

## Getting the best solution from a supplier – A social capital perspective

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### ABSTRACT

Due to the current shift towards solution provision in many industrial markets, buyers are under increasing pressure to develop sourcing strategies to procure custom solutions for their firm in order to achieve competitive advantage. The question arises as to how buyers can ensure they get the best solutions from their suppliers and whether social capital can be applied to improve solution provision processes and value creation. Existing empirical research, however, has paid only little attention to the antecedents of suppliers' solution provision performance, i.e., their capability to diagnose buyer needs and to design and implement solutions to meet them. We tested how social capital dimensions (relational, cognitive, and structural) relate to solution provision. The study uses empirical data obtained from a survey of 475 suppliers representing both manufacturing and service industries. Partial least squares (PLS) structural equation modeling (SEM) and polynomial regression were used to analyze the data. The results demonstrate that the availability of social capital in a buyer-supplier relationship is a relevant antecedent to successful solution provision activities. However, the different dimensions of social capital are found to compensate for each other to some extent. Our study further demonstrates that solution provision is not a monolithic activity but can better be understood as a multi-phase process (diagnosis, solution design, and implementation). Different aspects of social capital may have a different impact depending on the phase of solution provision. The successful diagnosis of buyer needs mediates the effect of social capital on solution design and implementation. It is also found that production characteristics of a buyer and the type of a supplier solution affect the role of social capital in solution provision process.

### 1. Introduction

In many industries and markets, we are witnessing a shift toward solution business, as firms supplying products and services are increasingly offering combinations of services and products that are customized, integrated, and solve customer-specific problems (Nordin and Kowalkowski, 2010; Tuli et al., 2007; Davies et al., 2006; Sawhney, 2006). Solution provision enables suppliers to differentiate themselves and create new kinds of value (Kim et al., 2006). New solutions shift greater responsibility to suppliers in the business of their buyers. However, skillful suppliers are few in number. This study investigates the antecedents to successful solution provision in a buyer-supplier context by investigating the role played by social capital.

*Solutions* are typically broad and complex offerings that require buyers to not only source products and services but also to enable technical integration, provide specific competencies, and focus on the total usage context (cf. Tuli et al., 2007; Nordin and Kowalkowski, 2010). There are several examples of this phenomenon in practice. Rolls-Royce provides a TotalCare solution labeled “power-by-the-hour”

that includes aircraft engines supported by maintenance, repair, and upgrading services (Kim et al., 2006) to facilitate flight scheduling and increase aircraft availability. Airlines essentially pay for trouble-free operation in a long-term contract. Similarly, in the logistics company participating in this study, a forklift supplier determined the optimal number of forklifts, related resources, and warehouse processes on behalf of its buyer.

Solution provision is a much more complex process than the conventional delivery of goods or services. Since the final product is difficult to analyze at the moment of contracting, the supplier has to demonstrate its competence to offer a solution (Golfetto and Gibbert, 2006). At the same time, the literature on solution business suggests that solution provision should be customer-driven and linked to clear customer needs. However, studies by Tuli et al. (2007) and Nordin and Kowalkowski (2010) have found that many customers struggle in describing their total problems and needs. Hence, solution provision often takes the shape of a problem-solving process, during which the customer's needs and the supplier's offerings are matched in interaction between the two actors (Aarikka-Stenroos and Jaakkola, 2012). Recent

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literature on solutions has emphasized the processual nature of solution provision, i.e., the process comprises different collaborative tasks such as defining needs, designing feasible options, and eventually implementing solutions (see e.g., Tuli et al., 2007; Aarikka-Stenroos and Jaakkola, 2012; Petri and Jacob, 2016).

In the present study, the terms *buyer* or *buyer firm* will be used to refer to a customer company interacting with a supplier in solution provision. It is notable that solution provision activities involve people widely across a buyer firm and not only employees representing the purchasing function. In turn, *solution provision* includes interaction that defines both *what* is delivered and *how* it is delivered, requiring buyers and suppliers to commit to shared goals, understand the internal processes of the buyer, create trust, and co-operate (Hakanen and Jaakkola, 2012). Consequently, solution provision is an interactive, value-creating process between the supplier and buyer that must be managed. In this paper, we address this challenge by focusing on the link between social capital and the solution provision process by analyzing how social capital affects solution provision. Taking social interaction as a point of departure, it can be hypothesized that the availability of social capital is highly relevant for optimizing solution provision (e.g., Nahapiet and Ghoshal, 1998). Understanding social capital as an antecedent to solution provision could offer a key to managing the complex buyer-supplier relationships. Surprisingly, the literature on solution provision has not yet detailed out social capital's role in solution provision.

Social capital theory supports the analysis of buyer-supplier relationships with complex social processes (Horn et al., 2014) and powerfully theorizes the characteristics of connections and collaboration between organizations (Adler and Kwon, 2002). It is also beneficial for examining the link between social networks of companies and competitive advantage (Carey et al., 2011). Social capital has been successfully used as a tool to analyze interaction processes in business networks (Butler and Purchase, 2008; Hartmann and Herb, 2014; Purchase and Phungphol, 2008) and supply chains (Krause et al., 2007; Lawson et al., 2008; Preston et al., 2017). The basic assumption is that resource exchange between companies requires the development of relational, structural, and cognitive social capital in these business relationships (Hughes and Perrons, 2011). For example, software platforms such as product information systems can provide structural capital for the interactions in solution design.

Several studies on purchasing and supply management have concentrated on the performance implications of social capital on individual companies, often buyers (Krause et al., 2007; Lawson et al., 2008; Villena et al., 2011), and emphasize operational performance benefits rather than impacts on strategic performance (Gelderman et al., 2016). Prior research has paid less attention to complex value creation through social capital in buyer-supplier relationships (Hughes and Perrons, 2011) and to the relevant activities required (e.g., suppliers' diagnosis of buyer needs). A study by Madhavaram and Hunt (2017) investigated social capital in the customization of a supplier's offerings for buyers but focused only on the use of social capital for the internal interactions of a single company, while the present study focuses on buyer-supplier relationships. Further, existing research has mostly concentrated on product delivery (e.g. Lee, 2015; Gelderman et al., 2016; Whipple et al., 2015), while solution provision has gained very limited attention.

Based on the simultaneous lack of theory-backed explanations for successful solution provision (cf. Tuli et al., 2007) and the suggestion of social capital theory as a promising approach to apply to interaction-intensive activities (Horn et al., 2014; Nahapiet and Ghoshal, 1998), the following research questions arise:

RQ1: Can the dimensions of social capital explain successful buyer-supplier solution provision?

RQ2: If so, which forms of social capital are important for which activities of solution provision?

The empirical content of this paper is based on a sample of 475 responses analyzed by partial least squares (PLS) based on structural equation modeling (SEM), multigroup analysis, and polynomial regression. The sample includes both manufacturing and service companies. While the buyers of the supplier respondents are headquartered in Nordic countries, the suppliers operate globally on all continents, but the majority are located in European countries.

The findings support the usefulness of social capital theory to analyze solution provision by explaining about half of the variance between effective and poor solution provision. However, the results also demonstrate that the diverse types of social capital influence the activities of solution provision differently. The activity most significantly affected by social capital in the buyer-supplier relationship is the diagnosis of buyer needs. Structural capital may play a stronger role in solution provision than relational capital.

This paper intends to generate useful knowledge for purchasing and supply management by analyzing social capital in solution provision. The study contributes to the social capital research by showing how the different dimensions of social capital ensure and improve a supplier's solution provision performance. To the best of our knowledge, this study is the first to apply polynomial regression to social capital and is therefore able to show that some dimensions of social capital (structural and relational capital) can compensate for each other in the presented context. This has substantial implications both for theory and practical applications in the field of purchasing and supply management. Further, this paper contributes by testing a model of solution provision including different processual activities. As the majority of solution research is qualitative or conceptual in nature (e.g., Tuli et al., 2007; Nordin and Kowalkowski, 2010; Aarikka-Stenroos and Jaakkola, 2012; Hakanen and Jaakkola, 2012), there is an urgent need to study and quantitatively test how the solution provision process within buyer-supplier interactions can be optimized. The empirical value of including several solution provision activities is demonstrated, emphasizing the need for a differentiated view on solution provision. Finally, the successful use of social capital theory can provide a new theoretical foundation for solution business research and, as such, open new avenues for fruitful research.

## 2. Literature review

### 2.1. Social capital in supply chains

Social capital has long been identified as relevant to many business activities. This topic has attracted significant academic attention in recent decades with studies investigating social capital in the relationships of individuals and organizations (Tsai and Ghoshal, 1998). Social capital has been utilized in many different contexts such as operations, personnel, and innovation management (Lawson et al., 2008). The supply chain context has also been increasingly studied in light of social capital (e.g., Krause et al., 2007; Lawson et al., 2008; Horn et al., 2014; Hartmann and Herb, 2014; Koka and Prescott, 2002). The availability of social capital may also stand at the core of supplier satisfaction with a customer (Schiele et al., 2015). Next, we discuss the essence of social capital and then zoom into what has been written previously about the role social capital plays in supply chain contexts.

Nahapiet and Ghoshal (1998, p. 243) define 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". Social capital captures the various dimensions of relational contexts where companies co-create value and exchange resources (Nahapiet and Ghoshal, 1998). Social capital has been found to facilitate interactions and operations between actors, improve efficiency, and bind actors together (Nahapiet and Ghoshal, 1998). Social capital represents the social ties that exist between actors (both individuals and organizations), supporting their access to the benefits that arise from these ties (Portes, 1998). Social capital also includes the

capability of companies working in networks to obtain benefits such as access to resources, knowledge, technologies and markets (Inkpen and Tsang, 2005). It can be seen as goodwill rooted in social relations and obtainable for individuals and groups (Adler and Kwon, 2002). Difficulty to imitate social ties enhances the ability of social capital to facilitate competitive advantage (Edelman et al., 2004). Social capital can be used to analyze buyer-supplier relationships, which include complex social processes where the partners communicate, exchange information, jointly solve problems, and form interdependent relationships (Horn et al., 2014).

