

# A Matter of Perspective – Navigating Interpersonal Relationships in Supply Chain Risk Management

## Summary Abstract

Research has established the need for multilevel theorization in our discipline. Especially in supply chain disruption (SCD) management, we have learned that risk is mostly managed by individuals as members of organizations. Surprisingly, SCD studies have not yet leveraged to potential of conducting interpersonal research. This study aims to take established interorganizational SCD-constructs and research them on an interpersonal level. Researching two industry clusters, we look into ways that managers can leverage these relationships through the appropriate use of interorganizational governance mechanisms. Structural equation modelling is conducted with 229 responses, showing that personal relationships are significant determinants for successful SCD management. Appropriate governance depends on the industry cluster.

**Keywords:** Interpersonal, Supply Chain Risk Management, Multi-level Research

## Introduction

The first entry in EBSCO's Business Source Complete database on "supply chain risk management" can be traced back to Harris' (1993) essay on corporate strategies and their linkage to the appearance of network risks. Until now, researchers in this subject area have sought to show the negative effect of supply chain disruptions (SCDs) on both shareholder wealth and business performance. These researchers have either taken a network perspective (Bode and Wagner, 2015), a manufacturing perspective (Gualandris and Kalchschmidt, 2015), or an intra-organizational perspective (Son and Orchard, 2013).

Another group of researchers has sought to find ways to reduce SCDs by conducting their research on an inter-organizational level, although from different points of view, researching the perception that one firm has for another firm (Talluri *et al.*, 2010). Even studies that looked at behavioral aspects in risk management have eventually researched the interorganizational level (Ellis *et al.*, 2010), asking individuals for their assessment of their organization's attitude towards its partner organizations. However, it is often difficult to have this correctly assessed from a single respondent's perspective.

In line with social capital theory, we hypothesize that interpersonal relationships substantially shape supply chain activities and outcomes. It is mostly individuals as members of organizations who try to identify, assess, treat and monitor disruption risks (Zsidisin *et al.*, 2005). We therefore hypothesize further that the field of SCD management will substantially benefit from revisiting the impacts of interorganizational relational determinants (one organization to another organization) on an interpersonal level (individuals to other individuals). Such research, which uses new levels of measurement, has been identified as an area for further study in our field with critical importance in terms of theoretical development and construct definition (Carter *et al.*, 2015).

Building on Dyer and Singh (1998), the aim of this study is to take three established interorganizational constructs (investments, information sharing and complementarity) and research them in an interpersonal SCD context. We thereby seek to research the SCD management value created by a buying-firm's employees in their interaction with employees at the supplying-firm. This study provides four contributions to the supply chain literature. The first is framed around the fact that existing supply chain research has primarily used an interorganizational lens to examine SCD management. Conversely, we discuss and test how interper-

sonal linkages foster and hamper SCD performance at the buying-firm. Second, we investigate potential inferences from our proposed model for managers. Conducting a multi-level analysis, we research which governance mechanisms should be deployed by managers on an organizational level to positively moderate proposed interpersonal relationships. Third, we consider two industry clusters as a potential moderating variable for the value of interpersonal interaction in the field of SCD management. Fourth, in contrast to existing SCD research that has measured SCD performance as a single latent construct, we discern between SCD performance improved ‘with the particular supplier’ (relational SCD performance) and SCD performance improved ‘with other suppliers’ (re-deployable performance).

The remainder of this article is structured as follows: Section 2 provides the theoretical backdrop to the proposed model; Section 3 describes how we tested the proposed model. Findings are presented in Section 4, followed by a discussion in Section 5. Finally, Section 6 provides limitations, future research potentials and some concluding remarks.

### Theoretical perspectives on the interpersonal management of SCDs

The relational view (RV) theorizes that firms gain a competitive advantage from being embedded in a network of firms (Dyer and Singh, 1998). This study combines this theory with social capital theory (SCT), which posits that SC firms are themselves composed of people, and the skills and relationships among these people. These interpersonal links between supply chain partners shape supply chain activities and outcomes (Ketchen Jr. and Hult, 2007).

Figure 1 depicts our proposed hypothetico-deductive model. It considers two forms of SCD management performance, arguing that one can simultaneously be involved in, and benefit from, a supplier relationship. Drawing on Mesquita *et al.* (2008), we argue that disruptions can be successfully managed within the partnership (“Relational SCD Performance” – abbr. RelSCDPerf) while learning benefits are available to employees involved in the firm’s other supplier partnerships (“Re-deployable SCD Performance” abbr. Re-depSCDPerf).

