7(4), 375-387.

Grant, R.M. (1996b). Toward a Knowledge-Based Theory of the Firm. *Strategic Management Journal*, 17(Winter Special Issue), 109-122.

Greve, H.R., Baum, J.A.C., Mitsuhashi, H., and Rowley, T.J. (2010). Built to Last but Falling Apart: Cohesion, Friction, and Withdrawal from Interfirm Alliances. *Academy of Management Journal*, 53(2), 302-322.

Griffith, D.A., Myers, M.B., and Harvey, M.G. (2006). An Investigation of National Culture's Influence on Relationship and Knowledge Resources in Interorganizational Relationships between Japan and the United States. *Journal of International Marketing*, 14(3), 1-32.

Gupta, A.K. and Govindarajan, V. (2000). Knowledge Flows within Multinational Corporations. *Strategic Management Journal*, 21(4), 473-496.

Haas, M.R. (2010). The Double-Edged Swords of Autonomy and External Knowledge: Analyzing Team Effectiveness in a Multinational Organization. *Academy of Management Journal*, 53(5), 989-1008.

Haas, M.R. and Hansen, M.T. (2005). When Using Knowledge Can Hurt Performance: The Value of Organizational Capabilities in a Management Consulting Company. *Strategic Management Journal*, 26(1), 1-24.

Hagedoorn, J. (1993). Understanding the Rationale of Strategic Technology Partnering: International Modes of Cooperation and Sectoral Differences. *Strategic Management Journal*, 14(XX), 241-250.

Hagedoorn, J. and Duysters, G. (2002). External Sources of Innovative Capabilities: The Preferences for Strategic Alliances or Mergers and Acquisitions. *Journal of Management Studies*, 39(2), 167-188.

Hair, J.F., Black, W.C., Babin, B.J., and Anderson, R.E. (2009). Multivariate Data Analysis. 7th edition, Prentice Hall: Englewood Cliffs.

Hair, J.F., Ringle, C.M., and Sarstedt, M. (2011). Pls-Sem: Indeed a Silver Bullet. *Journal of Marketing Theory & Practice*, 19(2), 139-152.

Hair, J.F., Sarstedt, M., Ringle, C.M., and Mena, J.A. (2012). An Assessment of the Use of Partial Least Squares Structural Equation Modeling in Marketing Research. *Journal of the Academy of Marketing Science*, 40(3), 414-433.

Hakansson, H. (1987). Industrial Technological Development: A Network Approach, Croom Helm: London.

Hansen, M.T. (1999). The Search-Transfer Problem: The Role of Weak Ties in Sharing Knowledge across Organization Subunits. *Administrative Science Quarterly*, 44(1), 82-111.

Hansen, M.T., Mors, M.L., and LØVÅS, B. (2005). Knowledge Sharing in Organizations: Multiple Networks, Multiple Phases. *Academy of Management Journal*, 48(5), 776-793.

Hao, J.-X., Yan Yu, A., and Dong, X.-Y. (2011). Bridging the Role of Absorptive Capacity on Knowledge Management Systems Success. *Pacific Asia Conference on Information Systems*, Brisbane, Australia

Hayes, A.F. (2009). Beyond Baron and Kenny: Statistical Mediation Analysis in the New Millennium. *Communication Monographs*, 76(4), 408-420.

He, J. and Wang, H.C. (2009). Innovative Knowledge Assets and Economic Performance: The Asymmetric Roles of Incentives and Monitoring. *Academy of Management Journal*, 52(5), 919-938.

Helfat, C.E. and Peteraf, M.A. (2003). The Dynamic Resource-Based View: Capability Lifecycles. *Strategic Management Journal*, XX(24), 997-1010.

Henderson, R. and Cockburn, I. (1994). Measuring Competence? Exploring Firm Effects in Pharmaceutical Research. *Strategic Management Journal*, 15(S1), 63-84.

Henderson, R.M. and Clark, K.B. (1990). Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms. *Administrative Science Quarterly*, 35(1), 9-30.

Henseler, J. and Chin, W.W. (2010). A Comparison of Approaches for the Analysis of Interaction Effects between Latent Variables Using Partial Least Squares Path Modeling. *Structural Equation Modeling: A Multidisciplinary Journal*, 17(1), 82-109.

Henseler, J. and Fassott, G. (2010). Testing Moderating Effects in Pls Path Models: An Illustration of Available Procedures. In: *Handbook of Partial Least Squares: Concepts, Methods and Applications in Marketing and Related Fields*. Esposito Vinzi, V., Chin, W.W., Henseler, J., and Wang, H. (eds.), Springer-Verlag: Berlin, Heidelberg, pp. 713-735.

Henseler, J., Ringle, C.M., and Sinkovics, R.R. (2009). The Use of Partial Least Squares Path Modeling in International Marketing. *Advances in International Marketing*, 20, 277-319.

Hervas-Oliver, J.-L. and Albors-Garrigos, J. (2009). The Role of the Firm's Internal and Relational Capabilities in Clusters: When Distance and Embeddedness Are Not Enough to Explain Innovation. *Journal of Economic Geography*, 9(2), 263-283.

Hidalgo, A. and Albors, J. (2008). Innovation Management Techniques and Tools: A Review from Theory and Practice. *R&D Management*, 38(2), 113-127.

Hitt, M.A., Hoskisson, R.E., Johnson, R.A., and Moesel, D.D. (1996). The Market for Corporate Control and Firm Innovation. *Academy of Management Journal*, 39(5), 1084-1119.

Hladik, K.J. (1988). R&D and International Joint Ventures. In: *Cooperative Strategies in International Business*. Contractor, F.J. and Lorange, P. (eds.), Lexington Books: Lexington, MA, pp. 187-203.

Howells, J., James, A., and Malik, K. (2003). The Sourcing of Technological Knowledge: Distributed Innovation Processes and Dynamic Change. *R&D Management*, 33(4), 395-409.

Huang, F. and Rice, J. (2009). The Role of Absorptive Capacity in Facilitating "Open Innovation" Outcomes: A Study of Australian Smes in the Manufacturing Sector. *International Journal of Innovation Management*, 13(2), 201-220.

Huizingh, E.K.R.E. (2011). Open Innovation: State of the Art and Future Perspectives. *Technovation*, 31(1), 2-9.

Hulland, J. (1999). Use of Partial Least Squares (Pls) in Strategic Management Research. A Review of Four Recent Studies. *Strategic Management Journal*, 20(2), 195-204.

Hult, G.T.M., Ketchen, D.J., and Arrfelt, M. (2007). Strategic Supply Chain Management: Improving Performance through a Culture of Competitiveness and Knowledge Development. *Strategic Management Journal*, 28(10), 1035-1052.

Hult, G.T.M., Ketchen, D.J., and Slater, S. (2004). Information Processing, Knowledge Development, and Strategic Supply Chain Performance. *Academy of Management Journal*, 47(2), 241-253.

Inkpen, A.C. (2000). Learning through Joint Ventures: A Framework of Knowledge Acquisition. *Journal of Management Studies*, 37(7), 1019-1043.

Inkpen, A.C. and Tsang, E.W.K. (2005). Social Capital, Networks, and Knowledge Transfer. *Academy of Management Review*, 30(1), 146-165.

Jaccard, J. and Turrisi, R. (2003). Interaction Effects in Multiple Regression 2nd edition, Sage: Thousand Oaks.

Jansen, J.J.P., Van Den Bosch, F.A.J., and Volberda, H.W. (2005). Managing Potential and Realized Absorptive Capacity: How Do Organizational Antecedents Matter? *Academy of Management Journal*, 48(6), 999-1015.

Jarvis, C.B., Mackenzie, S.B., Podsakoff, P.M., Mick, D.G., and Bearden, W.O. (2003). A Critical Review of Construct Indicators and Measurement Model Misspecification in Marketing and Consumer Research. *Journal of Consumer Research*, 30(2), 199-218.

Joshi, K.D., Chi, L., Datta, A., and Han, S. (2010). Changing the Competitive Landscape: Continuous Innovation through It-Enabled Knowledge Capabilities. *Information Systems Research*, 21(3), 472-495.

Kearns, G., S. and Lederer, A.L. (2004). The Impact of Industry Contextual Factors on It Focus and the Use of It for Competitive Advantage. *Information & Management*, 41(7), 889-919.

Keil, T., Maula, M., Schildt, H., and Zahra, S.A. (2008). The Effect of Governance Modes and Relatedness of External Business Development Activities on Innovative Performance. *Strategic Management Journal*, 29(8), 895-907.

Khanna, T., Gulati, R., and Nohria, N. (1998). The Dynamics of Learning Alliances: Competition, Cooperation, and Relative Scope. *Strategic Management Journal*, 19(193-210)

Kimberly, J.R. and Evanisko, M.J. (1981). Organizational Innovation: The Influence of Individual, Organizational, and Contextual Factors on Hospital Adoption of Technological and Administrative Innovations. *Academy of Management Journal*, 24(4), 689-713.

Kirsch, L.J. (1997). Portfolios of Control Modes and Is Project Management. *Information Systems Research*, 8(3), 215.

Klein, H.K. and Myers, M.D. (1999). A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems. *MIS Quarterly*, 23(1), 67-93.

Klein, K.J. and Sorra, J.S. (1996). The Challenge of Innovation Implementation. *Academy of Management Review*, 21(4), 1055-1080.

Knight, K.E. (1967). A Descriptive Model of the Intra-Firm Innovation Process. *Journal of Business*, 40(4), 478-196.

Ko, D.-G., Kirsch, L.J., and King, W.R. (2005). Antecedents of Knowledge Transfer from Consultants to Clients in Enterprise System Implementations. *MIS Quarterly*, 29(1), 59-85.

Koch, A. and Strotmann, H. (2008). Absorptive Capacity and Innovation in the Knowledge Intensive Business Service Sector. *Economics of Innovation and New Technology*, 17(6), 511-531.

Kogut, B. (2000). The Network as Knowledge: Generative Rules and the Emergence of Structure. *Strategic Management Journal*, 21(3), 405-425.

Kogut, B. and Zander, U. (1992). Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology. *Organization Science*, 3(3), 383-397.

Kogut, B. and Zander, U. (1993). Knowledge of the Firm and the Evolutionary Theory of the Multinational Corporation. *Journal of International Business Studies*, 24(XX), 625-645.

Krackhardt, D. (1998). Simmelian Tie: Super Strong and Sticky. In: *Power and Influence in Organizations*. Kramer, R.M. and Neale, M.A. (eds.), Sage: Thousand Oaks, CA, pp. 21-38.

Kreps, D.M., Milgrom, P., Roberts, J., and Wilson, R. (1982). Rational Cooperation in the Finitely Repeated Prisoner's Dilemma. *Journal of Economic Theory*, 27(2), 245-252.

Kuoching, F., Chen, E.T., and Wenching, L. (2004). Implementation of Knowledge Management Systems and Firm Performance: An Empirical Investigation. *Journal of Computer Information Systems*, 45(2), 92-104.

Laine, M.O.J. and Laine, A.V.O. (2012). Open Innovation, Intellectual Capital and Different Knowledge Sources. *Proceedings of the European Conference on Intellectual Capital*, 239-245.

Lane, P.J., Koka, B.R., and Pathak, S. (2006). The Reification of Absorptive Capacity: A Critical Review and Rejuvenation of the Construct. *Academy of Management Review*, 31(4), 833-863.

Lane, P.J. and Lubatkin, M. (1998). Relative Absorptive Capacity and Interorganizational Learning. *Strategic Management Journal*, 19(5), 461-477.

Lane, P.J., Salk, J.E., and Lyles, M.A. (2001). Absorptive Capacity, Learning, and Performance in International Joint Ventures. *Strategic Management Journal*, 22(12), 1139-1161.

Laursen, K., Masciarelli, F., and Prencipe, A. (2012). Regions Matter: How Localized Social Capital Affects Innovation and External Knowledge Acquisition. *Organization Science*, 23(1), 177-193.

Laursen, K. and Salter, A. (2006). Open for Innovation: The Role of Openness in Explaining Innovation Performance among U.K. Manufacturing Firms. *Strategic Management Journal*, 27(2), 809-825.

Lee, A.S. and Baskerville, R.L. (2003). Generalizing Generalizability in Information Systems Research. *Info. Sys. Research*, 14(3), 221-243.

Lee, C., Lee, K., and Pennings, J.M. (2001). Internal Capabilities, External Networks, and Performance: A Study on Technology-Based Ventures. *Strategic Management Journal*, 22(6-7), 615-640.

Leiponen, A. and Helfat, C.E. (2010). Innovation Objectives, Knowledge Sources, and the Benefits of Breadth. *Strategic Management Journal*, 31(2), 224-236.

Lesser, E.L., Fontaine, M.A., and Slusher, J.A. (2000). Knowledge and Communities, Butterworth-Heinemann: Oxford.

Levin, D.Z. and Cross, R. (2004). The Strenght of Weak Ties You Can Trust: The Mediating Role of Trust in Effective Knowledge Transfer. *Management Science*, 50(11), 1477-1490.

Li, D.A.N., Eden, L., Hitt, M.A., and Ireland, R.D. (2008). Friends, Acquaintances, or Strangers? Partner Selection in R&D Alliances. *Academy of Management Journal*, 51(2), 315-334.

Li, Y., Li, X., Liu, Y., and Barnes, B.R. (2011). Knowledge Communication, Exploitation and Endogenous Innovation: The Moderating Effects of Internal Controls in Smes. *R&D Management*, 41(2), 156-172.

Liao, S.-h., Fei, W.-C., and Chen, C.-C. (2007). Knowledge Sharing, Absorptive Capacity, and Innovation Capability: An Empirical Study of Taiwan's Knowledge Intensive Industries. *Journal of Information Science*, 33(3), 340-359.

Liao, S.-h., Wu, C.-c., Hu, D.-c., and Tsui, K.-a. (2010). Relationships between Knowledge Acquisition, Absorptive Capacity and Innovation Capability: An Empirical Study on Taiwan's Financial and Manufacturing Industries. *Journal of Information Science*, 36(1), 19-35.

Lichtenthaler, U. (2009). Absorptive Capacity, Environmental Turbulence, and the Complementarity of Organizational Learning Processes. *Academy of Management Journal*, 52(4), 822-846.

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

Lindell, M.K. and Whitney, D.J. (2001). Accounting for Common Method Variance in Cross-Sectional Research Designs. *Journal of Applied Psychology*, 86(1), 114-121.

Lu, Y. and Ramamurthy, K. (2011). Understanding the Link between Information Technology Capability and Organizational Agility: An Empirical Examination. *MIS Quarterly*, 35(4), 931-954.

Lyles, M.A. and Salk, J.E. (1996). Knowledge Acquisition from Foreign Parents in International Joint Ventures: An Empirical Examination in the Hungarian Context. *Journal of International Business Studies*, 27(5), 877–903.

MacKinnon, D.P., Lockwood, C.M., Hoffman, J.M., West, S.G., and Sheets, V. (2002). A Comparison of Methods to Test Mediation and Other Intervening Variable Effects. *Psychological Methods*, 7(1), 83-104.

MacKinnon, D.P., Warsi, G., and Dwyer, J.H. (1995). A Simulation Study of Mediated Effect Measures. *Multivariate Behavioral Research*, 30(1), 41-62.

Malhotra, A., Gosain, S., and Sawy, O.A.E. (2005). Absorptive Capacity Configurations in Supply Chains: Gearing for Partner-Enabled Market Knowledge Creation. *MIS Quarterly*, 29(1), 145-187.

Mathieu, J.E., DeShon, R.P., and Bergh, D.D. (2008). Mediational Inferences in Organizational Research: Then, Now, and Beyond. *Organizational Research Methods*, 11(2), 203-223.

Matusik, S.F. and Heeley, M.B. (2005). Absorptive Capacity in the Software Industry: Identifying Dimensions That Affect Knowledge and Knowledge Creation Activities. *Journal of Management*, 31(4), 549-572.

Maurer, I., Bartsch, V., and Ebers, M. (2011). The Value of Intra-Organizational Social Capital: How It Fosters Knowledge Transfer, Innovation Performance, and Growth. *Organization Studies*, 32(2), 157-185.