The following three dimensions of social capital have been identified: structural, cognitive and relational (Nahapiet and Ghoshal, 1998). The *structural dimension* refers to the impersonal formation of linkages and the existence of connections in a social structure (structural links) (Nahapiet and Ghoshal, 1998; Villena et al., 2011). The structural dimension can refer to the density of interactions and the number of connections in a social system which are beneficial in resource exchange (Zaheer and Bell, 2005). A high level of structural capital exists when relationship partners interact through multiple channels. The benefits of the structural dimension become more apparent through frequent interactions at different levels (e.g., strategic or operative) and for different functions (e.g., marketing and purchasing) (Villena et al., 2011).

The *cognitive dimension* consists of shared interpretations such as codes, goals, norms, and attitudes that support the social system (Horn et al., 2014; Tsai and Ghoshal, 1998). The shared culture and interpretations that result from the relationship between involved actors and joint goals are important components of cognitive capital (Inkpen and Tsang, 2005; Villena et al., 2011).

The *relational dimension* refers to the relationships developed between individuals through interactions (Nahapiet and Ghoshal, 1998). Trust, commitment, and mutual respect between parties are common embodiments of the relational component of social capital (Carey et al., 2011; Kale et al., 2000; Lee and Cavusgil, 2006). Trust especially is often regarded as a key element of relational capital (Horn et al., 2014; Tsai and Ghosal, 1998; Whipple et al., 2015).

Table 1 summarizes previous empirical studies on social capital in supply chains and buyer-supplier relationships. Although the various dimensions of social capital have been studied, much of the previous research has not incorporated all three forms of social capital (Matthews and Marcek, 2012). Specifically, relational capital has received most attention (Krause et al., 2007; Lawson et al., 2008; Min et al., 2008) in previous research, while cognitive capital has been particularly understudied (Gelderman et al., 2016). The present study incorporates the three forms of social capital, which enables a comparison of their impacts.

Most previous studies either assessed interconnections between the dimensions of social capital (Carey et al., 2011; Horn et al., 2014; Roden and Lawson, 2014) or investigated the operational performance benefits of social capital, such as cost, delivery performance and quality (Carey et al., 2011; Lawson et al., 2008; Matthews and Marcek, 2012; Whipple et al., 2015). Previous research also indicates that social capital is beneficial to strategic performance, i.e., product development and technology development (Gelderman et al., 2016; Villena et al., 2011). The present study extends previous findings by specifying the benefits of social capital for suppliers' solution provision activities. In this way we also answer to the call for more sophisticated measurements of mutual buyer-supplier benefits of social capital (Gelderman et al., 2016). It can be assumed that social capital may be of only limited importance in delivering goods, whereas its importance may increase notably in the provision of complex solutions. Surprisingly, this viewpoint has yet not received notable attention in the literature.

All of the studies reviewed examined manufacturing contexts, typically in cross-industrial settings. This study contributes by incorporating a service context into the analysis. With a relatively small number of survey responses, the samples of previous studies have not

enabled a comparison of industry differences in the results. This study compares the findings between different contextual settings. Many earlier studies examined the role of social capital in business relationships from the buyer perspective (Gelderman et al., 2016). This study sheds light on the supplier viewpoint.

## 2.2. Solution business and solution provision process

A *solution* is widely understood as a customized and integrated combination of services and products that meets the business needs of a buyer (Davies et al., 2006; Sawhney, 2006). Different viewpoints regarding solutions may exist between suppliers and buyers: suppliers see solutions as a sum of products and services, while buyers highlight the importance of relational activities during the provision of an offering, which include defining the buyer's requirements and customizing, implementing, and delivering a solution (Tuli et al., 2007).

Solution business and provision can be linked to extensive research currently taking place on value creation, and particularly to service dominant logic and its concept of value-in-use, which is the final outcome of value co-creation process (Vargo and Lusch, 2004) integrating resources of participating actors (Vargo et al., 2008). Partly following this thinking, we approach solution provision as a value creation process that requires suppliers to interact with buyers and includes several process elements aimed at creating optimal value.

In order to study social capital in a value-creating, interactive solution provision process, the process must be modeled as such. A few studies have already presented process models for solution provision. In the model by Tuli et al. (2007), four process phases were proposed, namely, requirements definition, customization and integration, deployment, and post-deployment support. Aarikka-Stenroos and Jaakkola (2012) identified five supplier activities of which three process elements address solution provision, namely, diagnosing the needs, designing and producing the solution, implementing the solution, and two other elements focused on managing and supporting the process as a whole, namely, managing value conflicts and organizing the process and resources. This study concentrates on the three activities directly related to the solution provision process: the diagnosis of buyer needs, the design of a solution and implementation of a solution. The two other activities of the model were excluded due to their broader and more supportive nature.

The *diagnosis of buyer needs* is a critical part of the solution provision process. Because buyers often lack a proper understanding of their own needs (Lapierre, 1997), successful suppliers may help buyers identify their needs regarding products and services. This is especially the case with inexperienced buyers, who require supplier support to help them articulate their problem (Aarikka-Stenroos and Jaakkola, 2012). *Designing a solution* involves specifying the problem and negotiating between the supplier and buyer to reach a solution. Studies have indicated that this activity is not only the most important for creating optimal value in the relationship but also the most time-consuming and challenging (Aarikka-Stenroos and Jaakkola, 2012). *The implementation of a solution* refers to the implementation or production of outputs in the solution design process and can help a buyer utilize the solution in the most efficient and effective way. However, a separate implementation activity does not always occur.

It has been suggested that these activities, i.e., process elements for solution provision, are interconnected (Tuli et al., 2007). Solution design may benefit from a good understanding of buyer needs (Lagrosen, 2005), and a good solution is obviously required for effective implementation. The prevalent understanding is that the activities are linked in a linear fashion; however, contrasting observations have also been made (Aarikka-Stenroos and Jaakkola, 2012; Sawhney, 2006).

The interaction between the supplier and buyer is essential for successful solution provision, raising the importance of social capital in this context. Because different activities of solution provision have different characteristics (Aarikka-Stenroos and Jaakkola, 2012; Tuli

**Table 1**  
Overview of empirical studies on social capital in supply chains.

Methodology, data, context	Findings	Source
185 supplier-buyer relationships in European manufacturing context Supplier perspective Survey, PLS-SEM	Relational capital moderates the positive impacts of supplier development on relationship outcomes.	Blonska et al., (2013)
163 buyer-supplier relationships in cross-industrial manufacturing context Buyer perspective Survey, OLS regression	Relational capital mediates (fully or partially) the impact of cognitive capital on the cost performance of a buying company and partially mediates the link between structural capital and the innovation performance of a buyer.	Carey et al., (2011) <sup>a</sup>
163 buyer-supplier relationships in UK manufacturing industry Buyer perspective Survey, hierarchical regression	Structural and cognitive capital have a positive link with relational capital, and this link is moderated by the level of the relationship adaptations of both companies.	Roden and Lawson, (2014) <sup>a</sup>
88 customer-supplier relationships in European manufacturing context Supplier perspective Survey, OLS regression	Cognitive capital in customer relationships has an effect on the strategic performance of suppliers. No significant impact of relational and structural social capital on strategic performance was found.	Gelderman et al., (2016)
82 buyers in German automotive OEM Survey, PLS-SEM	Cognitive and structural capital are positively linked to relational capital, both internally and in supplier relationships. Internal and external integration in global sourcing is supported by social capital.	Horn et al., (2014)
84 suppliers in Finnish metal and electronics industries Survey, PLS-SEM	Relational capital affects positively supplier-customer relationship performance improvement. Relational capital positively moderates the link between relationship structures and the improvement of relationship performance.	Kohtamäki et al. (2012)
374 buyers in U.S. automotive and electronics industries and 75 suppliers in diverse industries Both buyer and supplier perspectives Survey, OLS regression	Social capital dimensions in buyer-supplier relationships improve the performance of a buying firm and have various outcomes depending on the performance goals.	Krause et al., (2007)
111 buyers in UK manufacturing industry Buyer perspective Survey, CB-SEM	Relational capital in supplier relationships improves buyer performance.	Lawson et al., (2008)
207 supplier-buyer relationships in South Korea, including machinery, electronics, telecommunications, and chemical industries Supplier perspective Survey, CB-SEM	Structural capital links positively with the environmental performance of a supplier. Relational capital has a positive relationship with both operational and environmental performance of a supplier.	Lee, (2015)
132 Spanish firms in various industries (service companies excluded) Buyer perspective Survey, OLS regression	Both too little and too much social capital can have a negative effect on the performance of a buyer firm.	Villena et al., (2011)
108 buyers and 109 suppliers from U. S. manufacturing firms Both buyer and supplier perspectives Survey, CB-SEM	Internal collaborative process competence has no positive effect on the operational performance of a buyer or supplier if social capital is not build in the buyer-supplier relationship.	Whipple et al., (2015)

<sup>a</sup> The studies by Carey et al. (2011) and Roden and Lawson (2014) use the same empirical data.

et al., 2007), a more detailed understanding is needed of the role social capital plays in each of these activities. Previous research on supportive relational characteristics is superficial. More specific understanding on the interaction between supplier and buyer is beneficial for several reasons. For example, suppliers need to contact various actors in the buyer firm to obtain correct answers to questions regarding buyer needs (Petri and Jacob, 2016), and interaction is needed to enact the different modifications occurring during solution implementation (Tuli et al., 2007). However, previous research has not analyzed this interaction through the lens of social capital.

### 2.3. Summary of key concepts

To summarize the discussion above, Table 2 displays the key concepts of this study and their definitions, including the three supplier activities in the solution provision process (diagnosis of buyer needs, design of a solution, implementation of a solution) and the three forms of social capital (structural, cognitive and relational).

### 3. Hypotheses development

Solution provision includes different activities, which have somewhat different characteristics. At the same time, the various forms of social capital have unique effects which link to the goals that are pursued (Krause et al., 2007). This suggests that the specific activities of solution provision may require different forms of social capital.

Structural capital enables frequent communication (Krause et al., 2007; Lawson et al., 2008) and is beneficial to information flow and

information diversity (Camps and Marques, 2014; Koka and Prescott, 2002). Structural capital supports access to diverse and unique information, while the absence of structural capital makes it difficult to access important information (Villena et al., 2011). The structured flow of valid information received at the right time benefits business partners (Chen et al., 2009; Villena et al., 2011), for example, by facilitating mutual understanding (Leuthesser, 1997). In solution provision, suppliers need to understand the buyers' value chain in order to understand their needs (Ravald and Grönroos, 1996).

