The impact of knowledge management and social capital on dynamic capability in organizations

Knowledge Management Research & Practice (2014), 1–17

www.palgrave-journals.com/kmrp/

The impact of knowledge management and social capital on dynamic capability in organizations

Jurriaan van Reijsen[1]
Remko Helms[1,2]
Ronald Batenburg[1,3] and
Ralph Foorthuis[1,4]

[1] *Utrecht University, Utrecht, The Netherlands;* [2] *Open University, Heerlen, The Netherlands;* [3] *Netherlands Institute for Health Services Research, Utrecht, The Netherlands;* [4] *UWV, Amsterdam, The Netherlands*

Correspondence: Jurriaan van Reijsen, Department of Information and Computing Sciences, Utrecht University, Princetonplein 5, 3584 CH, Utrecht, The Netherlands.
Tel: +31 (0)6 4263 5036;
Fax: +31 (0)3 0253 2804;
E-mail: j.vanreijsen@uu.nl

Received: 2 April 2012
Revised: 16 April 2013
Accepted: 5 December 2013

Abstract
The Holy Grail in strategic management is the Dynamic Capability (DC) of organizations to realize sustainable competitive advantage. This requires organizations to continuously sense market changes and adapt their resources and routines accordingly, for which they are heavily dependent on knowledge. Knowledge as an antecedent for DC is, however, understudied. Inspired by the recognition of knowledge as an antecedent for DC, this paper sets out to uncover how organizations can foster DC from a knowledge management (KM) perspective. In an empirical survey on 55 knowledge-intensive organizations, we studied DC in organizations from two key perspectives on knowledge: formal, through the adoption of KM policies, and informal, through the availability of social capital. Our research results show that, although a formal KM approach strengthens DC, the availability of social capital appears unrelated to DC. The paper concludes with a practical outlook on advancing DC.
Knowledge Management Research & Practice advance online publication, 20 January 2014; doi:10.1057/kmrp.2013.59

Keywords: knowledge management theory; knowledge management practice; social capital; dynamic capability

Introduction

The importance of knowledge in organizations is not new. Knowledge is regarded as the primary asset of an organization (Alavi & Leidner, 2001). This is the result of a shift in strategic thinking from the resource-based view (RBV) of the firm (Penrose, 1959; Wernerfelt, 1984; Barney, 1991) to the knowledge-based view of the firm (Grant, 1996), regarding knowledge as the primary strategic resource of the firm. Consequently, knowledge management (KM), which is regarded as the management of knowledge processes, is widespread in organizations (Davenport & Prusak, 1998; Jashapara, 2004) and is no longer a new principle (Hansen, 1999). The value of knowledge is underscored by the recognition of knowledge as an impacting factor for performance (Helms & van Reijsen, 2008; Wu, 2008) and competitive advantage for organizations (Cohen & Levinthal, 1990; Drucker, 1991; Kogut & Zander, 1992; Spender, 1996; Ho, 2008). Knowledge is also suggested as the basis for the capability of innovation in organizations (Barlett & Ghoshal, 1989; Hedlund & Nonaka, 1993; Doz & Hamel, 1997; Miguel *et al*, 2008) and to be related to sustainable development (Jorna *et al*, 2004; McElroy, 2008). The importance of knowledge for sustainable development is suggested owing to the increased complexities of the topic of sustainability: organizations need to rely more than ever on knowledge for sustainable development (Faber *et al*, 2005).

Despite its recognition, an explicit connection between sustainable development and knowledge in organizations as its antecedent has been lacking. In earlier research, we investigated the concept of sustainable innovation (McElroy, 2006; Jorna *et al*, 2009) which formulates that for an organization to be sustainable, it should have full knowledge of its impact on the world and the capability to learn and adapt in response. We were triggered by the latter requirement as we identified it as a well-known topic in strategic management: Dynamic Capability (Teece *et al*, 1997; Barreto, 2010) (DC). Through this identification, and given the lack of a clear connection between KM and DC as well (Easterby-Smith & Prieto, 2008), we questioned to what extent KM could serve as an antecedent for DC.

McElroy's concept of sustainable innovation is based on a theoretical foundation that prescribes how organizations may 'implement' sustainable innovation that McElroy (2003) had proposed earlier and coined 'The New Knowledge Management' (NKM). Subsequently, he operationalized NKM by means of 'The Sustainability Code': a policy model comprising formal KM policies that target sustainable innovation (McElroy, 2006). NKM was criticized for being too theoretical (Connell, 2003; Nowe, 2003; Loan, 2006) and as empirical support for the effect of NKM adoption was lacking, our previous research tested this link and indeed found a positive result (van Reijsen *et al*, 2007a, b).

However, through advances in the field of KM, it is nowadays a commonly accepted idea that, in supplement to formal approaches to knowledge, knowledge actually remains tacit and is accessed through informal networks in organizations (Brown & Duguid, 1991; Kogut & Zander, 1992; Macdonald, 1995; Cross *et al*, 2001; Cross & Parker, 2004), also referred to as knowledge networks (Helms & Buysrogge, 2006; Helms, 2007). In this perspective, a relational approach to knowledge is adopted where the main interest in knowledge is in social relationships and interaction (Kianto & Waajakoski, 2010). The suggestion that organizational outcomes are influenced by knowledge processes in informal networks was even stated long ago (e.g., Kotter, 1982, 1985; Kanter, 1983, 1989; Miles & Snow, 1994). These thoughts already underscored that a variance exists between the formal denotation of the organization and its actual (informal) working (Orr, 1990). In contrast, NKM is formal in nature as it comprises formal policies that are 'implemented' by management. We identify this as an incomplete lens on the potential impact of knowledge on DC.

This research offers the following contributions: to retest the potential leverage of adopting KM policies on DC in organizations in a more elaborate study; to test the potential leverage of social capital availability on DC; and to compare the effect of both formal and informal perspectives. Herewith, this research proposes to test the effect of knowledge perspectives on DC in organizations. However, it does not claim to test the direct impact of these perspectives on sustainable development. This research focuses on the latter aspect of sustainable innovation (i.e., DC) and not on the former (i.e., building a knowledge base on organizational impact on the world). We take this focus to align with earlier research, where only the link with DC was tested.

The remainder of this paper is structured as follows. In the theoretical background, a comprehensive acknowledgement for the main constructs of our research is provided: sustainable innovation, DC, NKM and social capital. Next, we propose three research questions that guide our research. Following this, we introduce our research model that aims at testing the impact of both knowledge perspectives on DC. We then introduce our survey and explain how our data collection process was carried out. In the data analysis section, we reveal the results of the survey and discuss both our analysis approach and an elaborate set of validity tests to support the model and its outcomes. Finally, we face our research questions and conclude on the main findings. The paper is finalized by an acknowledgement of limitations of our research and suggested directions for future research.

Theoretical background

Sustainable innovation

The concept of *sustainable innovation*, as proposed by McElroy (2006), embodies the knowledge-driven processes and routines in organizations for *sustainable development*, that is, *to be sustainable*, that is, to sustainably impact ecology, economy and society. McElroy (2006) claims that in order for an organization to be sustainable, it requires two things: 'knowledge of its impact on the world' and 'the uninhibited capability to learn and adapt in response' with the aim to improve that impact in light of sustainable development. Both requirements are based on knowledge processes in organizations (Jorna *et al*, 2009) (i.e., building a knowledge base of its impact and stimulating its capability to learn and adapt). While the goal of sustainable innovation is to boost sustainable development, these knowledge processes cannot directly impact sustainable development. Instead, an indirect relation exists that is referred to as the three-tier model (McElroy, 2008): the output of knowledge processes is the input for business (operational) processes (i.e., action is knowledge in use). That output, in turn, impacts the organization and its environment and hence affects sustainable development. Through this relation, it can be argued that knowledge processes can impact sustainable development. Sustainable innovation is then defined as follows:

> Sustainable innovation embodies knowledge management and practices that provide an organization with knowledge of its impact on the world and the capability to learn and adapt in response, aiming at sustainable development.

It should be noted, however, that there is no guarantee that organizations will actually apply that knowledge base and capability to learn and adapt to improve their sustainability performance (Loan, 2006). However, as argued above, the concept of sustainable innovation does suggest an important role for knowledge in organizations with regard to sustainability.

This role is further illustrated by the notion that sustainability is an increasingly complex concept owing to the scale on which sustainability is nowadays regarded (Faber *et al*, 2005). While sustainability was originally approached in practice as a problem on a world scale (i.e., sustainability of the world), it is now also regarded from a local perspective (i.e., sustainability of a region). These local specificities increase the complexity of sustainability and underscore that sustainability has become more dependent on a process of continuous learning. Therefore, organizations need to rely more than ever on knowledge when addressing their sustainability performance (Jorna *et al*, 2004; McElroy, 2008).

Since this link is evident between knowledge and sustainability (i.e., the condition), it is worthwhile to investigate exactly how knowledge can contribute to sustainable innovation (i.e., the process). We therefore propose to examine the link between knowledge in organizations and sustainable innovation. However, since sustainable innovation, in the way that McElroy postulates, is not a widely recognized nor researched concept, we first drill down into its properties to seek more commonly recognized attributes and to thus better embed the concept of sustainable innovation in literature and practice.

The first property of sustainable innovation is the effort to acquire knowledge about the impact that a system (e.g., an organization) has on its environment. It thus refers to a mechanism that allows for the tracking and reporting on the sustainability impact (of an organization). In practice, various sustainability (or corporate social responsibility) principles and reporting frameworks exist nowadays (compare, e.g., Hall, 2011; COM, 2011; ISO 26000: 2010; AccountAbility, 2008). While most frameworks focus on the process of addressing sustainable development, an exception is the Global Reporting Initiative (GRI, 2011) framework that additionally provides an extensive set of into Key Performance Indicators (KPIs) per sustainability topic (e.g., environment, society, labour), which allows for tangible measurement. Measuring such KPIs could very well operationalize this property of sustainable innovation.

The second property of sustainable innovation concerns the capability of a system (i.e., organization) to learn and adapt in response to the current state of sustainable development. This notion resembles a more widely studied phenomenon, namely, DC. Since DC is a well-known topic in strategic management, it pays to investigate the components of DC as it will help to understand its inner working and how it can be measured in empirical research. We will do so in the next section.