Maurer, I. and Ebers, M. (2006). Dynamics of Social Capital and Their Performance Implications: Lessons from Biotechnology Start-Ups. *Administrative Science Quarterly*, 51(2), 262-292.

McFadyen, M.A. and Cannella, A.A. (2004). Social Capital and Knowledge Creation: Diminishing Returns of the Number and Strength of Exchange Relationships. *Academy of Management Journal*, 47(5), 735-746.

McLure Wasko, M. and Faraj, S. (2005). Why Should I Share? Examining Social Capital and Knowledge Contribution in Electronic Networks of Practice. *MIS Quarterly*, 29(1), 35-57.

Meredith, J.R., Raturi, A., Amoako-Gyampah, K., and Kaplan, B. (1989). Alternative Research Paradigms in Operations. *Journal of Operations Management*, 8(4), 297-326.

Meyer, A.D. and Goes, J.B. (1988). Organizational Assimilation of Innovations: A Multilevel Contextual Analysis. *Academy of Management Journal*, 31(4), 897-923.

Miller, D.J., Fern, M.J., and Cardinal, L.B. (2007). The Use of Knowledge for Technological Innovation within Diversified Firms. *Academy of Management Journal*, 50(2), 307-326.

Mokken, R.J. (1979). Cliques, Clubs and Clans. *Quality and Quantity*, 13(2), 161-173.

Moran, P. (2005). Structural Vs. Relational Embeddedness: Social Capital and Managerial Performance. *Strategic Management Journal*, 26(12), 1129-1151.

Mowery, D.C., Oxley, J.E., and Silverman, B.S. (1996). Strategic Alliances and Interfirm Knowledge Transfer. *Strategic Management Journal*, 17(Winter Special Issue), 77-91.

Munari, F., Oriani, R., and Sobrero, M. (2010). The Effects of Owner Identity and External Governance Systems on R&Amp;D Investments: A Study of Western European Firms. *Research Policy*, 39(8), 1093-1104.

Muscio, A. (2007). The Impact of Absorptive Capacity on Smes' Collaboration. *Economics of Innovation and New Technology*, 16(8), 653-668.

Myers, M.D. (2013). Qualitative Research in Business and Management, Sage: Los Angeles et al.

Nahapiet, J. and Ghoshal, S. (1998). Social Capital, Intellectual Capital, and the Organizational Advantage. *Academy of Management Review*, 23(2), 242-266.

Nakano, D., Moraes, R.d.O., and Ress, A.P.P.d.M. (2013). Does Knowledge Management Systems Moderate Turnover Effects?: A Study on Software Development Teams. *International Journal of Knowledge Management (IJKM)*, 9(4), 1-16.

Nakayama, M. (2003). An Assessment of Edi Use and Other Channel Communications on Trading Behavior and Trading Partner Knowledge. *Information & Management*, 41, 563-580.

Nambisan, S., Lyytinen, K., Majchrzak, A., and Song, M. (2014). Information Technology and Innovation. *MIS Quarterly*, Call for Papers, 1-4.

Naor, M., Linderman, K., and Schroeder, R. (2010). The Globalization of Operations in Eastern and Western Countries: Unpacking the Relationship between National and Organizational Culture and Its Impact on Manufacturing Performance. *Journal of Operations Management*, 28(3), 194-205.

Nelson, K.M. and Cooprider, J.G. (1996). The Contribution of Shared Knowledge to Is Group Performance. *MIS Quarterly*, 20(4), 409-432.

Nelson, R.R. and Winter, S.G. (1982). An Evolutionary Theory of Economic Change, The Belknap Press of Harvard University Press: Cambridge (Mass.).

Newell, S., Tansley, C., and Huang, J. (2004). Social Capital and Knowledge Integration in an Erp Project Team: The Importance of Bridging and Bonding. *British Journal of Management*, 15(S1), 43-57.

Nonaka, I. (1994). A Dynamic Theory of Organizational Knowledge Creation. *Organization Science*, 5(1), 14-37.

Nonaka, I. and Takeuchi, H. (1995). The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation, Oxford University Press: Oxford et al.

Nunnally, J.C. (1978). Psychometric Theory, McGraw Hill: New York (NY).

Oh, H., Chung, M.-H., and Labianca, G. (2004). Group Social Capital and Group Effectiveness: The Role of Informal Socializing Ties. *The Academy of Management Journal*, 47(6), 860-875.

Orlikowski, W.J. and Baroudi, J.J. (1991). Studying Information Technology in Organizations: Research Approaches and Assumptions. *Information Systems Research*, 2(1), 1-28.

Padilla-Meléndez, A., Del Aguila-Obra, A.R., and Lockett, N. (2013). Shifting Sands: Regional Perspectives on the Role of Social Capital in Supporting Open Innovation through Knowledge Transfer and Exchange with Small and Medium-Sized Enterprises. *International Small Business Journal*, 31(3), 296-318.

Pavlou, P.A. and El Sawy, O.A. (2006). From It Leveraging Competence to Competitive Advantage in Turbulent Environments: The Case of New Product Development. *Information Systems Research*, 17(3), 198-227.

Pavlou, P.A. and El Sawy, O.A. (2010). The "Third Hand": It-Enabled Competitive Advantage in Turbulence through Improvisational Capabilities. *Information Systems Research*, 21(3), 443-471.

Pérez-Nordtvedt, L., Kedia, B.L., Datta, D.K., and Rasheed, A.A. (2008). Effectiveness and Efficiency of Cross-Border Knowledge Transfer: An Empirical Examination. *Journal of Management Studies*, 45(4), 714-744.

Perry-Smith, J.E. (2006). Social yet Creative: The Role of Social Relationships in Facilitating Individual Creativity. *Academy of Management Journal*, 49(1), 85-101.

Persaud, A. (2005). Enhancing Synergistic Innovative Capability in Multinational Corporations: An Empirical Investigation. *Journal of Product Innovation Management*, 22(5), 412-429.

Petter, S., DeLone, W., and McLean, E. (2008). Measuring Information Systems Success: Models, Dimensions, Measures, and Interrelationships. *Eur J Inf Syst*, 17(3), 236-263.

Podsakoff, P.M., MacKenzie, S.B., Lee, J.-Y., and Podsakoff, N. (2003). Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies. *Journal of Applied Psychology*, 88(5), 879-903.

Polanyi, M. (1962). Tacit Knowing: Its Bearing on Some Problems of Philosophy. *Reviews of Modern Physics*, 34(4), 601-616.

Popadiuk, S. and Choo, C.W. (2006). Innovation and Knowledge Creation: How Are These Concepts Related? *International Journal of Information Management*, 26(4), 302-312.

Porter, M.E. (1985). Competitive Advantage. Creating and Sustaining Superior Performance., Free Press: New York (NY).

Powell, W.W., Koput, K.W., and Smith-Doerr, L. (1996). Interorganizational Collaboration and the Locus of Innovation: Networks of Learning in Biotechnology. *Administrative Science Quarterly*, 41, 116-145.

Preacher, K. and Hayes, A. (2004). Spss and Sas Procedures for Estimating Indirect Effects in Simple Mediation Models. *Behavior Research Methods, Instruments, & Computers*, 36(4), 717-731.

Preacher, K. and Hayes, A. (2008). Asymptotic and Resampling Strategies for Assessing and Comparing Indirect Effects in Multiple Mediator Models. *Behavior Research Methods*, 40(3), 879-891.

Randall, D., Hughes, J., O'Brien, J., Rouncefield, M., and Tolmine, P. (2001). 'Memories Are Made of This': Explicating Organisational Knowledge and Memory. *European Journal of Information Systems*, 10(2), 113-121.

Rass, M., Dumbach, M., Danzinger, F., Bullinger, A.C., and Moeslein, K.M. (2013). Open Innovation and Firm Performance: The Mediating Role of Social Capital. *Creativity & Innovation Management*, 22(2), 177-194.

Reagans, R. and McEvily, B. (2003). Network Structure and Knowledge Transfer: The Effects of Cohesion and Range. *Administrative Science Quarterly*, 48(2), 240-267.

Reich, B.H. and Kaarst-Brown, M.L. (2003). Creating Social and Intellectual Capital through It Career Transitions. *Journal of Strategic Information Systems*, 12(2), 91-109.

Reinholt, M.I.A., Pedersen, T., and Foss, N.J. (2011). Why a Central Network Position Isn't Enough: The Role of Motivation and Ability for Knowledge Sharing in Employee Networks. *Academy of Management Journal*, 54(6), 1277-1297.

Richardson, H.A., Simmering, M.J., and Sturman, M.C. (2009). A Tale of Three Perspectives: Examining Post Hoc Statistical Techniques for Detection and Correction of Common Method Variance. *Organizational Research Methods*, 12(7), 762-800.

Robert, J.L.P., Dennis, A.R., and Ahuja, M.K. (2008). Social Capital and Knowledge Integration in Digitally Enabled Teams. *Information Systems Research*, 19(3), 314-334.

Roberts, N., Galluch, P.S., Dinger, M., and Grover, V. (2012). Absorptive Capacity and Information Systems Research: Review, Synthesis, and Directions for Future Research. *MIS Quarterly*, 36(2), 625-A626.

Robertson, P.L., Casali, G.L., and Jacobson, D. (2012). Managing Open Incremental Process Innovation: Absorptive Capacity and Distributed Learning. *Research Policy*, 41(5), 822-832.

Rodan, S. and Galunic, C. (2004). More Than Network Structure: How Knowledge Heterogeneity Influences Managerial Performance and Innovativeness. *Strategic Management Journal*, 25(6), 541-562.

Rogelberg, S.G. and Stanton, J.M. (2007). Introduction: Understanding and Dealing with Organizational Survey Nonresponse. *Organizational Research Methods*, 10(2), 195-209.

Rothaermel, F.T. and Alexandre, M.T. (2009). Ambidexterity in Technology Sourcing: The Moderating Role of Absorptive Capacity. *Organization Science*, 20(4), 759-780.

Rothaermel, F.T. and Hess, A.M. (2010). Innovation Strategies Combined. *MIT Sloan Management Review*, 51(3), 13-15.

Rowley, J. and Slack, F. (2004). Conducting a Literature Review. *Management Research News,*, 27(6), 31-39.

Roxenhall, T. (2013). Network Structure and Innovation in Strategic Innovation Networks. *International Journal of Innovation Management*, 17(2), 1350002.

Rubera, G. and Kirca, A.H. (2012). Firm Innovativeness and Its Performance Outcomes: A Meta-Analytic Review and Theoretical Integration. *Journal of Marketing*, 76(3), 130-147.

Rycroft, R.W. and Kash, D.E. (1999). Innovation Policy for Complex Technologies. *Issues in Science and Technology*, 16(1)

Sabel, C. (1993). Studied Trust: Building New Forms of Cooperation in a Volatile Economy. *Human Relations*, 46(9), 1133-1170.

Sabherwal, R. and Sabherwal, S. (2005). Knowledge Management Using Information Technology: Determinants of Short-Term Impact on Firm Value. *Decision Sciences*, 36(4), 531-567.

Salge, T.O., Farchi, T., Bohné, T.M., and Piening, E.P. (2012). Harnessing the Value of Open Innovation: The Moderating Role of Innovation Management. *International Journal of Innovation Management*, 16(03), 1240005.

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

Sammarra, A. and Biggiero, L. (2008). Heterogeneity and Specificity of Inter-Firm Knowledge Flows in Innovation Networks. *Journal of Management Studies*, 45(4), 800-829.

Schulz, M. (2001). The Uncertain Relevance of Newness: Organizational Learning and Knowledge Flows. *Academy of Management Journal*, 44(4), 661-681.

Schumpeter, J.A. (1934). Theory of Economic Development, Harvard University Press: Cambridge, MA.

Seddon, P.B. and Scheepers, R. (2012). Towards the Improved Treatment of Generalization of Knowledge Claims in Is Research: Drawing General Conclusions from Samples. *Eur J Inf Syst*, 21(1), 6-21.

Seibert, S.E., Kraimer, M.L., and Liden, R.C. (2001). A Social Capital Theory of Career Success. *The Academy of Management Journal*, 44(2), 219-237.

Sharma, R., Yetton, P., and Crawford, J. (2009). Estimating the Effect of Common Method Variance: The Method--Method Pair Technique with an Illustration from Tam Research. *MIS Quarterly*, 33(3), 473-A413.

Sherif, K., Hoffman, J., and Thomas, B. (2006). Can Technology Build Organizational Social Capital? The Case of a Global It Consulting Firm. *Information & Management*, 43(7), 795-804.

Shrout, P.E. and Bolger, N. (2002). Mediation in Experimental and Nonexperimental Studies: New Procedures and Recommendations. *Psychological Methods*, 7(4), 422-445.

Sivo, S.A., Saunders, C.S., Chang, Q., and Jinag, J.J. (2006). How Low Should You Go? Low Response Rates and the Validity of Inference in Is Questionnaire Research. *Journal of the Association for Information Systems*, 7(6), 351-414.

Smedlund, A. (2008). The Knowledge System of a Firm: Social Capital for Explicit, Tacit and Potential Knowledge. *Journal of Knowledge Management*, 12(1), 63-77.

Smith, K.G., Collins, C.J., and Clark, K.D. (2005). Existing Knowledge, Knowledge Creation Capability, and the Rate of New Product Introduction in High-Technology Firms. *Academy of Management Journal*, 48(2), 346-357.

Spender, J.-C. (1996). Making Knowledge the Basis of a Dynamic Theory of the Firm. *Strategic Management Journal*, 17(Special Issue: Knowledge and the Firm), 45-62.

Spender, J.C. and Grant, R.M. (1996). Knowledge and the Firm: Overview. *Strategic Management Journal*, 17, 5-9.

Stam, W. and Elfring, T. (2008). Entrepreneurial Orientation and New Venture Performance: The Moderating Role of Intra- and Extraindustry Social Capital. *Academy of Management Journal*, 51(1), 97-111.

Stein, E.W. and Zwass, V. (1995). Actualizing Organizational Memory with Information Systems. *Information Systems Research*, 6(2), 85-117.

Stock, G.N., Greis, N.P., and Fischer, W.A. (2001). Absorptive Capacity and New Product Development. *The Journal of High Technology Management Research*, 12(1), 77-91.

Straub, D.W. (1989). Validating Instruments in Mis Research. *MIS Quarterly*, 13(2), 147-169.

Straub, D.W., Boudreau, M.-C., and Gefen, D. (2004). Validation Guidelines for Is Positivist Research. *Communications of the AIS*, 13, 380-427.

Subramaniam, M. and Youndt, M.A. (2005). The Influence of Intellectual Capital on the Types of Innovative Capabilities. *Academy of Management Journal*, 48(3), 450-463.

Subramanian, A. and Nilakanta, S. (1996). Organizational Innovativeness: Exploring the Relationship between Organizational Determinants of Innovation, Types of Innovations, and Measures of Organizational Performance. *Omega*, 24(6), 631-647.

Sun, P.Y.T. and Anderson, M.H. (2010). An Examination of the Relationship between Absorptive Capacity and Organizational Learning, and a Proposed Integration. *International Journal of Management Reviews*, 12(2), 130-150.

Szulanski, G., Cappetta, R., and Jensen, R.J. (2004). When and How Trustworthiness Matters: Knowledge Transfer and the Moderating Effect of Causal Ambiguity. *Organizational Science*, 15(5), 600-613.

Szymanski, D.M., Kroff, M.W., and Troy, L.C. (2007). Innovativeness and New Product Success: Insights from the Cumulative Evidence. *Journal of the Academy of Marketing Science*, 35(1), 35-52.

Tarafdar, M. and Gordon, S.R. (2007). Understanding the Influence of Information Systems Competencies on Process Innovation: A Resource-Based View. *The Journal of Strategic Information Systems*, 16(4), 353-392.

Teece, D.J., Pisano, G., and Shuen, A. (1997). Dynamic Capabilities and Strategic Management. *Strategic Management Journal*, 18(7), 509-533.