Willingness to share information in the relationship aids in the understanding of the core content of a solution (Hakanen and Jaakkola, 2012). Structural capital increases transparency, which decreases the possibility of opportunism and reduces uncertainty (Hartmann and Herb, 2014). Structural capital is therefore beneficial to the removal of barriers to communication and the creation of structures for interaction and information sharing. Interaction and information sharing relates to fast problem solving (Dyer and Nobeoka, 2000; Lawson et al., 2008; Stuart et al., 1998) and the generation of new ideas (Li et al., 2014; Yim and Leem, 2013), which reflect solution design. Solution implementation also requires interaction between buyer and supplier due to, e.g., additional modifications that are needed for products or services (Tuli et al., 2007). Communication helps to coordinate activities (Mohr et al., 1996) during solution implementation. We pose the following hypothesis:

**H1.** Structural capital is positively related to the solution provision activities of a) diagnosis of buyer needs, b) design of a solution, and c) implementation of a solution.



**Table 2**  
Definitions of key concepts.

Concept	Definition	Sources
Solution provision	Interaction between supplier and buyer that addresses the defining of <i>what</i> is delivered and <i>how</i> it is delivered.	Hakanen and Jaakkola, (2012)
Diagnosis of buyer needs	A supplier's support in identifying a buyer's needs that require solutions.	Aarikka-Stenroos and Jaakkola, (2012)
Design of a solution	Specification of the problem and negotiation between supplier and buyer in order to reach a resolution.	Aarikka-Stenroos and Jaakkola, (2012)
Implementation of a solution	Implementation of outputs in the solution design process and support for a buyer in utilizing the solution in the most efficient and effective way.	Aarikka-Stenroos and Jaakkola, (2012)
Solution provision performance	A supplier's ability to diagnosis the buyer's needs and to design and implement a solution.	Adapted from Aarikka-Stenroos and Jaakkola, (2012)
Cognitive capital	Shared interpretations such as codes, norms, and attitudes that support the social system.	Tsai and Ghoshal, (1998)
Structural capital	Formation of linkages and the existence of connections in a social structure.	Nahapiet and Ghoshal, (1998); Zaheer and Bell, (2005)
Relational capital	Relationships developed between people through interactions and supported by trust.	Nahapiet and Ghoshal, (1998); Kale et al., (2000)

The diagnosis of buyer needs requires a supplier to understand the buyers's expectations. Cognitive capital, in the form of joint values and vision, supports understanding of each party's needs (Krause et al., 2007; Tsai and Ghoshal, 1998), limits misinterpretations and information asymmetry (Hartmann and Herb, 2014; Min et al., 2008), and aligns objectives (Parra-Requena et al., 2010).

Cognitive capital may improve commitment and reduce the need for formal control in a business relationship (cf. Ouchi, 1980). It can enable shared thinking processes, mutual collaboration (De Carolis and Saporito, 2006), and the exchange of work (Inkpen and Tsang, 2005) and resources in a business relationship (Tsai and Ghoshal, 1998). These aspects have been deemed important in the solution design process (Hakanen and Jaakkola, 2012).

We also expect that cognitive capital is beneficial to solution implementation. Projects requiring close collaboration between a buyer and supplier benefit from cognitive capital because it supports the creation of common interests (Coleman, 1994), as the synergy of shared interests and goals strengthens each party's efforts (Jap and Anderson, 2003). Also, the standardized activities supported by cognitive capital (Gulati et al., 2000) are beneficial to the implementation of a solution. Hence, we hypothesize:

**H2.** *Cognitive capital is positively related to the solution provision activities of a) diagnosis of buyer needs, b) design of a solution, and c) implementation of a solution.*

Both relational and structural capital may improve information sharing between companies (Krause et al., 2007; Villena et al., 2011), but their importance may depend on the purpose of this information sharing. Moran (2005) found that structural capital is more important for execution-oriented managerial tasks, whereas relational capital is more important for innovation-oriented tasks. The diagnosis of buyer needs and designing solutions, in particular, have innovation elements that may also be driven by relational capital.

Relational capital facilitates strong and rich exchange of information (Liu et al., 2010; Spekman and Carraway, 2005). It may enable a supplier to obtain confidential information about a buyer (Ireland and Webb, 2007; Tuli et al., 2010) and increase confidence in the information exchanged (Dyer and Singh, 1998). Relational capital can also support joint learning (Huikkola et al., 2013; Muthusamy and White, 2005). These benefits likely support the supplier's diagnosis of the buyer's needs.

Relational capital has been found to support innovation-oriented tasks (Moran, 2005) such as product development (Huikkola et al., 2013) and value creation for both parties (Hartmann and Herb, 2014; Wang et al., 2013), which characterize the activity of solution design. Trust, an important aspect of relational capital, supports problem solving (Claro et al., 2003) and innovativeness (Panayides and Venus Lun, 2009), which are closely related to the design of a solution (Aarikka-

Stenroos and Jaakkola, 2012). Relational capital can also decrease transaction costs (Dyer and Singh, 1998), increase the costs of dissolving the relationship (Hartmann and Herb, 2014; Wang et al., 2013), inhibit opportunism (Liu et al., 2009), and enable buyers to obtain and leverage supplier resources (Kale et al., 2000; Villena et al., 2011), which, in turn, may support the fluent implementation of a solution. The following hypothesis is proposed:

**H3.** *Relational capital is positively related to the solution provision activities of a) diagnosis of buyer needs, b) design of a solution, and c) implementation of a solution*

There is significant evidence of the joint and interconnected effects of different forms of social capital. In particular, previous literature suggests that structural and cognitive capital result in relational capital (Horn et al., 2014; Inkpen and Tsang, 2005; Preston et al., 2017; Tsai and Ghoshal, 1998). The development of common values and shared goals between companies supports trust-building and a reduction in opportunistic behavior (Panayides and Venus Lun, 2009; Tsai and Ghoshal, 1998). Structural capital in the form of information flows supports the creation of relational capital (Carey et al., 2011). Social ties developed over time are also important for relational capital (Horn et al., 2014). Transparency and interaction lessen fears of exploitation and improve commitment to the relationship (Carey et al., 2011). Hence, it can be suggested that possessing all three forms of social capital is beneficial due to their combined positive effects.

Previous research has given some indication that the benefits of social capital may also be curvilinear, i.e., levels of social capital that are too low or too high level can have detrimental effects (Son et al., 2016; Villena et al., 2011). Too much structural capital may lead to redundant information and information overload (Koka and Prescott, 2002). An excessive amount of cognitive capital may lead to overly homogenous thinking between the buyer and supplier, which reduces the potential to create innovative solutions (Bendoly et al., 2010). Too much relational capital may create risks for opportunistic behavior (Wuyts and Geykens, 2005), limit flexibility (Koufteros et al., 2007), and make supplier switches more difficult (Kim et al., 2006). These findings indicate that a balance between the different dimensions should be sought, with no single one dominating. Therefore, we propose the following hypothesis:

**H4.** *All the three forms of social capital are needed for the high solution provision performance of a supplier.*

Several control variables are used. The customization level of a supplier's offering can impact the supplier's solution provision performance. More customized solutions may require more sophisticated activities for solution provision. The length of the buyer-supplier relationship may also have a role in the hypothesized relationships. Longer business relationships are characterized by trust (Lawson et al.,

**Table 3**  
Background information of the companies participating in the study.

Number of supplier firms	475
Annual revenue in 2015	< 2 million € 17.6%; 2 million - 10 million € 24%; 10 million - 50 million € 27.1%; 50 million - 100 million € 7.5%; 100 million - 500 million € 9.5%; and > 500 million € 14.3%;
Length of the relationship with the buyer firm	< 1 year 0.4%; 1 year - 3 years 6.8%; 3 years–5 years 11.7%; 5 years–10 years 13.7%; 10 years–20 years 30.4%; and > 20 years 37.0%;
Share of key suppliers	Key suppliers 28.4%; non-key suppliers 71.6%

2008) and may drive a supplier to offer its best solutions. Company size may also explain the investigated relationships. Larger companies often use more sophisticated practices in their relationships (Li et al., 2005). Finally, the importance of a buyer, as perceived by the supplier, may affect the supplier's willingness to invest its best resources in solution provision. The total model used to test the hypotheses H1-H3 is presented in Appendix 1. H4 will be tested with a separate model and analyzed with polynomial regression.

## 4. Methodology

### 4.1. Empirical data

A survey was used to collect data to complement the existing, mostly qualitative research on solution business. The survey was provided to the suppliers of four buyer firms. The unit of analysis is the relationship between the respondent's company and one of the four buyer firms. The study investigates existing business relationships. The four large buyer companies mainly operate in business-to-business markets. Two companies operate in the manufacturing business (the forest and machine construction industry) and the two others represent service industries (information and communications technology (ICT) and the logistics industry). Further, the production modes of the buyer companies vary. One of the both service and manufacturing companies have process-type production and fairly high volume of production. The other two companies operate in the project business and they customize their offerings at least to the moderate extent. The industries were selected to achieve maximum variation to obtain findings in several contextual settings of solution provision.

This study is a part of a larger project 'Value Creating Procurement' which involved academic research and development activities supporting company practitioners. As a part of this project, a large survey was conducted serving the information needs of both research and practice. This survey included around 70 statements evaluated on a 7-point Likert scale ranging from 'strongly disagree' to 'strongly agree'. The parts of the survey used in this study captured social capital dimensions and a supplier's solution provision performance and included 23 survey statements. In addition, background information on the respondents' companies was collected. The survey form was tested by other researchers and representatives of the intended population (Andrews et al., 2003), which led to small changes in the wording of the statements to avoid misinterpretations, and to ensure that precise answers were provided for the measured aspects. In addition, some changes were made to the order of the questions and section titles used in the survey. Complex academic concepts and terms were avoided in the section titles of the survey in order to facilitate responding.

The questionnaire was implemented with an electronic survey solution. The respondents had access to complete the survey for 3 weeks

during which two reminders were emailed for non-respondents. Non-response bias was tested by dividing the responses into three groups as follows: initial invitation, first reminder, and second reminder (Leslie, 1972). A T-test was performed on the all research constructs, and no statistically significant differences were found, indicating that non-response bias is not a problem in our study. To decrease the risk of social desirability bias, the cover letter of the survey clearly presented that individual statements, individual responses and company names would not be revealed to the buyer firm, and that all of the data analyses would be carried out by external researchers.