Dynamic capability

The concept of DC was coined by Teece *et al* (1997). These authors referred to this concept as 'a firm's ability to integrate, build and reconfigure internal and external competences to address rapidly changing environments' (Teece *et al*, 1997). The authors regard DC as an extension of the RBV of the firm as the RBV explains firm success or failure based on their resources and capabilities. Moreover, they proposed the capability framework that allows examination of the underlying dimensions of DC. In light of this framework, Barreto (2010) underscores that DC has been regarded from a wide variety of perspectives and in an attempt to provide focus, he summarizes the various ways in which DC has been regarded until now. For example, the nature of DC of an organization has been regarded not only as an ability or capacity (e.g., Zahra *et al*, 2006; Helfat *et al*, 2007) but also as a process (Eisenhardt & Martin, 2000) and as a collective activity (Zollo & Winter, 2002).

The anticipated outcome of DC varies: the benefits ascribed to DC have included performance (Teece *et al*, 1997), economic profit (Makadok, 2001) and competitive advantage (Teece, 2007). One thing these anticipated outcomes have in common is that they all regard benefits for the organization itself. This is also reflected in the various definitions that have been opted for DC over the years. Teece (2000), for example, refers to 'seizing opportunities quickly and proficiently', and in another paper Teece (2007) depicts DC as beneficial to 'maintain competitiveness'. However, definitions that are less strictly tied to direct organizational benefits exist as well. A more relaxed definition is postulated by Zollo & Winter (2002), who relate DC to the 'pursuit of improved effectiveness'. Even more relaxed is the notion of Zahra *et al* (2006) who regard DC as the ability to 'reconfigure a firm's resources and routines in the manner envisioned and deemed appropriate'. In addition, Eisenhardt & Martin (2000) relate to DC as 'organizational and strategic routines by which firms achieve new resource configuration'. Barreto (2010) argues that 'a dynamic capability is the firms' potential to systematically solve problems'.

On the basis of the above definitions, it becomes apparent that McElroy's 'capability to learn and adapt' is closely related to DC as set forth in the literature. Noblet *et al* (2011) describe DC as an 'organizational skill that creates, builds up and reconfigures its resources so as to better address changes in its environment'. 'Resources' in the context of sustainable innovation could be the knowledge that an organization acquires about its impact on the world. The correlating 'skill' could then be the process of organizational learning and adaption based on the acquired knowledge. This notion is comparable to the view of Zollo & Winter (2002) who regard DC as the result of organizational learning and furthermore underscore the role of learning mechanisms for DC.

The new knowledge management

NKM was coined by McElroy (2003) and is based on four cornerstones. While these cornerstones are not completely new, the novelty of NKM lies in the extension of these cornerstones, explicit focus on knowledge evaluation and the claim that adoption of the NKM proposition will boost sustainable innovation in organizations.

Table 1 The policies of the NKM proposition, mapped onto their cornerstones

Policy	*Description*
Cornerstone: Knowledge Life Cycle (KLC)	
Fallibility	Knowledge is regarded as never true with certainty and hence fallible
Fact/value	Knowledge claims of both fact and value are evaluated
Fair comparison	Openness to testing and criticizing knowledge
Internalization	Social and environmental impact of knowledge processes are evaluated
Cornerstone: Open Enterprise (OE)	
Transparency	All knowledge is available to all actors
Inclusiveness	All actors have access to all learning processes
Looking for trouble	Actors evaluate the performance of knowledge in action
Growth of knowledge	All actors may produce new knowledge policies if not contradicting
Policy synchronization	Policy is formed from behaviour, not the other way around
Enforcement	Actors that do not abide by these policies leave the organization
Cornerstone: Knowledge Management (KM)	
Knowledge management	A distinct knowledge management function exists with distinct budget
Cornerstone: Complex Adaptive Systems (CAS)	
Embryology	Employees should be allowed to have their own personal learning agendas
Politics of knowledge	Knowledge creation may not be limited to the executive function
Ethodiversity	Employees should be hired based on divergent worldviews
Connectedness	Resources for IT-based and social connectivity must be adequate

The first cornerstone is referred to as the *Knowledge Life Cycle* (KLC). This concept represents the cyclical flow of knowledge in organizations (e.g., creation, distribution and application). This idea was previously discussed by scholars such as Wiig (1993) and Weggeman (1997). McElroy adds the explicit evaluation of knowledge claims as a part of the life cycle, stressing that knowledge should always be regarded as fallible and hence be evaluated regularly.

The second cornerstone of NKM is the idea of the *Open Enterprise* (OE) that states that knowledge making is not the same as decision making. The organization should be open so that every employee can participate in knowledge processes and learning and that all knowledge is accessible to everyone in the organization. The idea of OE is derived from, for example, Daft (2003), who argues about organizations as organic structures instead of bureaucratic systems. It also leans on the concept of Empowerment (Thomas & Velthouse, 1990).

The third cornerstone of NKM is based on the idea of an Epistemic Hierarchy that promotes separation of knowledge processes and business processes. It calls for a distinct KM function that is not integrated in the executive (decision making) function. The KM function should have its own resources. Earlier scholars that detected the formation of such distinct KM functions in organizations are Davenport & Prusak (1998), Smith & McKeen (2003) and Awad & Ghaziri (2004).

The fourth cornerstone of NKM is the theory of *Complex Adaptive Systems* (CAS), previously proposed by Holland (1995). CAS theory promotes the self-organizing tendencies of humans (in organizations) and underscores the potential value of that capability for organizations. Every human is regarded as a CAS that will intrinsically adapt its behaviour based on the changing environment it is acting in. McElroy states that an organization may also be regarded as a CAS.

The NKM proposition was criticized by other scholars, for defects in its theory formulation (Loan, 2006) but mainly for its lack of guidelines for organizations to implement NKM in practice, while the primary work on NKM was aimed at practitioners (Connell, 2003; Nowe, 2003; Loan, 2006).

Perhaps therefore, McElroy (2006) formulated a policy model based on the four cornerstones: the Sustainability Code. The sustainability code consists of 11 policies: guidelines that an organization can adopt. The 11 policies from the Sustainability Code are based on three of the four NKM cornerstones. In order to cover all four cornerstones, we extended the model with the four policies from CAS theory as defined in McElroy (2003), resulting in a model of 15 policies (van Reijsen *et al*, 2007b). Table 1 provides a brief overview of these policies.

Social capital

Social capital is a component of intellectual capital that specifically focuses on the availability of social relationships and shared values and trust in organizational networks (Coleman, 1988; Adler & Kwon, 2000; Lin, 2001) and is hence argued to be a suitable indicator for informal activity in an organization. We adopt the availability of social capital as a means to operationalize the informal approach to the potential impact of knowledge on DC.

The concept of social capital is well defined by Lin (2001), who defines it as 'resources embedded in social structure that are accessed and/or mobilized in purposive actions'. Social capital follows a relational approach towards knowledge in organizations (Brown & Duguid, 1991; Lave & Wenger, 1991; Nahapiet & Ghoshal, 1998; Cohen & Prusak, 2001). In Kianto & Waajakoski (2010), the authors provide a clear overview of the relational approach that social capital has towards knowledge. They state that knowledge is understood as a 'socially constructed and shared resource', that the main interest is 'social relationships and interaction' and that the focus is on 'the characteristics of the social relationships connecting the actors and social capital embedded in them'. The availability of social capital is regarded as a valuable resource that supports employees in performing activities in organizations. In literature, several views and/or levels of social capital have been described. Four of these views will be discussed below as they help to operationalize the measurement of social capital.

Social capital can be divided into three dimensions: structural, relational and cognitive (Nahapiet & Ghoshal, 1998). Structural refers to the existence of relations between actors (i.e., people in organizations). Relational focuses on the quality of these relations and is expressed in the form of norms, shared values and trust. Cognitive focuses on the extent to which relational capital is shared among actors in the organization and is hence a marker for a shared organizational mind. Hence, social capital describes the relations between people that they can use to utilize the knowledge of their colleagues. Through these social relations they share knowledge and contribute to knowledge creation in the organization.

Another view on social capital is presented by Adler & Kwon (2002) who distinguish two viewpoints. First is the egocentric approach focusing on the benefits of social capital for the individual actor in a network (i.e., the organization). Second is the sociocentric approach (Putnam, 1993) focusing on social capital as a shared resource for the collective (i.e., the organization). In our research, we only focus on social capital from a sociocentric approach as we are interested in potential benefits for the entire organization and to allow to compare with formal KM approaches that also focus on an organizational level.

Finally, social capital can be regarded from an internal and an external scope. The internal or intra-organizational (Kianto & Waajakoski, 2010) scope focuses on the availability and advantages of social capital in the internal organization. The external or inter-organizational (Kianto & Waajakoski, 2010) scope focuses on the availability of social capital between a focal organization and its environment (e.g., customer, supplier) and its potential advantages for both parties.

Research questions

Now that the link between organizational knowledge and DC has been clarified from a theoretical stance, we ask ourselves whether this link can be empirically supported. Moreover, given the recognition for both a formal and an informal approach to knowledge in organizations, we wish to examine both perspectives with regard to DC. Here, we take an exploratory approach with no predefined hypotheses on which approach is better suited to impact DC. Our effort is thus a theory-building effort instead of a theory-testing effort.

As mentioned in the 'Introduction', earlier exploratory research tested the impact of a formal approach towards knowledge on DC in organizations (van Reijsen *et al*, 2007a, b). We then operationalized this formal approach by means of the 15 NKM policies and found a positive relation with DC. In our current research, we aim to retest this link using both a larger sample and a more advanced research approach. For this purpose, we propose our first research question as follows:

Q1a: Does NKM adoption positively impact DC in organizations?

Since the NKM policies are grouped into the four cornerstones of NKM adoption, we can furthermore research on the link between these specific dimensions of NKM and DC to observe whether certain dimensions are better capable of boosting DC than others. We therefore formulate a side question:

Q1b: Which specific NKM cornerstones are better suited to impact DC in organizations?

Referring to our notion that knowledge should not only be regarded from a formal perspective, we are also interested in the potential impact of an informal perspective on DC. We operationalize this informal approach by means of social capital availability in organizations. Our second research question is then:

Q2a: Does the availability of social capital positively impact DC in organizations?

Since social capital comprises separate dimensions, we are also interested in the individual contribution of these dimensions to DC in organizations and formulate a second side question:

Q2b: Which specific social capital dimensions are better suited to impact DC in organizations?