Thornhill, S. (2006). Knowledge, Innovation and Firm Performance in High- and Low-Technology Regimes. *Journal of Business Venturing*, 21(5), 687-703.

Tippins, M.J. and Sohi, R.S. (2003). It Competency and Firm Performance: Is Organizational Learning a Missing Link? *Strategic Management Journal*, 24(8), 745-761.

Tiwana, A. (2008). Do Bridging Ties Complement Strong Ties? An Empirical Examination of Alliance Ambidexterity. *Strategic Management Journal*, 29(3), 251-272.

Tiwana, A. and McLean, E.R. (2005). Expertise Integration and Creativity in Infomations Systems Develeopment. *Journal of Management Information Systems*, 22(1), 13-43.

Todorova, G. and Durisin, B. (2007). Absorptive Capacity: Valuing a Reconceptualization. *Academy of Management Review*, 32(3), 774-786.

Torraco, R.J. (2005). Writing Integrative Literature Reviews: Guidelines and Examples. *Human Resource Development Review*, 4(3), 356-367.

Tortoriello, M. and Krackhardt, D. (2010). Activating Cross-Boundary Knowledge: The Role of Simmelian Ties in the Generation of Innovations. *Academy of Management Journal*, 53(1), 167-181.

Tortoriello, M., Reagans, R., and McEvily, B. (2012). Bridging the Knowledge Gap: The Influence of Strong Ties, Network Cohesion, and Network Range on the Transfer of Knowledge between Organizational Units. *Organization Science*, 23(4), 1024-1039.

Tsai, W. (2000). Social Capital, Strategic Relatedness and the Formation of Intraorganizational Linkages. *Strategic Management Journal*, 21(9), 925-939.

Tsai, W. (2001). Knowledge Transfer in Intraorganizational Networks: Effects of Network Position and Absorptive Capacity on Business Unit Innovation and Performance. *Academy of Management Journal*, 44(5), 996-1004.

Tsai, W. (2002). Social Structure of 'Coopetition'. Within a Multiunit Organization: Coordination, Competition, and Intraorganizational Knowledge Sharing. *Organization Science*, 13(2), 179-190.

Tsai, W. and Ghoshal, S. (1998). Social Capital and Value Creation: The Role of Intrafirm Networks. *Academy of Management Journal*, 41(4), 464-476.

Tsoukas, H. and Vladimirou, E. (2001). What Is Organizational Knowledge? *Journal of Management Studies*, 38(7), 973-993.

van Den Bosch, F.A.J., Volberda, H.W., and de Boer, M. (1999). Coevolution of Firm Absorptive Capacity and Knowledge Environment: Organizational Forms and Combinative Capabilities. *Organization Science*, 10(5), 551-568.

van Wijk, R., Jansen, J.J.P., and Lyles, M.A. (2008). Inter- and Intra-Organizational Knowledge Transfer: A Meta-Analytic Review and Assessment of Its Antecedents and Consequences. *Journal of Management Studies*, 45(4), 830-853.

Varis, M. and Littunen, H. (2010). Types of Innovation, Sources of Information and Performance in Entrepreneurial Smes. *European Journal of Innovation Management*, 13(2), 128-154.

Vekstein, D. (1998). Managing Knowledge and Corporate Performance: An Empirical Analysis of the World Automobile Industry. *Omega*, 26(5), 551.

Vera, D. and Crossan, M. (2004). Strategic Leadership and Organizational Learning. *Academy of Management Review*, 29(2), 222-240.

Volberda, H.W., Foss, N.J., and Lyles, M.A. (2010). Absorbing the Concept of Absorptive Capacity: How to Realize Its Potential in the Organization Field. *Organization Science*, 21(4), 931-951.

vom Brocke, J., Simons, A., Niehaves, B., Riemer, K., Plattfaut, R., and Cleven, A. (2009). Reconstructing the Giant: On the Importance of Rigour in Documenting the Literature Search Process. *17th European Conference on Information Systems (ECIS)*, Verona, Italy, 789–801.

von Hippel, E. (1988). The Sources of Innovtion, Oxford University Press: Oxford et al.

Wade, M. and Hulland, J. (2004). Review: The Resource-Based View and Information Systems Research: Review, Extension, and Suggestions for Future Research. *MIS Quarterly*, 28(1), 107-142.

Wagner, H.-T. and Moos, B. (2014). Knowledge Management. In: *Wiley Encyclopedia of Management (Volume 8)*. Cooper, C.L. (ed.), 3rd edition, John Wiley & Sons: Hoboken, NJ, (forthcoming).

Wagner, H.-T., Weitzel, T., Beimborn, D., and Moos, B. (2011). Unternehmensnetzwerke Und Innovationserfolg: Eine Empirische Untersuchung Im Produzierenden Gewerbe, ibidem Verlag: Stuttgart.

Walker, G., Kogut, B., and Shan, W. (1997). Social Capital, Structural Holes and the Formation of an Industry Network. *Organization Science*, 8(2), 109-125.

Wang, C. and Han, Y. (2011). Linking Properties of Knowledge with Innovation Performance: The Moderate Role of Absorptive Capacity. *Journal of Knowledge Management*, 15(2), 802-819.

Webster, J. and Watson, R.T. (2002). Analyzing the Past to Prepare for the Future: Writing a Literature Review. *MIS Quarterly*, 26(2), xiii-xxiii.

Wei, Z. (2010). A Social Capital Perspective of Innovation from Individuals to Nations: Where Is Empirical Literature Directing Us? *International Journal of Management Reviews*, 12(2), 151-183.

Wetzels, M., Odekerken-Schröder, G., and van Oppen, C. (2009). Using Pls Path Modeling for Assessing Hierarchical Construct Models: Guidelines and Empirical Illustration. *MIS Quarterly*, 33(1), 177-195.

Widén-Wulff, G. and Ginman, M. (2004). Explaining Knowledge Sharing in Organizations through the Dimensions of Social Capital. *Journal of Information Science*, 30(5), 448-458.

Williams, L.J., Hartman, N., and Cavazotte, F. (2010). Method Variance and Marker Variables: A Review and Comprehensive Cfa Marker Technique. *Organizational Research Methods*, 13(3), 477-514.

Wolfe, R.A. (1994). Organizational Innovation: Review, Critique and Suggested Research Directions*. *Journal of Management Studies*, 31(3), 405-431.

Wu, W.-p. (2008). Dimensions of Social Capital and Firm Competitiveness Improvement: The Mediating Role of Information Sharing. *Journal of Management Studies*, 45(1), 122-146.

Xiong, G. and Bharadwaj, S. (2011). Social Capital of Young Technology Firms and Their Ipo Values: The Complementary Role of Relevant Absorptive Capacity. *Journal of Marketing*, 75(6), 87-104.

Yang, L., Fu, X., and Pan, S.L. Leveraging Social Capital and Absorptive Capacity for Knowledge Integration: A Case Study of a Cross-Organization It Project. European Conference on Information Systems, Barcelona (Spain), 2012: 1-12 (Paper 152).

Yi-Wen, F. and Cheng-Chieh, W. (2011). The Role of Social Capital in Knowledge Sharing: A Meta-Analytic Review. *System Sciences (HICSS), 2011 44th Hawaii International Conference on*, 1-10.

Yli-Renko, H., Autio, E., and Sapienza, H.J. (2001). Social Capital, Knowledge Acquisition, and Knowledge Exploitation in Young Technology-Based Firms. *Strategic Management Journal*, 22(6/7), 587.

Yu, A.Y., Hao, J.-X., Dong, X.-Y., and Mohamed, K. (2010). Revisiting the Effect of Social Capital on Knowledge Sharing in Work Teams: A Multilevel Approach. *Internation Conference on Information Systems (ICIS)*, St. Louis (USA), 1-18 (Paper 159).

Zaheer, A. and Bell, G.G. (2005). Benefiting from Network Position: Firm Capabilities, Structural Holes, and Performance. *Strategic Management Journal*, 26(9), 809-825.

Zahra, S.A. and George, G. (2002). Absorptive Capacity: A Review, Reconceptualization, and Extension. *Academy of Management Review*, 27(2), 185-203.

Zahra, S.A., Ireland, R.D., and Hitt, M.A. (2000). International Expansion by New Venture Firms: International Diversity, Mode of Market Entry, Technological Learning, and Performance. *Academy of Management Journal*, 43(5), 925-950.

Zheng, S., Zhang, W., and Du, J. (2011). Knowledge-Based Dynamic Capabilities and Innovation in Networked Environments. *Journal of Knowledge Management*, 15(6), 1035 - 1051.

Zollo, M. and Winter, S.G. (2002). Deliberate Learning and the Evolution of Dynamic Capabilities. *Organization Science*, 13(3), 339-351.

PAPER I

Suggestions for Measuring Organizational Innovativeness: A Review

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PAPER II

Whom to Ask for What Knowledge?

A Comparison of Exchange Partners and Their Impact on Knowledge Types

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PAPER III

The Contagious Power of Innovativeness: How Different Corporate Partners Contribute to a Firm's Knowledge[1]

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PAPER IV

The Role of Innovation Govern-ance and Knowledge Manage-ment for Innovation Success

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PAPER V

The Role of Knowledge Management Systems for Innovation: An Absorptive Capacity Perspective[1]

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PAPER VI

Innovation Success and Absorptive Capacity: The Combined Influence of Information Systems and Combinative Capabilities - A Theoretical Model

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PAPER VII

What Makes a Firm Innovative? A Social Capital Perspective on External Partners and Internal Knowledge Capabilities

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Abstract

This research investigates how and to which extent the social capital inherent in a firm's external relationships to diverse business partners contributes to the firm's innovation success and how firm-external social capital and internal knowledge capabilities co-create innovativeness. By combining social capital and absorptive capacity perspectives, we explain innovation success in a novel theoretical way and extend previous research by distinguishing between different external knowledge sources and types of knowledge. Using data from 153 German manufacturing firms, a PLS-based analysis reveals that a firm's external social capital contributes significantly and positively to innovation success, but requires internal capabilities to be applied effectively. The results provide important insights into how and through which mechanisms firms can become successful innovators.

1.   Introduction

Research consistently shows innovation to be an important driving force for the prosperity of single firms and entire economies (Schumpeter 1934). But what makes a firm innovative? A key insight over the years is that a firm's knowledge capabilities are the main driving force of its innovativeness (Hult *et al.* 2004). Consequently, effective exchange and combination of knowledge are at the core of innovativeness (Easterby-Smith *et al.* 2008; Henderson and Clark 1990).

As the ability of firms to innovate successfully depends on both the absorption and combination of new and existing knowledge and its exploitation, a key challenge for firms is to connect different knowledge domains and knowledge sources relevant to its performance. In this context, the social capital perspective focuses on relationships between entities such as individuals and organizational units as a means to access knowledge. Social capital is 'the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit' (Nahapiet and Ghoshal 1998, p. 243). A firm's social capital has been shown to contribute to value creation in inner-firm networks, such as between different departments (Tsai 2000; Tsai and Ghoshal 1998), and its development has been demonstrated to significantly influence the formation of external networks (Walker *et al.* 1997). By contrast, only a few studies investigate social capital inherent in a firm's external relationships (firm-external social capital) such as its effect on knowledge transfer between members of strategic alliances or industrial districts (Inkpen and Tsang 2005). While these contributions provide valuable insights on effects of firm-external social capital, they do not differentiate between specific partner types such as customers and suppliers and only focus on specific coordination forms such as strategic alliances. Furthermore, existing studies neglect the role of different types of knowledge in

knowledge transfer (Pérez-Nordtvedt *et al.* 2008; Sammarra and Biggiero 2008) and only a few studies investigate organization-level outcomes such as, in particular, innovativeness (a notable exception is Laursen et al. (2012)). Particularly firm-external social capital may play an important role for a firm's innovativeness because 'few firms appear able to innovate alone' (de Jong and Freel 2010, p. 47) and has also been identified as 'an interesting domain for further theoretical investigation' (Easterby-Smith *et al.* 2008, p. 677).

To address these challenges and better understand whether and how firm-external social capital with different partners contributes to a firm's innovation success, we propose, first, to embrace all partners that are important to a firm regardless of their geographic location and specifics of contractual agreements, and, second, to examine "innovation success" as the organization-level outcome of firm-external social capital by combining arguments of social capital theory with absorptive capacity (ACAP). The aim is to better understand the transmission from the pure opportunity to access new external knowledge through internal capabilities to innovation success (e.g., Lane *et al.* 2006). In particular, we develop an innovation success model that integrates firm-external social capital and a firm's internal capabilities to absorb knowledge from these networks. The guiding research question is:

How and to what extent does a firm's external social capital (i.e., its relationship with external partners) contribute to its innovation success?

In the following, we draw on the theoretical concepts of social capital (SC) and absorptive capacity (ACAP), or more specifically potential absorptive capacity (PACAP), and develop an innovation success model which is then empirically evaluated using data from 153 firms. Results show that a firm's *external* social capital (its 'network') is a key driver of innovation success and that this impact is mediated by PACAP if this ability is enacted and put to practice (enacted PACAP). Our study, therefore, offers a unified picture of how key elements from different theories jointly constitute innovation success. Our results show that firm-external social capital significantly contributes to the formation of firm-internal market and technological knowledge and eventually innovation success. Simultaneously, enacted potential absorptive capacity partially mediates the effect of firm-external social capital on knowledge formation. Thus, we are able to demonstrate to which extent external network partners of a firm contribute to a firm's knowledge stock, that social capital formed at the boundary of the firm to external network partners plays a crucial role, and that a firm's enacted potential absorptive capacity partially mediates this interplay.

In the following, we first introduce the underlying theoretical concepts and develop our research model. Then, we test the model based on quantitative data and finally discuss the results, implications, and limitations of our research.

2.   Theoretical Foundation

2.1 Innovation

The combination and exchange of knowledge are a central tenet of the Austrian School of Economics (Schumpeter 1934) and lead to creating and adopting innovations that can be defined "as the successful implementation of creative ideas, tasks, or procedures" (Cummings and Kiesler 2003, p. 297). Continuous innovation leaves competitors behind and enhances firm performance. Some products and services are innovative in the sense that they result from applying new knowledge, whereas others are based on the reconfiguration of existing knowledge (Henderson and Clark 1990). Therefore, a firm's market success is based upon the efficacy of knowledge integration, where increasing the range of integrated knowledge also increases the potential to outperform competitors. For explaining how a firm successfully creates innovations, we integrate two theoretical concepts: absorptive capacity and social capital theory.

2.2 Social Capital Theory (SCT)

SCT deals with relationships between actors (e.g., individuals, groups, firms) and highlights their importance for the exchange and combination of knowledge (McFadyen and Cannella 2004; Nahapiet and Ghoshal 1998). Social capital "inheres in the structure of relations between actors and among actors" (Coleman 1988, p. 98) and thus resides in relationships.

SCT predicts that social capital positively influences *intellectual capital,* that is, "the knowledge and knowing capability of a social collectivity" (Nahapiet and Ghoshal 1998, p. 245) created by the combination and exchange of knowledge (Kogut and Zander 1992). As conceptualized in SCT, intellectual capital deals particularly with social explicit and social tacit knowledge[1]. Social explicit knowledge, or what Spender (1996) calls objectified knowledge (e.g., established standards and practices), "represents the shared corpus of knowledge" (Nahapiet and Ghoshal 1998, p. 247). Social tacit knowledge, termed collective knowledge by Spender (1996), "resides in the tacit experiences and enactment of the collective" and is a form of "shared knowledge [that] has been defined as 'routines' by Nelson and Winter (1982)" (Nahapiet and Ghoshal 1998, p. 247). Thus, intellectual capital can be interpreted as the knowledge stock of a firm that is shared among a firm's employees.

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[1] Please note that individual components are not part of Nahapiet and Ghoshal's concept of intellectual capital.