The questionnaire was sent to a total of 1,630 suppliers and 662 responses were received, meaning a high response rate of 41%. As regards the responses to the survey, the number of missing values varied 5–15%. Casewise deletion was used which reduced the sample size to 475, representing 29% of the population. The respondents of the survey were the suppliers' contact persons (key account managers, CEOs and senior managers) for their relationship with a specific buyer and thereby were highly knowledgeable regarding the particular buyer relationships. Table 3 presents the background information of respondent companies.

The size of the supplier companies was rather evenly distributed, and these companies had relatively long relationships with their buyers. Slightly less than one third of the suppliers had obtained key supplier status according to their buyer.

### 4.2. Measurement of research variables

The development of the survey instrument followed the standards of psychometric scale development (Gerbing and Anderson, 1988). The survey development was supported by the extensive literature review of purchasing and supply management and industrial marketing management. Already tested survey items were applied whenever possible. In some instances, the viewpoint of the question was switched from the perspective of the buyer to that of the supplier.

While the concept of social capital has proven to be a valuable instrument in analyzing buyer-supplier relationships, its traditional measurement instruments have been criticized, calling for refinement (Carey et al., 2011, Preston et al., 2017). At the same time, a wide variety of measurements is used, but often confined to one or two out of the three dimensions of social capital (Matthews and Marzec, 2012; Preston et al., 2017). This study covers all three dimensions and tries to overcome some of the shortcomings in previous measurements by specifying the sub-elements of the dimensions.

The first form of social capital, structural capital, refers to frequent interactions occurring among the various connections of a social system (Zaheer and Bell, 2005). Bohnenkamp et al. (2020) criticize the traditional measurement, arguing that structural capital must be split into three underlying concepts, reflecting the infrastructure available, the quantity of interaction and the nature of the interaction. Unfortunately, they do not provide a complete measurement instrument. However, in this study, the instrument applied covers these different aspects of structural capital. The infrastructure available was measured by meetings, goal setting and performance review moments (Cousins et al., 2008; Ulaga and Eggert, 2006; Whipple and Frankel, 2000). Interaction frequency was measured both generally and specifically regarding face-to-face interactions in meetings (Chen et al., 2004) between company representatives. The nature of interaction was measured by information sharing, specifically, cost information sharing (Noshad and Awasthi, 2015).

The essence of cognitive capital consists of shared interpretations such as codes, norms and attitudes that support the social system (Horn et al., 2014; Tsai and Ghoshal, 1998). In this study, cognitive capital was measured by considering whether the firms had similar organizational cultures (Preston et al., 2017) and management styles (Villena et al., 2011; Whipple and Frankel, 2000). Further, a statement regarding the potential challenges generated by cultural backgrounds was

**Table 4**  
Characteristics of the data.

Constructs	Mean (std. dev.)	Correlations											
		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	
1. Structural capital	5.05 (1.17)	1											
2. Cognitive capital	4.84 (1.14)	0.50 <sup>a</sup>	1										
3. Relational capital	5.82 (0.95)	0.57 <sup>a</sup>	0.55 <sup>a</sup>	1									
4. Solution provision performance	6.02 (0.73)	0.57 <sup>a</sup>	0.50 <sup>a</sup>	0.56 <sup>a</sup>	1								
5. Diagnosis of buyer needs	6.02 (0.75)	0.51 <sup>a</sup>	0.49 <sup>a</sup>	0.55 <sup>a</sup>	0.80 <sup>a</sup>	1							
6. Design of a solution	5.97 (0.88)	0.53 <sup>a</sup>	0.40 <sup>a</sup>	0.48 <sup>a</sup>	0.88 <sup>a</sup>	0.64 <sup>a</sup>	1						
7. Implementation of a solution	6.12 (0.82)	0.46 <sup>a</sup>	0.43 <sup>a</sup>	0.47 <sup>a</sup>	0.90 <sup>a</sup>	0.62 <sup>a</sup>	0.68 <sup>a</sup>	1					
8. Company size	3.16 (1.72)	0.15 <sup>a</sup>	0.20 <sup>b</sup>	0.12 <sup>b</sup>	0.22 <sup>a</sup>	0.23 <sup>a</sup>	0.14 <sup>a</sup>	0.20	1				
9. Perceived importance of the buyer	8.20 (1.71)	0.38 <sup>a</sup>	0.31 <sup>a</sup>	0.45 <sup>a</sup>	0.36 <sup>a</sup>	0.33 <sup>a</sup>	0.31 <sup>a</sup>	0.30 <sup>a</sup>	−0.0	1			
10. Length of the relationship	4.75 (1.25)	−0.06	0.06	−0.02	0.07	0.09 <sup>b</sup>	0.01	0.08	0.20 <sup>a</sup>	0.11 <sup>b</sup>	1		
11. Customization level of the solution	3.11 (1.24)	0.04	−0.08	−0.03	0.06	0.04	0.07	0.05	−0.07	0.01	0.0	1	

<sup>a</sup> Pearson correlation significant at the 0.01 level.

<sup>b</sup> Pearson correlation significant at the 0.05 level.

adapted from Lambert et al. (1996).

Trust is an important embodiment of relational capital (Carey et al., 2011; Horn et al., 2014; Lee and Cavusgil, 2006). In this study, relational capital was measured by trust statements reflecting beliefs regarding 1) the helpfulness of a buyer firm's activities, i.e., competence trust (Kim et al., 2010; Mohr and Spekman, 1994; Whipple et al., 2015), and 2) a buyer's ability to keep promises, i.e., contractual trust (Kumar et al., 1995).

The activities of supplier solution provision were measured using the conceptual model proposed by Aarikka-Stenroos and Jaakkola (2012). The diagnosis of buyer needs was related to the role of the supplier as a value option advisor for its buyer and in helping the buyer articulate its needs. The supplier's ability to design solutions for its buyers was measured by emphasizing the role of the supplier as a value amplifier, specifically by providing appropriate product/services, offering additional products/services during the delivery of products and services, and supporting the joint design of solutions. The supplier's ability to implement its solutions was measured by considering the role of the supplier as a value process organizer (providing support during implementation and helping the buyer to use its resources) and value experience supporter (continuous daily support for the use of offerings and support for buyer in obtaining benefits over a longer period). Solution provision performance was a sum variable for all the three activities described above.

Each of the control variables were measured by a single item statement. Company size (annual revenue) and the length of the relationship (in years) were measured by using a six-step classification. The level of customization was measured by using a five-step scale varying from only standard products/services (1) to only customized products/services (5). The perceived importance of a buyer was measured by using a scale from 1 (not important at all) to 10 (absolutely crucial). All the statements used in the survey are listed in Appendix 2.

#### 4.3. Analysis methods

The survey data were analyzed using the statistical software IBM SPSS Statistics 24 and SmartPLS 3.0. PLS-SEM. Polynomial regression was applied to test the hypothesis 4 with bootstrapping of 5,000 rounds. PLS-SEM is a component-based estimation method that maximizes the amount of variance explained and does not make

assumptions regarding data distributions. PLS-SEM is specifically useful when the research is focused on predicting and explaining the variance of key constructs (Reinartz et al., 2009). This study utilized PLS for the following reasons. First, PLS-SEM is useful for testing prognostic models with latent variables when the theory is less developed, and the intention is to develop theory instead of testing one (Hair et al., 2011; Shmueli and Koppius, 2011). Second, PLS analysis is a suitable choice when the research aims at prediction instead of explanation (Evermann and Tate, 2016; Hair et al., 2017a). In the case of this study, the theory on social capital in solution business is still less established and the focus is on prediction by using cross-validated point-predictions and analysis of out-of-sample predictive performance. In this way we are to evaluate the degree of overfitting (Shmueli et al., 2016). Third, PLS-SEM is an appropriate choice when the investigated model is complex (Hair et al., 2017b; Rigdon et al., 2017) which is the case in our study, including fine-grained, three-dimensional measures for both social capital and solution provision. Finally, our data is not normally distributed, which requests non-parametric test methods (Hair et al., 2017a).

This study used SmartPLS 3.0 to obtain the estimates for hypotheses 1–3. A bootstrapping technique with 5,000 rounds was used in the analysis. In alignment with Peng and Lai (2012), we also tested the robustness of the PLS results by applying OLS regression to the average values of the items for each construct. The results of the robustness test indicated that there were no differences in the main results (reported in Table 6).

Table 4 presents the characteristics of the data in this study. When looking at the forms of social capital, relational capital appears to be at the highest level while cognitive capital received lowest results on average. Capability to provide solutions is high overall which may be explained by the fact that only major suppliers of their buyers were included in the population. It should be noted that constructs 5–7 are subcomponents of 4 (solution provision performance) and therefore highly correlated with it. Also the activities of solution provision (constructs 5–7) are closely connected, as also suggested by the literature (Tuli et al., 2007). With regard to control variables (8–11) company size and perceived importance of the buyer have the most visible relationships to the main research constructs.

Common method bias was tested by 1) Harman's single factor test and 2) a test with a common method factor (Podsakoff et al., 2003;

Liang et al., 2007). According to the results of Harman's test, none of the factors represent more than 50 percent of the variance in the data. The unmeasured common method factor test was conducted by following the approach presented by Liang et al. (2007). A common method factor was added that included the indicators of all the constructs. The variance of each indicator was investigated in relation to its principal construct and the common method factor. The substantive variance of the principal constructs was 0.660 on average, while the average variance in the method factor was 0.006. The ratio of substantive variance to common method variance was approximately 102. Further, common method factor loadings were non-significant in most cases.

Multicollinearity was tested by using the variance inflation factor (VIF) (O'Brien, 2007). According to Kock (2015), VIF higher than 3.3 is a sign of uncontrolled collinearity and potential common method bias in the model. Hence, if every factor-level VIF is lower than 3.3 as a result of full collinearity test, common method bias is unlikely to occur. Table 6 reports the VIF values in our study which vary between 1.63 and 2.09 indicating absence of multicollinearity (Duzan and Shariff, 2015). Based on these tests, we also conclude that common method bias is unlikely to be a problem in our study.