Finally, we are interested to learn whether NKM adoption, as a formal approach or social capital availability, as an informal approach, has more leverage on DC. Learning which approach can better leverage DC may provide us with new knowledge on how to effectively improve DC in organizations. We formulate our third research question as follows:

Q3: Which of formal and informal knowledge perspectives has more leverage to impact DC in organizations?

Research model

On the basis of our research questions above, we introduce our research model. Our model is composed as a Structural Equation Model (SEM), where all constructs are formatively measured. The model consists of one central dependent variable (DC) and two determinant variables: NKM adoption and social capital availability. Each of the four cornerstones of NKM adoption are first-order constructs that together constitute the formative second-order construct NKM adoption. An analogous reasoning holds for the six dimensions of social capital availability.

A SEM approach

We decided to apply a Partial Least Squares Structural Equation Modelling (PLS-SEM) approach and did so for multiple reasons. First and foremost, PLS-SEM provides a more robust estimation of our structural model than other analysis techniques (e.g., Reinartz *et al*, 2009; Ringle *et al*, 2009). Second, there is not yet a scientific foundation for the effect of NKM adoption and/or the availability of social capital on DC, and therefore this research is moreover oriented to theory development rather than theory testing. PLS-SEM is the better approach in this case compared with, for example, components-based SEM (Gefen *et al*, 2000). Moreover, PLS-SEM allows for the application of formative constructs. While the indicators that we associated with NKM adoption and social capital availability *constitute* instead of *representing* their respective constructs, our model is based on formative constructs. In addition, the first-order constructs applied in our model are different *aspects* instead of *indices* of their respective second-order constructs (Becker *et al*, 2012) and are hence formatively linked to their second-order constructs. This design choice prevents us from wrongfully modelling our items as reflective, which may lead to biased analysis results (Jarvis *et al*, 2003). PLS-SEM is also well suited when a relatively small sample size is available (Marcoulides & Saunders, 2006; Sosik *et al*, 2009) such as in our case ($N = 55$). Furthermore, PLS-SEM is well capable of handling ordinal measures (Haenlein & Kaplan, 2004; Chin, 2010; Hair *et al*, 2010) (which our measures are) and it can deal with models that contain both single-item and multiple-item constructs (Hair *et al*, 2010), which is the case in our model.

Measurement formulation

To allow observation of the proposed constructs in empirical research, we formulated a set of measures for each construct. First, 15 measures are introduced for the adoption of NKM policies. The measures are formatively assigned to their respective NKM cornerstone construct in line with Table 1. Each measure is attributed three values that reflect a 0, 50 or 100% adoption of the policy of focus. This value attribution is identical to our previous NKM measurement effort (van Reijsen *et al*, 2007a, b) where it proved to be an adequate means to observe NKM adoption. Moreover, this component was expert-reviewed by several KM experts, providing face validity.

Second, 18 measures are introduced to capture social capital availability. For each first-order social capital construct in our model, three measures are formatively assigned. Each measure is valued by a 5-point Likert scale question, whose scale runs from 'totally disagree' to 'totally agree'. These questions have been successfully applied previously by Kianto & Waajakoski (2010) in their research on the impact of social capital on organizational growth. Reapplying this approach positively impacts face validity for this component of our research model and is moreover supportive for the coverage of the concept space (Petter *et al*, 2007) of social capital.

Third, we introduce a set of measures for DC. Admittedly, this construct is hard to measure. Barreto (2010) argues that DC is not yet a theory, and although he proposes guidelines he concludes that, currently, an operationalization of the construct does not exist. This notion is supported by other researchers (c.f. Kraatz & Zajac, 2001; Winter, 2003; Danneels, 2008). As proposed by Barreto (2010), we approach the measurement of DC by means of objective proxies and introduce four proxy measures that are formatively assigned to the DC construct. Each measure is valued by a 5-point Likert scale question that expresses an extent of DC, for example, 'to what extent is your organization able to adapt to changing regulations' or 'client demands'. The Likert scale runs from 'far less' to 'far better'. These measures were expert-reviewed and their formulations were adjusted.

Data collection

Approach

In order to analyse the proposed model, a data collection approach was set up. We defined our population as knowledge-intensive organizations in general. In our sampling approach, we limited our scope to knowledge-intensive organizations in The Netherlands and Belgium for practical reasons. We did not restrict our sample for organizational characteristics such as size or industry. However, we did measure these variables in order to get an idea about the organizational characteristics of our sample. Thus, the applied sampling method is a convenient random sampling (Triola, 2004). In our sampling effort, we approached senior general, knowledge or HR managers from 75 organizations, aware of knowledge processes in their organization. To collect data from our sample, we used the open source web survey tool LimeSurvey (v1.90) that was made available from May to August 2011. Approached managers were invited by e-mail and offered a description of the survey and a link to participate.

The survey consists of four components. The first component is a generic component that gathers information about organizational characteristics such as size in Full Time Equivalent (FTE), structure (e.g., flat or hierarchical), value strategy (e.g., customer intimacy), and whether the organization has a KM function and/or KM IT infrastructure (e.g., intranet, Wiki). The other three components contain the measures for NKM adoption, social capital

availability and DC, respectively, as set forth in the section on measurement formulation.

Sample

A total of 55 managers participated in our survey ($N = 55$). Of the respondent organizations, 42% are SMEs (< 250 FTE) and 58% are large enterprises (250 + FTE). Moreover, 29% organizations have a flat structure and 71% have an average to hierarchical structure. Of our respondents, 55% hold customer intimacy as their value strategy, while 27% aim at product leadership and 18% at operational excellence. Although all organizations are knowledge-intensive organizations, only 35% have a dedicated KM department. Most KM departments measure up to 1–5 FTE. On the other hand, 80% of the respondents indicated that their organization has a KM IT infrastructure.

Data analysis and results

After collecting the data via our survey, we set up our SEM model and assigned our data as described. The PLS-SEM tool that we applied for our analysis is WarpPLS Version 3.0 (Kock, 2012). We preferred this tool over other PLS-SEM tools as it applies Wold's original PLS regression algorithm (Wold, 1982) that renders lower levels of collinearity, no inflated coefficients and more stable weights. Relatedly, since WarpPLS does not let the inner model influence the outer model, interpretational confounding and point variable instability do not influence our research. Moreover, WarpPLS is well suited for applying formative constructs. WarpPLS is also capable of identifying non-linear relationships, which means that it will draw a non-linear (or 'warped') curve instead of a straight linear curve line. This is useful since it is not logical to assume linear relations (Kock, 2011b) and helps to interpret more complex behaviour between two variables. For example: the effect of NKM on DC might be non-linear in nature, increasing for a limited extent of NKM adoption, but decreasing for a larger extent of NKM adoption. Only by using the non-linearity feature of WarpPLS are we allowed to demonstrate and interpret such non-linear effects, should they exist.

To load our data set in WarpPLS, we cleaned our data and left only the data required for the indicators of our model, that is, the indicators for NKM adoption, social capital availability and DC. In addition, we recoded contextual variables such as organizational size and hierarchy in an ordinal way so they can express an 'extent of largeness' and 'extent of hierarchy', respectively. We then imported all measures into WarpPLS and standardized all values to render the measures that were based on varying ordinal ranges dimensionless so as to allow value comparison among the variables. We then defined our hypothesized model in WarpPLS as depicted in Figure 1. All indicators are formatively linked to their first-order constructs, which are in turn formatively linked to their respective second-order constructs. Contrary to Kock's (2011b) approach of modelling second-order variables that resembles a two-stage approach (Ringle *et al*, 2009; Wetzels *et al*, 2009), we applied the repeated indicator approach (Becker *et al*, 2012). A two-stage approach separately estimates the lower- and higher-order model that might cause interpretational confounding (Wilson & Henseler, 2007), although WarpPLS will prevent this from happening as well. Moreover, Becker *et al* (2012) empirically found the repeated indicator approach to yield the most stable model estimations.

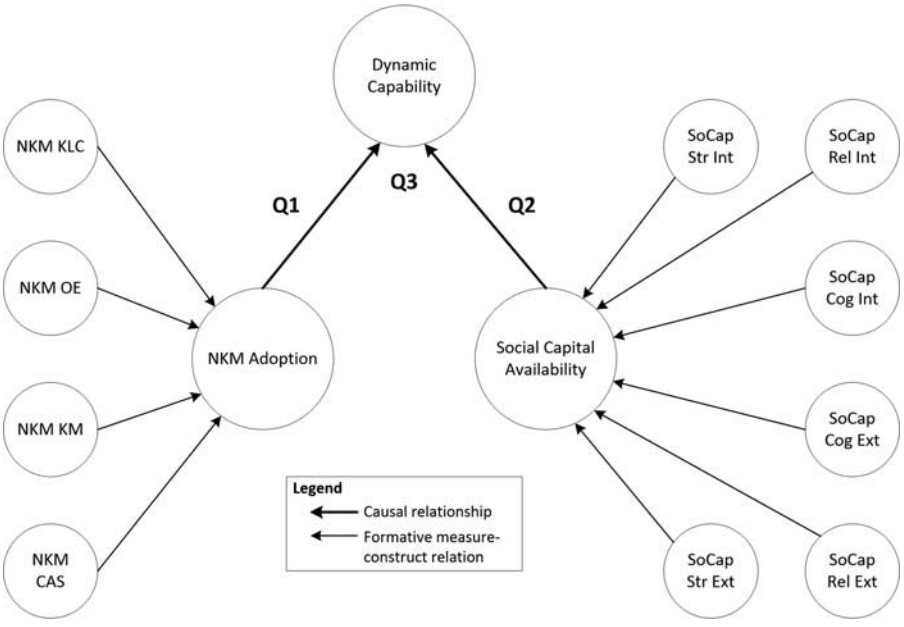

Figure 1 Research model.

Model evaluation

Since our model is fully formatively constructed, we are required to validate our model with formative validation techniques instead of standard tests such as convergent validity and reliability. The indicators that we applied to measure our constructs are not necessarily expected to be highly correlated since they all represent different *aspects* of their respective constructs (Hair *et al*, 2010; Kock, 2010). Therefore, for the validation of our model, we follow the evaluation guidelines for formative PLS-SEM models, as posed by Hair *et al* (2011), that focus on the measurement (outer) model and the structural (inner) model. Instead of applying bootstrapping for significance assessment, we applied jackknifing. This resampling technique has two advantages over bootstrapping: it has more reliable *P*-values and hence renders a more stable model with sample sizes below 100 and reduces the effect of outliers in our data (Kock, 2011a). The model outcomes are displayed in Figure 2.