2.3   Absorptive Capacity (ACAP)

As second theoretical concept, we draw on the ACAP of a firm which is an important factor for organizational learning (Cohen and Levinthal 1990; Nahapiet and Ghoshal 1998) and has been shown to positively impact firm performance (Lane *et al.* 2001) and innovation (Tsai 2001). Proposed by Cohen and Levinthal (1990, p. 128), absorptive capacity can be defined "as the ability to recognize the value of external information, assimilate it and apply it to commercial ends". This ability does not reside in any single individual, but rather depends on interactions, interdependent activities, and knowledge exchanges among individuals (Nelson and Winter 1982). Absorptive capacity, and thus the ability to sense the environment and detect opportunities, crucially depends on prior knowledge accumulated over time and is therefore path-dependent (Cantwell 2002). Furthermore, Eisenhardt and Santos (2002, p. 141) identify major determinants of ACAP which are "internal channels of communication, the distribution of knowledge in the environment and in the firm".

Zahra and George (2002) distinguish between two components of ACAP: potential absorptive capacity (PACAP) and realized absorptive capacity (RACAP). PACAP refers to the ability of firms to acquire and assimilate external knowledge while RACAP refers to the ability of firms to transform and exploit the available knowledge. PACAP comprises acquisition and assimilation capabilities; an *acquisition* capability is the ability of a firm to identify and to acquire knowledge from outside the firm which nevertheless is business critical while *assimilation* "refers to the firm's routines and processes that allow it to analyze, process, interpret, and understand the information obtained from external sources" (Zahra and George 2002, p. 189). RACAP comprises transformation and exploitation capabilities, with transformation denoting "a firm's capability to develop and refine the routines that facilitate combining existing knowledge and the newly acquired and assimilated knowledge" (Zahra and George 2002, p. 190), which involves new interpretations of existing knowledge, adding new knowledge, and deleting pieces of old knowledge. Exploitation, finally reflects a firm's ability "to harvest and incorporate knowledge into its operations" (Zahra and George 2002, p. 190). For the purpose of this article we will focus on PACAP as outlined below.

3.   Model Development

Figure 1 delineates how our theoretical model integrates the theoretical domains of SCT and ACAP to explain innovation success, that is, the firm successfully implement "creative ideas, tasks, or procedures" (Cummings and Kiesler 2003, p. 297) and launches new products and services in the market. The model argues that innovation success is driven by intellectual capital, which represents newly generated organizational knowledge and thus forms the basis for developing new products or services. An im-

portant source for the creation of intellectual capital lies in a firm's external network (e.g., consisting of customers, suppliers, and R&D partners) represented by its *external* social capital (SC). This relationship between social capital and intellectual capital is mediated by the firm's *internal* enacted potential absorptive capacity (PACAP). The model builds on and extends well established theories: hypothesis 2 is drawn from social capital theory while hypothesis 3 is newly developed and hypothesis 1 connects intellectual capital with innovation success. In the following, the propositions are developed in detail.
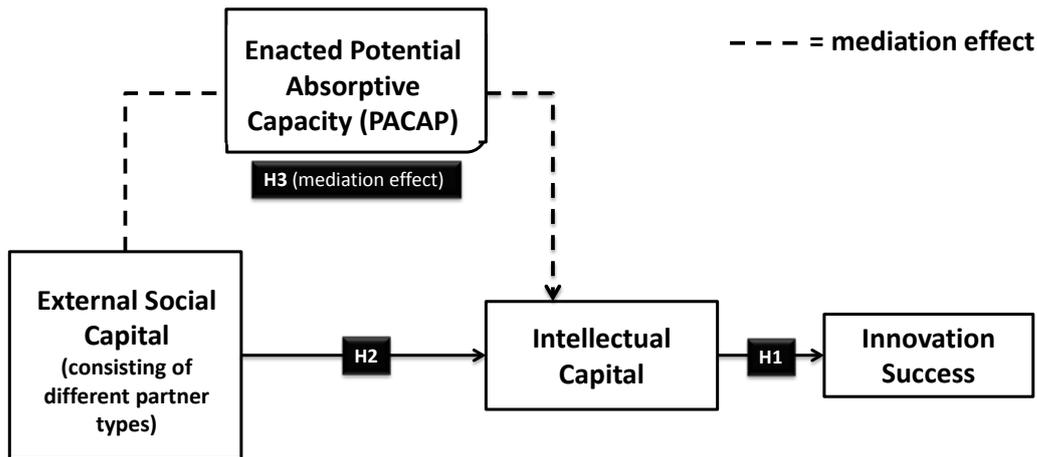
Figure 1: Theoretical model (simplified)

3.1 Intellectual Capital as Driver of Innovation Success (H1)

The model proposes that innovation success results from intellectual capital (Subramaniam and Youndt 2005) which represents collectively held knowledge. The literature suggests several categories of knowledge that are vital for innovation success and highlights two: market knowledge and technological knowledge (Maurer *et al.* 2011). *Market knowledge* represents knowledge about the external environment, and mainly about customers and competitors. It concerns not only the markets in which a firm is actually engaged, but also those that might be relevant to the firm in the future. Several studies have investigated market knowledge as knowledge about competitors and customers (de Luca and Atuahene-Gima 2007), knowledge about suppliers (Gold *et al.* 2001), knowledge about partners (Nakayama 2003), about industry information (Tippins and Sohi 2003), and about market knowledge in general (Yli-Renko *et al.* 2001). *Technological knowledge* refers primarily to competence with and recognition of new technologies and practices to optimize or innovate production, business processes, products and services. Prominent examples are IT knowledge (Bassellier *et al.* 2001), technological competence (Ko *et al.* 2005), and state-of-the-art technical practices (Matusik and Heeley 2005).

Several studies have empirically shown a positive link between firms' intellectual capital and innovation success (e.g., Bell and Zaheer 2007; Tsai and Ghoshal 1998; van Wijk *et al.* 2008). The basic notion of this perspective is that the ability to breed innovations is based on superior access to and integration of a range of specialized knowledge that is put to use and produces new goods and services (Grant 1996). Consequently, we propose:

Hypothesis 1 (H1a/b): Intellectual capital in terms of (a) market knowledge and (b) technological knowledge positively influences innovation success.

3.2 External networks as source of intellectual capital (H2)

In our model, external networks are conceptualized using a social capital perspective. According to Nahapiet and Ghoshal (1998), social capital should be conceptualized by three dimensions which characterize a relationship (van Wijk *et al.* 2008). The *structural dimension* deals with the existence and strength of links between actors and their structure. The concept of a tie and its strength is an important element of the structural dimension. A strong tie can be characterized as frequent and direct interaction between actors that facilitates the flow of information (Granovetter 1973). Second, the *relational dimension* of social capital refers to mutual respect and trust based on the development of relationships over time (Granovetter 1985). Trust, in turn, improves the exchange and integration of knowledge among actors and also guides further actions through the creation of mental maps or models that act as filters for information and lead to an increase of congruency regarding the perception of information (Galunic and Rodan 1998; Hansen 1999). Third, the *cognitive dimension* of social capital deals with shared vocabulary, narratives, and interpretations (Grant 1996; Kogut and Zander 1992). As with trust, the development of relationships over time also leads to greater understanding by creating a common language and symbols (Galunic and Rodan 1998), which in turn improves the exchange of knowledge.

According to social capital theory, social capital positively influences the creation of intellectual capital (Nahapiet and Ghoshal 1998) "because social capital directly affects the combine-and-exchange process and provides relatively easy access to network resources [external partners]" (McFadyen and Cannella 2004, p. 735) in several ways: (1) social capital increases access to knowledge (Zahra and George 2002) by providing the conduits for transferring knowledge (Hansen 1999); (2) social capital enhances the efficiency and effectiveness of knowledge transfer by facilitating knowledge sharing (Alavi and Leidner 2001) and by providing trusted relationships (Levin and Cross 2004); (3) social capital increases knowledge reach and richness through perspective-sharing and sense-making (Sambamurthy *et al.* 2003) by providing a shared language, alleviating

barriers to cooperation, and creating a common frame of reference (Nelson and Cooprider 1996) in which knowledge can be integrated (Grant 1996). Overall, social capital with external partners, such as customer and suppliers, refers to interactive, close, and trust based relationships which, in turn, affect the quality of knowledge transfer (Pérez-Nordtvedt *et al.* 2008). Therefore, applying SCT to the firm-external network of partners, we propose:

Hypothesis 2 (H2a/b): Higher levels of firm-external social capital lead to higher levels of intellectual capital in terms of (a) market knowledge and (b) technological knowledge.

3.3 Enacted PACAP as Mediator of the Influence of Social Capital on Innovation Success (H3)

Hypothesis 2 proposes a positive link between social capital and intellectual capital. In the following, we develop hypothesis H3 that proposes enacted PACAP to act as full mediator of this relationship.

Enacted PACAP can be seen as organizational routines representing "patterns of current practice and learning" (Teece *et al.* 1997, p. 518) within the boundary of a firm, and depending on the diversity and richness of knowledge sources. In our model, these sources encompass the external knowledge sources that are represented by different types of partners (e.g., customers, suppliers) and linked to the firm by social capital. Social capital provides the channels for exchanging knowledge (Hansen 1999) while enacted PACAP is the routine or 'pump' to transfer and absorb the knowledge via those channels to the firm. As mentioned before, PACAP encompasses both the *acquisition* capability (referring to the ability of a firm to identify and to acquire knowledge from outside the firm) and the *assimilation capability* (referring to the ability to "analyze, process, interpret, and understand the information obtained from external sources" (Zahra and George 2002, p. 189)). Thus, if PACAP in terms of acquisition and assimilation capabilities is enacted, external knowledge can actually be acquired and processed. Only after acquiring and processing this knowledge, it is available to the firm in a relevant form and thus part of its knowledge stock or intellectual capital. Enacted PACAP works as processor of external knowledge that corresponds to the definition of a mediator. According to Baron and Kenny (1986, p. 1173) a mediator "represents the generative mechanism through which the focal independent variable is able to influence the dependent variable of interest". In our case, enacted PACAP is the generative mechanism through which social capital influences intellectual capital. Accordingly, we propose that the effect of social capital on intellectual capital is fully mediated by enacted PACAP in terms of acquisition and assimilation capabilities. This interpretation is in line with Francalanci and Morabito (2008) who refer to absorptive capacity as mediating variable that translates input resources into performance. Enacted PACAP enables the formation of intellectual

capital by identifying appropriate external knowledge sources and knowledge relevant to the firm's operations, and by processing, interpreting, and incorporating externally acquired knowledge into a firm's activities (Tsai 2001). Thus, the enacted ability to acquire and assimilate knowledge from external relationships mediates the influence of social capital on intellectual capital. Hence, we propose:

Hypothesis 3 (H3a/b): Enacted PACAP fully mediates the influence of firm-external social capital on intellectual capital in terms of (a) market knowledge and (b) technological knowledge.

Figure 2 shows the detailed research model comprising all constructs and hypotheses.
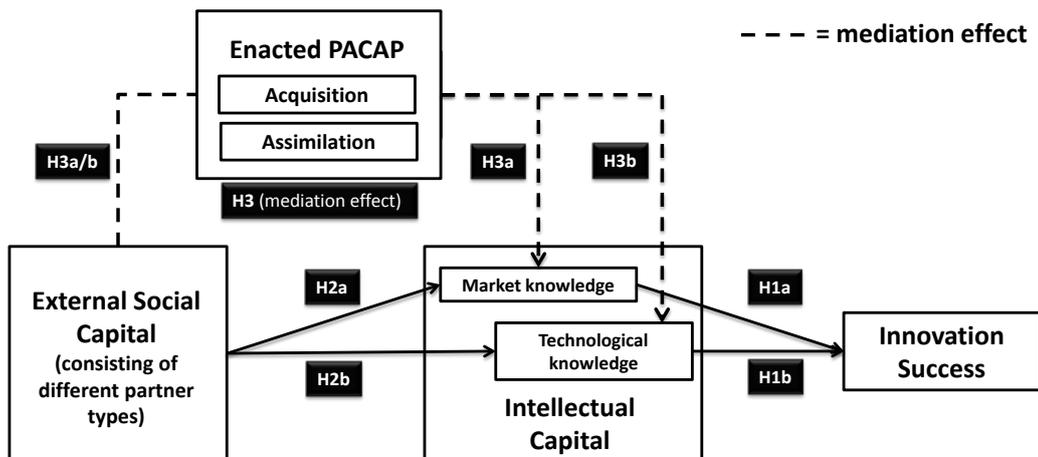
Figure 2: Theoretical model (detailed)

4.   Methodology

We tested our research model using survey data collected in the German manufacturing industry. In order to be able to detect effects of the influence of different types of external partners on innovation success, a firm must exhibit a minimum level of diversification of external partners and be able to focus on linkages where benefits are potentially high. Thus, similar to the argumentation of Cantwell (2002) we focus on larger firms that typically have the resources and routines to tackle various external partners. Further, we did not select the overall firm as level of analysis but their most important product division[2]. Firms often encompass various product divisions serving different markets with different technologies, with different partners, and with different degrees of success. Fo-

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[2] One might argue that focusing on the 'most important' product division would reduce variance because 'most important' might be intermingled with 'most successful' or 'most innovative' and thus our data set would be limited to the more successful product divisions. However, case studies conducted to support our survey preparations showed that 'most important' was consistently understood as a large and significant division of the firm. There might be a correlation with economic success, but not to a degree that would substantially reduce the variance of our variables. The advantage of collecting data from a large product division which is linked to a rich and heterogeneous network of external sources is assumed to outweigh potential limitations of losing some variance.

cusing on a single product division allows avoiding aggregation effects at the firm level and to select survey participants that are closer to the study variables examined.

4.1 Setting

In 2009, we identified the 2,500 largest German manufacturing firms (SIC codes 3011-3999) by revenue of 2007[3] and contacted each firm by phone to identify the manager responsible for the most important product division. For 2,160 firms, we were able to identify the person in charge of the selected product division or the manager responsible for the innovation activities in this division. To increase response rates we used several measures (see Dennis 2003): first, a questionnaire was sent to the managers including a stamped return envelope, followed by a reminder letter four weeks later and a reminder call after another two weeks. Furthermore, the questionnaire came with a letter indicating university sponsors, purpose and importance of the study, and an offer to participate in a lottery among study participants. We ultimately received 229 questionnaires. In the subsequent analyses we have used those 153 data sets to test our model which showed no missing values regarding the items used in the subsequent analysis[4].

4.2 Measurement

The questionnaire was developed by a project team of four experienced researchers after reviewing the comprehensive literature on SCT, ACAP, and firm innovativeness. We extracted measurement instruments from 97 journal articles relating to our constructs and assessed them regarding content validity and suitability regarding our research domain. The subset of measures which was identified by the project team to most adequately fit to our theoretical constructs was included in a pretest rolled out in eight firms (think-aloud approach with innovation managers). This led to several refinements in order to eliminate ambiguities and to better adapt them to the research domain and to the technical language of the target group. In this context and with regard to content validity, it was very important to ensure that, from the perspective of the industry experts, items relate to the underlying concept of the constructs. In addition, comments on ease-of-use of the instrument, understandability, sequence and comprehensiveness of questions as well as on appropriate key informants in companies were collected. The pretests showed that the concept of intellectual capital and its respective constructs (market knowledge and technical knowledge) were the most sophisticated. Therefore, we additionally carried out a card-sorting procedure with industry experts. These experts were asked to assign cards (encompassing one item per card) to the respective constructs.

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[3] All firms' revenues are above the European Union's definition for Small and Medium Sized Enterprises (i.e., 50 Mio €)

[4] Later on, we will explain how we compared the data from the 153 completed surveys with the remaining 76 answers to make sure that our results can be generalized to our overall data set.

After conducting these tests, three items had not been assigned to constructs as expected. One of them was deleted and two items were re-formulated to ensure a consistent grouping. Finally, the measurement instrument was again pre-tested by six representatives of companies responsible for innovation management. These pre-tests showed consistent answering behavior, so that no further adaptations deemed necessary. The final instrument encompasses reflective measures (3-4 per construct) for each construct (cf. Table 8 in the Appendix).