All of the constructs in this study are reflective in nature. Their reliability and internal consistency was evaluated by using composite reliability (CR) (Fornell and Larcker, 1981; Wetzels et al., 2009), average variance extracted (AVE) and factor loadings (Hair et al., 2014). The results are presented in Appendix 2. The Composite Reliability (CR) varied between 0.87 and 0.93, clearly exceeding Nunnally's (1978) threshold of 0.7. The values for AVE varied between 0.56 and 0.72, which exceeds the 0.50 cut-off (Fornell and Larcker, 1981), and all the Cronbach alphas were higher than 0.7, as proposed by Hair et al. (2014). Most of the survey items had outer loadings that were higher than the 0.7 threshold (Henseler et al., 2009). In alignment with Hulland (1999), one item with a loading higher than 0.6 was utilized in the study. The cross-loadings for each item were examined by comparing the loadings of different constructs and by using the threshold of 0.2 for the difference. The two research models used in PLS analysis (H1-H3) and polynomial regression analysis (H4) were examined separately. This resulted in the removal of two items for 'diagnosis of buyer needs' used in PLS analysis and two items for 'structural capital' used in both research models. In the case of construct 'solution provision performance' used in polynomial regression, three items were dropped. Appendix 2 presents the dropped items in more detail. Discriminant validity was tested, as proposed by Fornell and Larcker (1981). The squared correlations between the construct pairs were lower than the AVEs of individual constructs.

PLS-predict function (see Table 5) was used to determine the  $Q^2$  predictive effect size for endogenous variables and to measure the accuracy of the 10-fold, out-of-sample point predictions. Absolute percentage error (MAPE) was used to evaluate hold-out samples (Hora and Campos, 2015).

All the MAPE values are below 0.16, suggesting low uncertainty in

**Table 5**  
PLS prediction test results.

Item	MAPE	$Q^2$
DIAG1	0.114	0.281
DIAG2	0.138	0.230
DIAG3	0.098	0.226
DIAG4	0.095	0.225
DSOL1	0.128	0.202
DSOL2	0.124	0.258
DSOL3	0.135	0.203
ISOL1	0.151	0.178
ISOL2	0.133	0.232
ISOL3	0.115	0.222
ISOL4	0.117	0.219

the predicted results. The  $Q^2$  values vary between 0.178 and 0.281, indicating medium predictive relevance for the constructs (Hair et al., 2017a). The standardized root mean square residual (SRMR) was used as a goodness-of-fit (GoF) indicators for the model as suggested by Henseler et al. (2014). SRMR is 0.061 and hence below 0.08, indicating good model fit for the hypothesized model (Hair et al., 2017a).

For testing of H4, we applied a polynomial regression with surface analysis (Edwards and Parry, 1993). A polynomial regression can provide more insights when the interactions between two variables are studied. The purpose of using polynomial regression was to understand the potentially complementary nature or trade-offs between the various dimensions of social capital. Polynomial regression also explains whether the studied relationships between the research variables are linear or curvilinear. It was therefore suitable for identifying the potential curvilinear performance effects of social capital (Villena et al., 2011) in the studied relationships with predicted complexity (cf. Edwards and Van Harrison, 1993). The general form of a polynomial regression is  $Z = b_0 + b_1X + b_2Y + b_3X^2 + b_4XY + b_5Y^2 + \text{Covariates} + e$ , where Z is the dependent variable (solution provision performance), X is Predictor 1 (social capital dimension 1), and Y is Predictor 2 (social capital dimension 2). Three possible different combinations between the three social capital dimensions were tested.

A three-step analysis process was used for the polynomial regression, in alignment with Shanock et al. (2010). First, an agreement table was constructed to ensure that the polynomial regression is appropriate for the sample (see Appendix 3). Differences of standardized independent variables were used in this analysis. There were enough discrepancies between the independent variables, as a minimum of 10% of the responses needs to be in disagreement (Fleenor et al., 1997). Second, non-standardized independent variables were centered around the midpoint of their scales to reduce multicollinearity (Edwards, 1994) in the actual polynomial regression analysis. Centering was done by deducting the value of the mid-point of the scale. Separate polynomial regressions were carried out for the three possible combinations of social capital. Since the  $R^2$  of the polynomial regression was significant, further analysis was justified with the four surface test: a1, a2, a3, and a4 (Atwater et al., 1998). Third, the results were plotted by using an Excel spreadsheet, as in Shanock et al. (2010), to create a three-dimensional view of the studied relationships between the dimensions of social capital and solution provision performance. In addition, significance testing was applied. The four surface tests include the slope and curvature of two lines comprising the surface pattern of the graph.

## 5. Results

### 5.1. Relevance of social capital in suppliers' solution provision process

SEM was used to test hypotheses 1, 2 and 3. Fig. 1 illustrates all the significant relationships that were identified. Hypotheses regarding the role of social capital in the different activities of suppliers' solution provision are only partially supported. As suggested, the three forms of social capital are positively related to the supplier's ability to diagnose buyer needs. However, only structural capital has a statistically significant positive relationship with a supplier's ability to design a solution. Further, it appears that social capital is even less important for the implementation of a solution. The results of the PLS-SEM provide support for the role of cognitive capital in this activity, but the OLS regression result is not significant. Overall, we conclude that social capital is least important during the implementation of solutions, but it is highly relevant in the early activities of solution provision and most notably so during the diagnosis of buyer needs.

Positive relationship exists between diagnosing buyer needs and offering a solution and implementation of a solution. The results suggest that social capital contributes to solution provision, especially through its substantial role in supporting the diagnosis of buyer needs, which is, in turn, crucial for the other activities of solution provision.



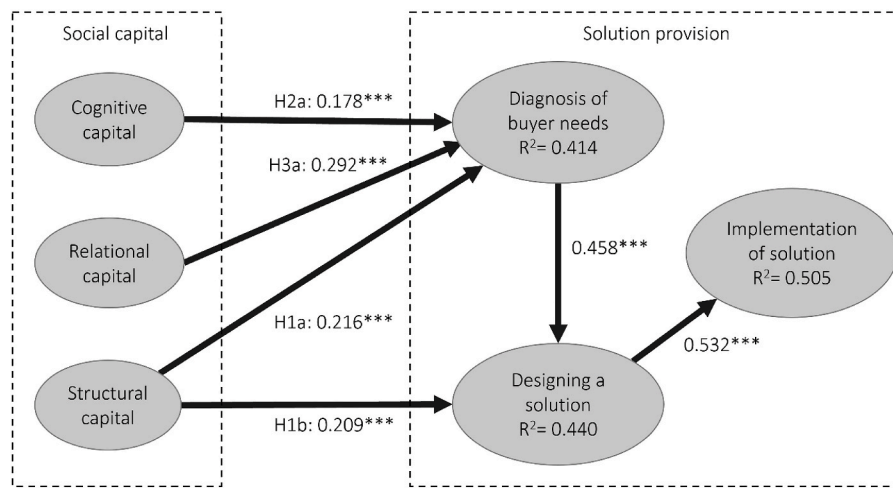


Fig. 1. The structural equation model including the significant relationships for H1-H3.

Hence, without good diagnosis of buyer needs supported by social capital, it is difficult to design and implement a good solution for the buyer.

Table 6 presents the results of the model in more detail. The structural model explains 41.4% of the variation in the diagnosis of buyer needs, 44% of the variation in the design of a solution and 50.5% of the variation in the implementation of a solution. The control variables did not affect the studied constructs. The results of the PLS-SEM suggest that larger companies are more able to diagnose the needs of their buyers and implement their solutions, but the OLS regression results do not provide support for this observation.

The F<sup>2</sup> statistics indicate that the size of the effect for the significant paths is small (higher than 0.02 but lower than 0.15). The results for the Q<sup>2</sup> statistics through cross-validate redundancy approach suggest that the model has at least medium level of predictive relevance.

To further verify the observed effects in the structural model, a mediation effects test was conducted for the effects on both design of a solution and implementation of a solution. The tests followed the procedure suggested by Hair et al. (2017a). The significance of specific indirect effects for the different paths was first tested in order to identify the possibility of mediation effects. The analysis continued by investigating the reported total indirect effects. Then the significance of

direct effects between the studied variables was examined in order to determine whether the mediation was full or complementary. Tables 7 and 8 report the results. In the case of significant indirect effects, both specific and total indirect effects were significant.

Table 7 shows that diagnosis of buyer needs fully mediates the effect of relational and cognitive capital on design of a solution. In turn, the effect of structural capital is partially mediated by diagnosis of buyer needs. Table 8 shows that diagnosis of buyer needs and design of a solution fully mediate the effect of structural and relational capital on implementation of a solution. The effect of cognitive capital is direct and not mediated. This direct effect was not supported by OLS regression, and it may be explained by factors not included in the path model (e.g. production characteristics of the buyer).

This study has a cross-industrial data set, and therefore the potential differences between different types of buyers and suppliers were analyzed using multigroup analysis, more specifically a permutation test as suggested by Hair et al. (2017a). 1) Differences in the results between suppliers of service and manufacturing buyers were analyzed. No statistically significant differences were identified in the results of these groups. 2) Differences in the results between suppliers of buyers with project-oriented and continuous production logic were analyzed. It was found that cognitive capital supports the implementation of solutions in

Table 6  
Results for hypotheses 1-3.

Path	PLS-SEM analysis results							OLS results <sup>a</sup>		
	VIF	β	t-value	p-value	R <sup>2</sup>	F <sup>2</sup>	Q <sup>2</sup>	β	t-value	p-value
<b>H1a</b> Structural capital → diagnosis of buyer needs	1.753	0.216	4.247	p < 0.001	<b>0.414</b>	0.045	<b>0.236</b>	0.238	5.083	p < 0.001
<b>H2a</b> Cognitive capital → diagnosis of buyer needs	1.627	0.178	3.796	p < 0.001		0.033		0.163	3.669	p < 0.001
<b>H3a</b> Relational capital → diagnosis of buyer needs	1.948	0.292	5.303	p < 0.001		0.075		0.282	5.884	p < 0.001
<b>H1b</b> Structural capital → design of a solution	1.832	0.209	4.013	p < 0.001	<b>0.440</b>	0.043	<b>0.315</b>	0.223	4.742	p < 0.001
<b>H2b</b> Cognitive capital → design of a solution	1.681	0.004	0.065	0.948, N.S.		-		0.007	0.162	0.871, N.S.
<b>H3b</b> Relational capital → design of a solution	2.093	0.054	0.881	0.379, N.S.		-		0.054	1.110	0.268, N.S.
<b>H1c</b> Structural capital → implementation of a solution	1.892	0.049	1.048	0.295, N.S.	<b>0.505</b>	-	<b>0.356</b>	0.030	0.684	0.494, N.S.
<b>H2c</b> Cognitive capital → implementation of a solution	1.638	0.137	3.201	p < 0.01		0.023		0.076	1.870	0.062, N.S.
<b>H3c</b> Relational capital → implementation of a solution	1.999	0.074	1.175	0.240, N.S.		-		0.029	0.645	0.519, N.S.