From a methodological perspective, a requirement for formative constructs is that they form their concept space, meaning that all theoretical concepts of the construct are taken into account by their measures (Petter *et al*, 2007). We have covered this requirement through prior expert and empirical validation of the measures for NKM adoption (van Reijsen *et al*, 2007a) and social capital availability (Kianto & Waajakoski, 2010). The measures for DC were evaluated by peers as well.

On an indicator level (outer model), we evaluated validity by examining the weights (relative contribution) and loadings (absolute contribution) of each indicator on their respective construct. Concerning the weights, Kock (2012) suggests that all *P*-values should be < 0.05. Most of the measures pass this test. Some measures, however, do not. This mainly applies to the measures that form the CAS cornerstone of NKM and the *Cognitive Internal* social capital construct. This finding suggests that these dimensions are either strongly or weakly associated with their respective constructs than the other dimensions. From a theoretical ground, however, there is no argument to remove these dimensions from our model and therefore decided to leave our model intact to examine in more detail how these dimensions behave in relation to their constructs. Concerning the loadings, we find comparable results as with the weights. In addition, Hair *et al* (2011) suggest inspecting each indicator's Variance Inflation Factor (VIF). While VIF factors indicate the extent to which an indicator's variance is explained by the other indicators of the same construct, high VIF values are signs of redundant indicators (Urbach & Ahlemann, 2010).

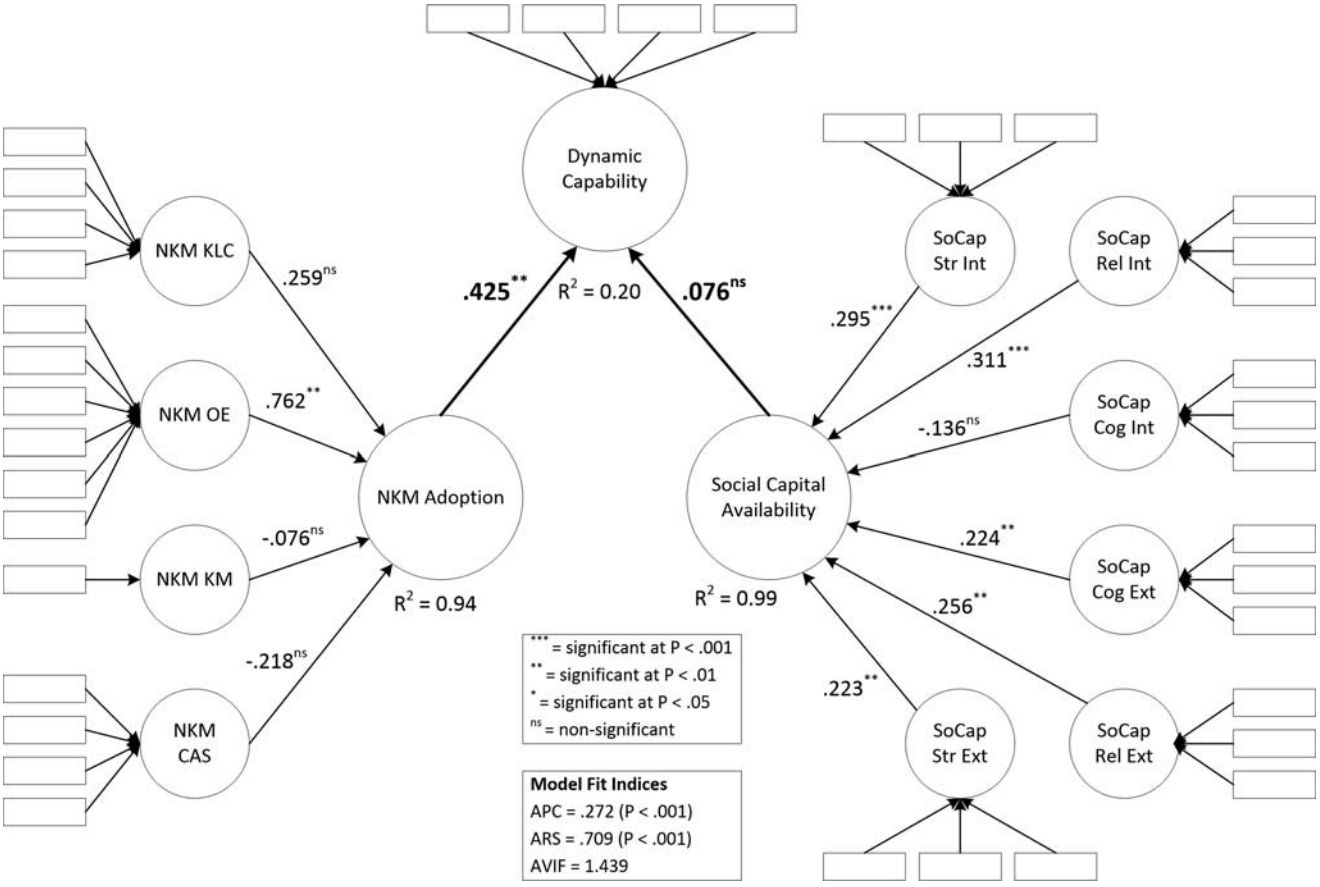

Figure 2 PLS-SEM model and outcomes.

Hair *et al* (2011) suggest that each VIF should be < 5. Kock (2012) suggests a stricter threshold of VIF < 2.5. In our model, all measures pass this stricter test, and hence there is no indication of multicollinearity among our model's indicators.

On a construct level (inner model), the R^2 values for endogenous latent variables indicate the percentage of explained variance for that latent variable, and therefore higher R^2 values indicate a higher explanatory power. The R^2 values of the second-order constructs are expectedly high because they are constructed through the repeated measures method (Becker *et al*, 2012) and hence represent the relationship between the construct and its measures. The R^2 value of the DC construct is 0.20, which Hair *et al* (2011) consider to be weak. Although this points out that the predictive power of our model is low, our goal is rather to find relationships among the constructs. Notwithstanding, we applied a set of additional tests to further evaluate the validity of our construct model (c.f. Foorthuis *et al*, 2012). First, we inspected the full-collinearity VIF for each latent variable that tests vertical and lateral collinearity. Higher values suggest conceptual redundancy. Kock & Lynn (2012) suggest a threshold of < 3.3. In our model, all full-collinearity VIFs are higher. However, lateral collinearity is expected, because we applied a higher-order construct model and used the repeated measures technique to model the second-order constructs. In order to check this assumption, we reconstructed our model in a theoretically identical composition but without a second-order hierarchy (i.e., directly linking all first-order constructs to the DC construct) and found that all full-collinearity VIFs would be then reduced to at least < 1.3. A different test for vertical collinearity is the Block VIF. Kock (2012) suggests a maximum of 3.3. In our model, the highest Block VIF is 1.6. Second, an extent of discriminant validity can be evaluated based on a test suggested by Andreev *et al* (2009) that requires all correlations between constructs to be < 0.71. Here, we only regarded correlations between the second-order constructs and the DC construct, while high correlations between the first- and second-order constructs are again expected. No correlation between the constructs in focus fails this test.

Next, we evaluated full model validity by means of checking several model fit indices. First, we evaluated the Average Path Coefficient (APC), Average R^2 (ARS) and Average Variance Inflation Factor (AVIF) of the model. Kock (2012) suggests that both the APC and ARS values should be significant at the 0.05 level. In our model, both indices are highly significant with *P*-values of < 0.001. Moreover, the AVIF that should be < 5 (Kock, 2012) is 1.4 in our model. Finally, we evaluate Stone and Geiser's Q^2 values for predictive relevance. All Q^2 values should be > 0 (Chin, 2010), which is true in our model.

To investigate the possible influence of organizational conditions on our results, we checked our model for confounding effects by means of controlling for the influence of contextual variables. In WarpPLS, this can be evaluated by modelling a contextual variable as a direct link to an endogenous variable. We applied two contextual variables (organizational size and hierarchy) and found that all significant relations in the original model remain significant while controlling for both contextual variables. From this finding, we derive that all significant relations retain their significance, regardless of organizational size or hierarchy.

As a final test, we visually inspected the curves of the correlations between our exogenous variables (NKM adoption and social capital availability) and our endogenous variable (DC). Since we applied the Warp3 PLS regression algorithm, WarpPLS will try to identify non-linear (warped) relationships (Kock, 2011b) and draw a non-linear curve if the relation between two variables is found to be non-linear in nature. We found that both correlations are indeed non-linear. Moreover, we found two suggestions. First, the NKM curve shows signs of decreasing returns to scale, suggesting that the positive effect of NKM adoption on DC decreases as NKM adoption increases. Second, the social capital availability curve approaches an inverted *u*-curve, which hints that a certain availability of social capital may be supportive for DC, but that too much social capital availability is in fact damaging DC. These findings will be further discussed in the conclusion section of this paper. The two curves are displayed in Figures A1 and A2 in the Appendix.

Discussion of the results

The primary insight that our model provides is the significant ($P < 0.01$) relation of NKM adoption with DC (Q1a). On the other hand, there appears to be no significant relation of social capital availability with DC (Q2a). This leaves us with the preliminary conclusion that the adoption of formal KM policies does and the availability of social capital does not impact DC. In order to better understand the impacts of our independent variables, we drilled down into the dimensions that build up NKM and social capital.

First, we observed how well the first-order NKM adoption constructs individually correlate with the DC construct. A correlation matrix on first-order construct level and an overview of *P*-values is provided in Tables A1 and A2 in the Appendix. It appears that both the KLC ($P < 0.001$) and OE ($P < 0.05$) cornerstone constructs are significantly positively correlated with DC. The other cornerstones are not. The CAS cornerstone is negatively correlated with DC. We argue that the findings occur because of the negative (non-significant) weights for the CAS measures we found earlier. To test this assumption, we re-rendered our model in WarpPLS, applying the Robust Path Analysis algorithm that equalizes all weights (Kock, 2012) and then found that the CAS cornerstone is no longer negatively correlated. However, no positive significant correlation was found either.

To provide more clarity on these findings, we zoomed in even one step further and inspected the correlations

among all individual measures of NKM adoption and DC. A correlation matrix on the measure level and an overview of *P*-values is provided in Table A3 in the Appendix. We found that indeed many KLC and OE policies have significant correlations with the DC construct. Standing out are the *Fact/Value (KLC)*, *Internalization (KLC)* and *Looking for Trouble (OE)* policies (Q1b). Furthermore, we found that most CAS correlations are non-significant, indeed suggesting no effect of the CAS cornerstone on DC. In any case, we should be modest about these CAS findings, given the non-significant weights of the CAS measures in our model.