Firm-external social capital was operationalized as a higher-order construct by capturing the three different dimensions of social capital as introduced in the previous section and for each of the different types of partners being typical for a firm's external network and relevant for knowledge transfer. In terms of partners that belong to the firm-external network and constitute the firm's external social capital, we focused on the following types, which have been conceptualized by prior research:

- Customers (Chen *et al.* 2009; Fosfuri and Tribo 2008; Laursen and Salter 2006).
- Suppliers (Chen *et al.* 2009; Fosfuri and Tribo 2008; Laursen and Salter 2006).
- R&D partners, such as R&D service providers (privately owned companies, e.g., engineering companies) (Laursen and Salter 2006) and public research institutions (e.g., universities) (Chen *et al.* 2009; Fosfuri and Tribo 2008; Laursen and Salter 2006).
- Communities/professional organizations (Lesser *et al.* 2000). Here, we focused on industry associations and related industry-wide working groups.
- Friendship communities (Jansen *et al.* 2005; Levin and Cross 2004). Here, we captured private contacts of the survey respondent (i.e., manager responsible for the focal division).

As firms have a number of different partners with individually varying social linkages, the overall firm-external social capital of a firm was measured as the superset of a firm's linkages to the five partner types while each of these linkages was captured by the three social capital dimensions. This leads to the measurement model being a tertiary construct of an aggregate of 45 items consisting of five partner type variables that each consist of three social capital dimensions measured with three reflective indicators each. Figure 3 visualizes the tertiary construct of the firm-external social capital of a firm.
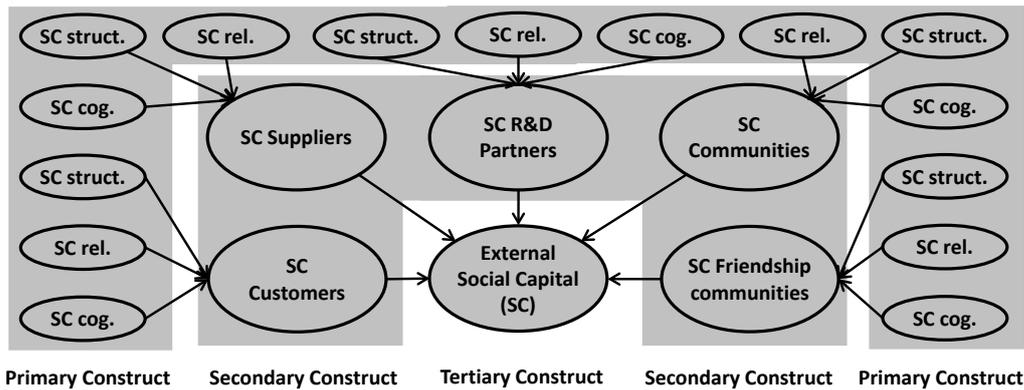
Figure 3: Tertiary construct of firm-external social capital (struct. = structural, rel. = relational, and cog. = cognitive)

Intellectual capital was conceptualized by two separate constructs: market knowledge and technological knowledge (compare Maurer *et al.* 2011) existing in the firm's product division; each of this knowledge types was operationalized by four reflective items. PACAP was conceptualized as a second-order construct consisting of acquisition capability and assimilation capability, which both were measured by three items each.

For partialling out rival explanations for innovation success, we used the following control variables: *firm size* (revenue)[5], *size of the R&D activities* of the product division (number of R&D employees relative to division)[6], *importance of the product division* for the firm (single item), *innovation governance* (innovation governance mechanisms geared to system capabilities and to coordination capabilities (Van den Bosch *et al.* 1999))[7], *strategy type* (based on Droge et al. (2008), with a scale ranging from 'focusing on optimization of processes' to 'focusing on innovation leadership'), *usage of knowledge management systems* (Moos *et al.* 2013) (three reflective items based on Pavlou and El Sawy (2006), Kulkarni et al. (2006), and Byrd and Turner (2001)), *environmental turbulence* (three reflective items based on De Luca and Atuahene-Gima (2007) and Jaworski and Kohli (1993)), and *experience* of the respondent (current position and number of years holding this position).

For evaluating the model, we used Partial Least Squares and applied smartPLS 2.0 M3 (Ringle *et al.* 2007). The size of the empirical model which covers 20 latent first-order variables and 62 items (plus controls) would have led to tremendous requirements re-

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[5] The effect of industry type was not tested because we surveyed only the manufacturing industry.

[6] We were not able to use the product division's R&D budget (absolute and relative to the revenue of the product division) as further control variable because we achieved too many missing values (would have reduced the data set from 153 to 128). However, testing the model with this smaller data set including the two additional control variables showed similar the same results.

[7] The first focuses on organizational policies and procedures and was measured by three items taken from Avlonitis et al. (2001). The latter one comprises mechanisms which foster the coordination between different business units like using analytical research techniques for capturing customer information (Atuahene-Gima 2005) and using tools for systematically monitoring the innovation process and its success.

garding sample size in case of covariance-based SEM[8]. However, we also tested parts of the models using covariance-based SEM (AMOS 20), which revealed structurally equivalent results (see appendix Table 12).

5.   Results

5.1 Validity of Data and Measurement Model

Before evaluating the research model, we need to evaluate the data regarding distributional assumptions and the measurement model regarding validity and reliability. Some of the items showed slight but significant deviations from normal distribution, which was another reason for using PLS. For testing the data on non-response bias we applied the wave and archival analysis techniques (Rogelberg and Stanton 2007; Sivo *et al.* 2006). Regarding wave analysis we compared the answers given by early respondents (first wave) and those that had answered after a reminder call or a subsequently sent questionnaire (second wave).[9] The test did not show significant differences in the items used. Further, we applied the archival analysis technique by comparing the demographics of revenue and number of employees of those firms that answered with those that did not answer. The results showed again no significant differences between these two groups.

The PLS-based quality criteria ensuring reliability and validity of the measurements are mostly fulfilled[10]: 58 of the 62 loadings are larger than 0.7 and all are highly significant (cf. Table 8 in the Appendix, which also shows the questionnaire items); four items are below 0.7 but two of them are at least larger than 0.6 (as suggested in Bagozzi and Yi 1988). The third item is one of the three items for measuring the strength of the structural linkage to industry associations (SCIS3) with a loading of 0.519 and the fourth one is one of the three items for measuring the cognitive dimension (SCIC3) to industry associations with a loading of 0.594. We decided to leave them in the model to ensure that the SC was measured identically for all partner types.

Further, composite reliability of all constructs is larger than 0.81 in every case and Cronbach's alpha ranges between 0.66 and 0.90 (i.e., sufficient construct reliability).

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[8] Since PLS does parameter estimation based on partial models, it has no sample size requirements based on the size of the overall model. The minimum sample size required by PLS is, as a rule of thumb, 10 times the largest number of predictors of any dependent variable (or largest number of formative items of any variable) (Gefen *et al.* 2011). Accordingly, the minimum sample size for our model is 130. By contrast, covariance-based SEM, as implemented in LISREL or AMOS, requires, as a rule of thumb, 3-5 data sets for each free parameter to be estimated. Thus, for testing our model, we would have needed a sample size of larger than 400.

[9] This approach, although not perfect, is typically applied to test data on non-response bias in articles published in leading journals (Compeau 1995; Kearns and Lederer 2004), since Armstrong and Overton (1977) argued that late respondents share similarities with non-respondents.

[10] In the next section, we test different variants of our research model. The test statistics, given in the Appendix, result from testing the 'full model'. Nevertheless, the 'direct model' fulfills the quality requirements as well.

Additionally, the AVEs of all (first-order) constructs are larger than 0.59 (i.e., sufficient convergent validity) (cf. Table 9 in the Appendix). Finally, the AVEs are larger than the squared correlations of the construct scores with any other construct scores (cf. Table 10 in the Appendix); correspondingly, the loadings of the indicators are higher than their correlations with any other construct (i.e., sufficient discriminant validity)[11].

5.2 Testing the Structural Model

The research model is tested in a two-step procedure in order to test for the mediation hypotheses. First, we test the *direct model* comprising the path from firm-external social capital via intellectual capital to innovation success (*direct model* = H1 + 2). Finally, we test the *full model* by adding the second-order enacted PACAP construct (*full model* = H1 – H3). Figure 4 shows the direct and the full model. Figure 4 also shows the levels of variance explained by the different models (R^2).
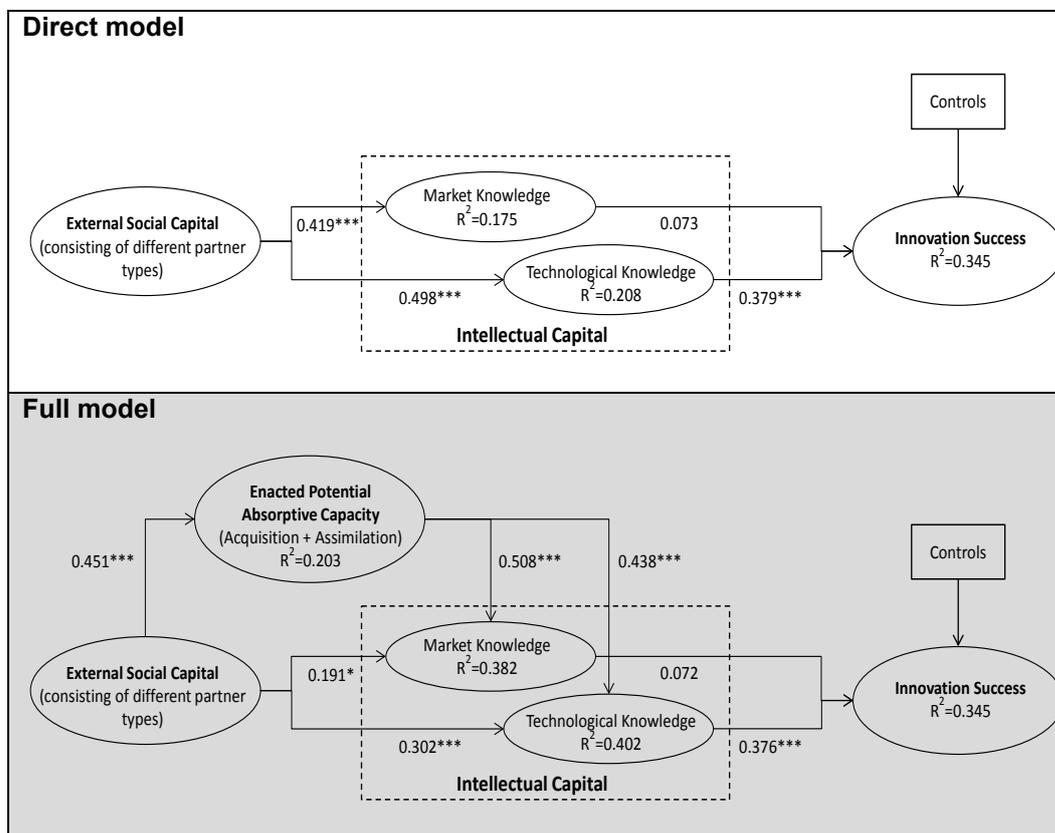
Figure 4: Innovation success models for evaluation including path coefficients (***: p<0.001; **: p<0.01, *: p<0.05) and explained variance (R^2)

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[11] We did not include this multi-page table in the manuscript but will of course provide it upon request. Similarly, the table of inter-item correlations could not be inserted here but can be delivered, as well.

Table 1 presents the estimated path coefficients of the various models. All models are calculated based on the same subsample, which contains no missing values.[12]

Table 1: PLS (***: p<0.001; **: p<0.01, *: p<0.05)

		Direct model	Full model
Hy-poth-eses	Market knowledge → Innovation success (H1a)	0.073	0.072
	Technological knowledge → Innovation success (H1b)	**0.379*****	**0.376*****
	Social capital → Market knowledge (H2a)	**0.419*****	**0.191***
	Social capital → Technological knowledge (H2b)	**0.498*****	**0.302*****
	Social capital → Enacted PACAP (H3a/b)	*n/a*	**0.451*****
	Enacted PACAP → Market knowledge (H3a)	*n/a*	**0.508*****
	Enacted PACAP → Technological knowledge (H3b)	*n/a*	**0.438*****
Con-trols	Company size (revenue)	**-0.137***	**-0.138***
	R&D employees in relation to all employees of the product division	-0.046	-0.046
	Experience of respondent in years	0.030	0.031
	Current position of the respondent	-0.012	-0.011
	Strategy type	**0.265*****	**0.265*****
	Environmental turbulence	-0.114	-0.116
	Innovation Governance	0.036	0.035
	Usage of Knowledge Management Systems	0.116	0.117
	Importance of the product division	0.040	0.040
R^2	R^2 Innovation success	0.345	0.345
	R^2 Market knowledge	0.175	0.382
	R^2 Technological knowledge	0.248	0.402
	R^2 Enacted PACAP	*n/a*	0.203

The statistical results show that firm-external social capital is a significant contributor to intellectual capital (direct model: R^2 of market knowledge = 0.175; R^2 of technological knowledge = 0.248; strong and highly significant path coefficients). Further, intellectual capital is a substantial determinant of innovation success, but only in terms of techno-logical knowledge, (highly significant path from technological knowledge). By contrast, the effect of market knowledge is too weak to become significant at the 0.05-level.

Regarding the mediation the results indicate that enacted PACAP is a partial mediator between firm-external social capital and intellectual capital (compare direct model with full model: substantial drop-down of path strength). To assess the significance of this drop-down we applied the Aroian test (Baron and Kenny 1986). Since newer approach-es are superior to this test (Preacher and Hayes 2008) we further carried out the boot-strap approach by calculating the confidence interval and thereby, following the recom-mendation by Shrout and Bolger (2002). Table 2 presents the results of these tests which indicate that the drop down of the path strengths is significantly underlining the mediation effect of enacted PACAP.

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[12] We also tested the models using covariance-based SEM (using AMOS 20), which revealed structurally equivalent results. Those and some details about the estimation are provided in the Appendix (Table 12).

Table 2: Mediation test results

Independent variable	Dependent variable	Mediator	Aroian test*		Bootstrapping
			z-score	p-value	Confidence interval**
Social Capital	Market knowledge	Enacted PACAP	5.00	0.000	(0.143/0.333)
Social Capital	Technological knowledge	Enacted PACAP	4.50	0.000	(0.116/0.309)
* Thresholds for significance: z-value > 1.96; p-value < 0.05 (Frazier *et al.* 2004)					
** Mediation is significant if zero is excluded (at alpha=.05 generating a 95% confidential interval) (Frazier *et al.* 2004)					

Table 3 summarizes the results of testing the hypotheses.

Table 3: Test results

Hyp #	Hypothesis	Test result	Comments
1	Intellectual capital ->Innovation success	confirmed*	*: Strong effect of technological knowledge but no effect of market knowledge.
2	Social capital -> Intellectual capital	confirmed	
3	Enacted PACAP mediates (Social capital -> Intellectual capital)	partially* confirmed	*: Direct paths remain significant when mediator is added, but drop significantly, indicating a partial mediation.
3a/b	Social capital -> Enacted PACAP	confirmed	
3a	Enacted PACAP -> Market Knowledge	confirmed	
3b	Enacted PACAP -> Technological Knowledge	confirmed	

Besides calculating the path coefficients, we analyze the single and total effects to capture the essential contribution each variable makes to the dependent variables. Since there are many alternative paths from one construct to another, the typically used f^2 test (results given in Table 4) does not sufficiently capture the impact of one construct on another. Therefore, we additionally report the total effects from the full model in Table 5.

Table 4: Single (direct) effects (f^2) (effect size: **=medium, *=weak)

Determinant	Innovation success	Intellectual capital	
		Market knowledge	Technological knowledge
Market knowledge	0.006		
Techn. knowledge	**0.127***		
Social capital		**0.050***	**0.134***
Enacted PACAP		**0.335****	**0.258****

Table 5: Total effects and levels of significance (**: p<0.01, *: p<0.05)

Determinant	Innovation success	Intellectual capital	
		Market knowledge	Technological knowledge
Market knowledge	0.072		
Techn. knowledge	**0.376****		
Social capital	**0.198***	**0.420****	**0.499****
Enacted PACAP	**0.201****	**0.508****	**0.438****

These analyses offer the further interesting insight that firm-external social capital shows strong and highly significant total effects on all endogenous variables. This supports the basic argument of this paper that firm-external social capital is a relevant contributor to a firm's intellectual capital and to its innovation success. But, which of the partners – customers, suppliers, R&D partners, professional organizations or private communities – has the most profound impact? Overall, all partner types exert an influence on innovation success (i.e. total effects are positive and significant) but R&D partners dominate the others, followed by customers, suppliers, private networks, and, finally, industry associations. It also turns out that technological knowledge is more driven by external sources than market knowledge is[13].