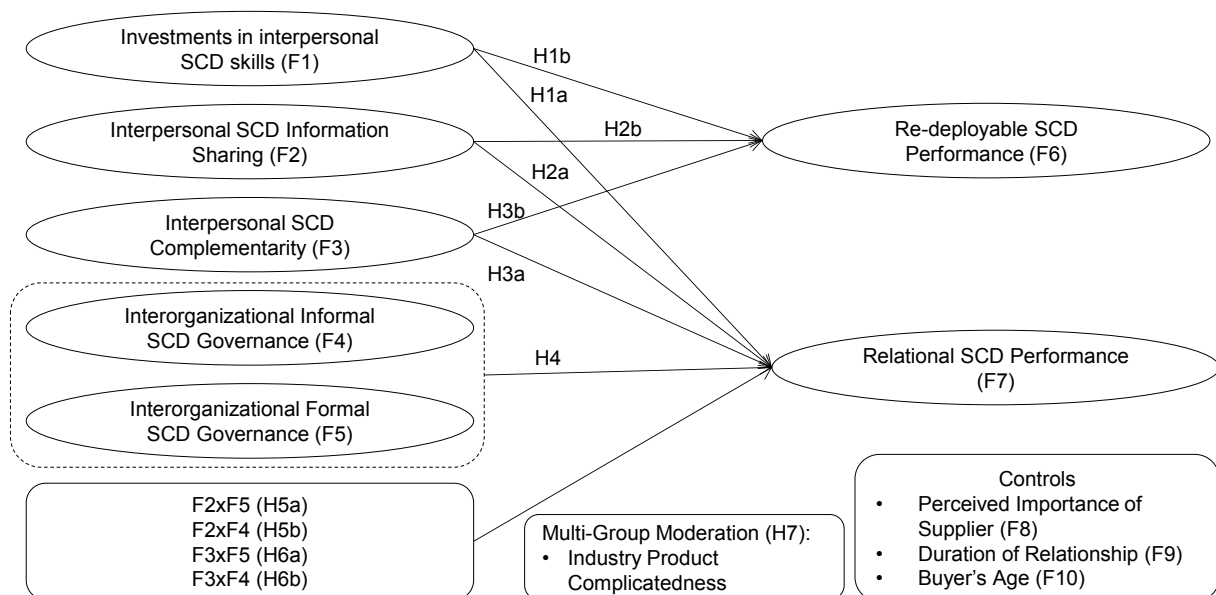


Figure 1 - Hypothetico-deductive model

#### Investments in interpersonal SCD skills and SCD performance

People have idiosyncrasies which make them unique in the way they operate in their work environment (Micheli, 2008). In the context of SCDs, personnel from both partners have to adjust and align their processes in order to modify and adjust their SCD management skills and adapt commonly learned procedures (Ramström, 2008). Such investments are usually intended to improve process capability and delivery capability (Li *et al.*, 2007). They include

the exchange of personnel between buyer and supplier organizations (Newman and Rhee, 1990) or the provision of supplier-specific trainings (Galt and Dale, 1991). They enhance group identity by raising group awareness and bringing members physically together. Raising group identity has been shown to increase the effort made by group members to avert harmful exogenous events for the group (Thompson, 2004). We therefore postulate that a buying-firm's employees will be able to increase RelSCDPerf through investments H1a:

**Hypothesis 1a:** *Investments in interpersonal SCD skills positively associate with relational SCD performance.*

We also argue employees can reuse them to a lesser extent in other supplier relationships.

**Hypothesis 1b:** *Investments in interpersonal SCD skills associate with re-deployable SCD performance.*

#### *Interpersonal SCD information sharing and SCD performance*

The importance of information flows in supply chains has been clearly established (Kembro and Näslund, 2014). Jüttner and Maklan (2011) propose that when firms manage to acquire the required information they will experience a positive impact on SCD performance. In an interpersonal context, it has been shown that the exchange of information helps people to perform closer to the rational equilibrium (Croson and Donohue, 2003).

In this study, Interpersonal SCD Information Sharing (SCDInfoSharing) refers to routines established between the employees of the SC partners, which are aimed at exchanging SCD management information. Therefore, it is postulated that:

**Hypothesis 2a:** *Interpersonal SCD information sharing positively associates with relational SCD performance.*

Further, this study suggests that benefits acquired from sharing information can also be re-deployed by the employees across other partners, leading to Re-deplSCDPerf

**Hypothesis 2b:** *Interpersonal SCD information sharing positively associates with re-deployable SCD performance.*

#### *Interpersonal SCD complementarity and SCD performance*

Research has long recognized the positive outcomes that arise from complementary skills among supply chain partners (Milgrom and Roberts, 1995). Value from complementarity is said to be achieved through two dimensions: accumulating similar capabilities and combining distinct ones (Larsson and Finkelstein, 1999). In the context of SCDs, it is assumed that supply chain partners lack certain capabilities for successfully managing SCDs independently and are thus dependent on their supply chain partner (Pfeffer and Salancik, 1978).