We then observed how the first-order social capital availability constructs correlate with the DC construct. Here, we find similar results as at the second-order construct level: no significant positive correlations are found. However, we did find a significant negative correlation: the *Internal Cognitive* social capital construct, which is again blurred by the negative (non-significant) weights of the construct measures as found earlier. Re-rendering our model using the Robust Path Analysis algorithm again confirmed that the negative correlation no longer exists if the measure weights are equalized. This finding, however, motivated us to again zoom in one level deeper and inspect the correlations of all individual social capital availability and DC measures. At this level of scope, we found some significant correlations (all positive) for the *Internal* social capital availability measures but almost none for *External* social capital availability (Q2b). Some of the significant correlations are found in the *Cognitive Internal* social capital measures, and thus we have to be modest about these findings. The implications of our findings are discussed in the next section.

Conclusions and discussion

In light of sustainable innovation as the process of striving for sustainable development, a link to organizational knowledge is suggested as its antecedent (McElroy, 2008; Jorna *et al*, 2009). In this paper, we were interested to learn how sustainable innovation can be regarded from a knowledge (management) perspective. We identified DC (Barreto, 2010) as a major component of sustainable innovation and set out to investigate how DC can be leveraged from two key perspectives on knowledge: formal and informal. In more detail, we observed the adoption of formal KM policies by organizations and the availability of social capital and tested whether these approaches towards knowledge are supportive for the DC of these organizations and to what extent.

Key findings

What can we learn from our research? On the basis of our main model, we found that the adoption of formal KM policies has more impact on the DC of an organization than the availability of social capital has. In fact, it appears that the formal perspective on KM (i.e., NKM adoption) is the only perspective that has an observable impact on DC.

This leaves us with the conclusion that, if organizations wish to improve their DC, their primary focus should be on implementing a formal KM approach instead of investing in their social capital (Q3). This approach should stimulate an open organization where knowledge may transparently flow (OE cornerstone) and where focus is on evaluation of that knowledge with regard to its accuracy and usability (KLC cornerstone). Because the findings of Faber *et al* (2005) indicate that in light of sustainable development organizations nowadays rely more than ever on their capability to process knowledge and adapt to changes, it can be argued that adopting the ideas of NKM provides organizations with the means to adequately address these challenges. Interestingly, these findings are consistent with the findings of Noblet *et al* (2011) who also conducted a study on DC (in their research more specifically on absorptive capacity). These authors found that an open organization is more likely to inspire a strong absorptive capacity, which aligns with our findings. Moreover, Noblet *et al* (2011) found that strong managerial commitment is a premise for absorptive capacity. This is in line with our main finding that a formal approach towards knowledge can best stimulate DC.

From a relational perspective, however, our main model did not uncover that the availability of social capital supports organizations to impact their DC. Since a formal and informal approach towards knowledge are in fact two sides of the same coin, we would have expected to find at least some support for an effect of social capital availability. From a theoretical stance, it could be expected that social capital can be of help to improve DC, for example, the existence of structural relations among employees could support more efficient and effective knowledge transfer throughout the organization. Furthermore, the quality of relations (e.g., trust) could be beneficial to the timeliness and validity in which crucial knowledge is exchanged. On the other hand, an abundance of relations could also be distorting to DC: employees with a lot of relations might be overburdened with retaining these relations, which might lead to inertia in knowledge exchange. This is in line with the non-linear relation that we found earlier, although we have to be modest about the non-linear curves, given the relatively low amount of cases that bend the curve. Moreover, but again in modesty, on a measure level, we did find several significant positive correlations for *Internal* social capital availability. This suggests that internal social capital is, to some extent, important for DC and more than external social capital. From a theoretical viewpoint, this again makes sense: DC first and foremost refers to a capability that involves the organization itself, that is, its internal employees. Moreover, it could be argued that organizations can only focus on one of the two perspectives at a time, and since we found hints that internal social capital supports organizations for their DC these organizations cannot be investing in external social capital at the same time. Clearly, our findings call for a more extensive investigation of the role of the informal perspective on knowledge

concerning the DC of organizations. Suggestions are provided below.

Practical implications

As a practical implication, we argue that organizations can embrace the NKM policies in practice to strengthen their DC. Strengthened DC makes organizations more aware of changing conditions and makes them more capable to adapt. In line with the NKM cornerstones that we found to be especially contributing to DC, organizations could strengthen their DC by introducing or underscoring the evaluation of both new and existing knowledge in their knowledge processes (*Fallibility*). In addition, an intervention could be applied that stimulates (incentivizes) employees to challenge the usefulness of existing knowledge and act when this is no longer true (*Fair Comparison*). Furthermore, organizations sho`uld focus on communicating knowledge (know-how and know-who) throughout the organization, so that employees will know what knowledge is available and who to turn to for specific knowledge (*Transparency*). Although IT in itself is no guarantee for knowledge sharing, the introduction of a knowledge repository or Wiki could help to communicate explicit knowledge. Similarly, a Yellow Pages tool could help to communicate tacit knowledge by pointing out which colleague knows what. Another intervention to focus on for organizations is to stimulate employees to evaluate knowledge post-usage, for example, writing down or discussing how available knowledge helped or limited them in performing in a project (*Looking for Trouble*). In line with the notion that KM should not be enforced but should instead provide the right context for knowledge processes to occur naturally, organizations should attune their KM policy creation to this idea. By involving employees in questioning what context and resources are required to work effectively, employees become themselves advocates of policies that support such context and resources (*Policy Synchronization*). Last but not least, organizations should introduce or underscore a knowledge process where the impact of their knowledge on their environment (e.g., customers, suppliers) is questioned (*Internalization*). In line with questioning the usefulness of knowledge for the *internal* organization, organizations should make it a habit to challenge how their knowledge has supported or influenced their *external* environment, for example, by questioning how their knowledge processes have impacted their environment and what knowledge was lacking to support their environment even better. This makes organizations aware that their knowledge processes in fact have impact on their environment and makes them more sensitive to evaluate that impact. This in turn may yield new knowledge that allows organizations to better comply with their changing environment, such as changing market demands, which is a core component of DC.

Investing in social capital could play an additional role to strengthen DC. However, additional research needs to further clarify the role and importance of social capital. Finally, NKM adoption could play a supportive part in corporate social responsibility initiatives. Such initiatives call for process guidelines. For example, the EU strategy on corporate social responsibility (COM, 2011, p. 681) calls for a 'code of good practice for self- and co-regulation exercises, which should improve the effectiveness of the CSR process'. Furthermore, the EU calls for a 'strategic approach to corporate social responsibility where company transparency should be stimulated' (COM, 2011). On the basis of our research findings, we are able to promote adoption of the NKM policies as a means to implement that *code of good practice* and operationalize that *strategic approach*.

Limitations

Concerning our PLS-SEM model, it should be noted that in terms of interpreting our results, we need to apply modesty. While our model did pass an elaborate set of evaluative tests, at least we may claim that our constructs are more than the arbitrary summary composites (Bollen, 2011). On the other hand, constructs cannot be validated in a single study (Cenfetelli & Bassellier, 2009). Clearly, there is room for more research to be conducted before our constructs can be claimed to be mature.

Another limitation could be the comprehensiveness of our central dependent variable 'DC'. As discussed, however, a true operationalization of this construct does not yet exist and would be multi-interpretable (Barreto, 2010). We therefore rely on our proxy measures.

Finally, while McElroy (2006) suggests that sustainable development requires both knowledge on the impact of the organization on the world and the capability to adapt in response, this study only examined the latter aspect. Although not decisive in our research approach, we add that measuring sustainability performance, for example, by means of incorporating a sustainability reporting framework in our survey would have been too extensive to conduct in our sample of 55 organizations. It has therefore been a choice of scope to focus on DC separately.

Future research

We recommend future research to further examine the links between formal and informal knowledge processes and DC. This extension could be achieved in multiple ways. One is to improve the measurement of DC. A framework that measures DC or absorptive capacity specifically could help here. Noblet *et al* (2011) propose such a framework, although it would still need to be operationalized before it can be applied in empirical research. Another extension would be to more deeply inspect the informal perspective of knowledge with regard to DC. Our research findings hinted that social capital availability is nonlinearly related to DC. However, our study does not uncover the inner workings of that relation. It could therefore be relevant to study the effect of informal knowledge characteristics on DC from a different angle, for example, from a relational angle, by means of observing social structures and their effect on DC.

References

AccountAbility (2008) Introduction to the revised AA1000 Assurance Standard and the AA1000 AccountAbility Principles Standard 2008. [WWW document] http://www.accountability.org/images/content/0/9/091/Introduction%20to%20the%20revised%20AA1000AS%20and%20AA1000APS.pdf (accessed 24 February 2012).

Adler P and Kwon SW (2000) Social capital: the good, the bad, and the ugly. In *Knowledge and Social Capital: Foundations and Applications* (Lesser E, Ed), pp 89–118, Butterworth-Heinemann, Boston, MA.

Adler P and Kwon SW (2002) Social capital: prospects for a new concept. *Academy of Management Review* **27**(**1**), 17–40.

Alavi M and Leidner DE (2001) Knowledge management and knowledge management systems: conceptual foundations and research issues. *MIS Quarterly* **25**(**1**), 107–136.

Andreev P, Heart T, Maoz H and Pliskin N (2009) Validating formative Partial Least Squares (PLS) models: methodological review and empirical illustration. In *Proceedings of ICIS 2009* (Nunamaker JF and Currie WL, Eds), Phoenix, AZ.

Awad EM and Ghaziri HM (2004) *Knowledge Management*. Pearson Education, Upper Saddle River, NJ.

Barlett CA and Ghoshal S (1989) *Managing across Borders: The Transnational Solution*. Harvard Business School Press, Cambridge, MA.

Barney JB (1991) Firm resources and sustained competitive advantage. *Journal of Management* **17**(**1**), 99–120.

Barreto I (2010) Dynamic capabilities: a review of past research and an agenda for the future. *Journal of Management* **36**(**1**), 256–280.

Becker JM, Klein K and Wetzels M (2012) Hierarchical latent variable models in PLS-SEM: guidelines for using reflective-formative type models. *Long Range Planning* **45**(**5–6**), 359–394.