<sup>a</sup> CB\_SEM was also used to further analyze the robustness of results. The analysis was carried out with IBM SPSS AMOS 24, and it produced essentially the same results. Significance of the path H2a was lower with p < 0.05.

**Table 7**  
Mediation effect tests on design of a solution.

Social capital dimension	Mediator diagnosis of buyer needs	$\beta$	t-value	p-value	Conclusions
Cognitive capital	Indirect effect	0.082	3.472	p < 0.01	Indirect only, full mediation
	Direct effect	0.004	0.065	0.948 (N.S.)	
Structural capital	Indirect effect	0.099	3.640	p < 0.001	Complementary (partial) mediation
	Direct effect	0.209	3.909	p < 0.001	
Relational capital	Indirect effect	0.134	4.515	p < 0.001	Indirect only, full mediation
	Direct effect	0.054	0.864	0.388 (N.S.)	

**Table 8**  
Mediation effect tests on implementation of a solution.

Social capital dimension	Mediators diagnosis of buyer needs and design of a solution	$\beta$	t-value	p-value	Conclusions
Cognitive capital	Indirect effect	0.045	1.495	0.135, N.S	Direct only, no mediation
	Direct effect	0.137	3.217	p < 0.01	
Structural capital	Indirect effect	0.164	4.598	p < 0.001	Indirect only, full mediation
	Direct effect	0.049	1.037	0.300 (N.S.)	
Relational capital	Indirect effect	0.100	3.042	p < 0.01	Indirect only, full mediation
	Direct effect	0.074	1.213	0.225 (N.S.)	

the relationship with project-oriented buyers ( $\beta = 0.244$ ;  $p = 0.000$ ) as opposed to buyers with continuous production logic ( $\beta = 0.033$ ;  $p = 0.580$ ).

Suppliers were asked to evaluate whether their solutions have more service or product characteristics. While balance between the two was a common situation, respondents also reported more product or service characteristics in their solutions, and this information was used in group comparison. It was found that structural capital is less important for the diagnosis of buyer needs with service dominant solutions ( $\beta = 0.015$ ;  $p = 0.893$  vs.  $\beta = 0.309$ ;  $p < 0.000$ ).

**5.2. Social capital dimensions in the supplier's solution provision performance**

According to the fourth hypothesis, all forms of social capital are needed for successful solution provision. This was tested with polynomial regression analysis by comparing three pairs of social capital dimensions. The same control variables were included in the analysis as in the PLS tests for H1-H3. The results of the polynomial regression are presented in Table 9. The pair-wise comparison of cognitive and structural capital and of cognitive and relational capital gave the same message. The test for a1 representing the slope in the line of perfect agreement has strong statistical significance. This implies that the higher the symmetry between these pairs of social capital is, the higher the supplier's solution provision performance. Since a2 had a non-significant result, the relationship between these social capital dimensions and solution provision performance is linear when they agree perfectly. The curvature effect of incongruence line (a4) is significant

**Table 9**  
Polynomial regression results for hypothesis 4.

	Effect (as related to Z)	Coefficient	Standard error	T-value	p-value
Cognitive capital-structural capital	a1: Slope along x = y	0.36	0.03	12.134	0.000***
	a2: Curvature on x = y	0.02	0.04	0.422	0.673
	a3: Slope along x = -y	-0.01	0.07	-0.172	0.864
	a4: Curvature on x = -y	0.13	0.04	3.196	0.001**
Cognitive capital-relational capital	a1: Slope along x = y	0.33	0.07	5.065	0.000***
	a2: Curvature on x = y	0.03	0.01	1.721	0.086
	a3: Slope along x = -y	-0.12	0.11	-1.048	0.295
	a4: Curvature on x = -y	0.13	0.06	2.069	0.039*
Relational capital-structural capital	a1: Slope along x = y	0.28	0.07	3.742	0.000***
	a2: Curvature on x = y	0.07	0.04	1.731	0.084
	a3: Slope along x = -y	0.30	0.10	3.084	0.002**
	a4: Curvature on x = -y	0.25	0.05	4.979	0.000***

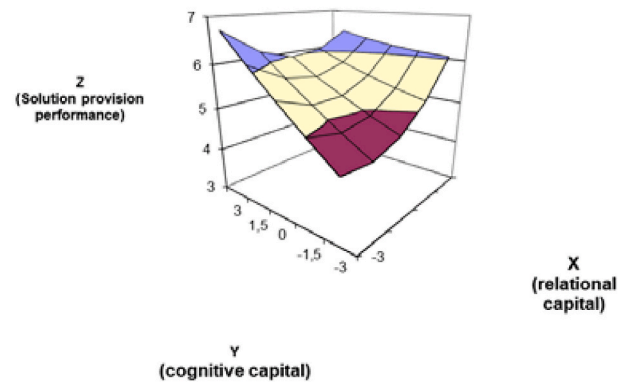
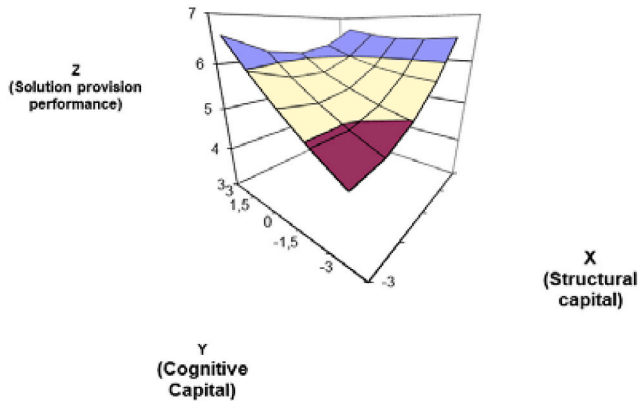
for both pair-wise comparisons, but it is more significant for cognitive capital and structural capital. This result indicates that solution provision performance increases more sharply when the degree of the discrepancy between the dimensions of social capital increases. Since the slope effect (a3) is nonsignificant, the dimensions of social capital appear to be complementary, i.e., solution provision benefits can be obtained regardless of which dimension has higher values.

The comparison between relational and structural capital had a slightly different result. Again, the slope of the line of perfect agreement has strong statistical significance (a1). There is a strong effect on solution provision performance when there are equal amounts of both structural and relational capital. The slope effect of the line of incongruence (a3) is also significant with a positive coefficient, which means that solution provision performance is higher when structural capital is higher than relational capital. This result reveals that there is another option for improving solution provision performance. Further, there is strong significance in the curvature effect of the line of incongruence (a4), and the relationship coefficient is higher than those for the other three pair-wise comparisons. This result implies that solution provision performance increases more sharply when the discrepancy between structural and relational capital increases.

Fig. 2 illustrates the results of the polynomial regression and reveals the different options for increasing suppliers' solution provision performance through the combinations of two forms of social capital. The main implication is that the most obvious option to improve solution provision is the equal combination of both forms of social capital. More interestingly, the figure also indicates that the dimensions of social capital can compensate for each other (the a4 tests were all significant).

**Solution provision performance as predicted by cognitive capital-structural capital**

**Solution provision performance as predicted by cognitive capital-relational capital**



**Solution provision performance as predicted by relational capital-structural capital**

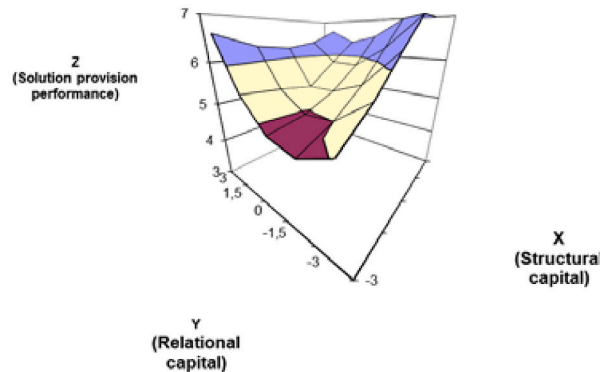


Fig. 2. Plotted results of the polynomial regression.

When the other dimensions (e.g. cognitive) is low and the other (e.g. structural) is high, there can still be good solution provision performance. The comparison of structural and relational capital reveals that structural capital appears to be more important and similarly cognitive capital is more important than relational capital. In comparison of cognitive and structural capital there is practically no difference. Overall, these results suggest that H4 is not fully supported. Here, the dimensions of social capital may also compensate for each other.

The control variables had some effect on solution provision performance in the analyzed models. In cognitive capital – structural capital investigation, supplier company size ( $\beta = 0.121$ , p-value = 0.001) and the perceived importance of a buyer ( $\beta = 0.119$ , p-value = 0.002) had some effect on solution provision performance. In comparing cognitive capital and relational capital, supplier company size ( $\beta = 0.127$ , p-value = 0.001), the perceived importance of a buyer ( $\beta = 0.156$ , p-value < 0.001) and the customization level of a supplier offering ( $\beta = 0.105$ , p-value = 0.002) affected solution provision performance. Finally, in the analysis of relational and structural capital, supplier company size again had some effect ( $\beta = 0.141$ , p-value < 0.001) on solution provision performance. Hence, especially large supplier size is related positively to high solution provision

performance when two elements of social capital are investigated at the same time.

## 6. Discussion: the benefits of social capital in solution provision

Our findings generate new understanding of the benefits of social capital in the solution provision process. The findings emphasize that the diagnosis of buyer needs is the activity in the buyer-supplier relationship that is most significantly driven by social capital. This is understandable since this activity requires emotional intelligence, the ability to understand the role of the buyer (Ravald and Grönroos, 1996; Strandvik et al., 2012), and the ability to share knowledge with the buyer. Such skills and tasks have been found to be enhanced by relational capital (Mahapatra et al., 2012; Tuli et al., 2010). In this respect, it is important to note that the different dimensions of social capital work together.