Table 6: Total effects of partner type on knowledge and innovation success
(**: p<.01, *: p<.05)

Partner type	Total effect on			
	Overall social capital	Market knowledge	Technological knowledge	Innovation success
R&D partners	0.388**	0.163**	0.194**	0.077*
Customers	0.351**	0.148**	0.175**	0.070*
Suppliers	0.325**	0.137**	0.162**	0.064*
Private contacts network	0.229**	0.096**	0.115**	0.045*
Industry associations	0.189**	0.080**	0.095**	0.038*

5.3   Stability and Validity of the Results

Our data showed a substantive proportion of missing values, which led to a reduction of the dataset from 229 to a usable 153 for testing our model. Most missing values appear in the social capital variables because some firms stated to have, e.g., no R&D partners, and skipped this part of the questionnaire. We compared the 153 firms with the 76 remaining ones to determine whether this reduced 'amount' of social capital in the latter group is related to the model's constructs as proposed. We calculated the scores of all

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[13] We included several control variables in the model to rule out rival explanations (see Table 1).

constructs by confirmatory factor analyses[14] and compared the average scores between the two groups. The only significant difference appeared regarding the level of technological knowledge ($p<0.037$).[15]

A possible issue threatening the validity of the results when using surveys is *common method bias (CMB)*. We applied several procedures to uncover indications of CMB. First, we conducted the Harman single-factor test, which showed no single component to explain the majority of overall variance (the largest component explained 20.2%). Second, we used two theoretically unrelated marker variables (Lindell and Whitney 2001) and tested for correlation with the latent variable scores. Some of them showed significant correlations (up to 0.277 for 22% of all construct to marker correlations, but with an insignificant average correlation of 0.123, T = 0.18). To test for the impact of method variance on our test results, we included a common method factor (reflected by the marker variables) that was linked to each endogenous construct of the full model[16]. When comparing the model with and without the common method factor, we did not find any structural differences in path strengths or R^2. Table 11 in the Appendix shows the results.

Additionally, to avoid single-response bias and for further analysis of CMB we collected data from a secondary source which was the manager of the marketing division for our endogenous innovation success variable. Since the size of this second survey was limited to the 229 participants of the original survey we only received 67 questionnaires (29.7% response rate) whereof 46 could be used because these participants match with the set of 153 firms used for the model evaluations. Thus, for directly using this secondary data, the size of the data set is unfortunately too small. However, the data is sufficient for evaluating the inter-rater agreements regarding the innovation success between the first and second respondents (see Tiwana 2008 for a similar procedure). The result shows that the correlations of the item scores between the first and second respondent are positive and highly significant underlining the quality of our data in terms of common method variance and it alleviates the subjectivity of our outcome measurement.

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14 For reasons of completeness, we report the resulting R^2 for each construct in Table 9 in the Appendix.

15 I.e., a firm/product division with missing values in the social capital section of the questionnaire rather stated that it has less technological knowledge.

16 We did not follow the best-of suggestion made in Podsakoff (2003) because Richardson et al. (2009) showed that the previous recommendations were misleading and can lead to wrong indications with a quite high probability.

6.   Discussion

6.1 Findings and Implications

Drawing on social capital theory and the literature on absorptive capacity, we have proposed a model that investigates the effect of firm-external social capital on innovation success mediated by the firm's enacted potential absorptive capacity.

Extending previous research, we distinguish between different external knowledge sources such as customers, suppliers, and professional organizations and elucidate the interplay between those external sources and the internal capabilities required to absorb and utilize their knowledge. Empirical analyses support the hypotheses and show that a firm's external social capital in the form of its partner network contributes significantly and positively to innovation success. The results provide important insights regarding how and through which mechanisms firms can become successful innovators.

As our main contribution, we found a strong impact of *firm-external* social capital (SC) across various partner types on intellectual capital, which is mediated by a firm's internal enacted potential absorptive capacity (PACAP), and eventually on innovation success. We show that the model encompassing enacted PACAP is superior in explaining knowledge formation and innovation success compared to the model encompassing social capital alone. We extend prior literature on social capital by, first, investigating an external perspective on social capital that spans a firm's most important partners and, second, by demonstrating a new way how SC generates organizational performance which is hitherto theoretically as well as empirically under-researched (Maurer *et al.* 2011). In addition, we explored the differential effect of firm-external social capital with specific external partners. External partners, by developing social capital with a focal firm, exert a strong influence on a firm's intellectual capital, i.e., market and technological knowledge that in turn transfers into innovation success. External partners can be regarded as knowledge sources delivering knowledge valuable for innovations. Social capital across the boundary of a firm is the mechanism that allows a firm to tap into these knowledge sources and thus is conducive to build up market and technological knowledge. Social capital theory suggests a direct link from social capital via intellectual capital to innovation and performance. We explicate that enacted PACAP mediates the influence of the external knowledge sources on intellectual capital. Enacted PACAP is critical because it facilitates the flow of knowledge from external sources and makes that knowledge available to the firm. External partners represent external knowledge sources while firm-external social capital forms the conduit on which knowledge can travel from them to the focal firm. A firm's enacted PACAP, i.e., the enacted ability to acquire and assimilate knowledge make knowledge from external partners available for

the focal firm, i.e., intellectual capital is created. Thus, the formation of intellectual capital is facilitated by enacted PACAP.

However, enacted PACAP shows only to be a partial mediator; thus, there remain further explanations of how a firm's external social capital is linked with intellectual capital. For example, social integration mechanisms support knowledge sharing by, e.g., short-term visits, meetings, and cross-unit teams through involvement of participating employees and the faster development of shared meanings (Björkman *et al.* 2007) which may serve to transform social capital into intellectual capital. Future research should investigate the role of additional intermediate variables in the link between social capital and intellectual capital.

Another interesting result of our study stems from the differentiation of intellectual capital into technological knowledge and market knowledge. Technological knowledge is usually in focus of research on absorptive capacity, which often deals with R&D and neglects other environments (Lane *et al.* 2006) while other types of knowledge are rarely addressed (for an exception see e.g., Maurer *et al.* 2011). We identify two major differences between the effects of technological and market knowledge. First, market knowledge does not contribute to innovation success while technological knowledge shows a strong effect on innovation success. To transform new technological knowledge into marketable products and/or services, firms need to combine and mutually adapt technological knowledge to anticipated visions of use. Accordingly, in relationships with external partners technological knowledge always conveys some market knowledge, e.g., regarding anticipated use scenarios (Sammarra and Biggiero 2008): On one side, the exchange of technological knowledge regarding information about new product developments includes also information about markets in which the new products will be launched. On the other side, the exchange of knowledge about markets and their future trends implies the exchange of ideas about possible new products and technologies. Drawing on case studies conducted alongside our survey, the findings point to the same direction: Interpretation of technological knowledge not only involves technical feasibility issues but also the assessment of how valuable some technological knowledge is with regard to future market success which in turn needs market knowledge to carry out the assessment.

6.2 Limitations

As any empirical research, our approach has some limitations. First, we have captured an organizational perspective by using data retrieved from a single key informant. This limitation was reduced by addressing the expert in charge of the innovation process to gather the relevant variables (Tallon *et al.* 2000) and by augmenting the survey with a set of case studies that allowed us to balance the view of the manager in charge with

the views of other managers where we did not find great deviations in the assessment. Furthermore, to show that method bias is not a serious problem, we collected supportive data from the marketing manager as secondary source and applied several analytical procedures to detect common method variance and to partial out a potential method factor. Second, the generalizability of results suffers from the single-industry perspective. However, this helps to sort out rather complex industry contingencies which otherwise could have affected our results (e.g., the different partner types will have completely different connotations and contributions towards a firm's knowledge in different industries). Third, there are further factors that contribute to innovation success but were not considered by our study. For example, organizational culture is a determinant that should be incorporated into further research. Fourth, as we used a cross-sectional study design we can neither validate the direction of causalities defined by the model nor can we account for long-term effects such as survival rates of firms exhibiting higher levels of PACAP. However, since our model was developed based on well-established theories, such as social capital theory, which have substantiated widely acknowledged causalities among the constructs considered, we are confident that the main effects are in the direction as hypothesized rather than the other way round. Overall, we can assume that applying rigorous data collection procedures, evaluating data quality, and using comprehensive tests for empirical validity and reliability have strongly contributed to achieving valid empirical results.

6.3 Future Research

A promising avenue for further relevant research is illuminating the role of particular types of external partners in an in-depth investigation of the different dimensions of external partners' social capital and their impact on the diverse representations of intellectual capital. Furthermore, the literature provides evidence that interactions with external partners are influenced by information technology, such as inter-organizational collaboration tools (Boland *et al.* 2007). Thus, social capital might be affected by consciously investing in IT systems and "provides an understanding of the role IT can and will play in the larger business environment" (Lyytinen and Rose 2003, p. 581).

7. Conclusion

This paper has investigated the role of firm-external knowledge sources in terms of social capital for innovation success. We developed and empirically tested a theoretical model that links a firm's external social capital and enacted potential absorptive capacity to its technological and market knowledge in order to explain organizational innovation success. By scrutinizing the relationship to external partners from a social capital perspective and by distinguishing different knowledge domains and different external part-

ners as well as by integrating the concept of enacted potential absorptive capacity we provide a more complete picture of inter-organizational knowledge transfer.

The analyses show that firm-external social capital is a significant contributor to intellectual capital, which in turn is an important determinant of innovation success. Moreover, enacted potential absorptive capacity mediates the impact of external knowledge sources on the formation of market and technological knowledge. Table 7 summarizes our contributions to theory and to practitioners.

Table 7: Summary of theoretical and managerial contributions

Research Question	Main Contribution to Theory	Implications for Practitioners
How and to what extent does a firm's external social capital (i.e., relationship with external partners) contribute to its innovation success?	Multi-theoretical innovation perspective: Theoretical explanation of how firm-external knowledge sources and enacted potential absorptive capacity influence innovation success of a firm shows: • **Firm-external social capital is important for innovation success**: External knowledge sources have a strong and significant impact on innovation success that is mediated by (and differs for) market and technological knowledge while the relation between firm-external social capital to these knowledge types is mediated by enacted potential absorptive capacity. • **New relational knowledge impact**: The study adds link characteristics, conceptualized as social capital, to the hitherto investigated knowledge characteristics and shows empirically the profound strength of this relational effect. • **Results support and add to Social Capital Theory**: The results offer strong support for the basic SCT perspective and extend it theoretically by explaining how SC and IC are related through enacted PACAP.	• **Role of network partners**: The results suggest a preference order beginning with the strongest knowledge contributors when investing in external knowledge sources: R&D partners, followed by customers, suppliers, private networks, and, finally, industry associations. Accordingly, resource allocation to external relationships should consider knowledge contribution as additional manageable object. • **Knowledge accumulation**: Management should foster the development of enacted potential absorptive capacity by investing in knowledge accumulation of the firm to be able to make more effective use of external knowledge sources. • **Relationship building**: Investments in relationship building with external sources also further increase internal enacted potential absorptive capacity, provide a firm with more valuable knowledge, and increase innovation success.

8.   References

Alavi, M. and Leidner, D.E. (2001). Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues. *MIS Quarterly*, 25(1), 107-136.

Armstrong, J.S. and Overton, T.S. (1977). Estimating Nonresponse Bias in Mail Surveys. *Journal of Marketing Research*, 14(3), 396-402.

Atuahene-Gima, K. (2005). Resolving the Capability - Rigidity Paradox in New Product Innovation. *Journal of Marketing*, 69(4), 61-83.

Avlonitis, G.J., Papastathopoulou, P.G., and Gounaris, S.P. (2001). An Empirically-Based Typology of Product Innovativeness for New Financial Services: Success and Failure Scenarios. *Journal of Product Innovation Management*, 18(5), 324-342.

Bagozzi, R.P. and Yi, Y. (1988). On the Evaluation of Structural Equation Models. *Journal of the Academy of Marketing Science*, 16(1), 74-94.

Baron, R.M. and Kenny, D.A. (1986). The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations. *Journal of Personality and Social Psychology*, 51(6), 1173-1182.

Bassellier, G., Reich, B.H., and Benbasat, I. (2001). Information Technology Competence of Business Managers: A Definition and Research Model. *Journal of Management Information Systems*, 17(4), 159-182.

Bell, G.G. and Zaheer, A. (2007). Geography, Networks, and Knowledge Flows. *Organization Science*, 18(6), 955-972.

Björkman, I., Stahl, G.K., and Vaara, E. (2007). Cultural Differences and Capability Transfer in Cross-Border Acquisitions: The Mediating Roles of Capability Complementarity, Absorptive Capacity, and Social Integration. *Journal of International Business Studies*, 38(4), 658-672.

Boland, R.J.J., Lyytinen, K., and Yoo, Y. (2007). Wakes of Innovation in Project Networks: The Case of Digital 3-D Representations in Architecture, Engineering, and Construction. *Organization Science*, 18(4), 631-647.

Byrd, T.A. and Turner, D.E. (2001). An Exploratory Examination of the Relationship between Flexible It Infrastructure and Competitive Advantage. *Information & Management*, 39(1), 41-52.

Cantwell, J.A. (2002). Innovation, Profits and Growth: Schumpeter and Penrose. In: *The Theory of the Growth of the Firm: The Legacy of Edith Penrose*. Pitelis, C.N. (ed.), Oxford University Press: Oxford, pp. 215-248.

Chen, Y.-S., Lin, M.-J.J., and Chang, C.-H. (2009). The Positive Effects of Relationship Learning and Absorptive Capacity on Innovation Performance and Competitive Advantage in Industrial Markets. *Industrial Marketing Management*, 38(2), 152-158.

Chung, S.H., Rainer, R.K., and Lewis, B.R. (2003). The Impact of Information Technology Infrastructure Flexibility on Strategic Alignment and Applications Implementation. *Communications of the AIS*, 11, 191-206.

Cohen, W.M. and Levinthal, D.A. (1990). Absorptive Capacity: A New Perspective on Learning & Innovation. *Administrative Science Quarterly*, 35(1), 128-152.

Coleman, J.S. (1988). Social Capital in the Creation of Human Capital. *American Journal of Sociology*, 94, 95-120.

Compeau, D. (1995). Computer Self-Efficacy: Development of a Measure and Initial Test. *MIS Quarterly*, 19(2), 189-211.

Croteau, A.-M. and Bergeron, F. (2001). An Information Technology Trilogy: Business Strategy, Technological Deployment and Organizational Performance. *Journal of Strategic Information Systems*, 10(2), 77-99.

Cummings, J. and Kiesler, S. (2003). Coordination and Success in Multidisciplinary Scientific Collaborations. *Proceedings of the 24th International Conference on Information Systems (ICIS)*, Seattle, Washington, USA, 296-303.

de Jong, J.P.J. and Freel, M. (2010). Absorptive Capacity and the Reach of Collaboration in High Technology Small Firms. *Research Policy*, 39(8), 47-54.

de Luca, L.M. and Atuahene-Gima, K. (2007). Market Knowledge Dimensions and Cross-Functional Collaboration: Examining the Different Routes to Product Innovation Performance. *Journal of Marketing*, 71(1), 95-112.

Dennis, J., William J. (2003). Raising Response Rates in Mail Surveys of Small Business Owners: Results of an Experiment. *Journal of Small Business Management*, 41(3), 278-295.

Denrell, J., Arvidsson, N., and Zander, U. (2004). Managing Knowledge in the Dark: An Empirical Study of the Reliability of Capability Evaluations. *Management Science*, 50(11), 1491-1503.