Bollen KA (2011) Evaluating effect, composite, and causal indicators in structural equation models. *MIS Quarterly* **35**(**2**), 359–372.

Brown JS and Duguid P (1991) Organizational learning and communities-of-practice: toward a unified view of working, learning, and innovation. *Organization Science* **2**(**1**), 40–57.

Cenfetelli RT and Bassellier G (2009) Interpretation of formative measurement in information systems research. *MIS Quarterly* **33**(**4**), 689–707.

Chin WW (2010) How to write up and report PLS analyses. In *Handbook of Partial Least Squares* (Esposito Vinzi V, Chin WW, Henseler J and Wang H, Eds), pp 655–690, Springer, New York.

Cohen WM and Levinthal DA (1990) Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly* **35**(**1**), 128–152.

Cohen D and Prusak L (2001) *In Good Company: How Social Capital Makes Organizations Work*. Harvard Business School Press, Boston, MA.

Coleman JS (1988) Social capital in the creation of human capital. *American Journal of Sociology* **94**(**Supplement**), S95–S120.

COM (2011) 681 Final 'A renewed EU strategy 2011–14 for Corporate social responsibility'. [WWW document] http://ec.europa.eu/enterprise/policies/sustainable-business/files/csr/new-csr/act_en.pdf (accessed 15 February 2012).

Connell C (2003) The new knowledge management – complexity, learning and sustainable innovation. Book review. *Knowledge Management Research & Practice* **1**(**1**), 64–66.

Cross R and Parker A (2004) *The Hidden Power of Social Networks: Understanding How Work Really Gets Done in Organizations*. Harvard Business School Press, Boston, MA.

Cross R, Borgatti SP and Parker A (2001) Beyond answers: dimensions of the advice network. *Social Networks* **23**(**3**), 215–235.

Daft RL (2003) *Organization Theory and Design*. 8th edn, South-Western College Publishing, Mason, OH.

Danneels E (2008) Organizational antecedents of second-order competences. *Strategic Management Journal* **29**(**5**), 519–543.

Davenport T and Prusak L (1998) *Working Knowledge – How Organisations Manage What They Know*. Harvard Business School Press, Boston, MA.

Doz Y and Hamel G (1997) *Alliance Advantage*. Harvard Business School Press, Cambridge, MA.

Drucker P (1991) *Post-Capitalist Society*. Butterworth-Heinemann, Oxford, UK.

Easterby-Smith M and Prieto IM (2008) Dynamic capabilities and knowledge management: an integrative role for learning? *British Journal of Management* **19**(**3**), 235–249.

Eisenhardt KM and Martin JA (2000) Dynamic capabilities: what are they? *Strategic Management Journal* **21**(**10–11**), 1105–1121.

Faber N, Jorna R and van Engelen J (2005) The sustainability of 'sustainability': a study into the conceptual foundations of the notion of 'sustainability'. *Journal of Environmental Assessment Policy and Management* **7**(**1**), 1–33.

Foorthuis R, van Steenbergen M, Bruls W, Brinkkemper S and Bos R (2012) A claim testing and theory building study of enterprise architecture compliance and benefits. Technical Report, Utrecht University, Utrecht, The Netherlands.

Gefen D, Straub DW and Boudreau M (2000) Structural equation modeling techniques and regression: guidelines for research practice. *Communications of AIS* **7**(**7**), 1–70.

Grant RM (1996) Toward a knowledge-based theory of the firm. *Strategic Management Journal* **17**(**Winter Special Issue**), 109–122.

Gri (2011) Sustainability Reporting Guidelines. Retrieved February 5, 2012, [WWW document] https://www.globalreporting.org/resourcelibrary/G3.1-Sustainability-Reporting-Guidelines.pdf.

Haenlein M and Kaplan AM (2004) A beginner's guide to partial least squares analysis. *Understanding Statistics* **3**(**4**), 283–297.

Hair JF, Black WC, Babin BJ and Anderson RE (2010) *Multivariate Data Analysis*, 7th edn, Pearson Prentice Hall, Upper Saddle River, NJ.

Hair JF, Ringle CM and Sarstedt M (2011) PLS-SEM: indeed a silver bullet. *Journal of Marketing Theory and Practice* **19**(**2**), 139–151.

Hall C (2011) United National global compact annual review 2010. [WWW document] http://www.unglobalcompact.org/docs/news_events/8.1/UN_Global_Compact_Annual_Review_2010.pdf (accessed 24 February 2012).

Hansen MT (1999) The search-transfer problem: the role of weak ties in sharing knowledge across organization subunits. *Administrative Science Quarterly* **44**(**1**), 82–111.

Hedlund G and Nonaka I (1993) Models of knowledge management in the West and Japan. In *Implementing Strategic Process, Change, Learning and Cooperation* (Lorange P, Chakravarthy B, Roos J and van de Ven A, Eds), pp 117–144, Macmillan, London.

Helfat CE *et al* (2007) *Dynamic Capabilities: Understanding Strategic Change in Organizations*. Blackwell, London.

Helms RW (2007) Redesigning communities of practice using knowledge network analysis. In *Hands-On Knowledge Co-Creation and Sharing: Practical Methods and Techniques* (Kazi AS, Wohlfart L and Wolf P, Eds), pp 253–273, Knowledgeboard, Stuttgart, Germany.

Helms RW and Buysrogge CM (2006) Application of knowledge network analysis to identify knowledge sharing bottlenecks at an engineering firm. In *Proceedings of the 14th European Conference on Information Systems* (Ljungberg J and Andersson M, Eds), 12–14 June, Gothenburg, Sweden.

Helms R and van Reijsen J (2008) Impact of knowledge network structure on group performance of knowledge workers in a product software company. In *Proceedings of the 9th European Conference on Knowledge Management* (Harorimana D and Watkins D, Eds), pp 289–296, Academic Conferences, Reading, UK.

Ho L (2008) What affects organizational performance?: the linking of learning and knowledge management. *Industrial Management and Data Systems* **108**(**9**), 1234–1254.

Holland JH (1995) *Hidden Order: How Adaptation Builds Complexity*. Addison-Wesley, Reading, MA.

International Organization for Standardization (2010) Discovering ISO 26000. [WWW document] http://www.iso.org/iso/discovering_iso_26000.pdf (accessed 24 February 2012).

Jarvis CB, MacKenzie SB and Podsakoff PM (2003) A critical review of construct indicators and measurement model misspecification in marketing and consumer research. *Journal of Consumer Research* **30**(**2**), 199–218.

Jashapara A (2004) *Knowledge Management: An Integrated Approach*. Financial Times/Prentice Hall, Harlow, UK.

Jorna RJ, van Engelen JM and Hadders H (2004) *Sustainable Innovation: Organisations and the Dynamics of Knowledge Creation*. Van Gorcum, Assen, The Netherlands.

Jorna RJ, Hadders H and Faber N (2009) Sustainability, learning, adaptation and knowledge processing. In *Knowledge Management and*