In alignment with the literature highlighting that continuous interactions and trust between the buyer and supplier are important for solution design and implementation (Brady et al., 2005; Nordin and Kowalkowski, 2010), this study hypothesized that social capital is also important in these steps of solution provision. For example, suppliers

can benefit from their contacts with key employees of the buyer firm (Windler et al., 2017) in implementing solutions. However, in regard to solution design and implementation, our findings are somewhat surprising.

During solution design, structural capital remains important, while the other dimensions of social capital decrease in importance. Solution development requires a good understanding of buyers' processes (Storbacka, 2011), which can be supported by structural capital. Previous research suggests that relational capital may reduce a buyer's dependence on the service provider (Hartmann and Herb, 2014). In the relationships under study, it appears that formal and frequent communication structures are needed during the design of solutions, reflecting the supplier's dependence on the buyer. Horn et al. (2014) indicated that cognitive capital was more important than structural capital for relationships within a single company, while the opposite was true for relationships between companies. While shared targets and values are important for inter-organizational relationships, the presence of contact points is even more important. This observation may partly explain our results.

Moran (2005) found that structural capital is more important for execution-oriented managerial tasks, whereas relational capital is more important for innovation-oriented tasks. Villena et al. (2011) suggested that relational capital may be more important than the other dimensions of social capital when the supplier and buyer seek to obtain strategic benefits. In light of the present study, these earlier findings would indicate that solution design is more execution-oriented and less strategic than the diagnosis of buyer needs, and this is not an easy argument to justify. However, there are varying results regarding the nature of solution development in the literature, and the process may be affected by the nature of the solution, as also demonstrated by this study.

Social capital appears to be even less important for solution implementation. This activity is especially characterized by independent work conducted by suppliers; however, solution implementation can require interaction, i.e., social capital (Aarikka-Stenroos and Jaakkola, 2012). For example, value verification and delivery monitoring require clearly defined practices (Storbacka, 2011). However, in our broad dataset, it appears that suppliers carry out solution implementation rather independently. Previous literature also discusses the dark side of social capital. Villena et al. (2011) indicated that structural and relational capital in buyer-supplier relationships may have negative consequences for the buyer's performance. For example, excessive cognitive capital can cause suppliers and buyers to become too similar in their thinking, hampering the creation of new solutions (Bendoly et al., 2010). These observations may explain some of our findings, which indicate relational capital is not always as important as it has been considered, and social capital is not necessarily important for solution implementation. However, comparing buyer firm characteristics indicated that cognitive capital may be more important in solution provision for a project company than for a company with a continuous production mode. More specifically, cognitive capital, reflected by shared interpretation, supports the implementation of solutions for project companies. One explanation for this may be that solutions in these contexts require more customization, which requires mutual understanding between the supplier and the buyer (cf. Hakanen and Jaakkola, 2012).

The nature of the problem to be solved can affect the characteristics of the solution process (Nordin and Kowalkowski, 2010). For example, Saccani et al. (2014) found that the type of solution can affect buyer-supplier relationships. More specifically, these scholars found that product support solutions are typically provided in alignment with transactional agreements, whereas customer support and process-related services require more long-term orientation and relational governance. It has also been found that a shared resource integration is needed in solution customization (Macdonald et al., 2016). Notably, the customization level of the supplier offerings was a control variable in

our study, and it did not have a significant effect on the findings in H1, H2 and H3. However, there was indication on the significance of this aspect when two elements of social capital were investigated in relation to solution provision performance (H4). In turn, the comparison of results between suppliers with service-oriented and product-oriented solutions revealed that structural capital is clearly less important in the solution provision of service-oriented suppliers, while cognitive and relational capital play a more significant role. Hence, it appears that the provision of intangible service solutions benefits less from formal structures in the relationship than more tangible solutions do. Less structured content and provision of services may also explain this observation.

The results of the polynomial regression for H4 contribute to the social capital literature. Previous research has shown that various forms of social capital are interdependent (Butler and Purchase, 2008; Nahapiet and Ghoshal, 1998), e.g., relational capital is supported by structural capital. A high level of social capital is not always beneficial (Villena et al., 2011), which may also suggest that a balance between different forms of social capital is necessary, i.e., too much of any form of social capital can have negative effects. The first part of the polynomial regression analysis supports H4 because the combination of two social capital dimensions appears to improve solution provision performance. However, the analysis also reveals that different forms of social capital can compensate for each other to some extent and result in almost equal solution provision performance. This is a new finding, which contributes to existing knowledge. One explanation for this finding may be that the negative effects of social capital are less apparent in the provision of solutions (cf. Villena et al., 2011). In this context we therefore suggest that a large amount of any form of social capital, even alone, can be beneficial. Surprisingly, our results reveal that solution provision performance can be even higher when structural capital is higher than relational capital. In contrast with other forms of social capital, structural capital is also directly related to the solution design. This result implies that the importance of connections in social structures should not be underestimated during solution provision.

The importance of relational capital received significant attention in earlier literature (Krause et al., 2007; Matthews and Marzec, 2012; Purchase and Phungphol, 2008). A recent study also identified cognitive capital as important for the strategic performance of a supplier (Gelderman et al., 2016). Cognitive capital has been linked especially to product innovations (Camps and Marques, 2014). In the present study, the emphasis on solutions may explain the somewhat less essential role of cognitive capital observed in the findings. Cognitive capital may well support sense-making and coherence but also hinder the provision of new information (Edelman et al., 2004), which is relevant when co-creating solutions. The results of this study add to current knowledge by identifying that structural capital can be the most important construct in creating solutions in a business relationship. However, it should be noted that service-oriented solutions seem to require forms of social capital other than structural capital.

## 7. Conclusions

### 7.1. Theoretical contributions

This study contributes to research on the benefits of social capital in supply chains, particularly for buyer-supplier interactions in solution business. In addition, it enhances understanding of how to improve solution provision by suppliers. Our findings reveal how the different dimensions of social capital contribute to diagnosing buyer needs and designing and implementing solutions. The findings make several contributions to the literature.

First, our study contributes to the literature on social capital in supply chains by revealing how social capital supports the achievement of the best possible solution provision from a supplier. It thereby responds to a request for more sophisticated measures of the benefits of



social capital (Gelderman et al., 2016) and specifies the link between social capital and strategic performance in a buyer-supplier-relationship (Villena et al., 2011). Overall, we conclude that it is beneficial for buyers to invest in building social capital in their relationships with suppliers because it facilitates an effective solution provision process, which starts with the supplier diagnosing the needs of the buyer. It is particularly important to pay attention to the impersonal connections in social structures to guarantee good solution provision performance.

This study also shows that the different forms of social capital can compensate for each other. When one dimension is missing, another must be present to gain the desired benefits. This phenomenon is particularly notable for structural and relational capital. In contrast to earlier studies that highlight the role of relational capital (Krause et al., 2007; Min et al., 2008), this study found that structural capital plays a more important role in solution provision performance than relational capital. This observation was evident when solution provision was split into separate activities, as well as in pair-comparison between different forms of social capital in solution provision performance.

This study further complements the literature on social capital in supply chains by including both manufacturing and service companies due to the use of an extensive dataset, which enabled comparison of different contexts. It was found that in particular the difference between suppliers with service- and product-oriented solutions has an effect on the role of social capital in solution provision.

Second, our research contributes to the literature of solution business by linking it to research on social capital in supply chains (e.g., Lawson et al., 2008; Horn et al., 2014; Hartmann and Herb, 2014) and providing theory-backed explanations for successful solution provision (Aarikka-Stenroos and Jaakkola, 2012). This study exposes the relevance of social capital, particularly in the critical early phases of solution provision: our findings support arguments that highlight the importance of suppliers understanding buyer needs to materialize innovation potential (Larsson et al., 2006). In turn, the diagnosis of buyer needs determines the value creation potential of later activities (solution design and implementation). The importance of taking a process perspective to solution provision and decompose it into different activities (diagnosis, design and implementation of a solution) becomes apparent. To conclude, in brief, our study is the first to demonstrate that social capital improves the supplier's ability to provide optimal solutions. Future research may benefit from understanding solution provision not as a monolithic single activity, but as a process.

### 7.2. Implications for managers

Our findings indicate that managers should realize the importance of social capital in buyer-supplier relationships, particularly in solution business. The findings indicate how social capital contributes to the entire solution provision process by enabling suppliers to effectively diagnose buyer needs, as well as design and implement solutions. To date, these different activities have received limited attention in the literature, and the responsibility for these activities is scattered throughout the supplier's organization; i.e., buyer needs are defined by sales or business development departments, while the business or customer support departments participate in the implementation of solutions (Tuli et al., 2007). Because the activities are highly connected, there is a clear need to scrutinize the whole process, which indicates that collaboration between the departments responsible for the individual activities (e.g., sales and product development) must be effectively coordinated. More specific managerial implications originating from our study are presented in Table 10.

Both buyers and suppliers need to acknowledge the importance of diagnosing buyer needs because it leads to the development of effective solutions and their successful implementation. All three forms of social

capital that exist in business relationships can improve the diagnosis of buyer needs. Both buyers and suppliers benefit from understanding the importance of structural capital in business relationships for improving the supplier's solution design. The structure of the social system can take the form of information system platforms or administrative structures and practices (e.g., joint target setting or development programs), which can be used to enhance the relationship. Buyers create a network of suppliers that have good solution provision performance; this can be done by investing in supplier development programs to guarantee that suppliers may generate ideas even at short notice rather than holding a formal concept competition or a formal process for supplier selection. Our results suggest that buyers should pay particular attention to suppliers that can diagnose buyer needs, as this capability eventually determines the success of solution provision. Suppliers, with whom it might be difficult to develop sufficient social capital, would not be considered as prime candidates for collaboration in solution business.

Suppliers benefit from a strategy of building social capital with their buyers. In addition, suppliers should analyze their whole solution provision process and its associated practices and identify ways to improve them via social capital inputs, for example, by acknowledging the interconnections between the different forms of social capital. Suppliers may benefit from focusing their sales efforts on those customers with whom they have solid social capital. This makes the diagnosis of a buyer needs easier which is pivotal to designing and eventually implementing a solution.