Droge, C., Calantone, R.J., and Harmancioglu, N. (2008). New Product Success: Is It Really Controllable by Managers in Highly Turbulent Environments? *Journal of Product Innovation Management*, 25(3), 272-286.

Easterby-Smith, M., Lyles, M.A., and Tsang, E.W.K. (2008). Inter-Organizational Knowledge Transfer: Current Themes and Future Prospects. *Journal of Management Studies*, 45(4), 677-690.

Eisenhardt, K.M. and Santos, F.M. (2002). Knowledge-Based View: A New Theory of Strategy? In: *Handbook of Strategy and Management*. Pettigrew, A.M., Howard, T., and Whittington, R. (eds.), Sage Publications Ltd.: London, Thousand Oaks, New Delhi, pp. 139-164.

Fang, E. (2008). Customer Participation and the Trade-Off between New Product Innovativeness and Speed to Market. *Journal of Marketing*, 72(4), 90-104.

Fosfuri, A. and Tribo, J.A. (2008). Exploring the Antecedents of Potential Absorptive Capacity and It's Impact on Innovation Performance. *Omega*, 36(2), 173-187.

Francalanci, C. and Morabito, V. (2008). Is Integration and Business Performance: The Mediation Effect of Organizational Absorptive Capacity in Smes. *Journal of Information Technology*, 23(4), 297-312.

Frazier, P.A., Tix, A.P., and Barron, K.E. (2004). Testing Moderator and Mediator Effects in Counseling Psychology Research. *Journal of Counseling Psychology*, 51(1), 115-134.

Galunic, D.C. and Rodan, S. (1998). Resource Recombinations in the Firm: Knowledge Structures and the Potential for Schumpeterian Innovation. *Strategic Management Journal*, 19(12), 1193-1201.

Garcia-Morales, V.J., Ruiz-Moreno, A., and Llorens-Montes, F.J. (2007). Effects of Technology Absorptive Capacity and Technology Proactivity on Organizational Learning, Innovation and Performance: An Empirical Examination. *Technology Analysis & Strategic Management*, 19(4), 527-558.

Gefen, D., Rigdon, E.E., and Straub, D.W. (2011). An Update and Extension to Sem Guidelines for Administrative and Social Science Research. *MIS Quarterly*, 35(2), iii-A7.

Gold, A.H., Malhotra, A., and Segars, A.H. (2001). Knowledge Management: An Organizational Capabilities Perspective. *Journal of Management Information Systems*, 18(1), 185-214.

Goles, T. and Chin, W.W. (2005). Information Systems Outsourcing Relationship Factors: Detailed Conceptualization and Initial Evidence. *The DATA BASE for Advances in Information Systems*, 36(4), 47-67.

Gosain, S., Malhotra, A., and El Sawy, O.A. (2004). Coordinating for Flexibility in E-Business Supply Chains. *Journal of Management Information Systems*, 21(3), 7-45.

Granovetter, M. (1973). The Strength of Weak Ties. *American Journal of Sociology*, 78(6), 1360-1380.

Granovetter, M. (1985). Economic Action and Social Structure: The Problem of Embeddedness. *American Journal of Sociology*, 91(3), 481-510.

Grant, R.M. (1996). Prospering in Dynamically-Competitive Environments: Organizational Capability as Knowledge Integration. *Organization Science*, 7(4), 375-387.

Hansen, M.T. (1999). The Search-Transfer Problem: The Role of Weak Ties in Sharing Knowledge across Organization Subunits. *Administrative Science Quarterly*, 44(1), 82-111.

Henderson, R.M. and Clark, K.B. (1990). Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms. *Administrative Science Quarterly*, 35(1), 9-30.

Hult, G.T.M., Ketchen, D.J., and Slater, S. (2004). Information Processing, Knowledge Development, and Strategic Supply Chain Performance. *Academy of Management Journal*, 47(2), 241-253.

Inkpen, A.C. and Tsang, E.W.K. (2005). Social Capital, Networks, and Knowledge Transfer. *Academy of Management Review*, 30(1), 146-165.

Jansen, J.J.P., Van den Bosch, F.A.J., and Volberda, H.W. (2005). Managing Potential and Realized Absorptive Capacity: How Do Organizational Antecedents Matter? *Academy of Management Journal*, 48(6), 999-1015.

Jaworski, B.J. and Kohli, A.K. (1993). Market Orientation: Antecedents and Consequences. *Journal of Marketing*, 57(3), 53.

Kearns, G., S. and Lederer, A.L. (2004). The Impact of Industry Contextual Factors on It Focus and the Use of It for Competitive Advantage. *Information & Management*, 41(7), 889-919.

Ko, D.-G., Kirsch, L.J., and King, W.R. (2005). Antecedents of Knowledge Transfer from Consultants to Clients in Enterprise System Implementations. *MIS Quarterly*, 29(1), 59-85.

Kogut, B. and Zander, U. (1992). Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology. *Organization Science*, 3(3), 383-397.

Kulkarni, U.R., Ravindran, S., and Freeze, R. (2006). A Knowledge Management Success Model: Theoretical Development and Empirical Validation. *Journal of Management Information Systems*, 23(3), 309-347.

Lane, P.J., Koka, B.R., and Pathak, S. (2006). The Reification of Absorptive Capacity: A Critical Review and Rejuvenation of the Construct. *Academy of Management Review*, 31(4), 833-863.

Lane, P.J., Salk, J.E., and Lyles, M.A. (2001). Absorptive Capacity, Learning, and Performance in International Joint Ventures. *Strategic Management Journal*, 22(12), 1139-1161.

Laursen, K., Masciarelli, F., and Prencipe, A. (2012). Regions Matter: How Localized Social Capital Affects Innovation and External Knowledge Acquisition. *Organization Science*, 23(1), 177-193.

Laursen, K. and Salter, A. (2006). Open for Innovation: The Role of Openness in Explaining Innovation Performance among U.K. Manufacturing Firms. *Strategic Management Journal*, 27(2), 809-825.

Lesser, E.L., Fontaine, M.A., and Slusher, J.A. (2000). Knowledge and Communities, Butterworth-Heinemann: Oxford.

Levin, D.Z. and Cross, R. (2004). The Strength of Weak Ties You Can Trust: The Mediating Role of Trust in Effective Knowledge Transfer. *Management Science*, 50(11), 1477-1490.

Liao, S.-h., Fei, W.-C., and Chen, C.-C. (2007). Knowledge Sharing, Absorptive Capacity, and Innovation Capability: An Empirical Study of Taiwan's Knowledge Intensive Industries. *Journal of Information Science*, 33(3), 340-359.

Lindell, M. and Whitney, D. (2001). Accounting for Common Method Variance in Cross-Sectional Research Designs. *Journal of Applied Psychology*, 86(1), 114-121.

Lyytinen, K. and Rose, G. (2003). The Disruptive Nature of Information Technology Innovations: The Case of Internet Computing in Systems Development Organizations. *MIS Quarterly*, 27(4), 557-595.

Matusik, S.F. and Heeley, M.B. (2005). Absorptive Capacity in the Software Industry: Identifying Dimensions That Affect Knowledge and Knowledge Creation Activities. *Journal of Management*, 31(4), 549-572.

Maurer, I., Bartsch, V., and Ebers, M. (2011). The Value of Intra-Organizational Social Capital: How It Fosters Knowledge Transfer, Innovation Performance, and Growth. *Organization Studies*, 32(2), 157-185.

McFadyen, M.A. and Cannella, A.A. (2004). Social Capital and Knowledge Creation: Diminishing Returns of the Number and Strength of Exchange Relationships. *Academy of Management Journal*, 47(5), 735-746.

Moos, B., Beimborn, D., Wagner, H.-T., and Weitzel, T. (2013). The Role of Knowledge Management Systems for Innovation: An Absorptive Capacity Perspective. *International Journal of Innovation Management*, 17(05), 1350019.

Nahapiet, J. and Ghoshal, S. (1998). Social Capital, Intellectual Capital, and the Organizational Advantage. *Academy of Management Review*, 23(2), 242-266.

Nakayama, M. (2003). An Assessment of Edi Use and Other Channel Communications on Trading Behavior and Trading Partner Knowledge. *Information & Management*, 40(6), 563-580.

Nelson, K.M. and Cooprider, J.G. (1996). The Contribution of Shared Knowledge to Is Group Performance. *MIS Quarterly*, 20(4), 409-432.

Nelson, R.R. and Winter, S.G. (1982). An Evolutionary Theory of Economic Change, The Belknap Press of Harvard University Press: Cambridge (Mass.).

Pavlou, P.A. and El Sawy, O.A. (2006). From It Leveraging Competence to Competitive Advantage in Turbulent Environments: The Case of New Product Development. *Information Systems Research*, 17(3), 198-227.

Pérez-Nordtvedt, L., Kedia, B.L., Datta, D.K., and Rasheed, A.A. (2008). Effectiveness and Efficiency of Cross-Border Knowledge Transfer: An Empirical Examination. *Journal of Management Studies*, 45(4), 714-744.

Podsakoff, P.M., MacKenzie, S.B., Lee, J.-Y., and Podsakoff, N. (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. and Hayes, A. (2008). Asymptotic and Resampling Strategies for Assessing and Comparing Indirect Effects in Multiple Mediator Models. *Behavior Research Methods*, 40(3), 879-891.

Richardson, H.A., Simmering, M.J., and Sturman, M.C. (2009). A Tale of Three Perspectives: Examining Post Hoc Statistical Techniques for Detection and Correction of Common Method Variance. *Organizational Research Methods*, 12(7), 762-800.

Ringle, C.M., Wende, S., and Will, A. Smartpls 2.0 M3 (Beta), Hamburg, 2007

Rogelberg, S.G. and Stanton, J.M. (2007). Introduction: Understanding and Dealing with Organizational Survey Nonresponse. *Organizational Research Methods*, 10(2), 195-209.

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

Sammarra, A. and Biggiero, L. (2008). Heterogeneity and Specificity of Inter-Firm Knowledge Flows in Innovation Networks. *Journal of Management Studies*, 45(4), 800-829.

Sarkar, M., Echambadi, R., Cavusgil, S.T., and Aulakh, P.S. (2001). The Influence of Complementarity, Compatibility, and Relationship Capital on Alliance Performance. *Journal of the Academy of Marketing Science*, 29(4), 358-373.

Schumpeter, J.A. (1934). Theory of Economic Development, Harvard University Press: Cambridge, MA.

Shrout, P.E. and Bolger, N. (2002). Mediation in Experimental and Nonexperimental Studies: New Procedures and Recommendations. *Psychological Methods*, 7(4), 422-445.

Sivo, S.A., Saunders, C.S., Chang, Q., and Jinag, J.J. (2006). How Low Should You Go? Low Response Rates and the Validity of Inference in Is Questionnaire Research. *Journal of the Association for Information Systems*, 7(6), 351-414.

Spender, J.-C. (1996). Making Knowledge the Basis of a Dynamic Theory of the Firm. *Strategic Management Journal*, 17(S2), 45-62.

Srinivasan, R., Lilien, G.L., and Rangaswamy, A. (2002). Technological Opportunism and Radical Technology Adoption: An Application to E-Business. *Journal of Marketing*, 66(3), 47-60.

Subramaniam, M. and Youndt, M.A. (2005). The Influence of Intellectual Capital on the Types of Innovative Capabilities. *Academy of Management Journal*, 48(3), 450-463.

Tallon, P.P., Kreamer, K.L., and Gurbaxani, V. (2000). Executives Perception of the Business Value of Information Technology: A Process-Oriented Approach. *Journal of Management Information Systems*, 16(4), 145-173.

Teece, D.J., Pisano, G., and Shuen, A. (1997). Dynamic Capabilities and Strategic Management. *Strategic Management Journal*, 18(7), 509-533.

Tippins, M.J. and Sohi, R.S. (2003). It Competency and Firm Performance: Is Organizational Learning a Missing Link? *Strategic Management Journal*, 24(8), 745-761.

Tiwana, A. (2008). Does Technological Modularity Substitute for Control? A Study of Alliance Performance in Software Outsourcing. *Strategic Management Journal*, 29, 769-780.

Tiwana, A. and McLean, E.R. (2005). Expertise Integration and Creativity in Infomations Systems Develeopment. *Journal of Management Information Systems*, 22(1), 13-43.

Tsai, W. (2000). Social Capital, Strategic Relatedness and the Formation of Intraorganizational Linkages. *Strategic Management Journal*, 21(9), 925-939.

Tsai, W. (2001). Knowledge Transfer in Intraorganizational Networks: Effects of Network Position and Absorptive Capacity on Business Unit Innovation and Performance. *Academy of Management Journal*, 44(5), 996-1004.

Tsai, W. and Ghoshal, S. (1998). Social Capital and Value Creation: The Role of Intrafirm Networks. *Academy of Management Journal*, 41(4), 464-476.

Van den Bosch, F.A.J., Volberda, H.W., and Boer, M.d. (1999). Co-Evolution of Firm Absorptive Capacity and Knowledge Environment: Organizational Forms and Combinative Capabilities. *Organization Science*, 10(5), 551-568.

van Wijk, R., Jansen, J.J.P., and Lyles, M.A. (2008). Inter- and Intra-Organizational Knowledge Transfer: A Meta-Analytic Review and Assessment of Its Antecedents and Consequences. *Journal of Management Studies*, 45(4), 830-853.

Walker, G., Kogut, B., and Shan, W. (1997). Social Capital, Structural Holes and the Formation of an Industry Network. *Organization Science*, 8(2), 109-125.

Yli-Renko, H., Autio, E., and Sapienza, H.J. (2001). Social Capital, Knowledge Acquisition, and Knowledge Exploitation in Young Technology-Based Firms. *Strategic Management Journal*, 22(6/7), 587.

Zahra, S.A. and George, G. (2002). Absorptive Capacity: A Review, Reconceptualization, and Extension. *Academy of Management Review*, 27(2), 185-203.

9. Appendix

Table 8: Construct specifications and item loadings

Variable	Label	Indicator	Loading	Sources
Innova-tion suc-cess	IS1	Compared to others in our industry, our product division launches more new products/services.	0.851	a, b
	IS2	Compared to others in our industry, our product division identifies and develops new markets considerably faster.	0.873	
	IS3	In the last three years, we were content with the profitability of our product division.	0.702	
Market know-ledge	MK1	Our product division's knowledge about our competitors' strategies is very thorough.	0.777	c, d
	MK2	Our product division's knowledge about our customers is broad and complete.	0.821	
	MK3	Our product division has thorough knowledge about emerging customers and their needs.	0.792	
	MK4	Our knowledge of potential competitors' strengths and weaknesses is very thorough.	0.870	
Techno-logical know-ledge	TK1	Our product division has very high knowledge about state-of-the-art technologies and practices relevant for us.	0.816	e, f, g
	TK2	Our product division has very high knowledge about implementing new technologies.	0.920	
	TK3	Our product division has the necessary skills to implement newly acquired technological knowledge.	0.892	
	TK4	Our product division has considerable competences in utilizing new technologies.	0.869	
Enacted PACAP – Assimila-tion	ASS1	Our coworkers know very exactly the most important enhancements of our products, expressed by customers, as well as known problems in the usage of the product.	0.673	j, k, i
	ASS2	In our firm we have a very high understanding about which information is needed when and where in order to achieve an outstanding result.	0.808	
	ASS3	Our product division very quickly recognizes the usefulness of new knowledge.	0.834	
Enacted PACAP – Acquisi-tion	ACQ1	Our product division has very high potential to absorb relevant knowledge of external sources.	0.815	f, l
	ACQ2	Our product division has very high competencies to get new technological knowledge into the firm.	0.897	
	ACQ3	Our product division is able to identify knowledge of interest to other product divisions and to forward it to these divisions.	0.810	

Table 8: Construct specifications and item loadings (cont.)