Organizational Learning (KING WR, Ed) Annals of Information Systems 4, Springer Verlag, New York.
KANTER RM (1983) *The Change Masters*. Simon & Schuster, New York.
KIANTO A and WAAJAKOSKI J (2010) Linking social capital to organizational growth. *Knowledge Management Research & Practice* **8(1)**, 4–14.
KOCK N (2010) *WarpPLS 1.0 User Manual*. ScriptWarp Systems, Laredo, TX.
KOCK N (2011a) Using WarpPLS in e-collaboration studies: descriptive statistics, settings, and key analysis results. *International Journal of e-Collaboration* **7(2)**, 1–18.
KOCK N (2011b) Using WarpPLS in e-collaboration studies: mediating effects, control and second order variables, and algorithm choices. *International Journal of e-Collaboration* **7(3)**, 1–13.
KOCK N (2012) *WarpPLS 3.0 User Manual*. ScriptWarp Systems, Laredo, TX.
KOCK N and LYNN GS (2012) Lateral collinearity and misleading results in variance-based SEM: an illustration and recommendations. *Journal of the Association for Information Systems* **13(7)**, 546–580.
KOGUT B and ZANDER U (1992) Knowledge of the firm, combinative capabilities and the replication of technology. *Organization Science* **3(3)**, 383–397.
KOTTER JP (1982) *The General Managers*. Free Press, New York.
KOTTER JP (1985) *Power and Influence: Beyond Formal Authority*. Free Press, New York.
KRAATZ MS and ZAJAC EJ (2001) How organizational resources affect strategic change and performance in turbulent environments: theory and evidence. *Organization Science* **12(5)**, 632–657.
LAVE J and WENGER E (1991) *Situated Learning: Legitimate Peripheral Participation*. Cambridge University Press, New York.
LIN N (2001) *Social Capital, Cambridge*. University Press, New York.
LOAN P (2006) Review of the new knowledge management: complexity, learning and sustainable innovation by Mark McElroy. *On the Horizon* **14(3)**, 130–138.
MACDONALD S (1995) Learning to change: an information perspective on learning in the organization. *Organization Science* **6(5)**, 557–568.
MAKADOK R (2001) Toward a synthesis of the resource-based and dynamic-capability views of rent creation. *Strategic Management Journal* **22(5)**, 387–401.
MARCOULIDES GA and SAUNDERS C (2006) PLS: a silver bullet? *MIS Quarterly* **30(2)**, iii–ix.
MCELROY MW (2003) *The New Knowledge Management*. Butterworth-Heinemann, Boston, MA.
MCELROY MW (2006) The sustainability code – a policy model for achieving sustainability in human social systems. [WWW document] http://www.sustainableinnovation.org/The-Sustainability-Code.pdf (accessed 3 July 2006).
MCELROY MW (2008) *Social Footprints: Measuring the Social Sustainability Performance of Organizations*. Doctoral Dissertation, Groningen University, Groningen, The Netherlands.
MIGUEL L, FRANKLIN M and POPADIUK S (2008) The knowledge creation with view to innovation as a dynamic capability in competitive firms. *Journal of Academy of Business and Economics* **8(4)**, 45–56.
MILES R and SNOW C (1994) *Fit Failure and the Hall of Fame*. Free Press, New York.
NAHAPIET J and GHOSHAL S (1998) Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review* **23(2)**, 242–266.
NOBLET J, SIMON E and PARENT R (2011) Absorptive capacity: a proposed operationalization. *Knowledge Management Research & Practice* **9(4)**, 367–377.
NOWE K (2003) Review of: McElroy, Mark W. The new knowledge management. Complexity, learning, and sustainable innovation. In *Information Research* (MUÑOZ JVR, Ed), 8(2), Review 081. KMCI Press, Butterworth-Heinemann, Boston, MA.
ORR J (1990) *Talking about Machines: An Ethnography of a Modern Job*. Cornell University, Ithaca, NY.
PENROSE ET (1959) *The Theory of the Growth of the Firm*. Wiley, New York.
PETTER S, STRAUB D and RAI A (2007) Specifying formative constructs in information systems research. *MIS Quarterly* **31(4)**, 623–656.
PUTNAM R (1993) The prosperous community: social capital and public life. *The American Prospect* **4(13)**, 35–42.
REINARTZ WJ, HAENLEIN M and HENSELER J (2009) An empirical comparison of the efficacy of covariance-based and variance-based SEM. *International Journal of Market Research* **26(4)**, 332–344.
RINGLE CM, GÖTZ O, WETZELS M and WILSON B (2009) On the use of formative measurement specifications in structural equation modeling: a Monte Carlo simulation study to compare covariance-based and partial least squares model estimation methodologies, *METEOR Research Memoranda* RM/09/014, Maastricht University, Maastricht, The Netherlands.
SMITH H and MCKEEN J (2003) Knowledge management in organizations: the state of current practice. In *Handbook on Knowledge Management* (HOLSAPPLE CW, Ed), Springer-Verlag, New York.
SOSIK JJ, KANHAI SS and PIOVOSO MJ (2009) Silver bullet or voodoo statistics? A primer for using the partial least squares data analytic technique in group and organization research. *Group & Organization Management* **34(1)**, 5–36.
SPENDER JC (1996) Making knowledge the basis of a dynamic theory of the firm. *Strategic Management Journal* **17(Winter Special Issue)**, 45–62.
TEECE DJ (2000) Strategies for managing knowledge assets: the role of firm structure and industrial context. *Long Range Planning* **33(1)**, 35–54.
TEECE DJ (2007) Explicating dynamic capabilities: the nature and micro-foundations of (sustainable) enterprise performance. *Strategic Management Journal* **28(13)**, 1319–1350.
TEECE DJ, PISANO G and SHUEN A (1997) Dynamic capabilities and strategic management. *Strategic Management Journal* **18(7)**, 509–533.
THOMAS KW and VELTHOUSE BA (1990) Cognitive elements of empowerment: an 'interpretive' model of intrinsic task motivation. *The Academy of Management Review* **15(4)**, 666–681.
TRIOLA MF (2004) *Elementary Statistics*, 9th edn, Pearson Education, Boston, MA.
URBACH N and AHLEMANN F (2010) Structural equation modeling in information systems research using partial least squares. *Journal of Information Technology Theory and Application* **11(2)**, 5–40.
VAN REIJSEN J, HELMS RW and BATENBURG RS (2007a) Validation of the new knowledge management claim. In *Proceedings of the 15th European Conference on Information Systems* (Osterle H, Schelp J and Winter R, Eds), pp 552–564, University of St. Gallen, St. Gallen, Switzerland.
VAN REIJSEN J, HELMS RW and BATENBURG RS (2007b) Organizational conditions for new knowledge management application. In *Proceedings of the 8th European Conference on Knowledge Management* (Martins B, Ed), pp 1040–1047, Academic Conferences, Barcelona, Spain.
WEGGEMAN M (1997) *Kennismanagement – Inrichting en besturing van kennisintensieve organisaties (in Dutch)*. Scriptum Management, Schiedam, The Netherlands.
WERNERFELT B (1984) A resource-based view of the firm. *Strategic Management Journal* **5(2)**, 171–180.
WETZELS M, ODEKERKEN-SCHRODER 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.
WIIG K (1993) *Knowledge Management Foundations*. Schema Press, Arlington, TX.
WILSON B and HENSELER J (2007) Modeling reflective higher-order constructs using three approaches with PLS path modeling: a Monte Carlo comparison. *Australian and New Zealand Marketing Academy Conference*, Otago, New Zealand, 791–800.
WINTER SG (2003) Understanding dynamic capabilities. *Strategic Management Journal* **24(1)**, 991–995.
WOLD H (1982) Soft modeling: the basic design and some extensions. In *Systems Under Indirect Observations: Part I* (JÖRESKOG KG and WOLD H, Eds), pp 1–54, North-Holland, Amsterdam, The Netherlands.
WU J (2008) *Exploring the Link between Knowledge Management Performance and Firm Performance*. Doctoral dissertation, University of Kentucky, Lexington, KY.
ZAHRA SA, SAPIENZA HJ and DAVIDSSON P (2006) Entrepreneurship and dynamic capabilities: a review, model and research agenda. *Journal of Management Studies* **43(4)**, 917–955.
ZOLLO M and WINTER SG (2002) Deliberate learning and the evolution of dynamic capabilities. *Organization Science* **13(3)**, 339–351.

About the authors

Jurriaan van Reijsen, M.Sc., obtained his masters in Business Informatics at Utrecht University. Since 2006, he has been a Ph.D. candidate at Department of Information and Computing Sciences, Utrecht University. His research interests and publications are in the field of knowledge management, social network analysis and dynamic capabilities. He is a reviewer for various international conferences in the Information Systems and Knowledge Management domains. Also, he is the founder of Comprehend, the platform that connects his research findings to business practice.

Remko Helms is an Assistant Professor at the Department of Information and Computing Sciences at Utrecht University, where he teaches Knowledge Management and Strategic Management of ICT. His research focuses on knowledge management with a focus on knowledge-sharing networks and social media. He regularly reviews for various Information Systems conferences and journals, is the department editor for Connected Scholars at the Association of Information Systems and co-founder of the International Association for Knowledge Management (E-mail: r.w.helms@uu.nl).

Ronald Batenburg obtained his masters at Utrecht University and his Ph.D. in 1991 at Groningen University. Afterwards, he worked at the Universities of Utrecht, Tilburg and Nijmegen as Assistant Professor in organization science. Since 2000, he has been an Associate Professor at Department of Information and Computing Sciences, Utrecht University. Since 2009, he has also been a programme coordinator at the Netherlands Institute for Health Services Research (NIVEL), focusing on organizations and labour markets, specifically in relation to IT and health care (E-mail: r.s.batenburg@uu.nl).

Ralph Foorthuis is currently a Senior IT Architect at UWV. He has worked at several organizations as a business and IT architect, systems analyst, database designer and developer. He has studied at the University of Amsterdam, where he obtained his masters in both Informatics and Communication Science. He holds a Ph.D. in Information Systems and has published multiple articles on enterprise architecture, projects and compliance (E-mail: r.m.foorthuis@uu.nl).

Appendix

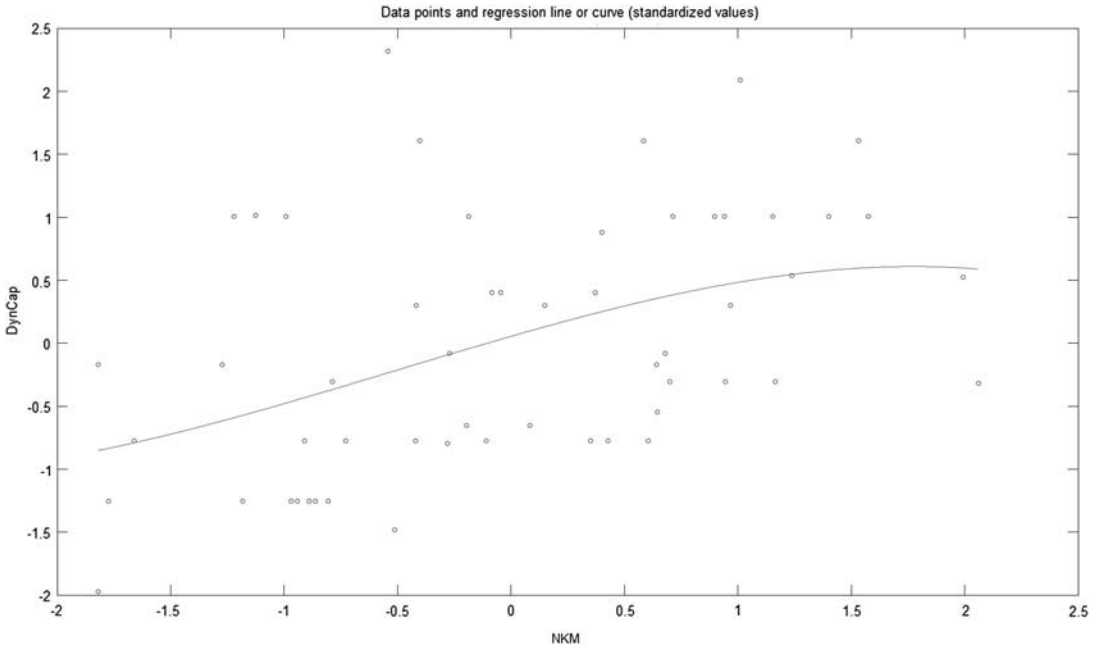

Figure A1 Curve of NKM adoption and DC.

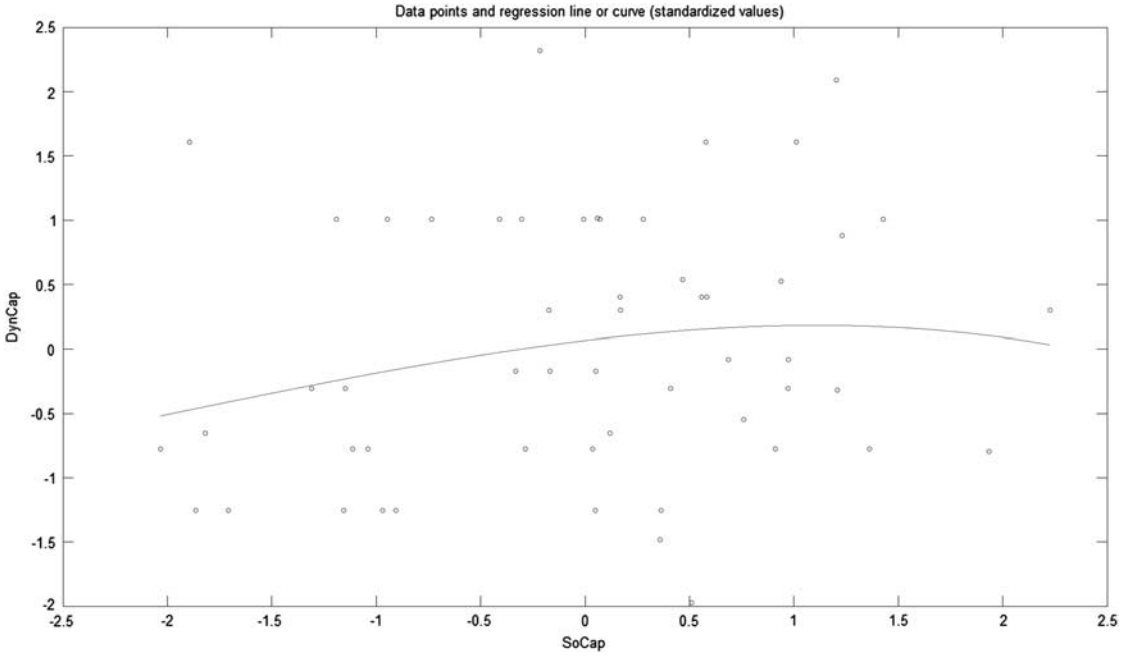

Figure A2 Curve of social capital availability and DC.