### 7.3. Future research and limitations

This study is not without limitations. It was carried out based on data from supplier companies representing different sizes and industries. Future studies could concentrate on more specific types of suppliers, such as suppliers with service-oriented solutions. In addition, future research should address the compensating role of the different dimensions of social capital in solution provision in more detail. The results of this study suggest that structural capital is more important than the other social capital dimensions; therefore, future research should investigate ways to build structural capital in business relationships. The scope of social capital dimensions should be acknowledged in interpreting the results of this study. Although the measurements of social capital used in earlier studies are linked to the conceptualization by Nahapiet and Ghoshal (1998), there are also some differences in the operationalizations of cognitive, structural and relational capital, which could influence the interpretation (Preston et al., 2017; Bohnenkamp et al., 2020). In this study, we intended to overcome some shortcomings of previous measurement attempts but also excluded certain elements of earlier studies. Measurement of structural capital captured quantity, frequency and nature of interaction, and infrastructural elements supportive to actor exchange. However, interaction between different organizational levels and functions (cf. Gelderman et al., 2016; Villena et al., 2011) was not captured in our low power distance culture setting. Cognitive capital measurement included shared interpretations and attitudes in the social system and excluded the potential overlaps of objectives in the relationship (cf. Bohnenkamp et al., 2020). Relational capital was operationalized through the existence of competence and contractual trust supporting the relationship. This excludes the elements of personal interaction (cf. Gelderman et al., 2016; Villena et al., 2011) and friendship (cf. Kale et al., 2000), which might antecede trust, but could also be interpreted as separate sub-dimensions of relational capital. Future research would benefit from comparing the many diverse social capital measurements (Preston et al., 2017), potentially leading to a conversion of measurements.

**Table 10**  
Implications of the main results.

	Diagnosis of buyer needs	Design of a solution	Implementation of a solution
Cognitive capital	<u>Moderate importance</u> Align the managerial style and culture of the supplier and buyer to facilitate the supplier's diagnosis of buyer needs		Social capital does not have a direct impact. Ensure that the diagnosis of buyer needs and solution design are conducted effectively and supported by the social capital in the relationship
Structural capital	<u>High importance</u> Build and sustain impersonal structures (e.g., information systems and administrative structures) in the relationship to improve information exchange and the diagnosis of buyer needs	<u>High importance</u> Build and sustain impersonal structures in the relationship to obtain the best possible solution for a buyer and facilitate its joint design	
Relational capital	<u>High importance</u> Invest in long-term relationship-building between the people involved in the relationship to enhance the benefits of cognitive and structural capital		

This study is based on the responses of suppliers; a future study could extend the scope to buyer firms to increase understanding of their contribution to the solution provision process and the types of activities they engage in. Buyers' evaluation of their suppliers' ability to perform in solution provision would also improve the reliability of results. From a statistical perspective, further, the right skewed character of the solution provision activities might imply that some potential relations between the studied constructs remain undisclosed in this study (Hair et al., 2017a). More qualitative studies are encouraged because a qualitative approach elaborates the results on specific forms of social capital (cf. Camps and Marques, 2014) and relevant complex social processes including different actors.

The different steps of solution provision appear to be a promising avenue for further statistical research that could test the results of this study in more specific settings. Future empirical research applying a confirmatory CB-SEM approach to the relationship between different types of solution processes, solutions, and social capital is needed. This study indicated that more customized offerings can require more sophisticated solution provision and that structural capital is less important when solutions are more service-oriented. Future studies could also utilize other measures for the status and characteristics of buyer-

supplier relationships (e.g., strategic supplier status and, the other way around, preferred customers status) to determine possible effects that accompany those of social capital.

**CRedit authorship contribution statement**

**Aki Jääskeläinen:** Conceptualization, Methodology, Investigation, Validation, Formal analysis, Writing, Visualization, Supervision.  
**Holger Schiele:** Conceptualization, Methodology, Validation, Writing.  
**Leena Aarikka-Stenroos:** Conceptualization, Writing.

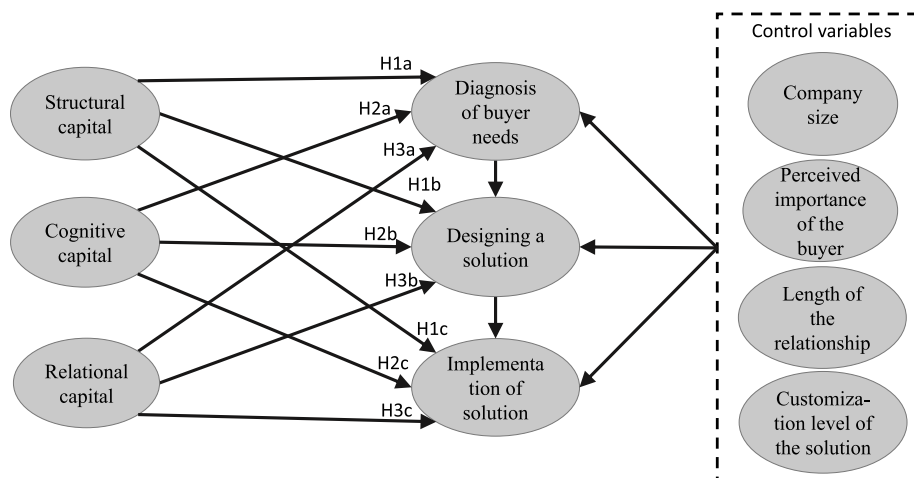
**Declaration of competing interest**

None.

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**Appendix 1. Tested structural equation model**



## Appendix 2. Measures, loadings, construct reliability and validity scores

Construct	Code	Item	Loading	CR	AVE	Cronbach's alpha
<b>Structural capital</b>	SC1	We communicate frequently enough with (BUYER)'s personnel.	0.739	0.907	0.620	0.877
	SC2	We have meetings frequently enough with (BUYER)'s personnel.	0.795			
	SC3	Our company and (BUYER) share relevant cost information with each other.	0.708			
	SC4	We set the strategic goals for the relationship together with (BUYER).	0.847			
	SC5	We have a systematic approach to sharing performance measurement information with (BUYER).	0.771			
	SC6	Representatives of our company and (BUYER) meet regularly to review the performance of the relationship.	0.855			
	dropped item	It is easy to identify the right contact persons at (BUYER).				
	dropped item	(BUYER) shares supplier evaluation results with our company.				
<b>Cognitive capital</b>	CC1	We have a similar organizational culture with (BUYER).	0.873	0.868	0.688	0.767
	CC2	Our company and (BUYER) have similar management styles.	0.889			
	CC3	Our cultural background does not create challenges in the relationship with (BUYER)	0.717			
<b>Relational capital</b>	RC1	We believe that (BUYER)'s activities will be helpful to our business.	0.835	0.887	0.724	0.809
	RC2	When it comes to things that are important to us, we can depend on (BUYER)'s support.	0.878			
	RC3	(BUYER) keeps its promises to our company.	0.838			
<b>Solution provision performance</b>	SPP1	We assist (BUYER) to articulate their needs concerning our company's products or services.	0.718	0.927	0.560	0.912
	SPP2	We offer (BUYER) alternative product or service options.	0.707			
	SPP3	We understand the needs of (BUYER) regarding product or service specifications.	0.610			
	SPP4	We are active in providing (BUYER)'s business with the most appropriate solution.	0.744			
	SPP5	We accelerate the joint design of a solution with (BUYER).	0.796			
	SPP6	We offer additional products or services to meet those customer needs that arise during the delivery.	0.803			
	SPP7	We have the capacity to support the implementation of our product or service in (BUYER).	0.788			
	SPP8	We accelerate the fluent implementation of our product or service at (BUYER).	0.796			
	SPP9	We offer (BUYER) long-term support in its use of our product/service.	0.750			
	SPP10	We support (BUYER) in achieving long-term benefits from our product/service.	0.751			
	dropped item	We understand the needs of < BUYER > regarding ...				
	dropped item	delivery time.				
	dropped item	product or service price.				
<b>Diagnosis of buyer needs</b>	DIAG1	We assist (BUYER) to articulate their needs concerning our company's products or services.	0.817	0.865	0.615	0.792
	DIAG2	We offer (BUYER) alternative product or service options.	0.776			
	DIAG3	We understand the needs of (BUYER) regarding ...	0.787			
	DIAG4	product or service specifications.	0.757			
	dropped item	product or service quality.				
	dropped item	delivery time.				
	dropped item	product or service price.				
<b>Design of a solution</b>	DSOL1	We are active in providing (BUYER)'s business with the most appropriate solution.	0.895	0.910	0.772	0.852
	DSOL2	We accelerate the joint design of a solution with (BUYER).	0.879			
	DSOL3	We offer additional products or services to meet those customer needs that arise during the delivery.	0.861			
<b>Implementation of a solution</b>	ISOL1	We have the capacity to support the implementation of our product or service in (BUYER).	0.845	0.928	0.765	0.897
	ISOL2	We accelerate the fluent implementation of our product or service at (BUYER).	0.868			
	ISOL3	We offer (BUYER) long-term support in its use of our product/service.	0.903			
	ISOL4	We support (BUYER) in achieving long-term benefits from our product/service.	0.880			

CR = composite reliability; AVE = average variance extracted.

## Appendix 3. Analysis of discrepancies in the polynomial regression

Comparison of structural capital and relational capital			
Groups	Percentage	Mean structural capital	Mean relational capital
Relational capital > structural capital	21.5	4.23	6.12
In agreement	40.6	5.31	6.00
Relational capital < structural capital	23	5.48	5.20
Comparison of structural capital and cognitive capital			
Groups	Percentage	Mean structural capital	Mean cognitive capital
Cognitive capital > structural capital	23.7	4.31	5.24
In agreement	36.9	5.25	5.03

Cognitive capital < structural capital	22.1	5.65	4.05
<b>Comparison of relational capital and cognitive capital</b>			
<b>Groups</b>	<b>Percentage</b>	<b>Mean relational capital</b>	<b>Mean cognitive capital</b>
Cognitive capital > relational capital	24.3	5.25	5.37
In agreement	39.9	5.94	5.00
Cognitive capital < relational capital	22.1	5.82	4.01

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