Variable	Label	Indicator	Loading	Sources
Social capital #partnertype# (structural)	SC#NT#S1	The exchange with our most important #partnertype# is very intensive.	>0.866	m, n, o
	SC#NT#S2	We exchange a lot of information with our most important #partnertype#.	>0.853	
	SC#NT#S3	Compared to the industry average we interact … frequently with our most important #partnertype #. (Scale: 'considerably less', 'less', ' rather less', 'just as', ' rather more', 'more', 'considerably more') [I and my most important private contacts have interacted … regarding business-related topics within the last three years. (Scale: 'weekly', 'monthly', 'quarterly', 'biannually', 'annually', 'less frequently, 'never')]	>0.703*	
Social capital #partnertype# (relational)	SC#NT#R1	The chemistry between us and our most important #partnertype# is right.	>0.846	p, q
	SC#NT#R2	Our most important #partnertype# are absolutely trustworthy.	>0.858	
	SC#NT#R3	The relationship to our most important #partnertype# is characterized by mutual respect.	>0.867	
Social capital #partnertype# (cognitive)	SC#NT#C1	We and our most important #partnertype# always agree about innovative topics.	>0.714	f
	SC#NT#C2	The communication with our most important #partnertype# about content wise topics is outstandingly.	>0.817	
	SC#NT#C3	Our most important #partnertype# and we always have a common language to deal with technical issues. (I and my most important private contacts tell similar anecdotes from daily business.)	>0.727**	

#partnertype#: 'customers', 'suppliers', 'R&D partners', industry associations', 'private contacts'. #NT#: 'c' for 'customer', 's' for 'supplier', 'r' for 'R&D partners', 'i' for 'industry associations', 'p' for 'private contacts'. In case of 'private contacts', all statements were formulated in singular instead of plural ('I' instead of 'we').

All items were originally in German and have been measured by a 7-Point-Likert-Scale, ranging from 1 (totally agree) to 7 (totally disagree) except item SC#NT#S3.

* In case of suppliers, the loading was only 0.629. In case of industry associations, the loading was only 0.519 and did not meet the usual thresholds. Nevertheless, we decided to capture it in order to ensure comparable measures across the different partner types.

** In case of industry associations, the loading was only 0.594.

Items are adopted and adapted to our research domain from: (a) (Srinivasan *et al.* 2002); (b) (Croteau and Bergeron 2001); (c) (de Luca and Atuahene-Gima 2007); (d) (Atuahene-Gima 2005); (e) (Matusik and Heeley 2005); (f) (Ko *et al.* 2005); (g) (Garcia-Morales *et al.* 2007); (h) (Liao *et al.* 2007); (i) (Jansen *et al.* 2005); (j) (Jaworski and Kohli 1993); (k) (Gosain *et al.* 2004); (l) (Denrell *et al.* 2004); (m) (Goles and Chin 2005); (n) (Chung *et al.* 2003); (o) (Fang 2008); (p) (Sarkar *et al.* 2001); (q) (Tiwana and McLean 2005).

Table 9: Quality measures on construct level (first-order constructs only)

	AVE	Composite reliability	Cronbach's alpha	R^2 of CFA
Innovation success	0.660	0.852	0.739	0.635
Market knowledge	0.665	0.888	0.832	0.677
Technological knowledge	0.766	0.929	0.897	0.754
Enacted PACAP – Assimilation	0.602	0.818	0.668	0.595
Enacted PACAP – Acquisition	0.708	0.879	0.793	0.682
Social capital customers (structural)	0.657	0.851	0.734	0.641
Social capital customers (relational)	0.757	0.903	0.840	0.763
Social capital customers (cognitive)	0.617	0.828	0.689	0.632
Social capital R&D partners (structural)	0.718	0.883	0.799	0.724
Social capital R&D partners (relational)	0.813	0.929	0.885	0.836
Social capital R&D partners (cognitive)	0.635	0.838	0.712	0.658
Social capital suppliers (structural)	0.664	0.852	0.741	0.668
Social capital suppliers (relational)	0.767	0.909	0.850	0.788
Social capital suppliers (cognitive)	0.694	0.872	0.779	0.686
Social capital industry associations (structural)	0.620	0.823	0.684	0.644
Social capital industry associations (relational)	0.794	0.920	0.870	0.810
Social capital industry associations (cognitive)	0.609	0.820	0.675	0.644
Social capital private contacts (structural)	0.727	0.888	0.810	0.714
Social capital private contacts (relational)	0.782	0.915	0.860	0.774
Social capital private contacts (cognitive)	0.590	0.811	0.656	0.607

Table 10: Latent variable correlations with square root of AVE in shaded cells

	Innovation success (IS)	Market knowledge (MK)	Technological knowledge (TK)	Assimilation (E-PACAP-ASS)	Acquisition (E-PACAP-ACQ)	Social Capital – customers – structural (SCCS)	Social Capital – customers – relational (SCCR)
IS	0.812						
MK	0.333	0.816					
TK	0.455	0.526	0.875				
E-PACAP-ASS	0.395	0.626	0.510	0.776			
E-PACAP-ACQ	0.354	0.433	0.515	0.612	0.842		
SCCS	0.283	0.385	0.393	0.346	0.260	0.811	
SCCR	0.202	0.312	0.372	0.305	0.196	0.419	0.87
SCCC	0.258	0.406	0.496	0.281	0.167	0.412	0.612
SCRS	0.228	0.225	0.285	0.274	0.365	0.256	0.175
SCRR	0.186	0.103	0.337	0.210	0.294	0.119	0.260
SCRC	0.138	0.200	0.313	0.299	0.322	0.191	0.260
SCSS	0.162	0.173	0.116	0.206	0.163	0.210	0.179
SCSR	0.131	0.237	0.244	0.291	0.229	0.092	0.266
SCSC	0.171	0.242	0.211	0.273	0.157	0.087	0.281
SCIS	0.152	0.266	0.285	0.210	0.241	0.135	0.082
SCIR	-0.036	0.060	0.192	0.095	0.051	-0.001	0.203
SCIC	-0.072	0.128	0.084	0.070	0.044	-0.053	0.015
SCPS	0.054	0.144	0.141	0.138	0.207	0.089	0.227
SCPR	0.049	0.260	0.219	0.125	0.135	0.027	0.238
SCPC	0.015	0.124	0.034	0.060	0.123	-0.073	0.109

	Social Capital – customers – cognitive (SCCC)	Social Capital – R&D partners – structural (SCRS)	Social Capital – R&D partners – relational (SCRR)	Social Capital – R&D partners – cognitive (SCRC)	Social Capital – suppliers – structural (SCSS)	Social Capital – suppliers – relational (SCSR)	Social Capital – suppliers – cognitive (SCSC)
SCCC	0.785						
SCRS	0.253	0.848					
SCRR	0.253	0.592	0.902				
SCRC	0.448	0.535	0.601	0.797			
SCSS	0.087	0.265	0.245	0.113	0.815		
SCSR	0.219	0.281	0.369	0.318	0.474	0.877	
SCSC	0.400	0.255	0.275	0.332	0.462	0.676	0.833
SCIS	0.070	0.197	0.200	0.151	0.188	0.284	0.200
SCIR	0.151	0.028	0.153	0.1578	0.049	0.286	0.141
SCIC	0.230	0.105	0.090	0.272	-0.066	0.207	0.271
SCPS	0.155	0.149	0.179	0.272	0.190	0.217	0.184
SCPR	0.282	0.145	0.228	0.291	0.17	0.342	0.238
SCPC	0.188	0.211	0.239	0.397	0.120	0.335	0.355

	Social Capital – industry assoc. – structural (SCIS)	Social Capital – industry assoc. – relational (SCIR)	Social Capital – industry assoc. – cognitive (SCIC)	Social Capital – private contacts – structural (SCPS)	Social Capital – private contacts – relational (SCPR)	Social Capital – private contacts – cognitive (SCPC)
SCIS	0.787					
SCIR	0.478	0.891				
SCIC	0.446	0.589	0.78			
SCPS	0.181	0.194	0.163	0.853		
SCPR	0.086	0.208	0.185	0.390	0.884	
SCPC	0.156	0.187	0.397	0.512	0.594	0.768

Table 11: Comparison of path strengths and R^2 in full model without and with common method factor (***: p<0.001; **: p<0.01, *: p<0.05)

Path	Full model	Full model with CMF
Market knowledge → Innovation success (H1a)	0.072	0.036
Technological knowledge → Innovation success (H1b)	**0.376*****	**0.400*****
Social capital → Market knowledge (H2a)	**0.191***	**0.176***
Social capital → Technological knowledge (H2b)	**0.302*****	**0.306*****
Social capital → Enacted PACAP (H3a/b)	**0.451*****	**0.416*****
Enacted PACAP → Market knowledge (H3a)	**0.508*****	**0.485*****
Enacted PACAP → Technological knowledge (H3b)	**0.438*****	**0.448*****
Company size (revenue) → Innovation success	**-0.138***	**-0.151***
R&D employees in relation to all employees of the product division → Innovation success	-0.046	-0.046
Experience of respondent in years → Innovation success	0.031	0.014
Current position of the respondent → Innovation success	-0.011	0.003
Strategy type → Innovation success	**0.265*****	**0.225****
Environmental turbulence → Innovation success	-0.116	-0.069
Innovation Governance → Innovation success	0.035	0.035
Usage of Knowledge Management Systems → Innovation Success	0.117	**0.135***
Importance of the product division → Innovation success	0.040	0.063
R^2 Innovation success	0.345	0.340
R^2 Market knowledge	0.382	0.394
R^2 Technological knowledge	0.402	0.405
R^2 Enacted PACAP	0.203	0.226

Table 12: Comparison of PLS results with covariance-based SEM (CV-SEM) results (***: p<0.001; **: p<0.01; *: p<0.05; +: p<0.1)

Path	Direct model		Full model	
	PLS results	CV-SEM results	PLS results	CV-SEM results
Market knowledge → Innovation success (H1a)	0.073	0.082	0.072	0.089
Technological knowledge → Innovation success (H1b)	**0.379*****	**0.400*****	**0.376*****	**0.400*****
Social capital → Market knowledge (H2a)	**0.419*****	**0.615*****	**0.191***	**0.213+**
Social capital → Technological knowledge (H2b)	**0.498*****	**0.717*****	**0.302*****	**0.369****
Social capital → Enacted PACAP (H3a/b)			**0.451*****	**0.665*****
Enacted PACAP → Market knowledge (H3a)			**0.508*****	**0.500*****
Enacted PACAP → Technological knowledge (H3b)			**0.438*****	**0.445*****
	X^2/df:	130.24 / 83 = 1.57	X^2/df:	240.9 / 157 = 1.53
	GFI:	0.931	GFI:	0.912
	RMR:	0.065	RMR:	0.080
	RMSEA:	0.050	RMSEA:	0.048
	CFI:	0.967	CFI:	0.957
	TLI:	0.958	TLI:	0.948

Notes: For testing the model with covariance-based SEM, AMOS 20 was used, applying ML estimation. The CV-SEM model did not include control variables. Data for social capital was aggregated via CFA to single scores for each node type which were used as items for the SC construct. This was necessary to keep the size of the model in a range that allowed its proper estimation given the size of the data set.

As a rival model, we also tested the role of enacted PACAP as moderator instead of mediator. As result, we did not find any of the interaction terms on technological or market knowledge to be significant. Further, the goodness-of-fit measures were substantially worse than in the original model.

PAPER VIII

Managing Acquired Knowledge from Different Network Partners: The Role of Knowledge Management Systems

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Appendix

Publications

Refereed Journals

Moos, B., Wagner, H.-T., Beimborn, D., and Weitzel, T. (forthcoming). The Contagious Power of Innovativeness: How Different Corporate Partners Contribute to a Firm's Knowledge. *International Journal of Innovation Management*. (PAPER III)

Moos, B., Beimborn, D., Wagner, H.-T., and Weitzel, T. (2013). The Role of Knowledge Management Systems for Innovation: An Absorptive Capacity Perspective. *International Journal of Innovation Management*, 17(05), 1350019. (PAPER V)

Refereed Conferences

Wagner, H.-T. and Moos, B. (2015). Social Capital and Usefulness of External Knowledge: The Moderating Role of Group Affiliation. *48th Hawaii International Conference on System Sciences (HICSS)*, Kauai (HI), USA, 3910-3919.

Moos, B. (2013). Managing Acquired Knowledge from Different Network Partners: The Role of Knowledge Management Systems. *11th International Conference on Wirtschaftsinformatik*, Leipzig, GER, 737-751 (best paper nomination). (PAPER VIII)

Moos, B., Wagner, H.-T., Beimborn, D., and Weitzel, T. (2013). Innovation Success and Absorptive Capacity: The Combined Influence of Information Systems and Combinative Capabilities - A Theoretical Model. *19th Americas Conference on Information Systems (AMCIS)*, Chicago (IL), USA, 1-7. (PAPER VI)

Moos, B., Wagner, H.-T., Beimborn, D., and Weitzel, T. (2012). Whom to Ask for What Knowledge? A Comparison of Exchange Partners and Their Impact on Knowledge Types. *45th Hawaii International Conference on System Science (HICSS)*, Maui (HI), USA, 3806-3815. (PAPER II)

Wagner, H.-T., Moos, B., Beimborn, D., and Weitzel, T. (2012). The Contagious Power of Innovativeness: A Comparison of Different Types of Firm Partners. *Academy of Management: Annual meeting*, Boston (MA), USA.

Moos, B., Beimborn, D., Wagner, H.-T., and Weitzel, T. (2011). Knowledge Management Systems, Absorptive Capacity, and Innovation Success. *19th European Conference on Information System (ECIS)*, Helsinki, Finland, Paper 145.

Moos, B., Wagner, H.-T., Beimborn, D., and Weitzel, T. (2011). The Role of Innovation Governance and Knowledge Management for Innovation Success. *44th Hawaii International Conference on System Sciences (HICSS)*, Kauai (HI), USA, 1-10. (PAPER IV)

Moos, B., Beimborn, D., Wagner, H.-T., and Weitzel, T. (2010). Suggestions for Measuring Organizational Innovativeness: A Review. *43rd Hawaii International Conference on System Sciences (HICSS)*, Kauai (HI), USA, 1-10. (PAPER I)

von Stetten, A., Beimborn, D., Kuznetsova, E., and Moos, B. (2010). The Impact of Cultural Differences on It Nearshoring Risks from a German Perspective. *43rd Hawaii International Conference on System Sciences (HICSS)*, Kauai (HI), USA 1-10.

Beimborn, D., Moos, B., Schlosser, F., and Weitzel, T. (2009). The Role of Client-Internal Social Linkages for Outsourcing Success - an SNA Approach. *15th Americas Conference on Information Systems (AMCIS)*, San Francisco (CA), USA, 1-11.

Refereed Workshops

Moos, B., Wagner, H.-T., Beimborn, D., and Weitzel, T. (2011). Knowledge Domains, Innovation Success, and Knowledge Management Systems: Evidence from an Empirical Study in the Manufacturing Industry. *Proceedings of IFIP 8.2/Organizations and Society in Information Systems (OASIS) (Pre-ICIS Workshop)*, Shanghai, China.

Beimborn, D., Moos, B., Wagner, H.-T., and Weitzel, T. (2010). The Impact of Knowledge Management on Absorptive Capacity. *Proceedings of IFIP 8.2/ Organizations and Society in Information Systems (OASIS) (Pre-ICIS Workshop)*, St. Louis (MO), USA.

Refereed Book Chapters

Wagner, H.-T. and Moos, B. (2014). Knowledge Management. In: Wiley Encyclopedia of Management (Volume 6). Cooper, C.L. (ed.), 3rd edition, John Wiley & Sons: Hoboken (NJ), USA.

Non-Refereed Research Report

Wagner, H.-T., Weitzel, T., Beimborn, D., and Moos, B. (2011). Unternehmensnetzwerke Und Innovationserfolg: Eine Empirische Untersuchung Im Produzierenden Gewerbe, ibidem Verlag: Stuttgart.

Beimborn, D., Blumenberg, S., König, W., Martin, S., Moos, B., Schlosser, F., and Weitzel, T. (2009). Erfolgreiche Gestaltung Partnerschaftlicher Outsourcingbeziehungen: Relationale Faktoren Im Outsourcingmanagement Der 1.000 Größten Banken in Deutschland, Books on Demand: Norderstedt.