Table A1 Correlations between the latent variables (with $\sqrt{AVE}$ shown on diagonal)

	DynCap	*NKM KLC*	*NKM OE*	*NKM KM*	*NKM CAS*	*NKM*	*SoCap Str Int*	*SoCap Rel Int*	*SoCap Cog Int*	*SoCap Str Ext*	*SoCap Rel Ext*	*SoCap Cog Ext*	*SoCap*
DynCap	**0.708**	0.432	0.34	0.118	–0.316	0.44	–0.05	0.217	–0.406	0.075	0.114	0.116	0.179
NKM KLC	0.432	**0.609**	0.164	0.007	–0.564	0.513	–0.162	–0.067	–0.096	–0.073	0.257	0.074	0.011
NKM OE	0.34	0.164	**0.578**	0.157	–0.324	0.866	0.192	0.296	–0.16	0.165	0.383	0.21	0.363
NKM KM	0.118	0.007	0.157	**1**	0.096	0.011	–0.195	–0.008	–0.048	–0.03	0.077	0.023	–0.041
NKM CAS	–0.316	–0.564	–0.324	0.096	**0.565**	–0.628	–0.136	–0.099	0.102	–0.088	–0.418	0.044	–0.206
NKM	0.44	0.513	0.866	0.011	–0.628	**0.45**	0.124	0.259	–0.192	0.104	0.426	0.117	0.312
SoCap Str Int	–0.05	–0.162	0.192	–0.195	–0.136	0.124	**0.807**	0.49	–0.176	0.319	0.289	0.242	0.68
SoCap Rel Int	0.217	–0.067	0.296	–0.008	–0.099	0.259	0.49	**0.758**	–0.396	0.407	0.282	0.208	0.71
SoCap Cog Int	–0.406	–0.096	–0.16	–0.048	0.102	–0.192	–0.176	–0.396	**0.666**	–0.259	–0.144	–0.286	–0.487
SoCap Str Ext	0.075	–0.073	0.165	–0.03	–0.088	0.104	0.319	0.407	–0.259	**0.749**	0.469	0.367	0.729
SoCap Rel Ext	0.114	0.257	0.383	0.077	–0.418	0.426	0.289	0.282	–0.144	0.469	**0.738**	0.479	0.687
SoCap Cog Ext	0.116	0.074	0.21	0.023	0.044	0.117	0.242	0.208	–0.286	0.367	0.479	**0.744**	0.625
SoCap	0.179	0.011	0.363	–0.041	–0.206	0.312	0.68	0.71	–0.487	0.729	0.687	0.625	**0.503**

Highlighted values are significant relationships at least at the < 0.05 level.

Table A2 *P*-values for correlations between the latent variables

	DynCap	*NKM KLC*	*NKM OE*	*NKM KM*	*NKM CAS*	*NKM*	*SoCap Str Int*	*SoCap Rel Int*	*SoCap Cog Int*	*SoCap Str Ext*	*SoCap Rel Ext*	*SoCap Cog Ext*	*SoCap*
DynCap		< 0.001	0.011	0.389	0.019	< 0.001	0.715	0.112	0.002	0.589	0.409	0.4	0.19
NKM KLC	0.001		0.23	0.957	< 0.001	< 0.001	0.238	0.625	0.484	0.596	0.058	0.592	0.936
NKM OE	0.011	0.23		0.253	0.016	< 0.001	0.16	0.028	0.244	0.229	0.004	0.124	0.006
NKM KM	0.389	0.957	0.253		0.484	0.935	0.153	0.955	0.73	0.826	0.576	0.869	0.764
NKM CAS	0.019	< 0.001	0.016	0.484		< 0.001	0.32	0.474	0.457	0.523	0.001	0.748	0.132
NKM	0.001	< 0.001	< 0.001	0.935	< 0.001		0.367	0.056	0.161	0.451	0.001	0.393	0.02
SoCap Str Int	0.715	0.238	0.16	0.153	0.32	0.367		< 0.001	0.199	0.018	0.032	0.076	< 0.001
SoCap Rel Int	0.112	0.625	0.028	0.955	0.474	0.056	< 0.001		0.003	0.002	0.037	0.128	< 0.001
SoCap Cog Int	0.002	0.484	0.244	0.73	0.457	0.161	0.199	0.003		0.056	0.294	0.034	< 0.001
SoCap Str Ext	0.589	0.596	0.229	0.826	0.523	0.451	0.018	0.002	0.056		< 0.001	0.006	< 0.001
SoCap Rel Ext	0.409	0.058	0.004	0.576	0.001	0.001	0.032	0.037	0.294	< 0.001		< 0.001	< 0.001
SoCap Cog Ext	0.4	0.592	0.124	0.869	0.748	0.393	0.076	0.128	0.034	0.006	< 0.001		< 0.001
SoCap	0.19	0.936	0.006	0.764	0.132	0.02	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	

Highlighted values are significant relationships at least at the < 0.05 level.

Table A3 Correlations between the individual measures of NKM adoption, social capital availability and DC, including their *P*-values

	DynCap Correlations				*DynCap P-values*			
NKM KLC	*Proxy 1*	*Proxy 2*	*Proxy 3*	*Proxy 4*	*Proxy 1*	*Proxy 2*	*Proxy 3*	*Proxy 4*
NKM.Fallability	–0.17	–0.03	–0.08	0.07	0.222	0.805	0.543	0.623
NKM.Fact / Value	**0.34**	**0.40**	**0.50**	0.22	**0.011**	**0.002**	**0.001**	0.111
NKM.Fair Comparison	**0.28**	0.12	0.26	–0.12	**0.038**	0.405	0.054	0.38
NKM.Internalization	**0.28**	0.18	0.05	**0.28**	**0.036**	0.18	0.71	**0.042**
NKM OE								
NKM.Transparency	–0.01	0.04	0.13	0.08	0.946	0.766	0.338	0.563
NKM.Inclusiveness	0.17	**0.28**	0.10	0.26	0.213	**0.041**	0.476	0.054
NKM.Looking for Trouble	0.16	**0.27**	–0.04	**0.35**	0.231	**0.045**	0.763	**0.008**
NKM.Growth of Knowledge	0.22	0.25	0.13	**0.31**	0.11	0.065	0.337	**0.02**
NKM.Policy Synchronization	0.08	0.14	0.10	0.16	0.571	0.32	0.473	0.236
NKM.Enforcement	0.04	–0.04	0.06	**0.28**	0.772	0.778	0.681	**0.042**
NKM KM								
NKM.Knowledge Management	0.22	0.09	0.04	–0.07	0.108	0.526	0.767	0.615
NKM CAS								
CAS.Politics of Knowledge	–0.19	–0.22	–0.02	–0.04	0.162	0.103	0.87	0.791
CAS.Embryology	0.15	0.19	0.12	0.12	0.288	0.161	0.386	0.4
CAS.Ethodiversity	0.13	0.23	–0.04	0.16	0.33	0.095	0.749	0.26
CAS.Connectedness	–0.11	0.22	0.20	**0.36**	0.448	0.111	0.15	**0.006**
SoCap structural internal								
SC.Structural.Internal.1	–0.04	–0.02	–0.19	0.19	0.795	0.908	0.163	0.157
SC.Structural.Internal.2	–0.15	0.05	–0.16	0.17	0.289	0.698	0.26	0.213
SC.Structural.Internal.3	–0.12	–0.09	–0.21	**0.32**	0.397	0.533	0.13	**0.018**
SoCap relational internal								
SC.Relational.Internal.1	–0.02	–0.02	0.03	0.13	0.901	0.908	0.832	0.365
SC.Relational.Internal.2	0.17	0.14	0.09	**0.43**	0.207	0.315	0.53	**0.001**
SC.Relational.Internal.3	0.01	0.15	0.04	**0.42**	0.96	0.265	0.791	**0.002**
SoCap cognitive internal								
SC.Cognitive.Internal.1	–0.04	0.02	–0.10	0.08	0.753	0.908	0.488	0.588
SC.Cognitive.Internal.2	**0.35**	**0.33**	0.07	**0.29**	**0.01**	**0.015**	0.638	**0.033**
SC.Cognitive.Internal.3	0.17	**0.30**	0.09	0.26	0.217	**0.024**	0.52	0.057
SoCap structural external								
SC.Structural.External.1	–0.13	0.03	–0.02	0.16	0.343	0.859	0.911	0.237
SC.Structural.External.2	0.08	0.15	0.08	0.15	0.549	0.281	0.555	0.275
SC.Structural.External.3	–0.04	–0.05	–0.02	0.12	0.747	0.736	0.887	0.367
SoCap relational external								
SC.Relational.External.1	–0.03	0.10	0.17	0.14	0.804	0.486	0.204	0.317
SC.Relational.External.2	–0.05	0.06	0.08	0.14	0.746	0.683	0.581	0.314
SC.Relational.External.3	–0.07	0.10	0.06	0.17	0.592	0.468	0.674	0.204
SoCap cognitive external								
SC.Cognitive.External.1	0.10	0.04	0.02	0.09	0.466	0.802	0.902	0.499
SC.Cognitive.External.2	0.09	–0.06	0.14	–0.12	0.517	0.668	0.299	0.402
SC.Cognitive.External.3	0.10	0.06	0.08	**0.34**	0.479	0.684	0.587	**0.011**

Bold values are significant at least at the < 0.05 level.