On an interpersonal level, complementarity allows people to generate actions that others can anticipate and understand. This has been shown to make better supply chain-related decisions (Wu and Katok, 2006). Therefore, we argue that:

**Hypothesis 3a:** *Interpersonal SCD Complementarity positively associates with relational SCD performance.*

We also argue that the SCD management capabilities can be unilaterally appropriated by the buying-firm's employees and re-deployed across other suppliers. This leads to:

**Hypothesis 3b:** *Interpersonal SCD Complementarity positively associates with re-deployable SCD performance.*

#### *The moderating effect of interorganizational SCD governance*

We will now hypothesize how managers can leverage the afore-proposed relationships by implementing appropriate formal and informal interorganizational governance mechanisms.

Formal governance usually builds upon the principles taught in transaction costs economics. Following this notion, interorganizational formal SCD governance (FormalSCDGov) is understood in this study as the extent to which the buying-firm has specific, customized, and

detailed contractual agreements with the supplying-firm, specifically designed for the management of SCDs (Poppo and Zenger, 2002).

Critics argue that formal governance mechanism are often incomplete and cannot take account of all future scenarios (Dekker *et al.*, 2013). It may also discourage suppliers from making additional efforts to reduce SCDs to the buying-firm. Informal SCD governance may provide more flexibility to the supplier. Kalkanci *et al.* (2011) indicate that simple contracts may outperform more complex contracts, because bounded rationality impacts peoples' behavior. This study argues that both governance mechanisms, formal and informal, make a valuable contribution to SCD performance, suggesting the following hypothesis:

**Hypothesis 4:** *Both formal and informal interorganizational SCD management governance are positively associated with the relational SCD performance.*

Multiple researchers have modeled the impact that interorganizational contracts have on the value and the type of information shared between supply chain partners (Corbett *et al.*, 2004). The basic notion in these studies is that managers can guide the sharing of correct information through appropriate inter-organizational governance mechanisms. Behavioral experiments have shown that the less binding contracts are, the more they lead to personal attributions of cooperation (Malhotra and Murnighan, 2002). It is therefore reasonable to assume that the value of interpersonal information sharing is considerably higher when the level of detail in interorganizational SCD contracts is low. Similarly, when interpersonal information sharing is high, very detailed contractual SCD agreements may hamper the value of interpersonal information sharing, as the resulting organizational actions are bound by the contractual agreements. We therefore hypothesize that:

**Hypothesis 5a:** *Formal interorganizational SCD governance dampens the positive relationship between interpersonal SCD information sharing and the relational SCD performance.*

It is further hypothesized that:

**Hypothesis 5b:** *Informal interorganizational SCD governance strengthens the positive relationship between interpersonal SCD information sharing and the relational SCD performance.*

Interorganizational FormalSCDGov can also function as a coordinating mechanism to make the best use of high interpersonal complementary skills. Huang *et al.* (2013) show that formal governance provides the coordination mechanism needed in order to allocate capacities according to the supply chain partner's individual capability. We thus hypothesize further:

**Hypothesis 6a:** *When interpersonal SCD complementarity is high, interorganizational formal SCD governance strengthens the positive relationship between interpersonal SCD complementarity and relational SCD performance.*

In line with Pilbeam *et al.*'s (2012) this study concurs that during SCDs, the coordinative mechanisms discussed above cannot be provided by reliance on informal governance alone. In relationships with low interpersonal complementarity, the coordinative mechanisms of FormalSCDGov become increasingly obsolete, and interorganizational informal SCD governance mechanisms suffice to support the benefit of low complementarity in relationships. It is therefore postulated that:

**Hypothesis 6b:** *When interpersonal SCD complementarity is low, interorganizational informal SCD governance strengthens the positive relationship between interpersonal SCD complementarity and relational SCD performance.*

*Dissociating high from low complex-product industries*

We will now make a conjecture about contextual differences in the usefulness of each governance mechanism in different industry clusters. Organizational theorists have long argued that complex-product industries tend to be characterized by a high degree of reciprocal interdependence (Pfeffer and Salancik, 1978). Novak and Eppinger (2001) found a positive link

between product complexity and vertical integration, as greater product complexity gives rise to coordination challenges.

Kotteaku *et al.* (1995) found that purchases of products with high complexity are often associated with high formalization scores. Firms in industries that deal with complex products commonly use detailed formal rules and written documents to describe all of the supplier's tasks in detail. Companies in these industries have been shown to involve many employees within the buying process, thereby negatively impacting the value of the individual interpersonal relationship (Kotler and Armstrong, 2015). We therefore suggest a moderating role of complex-product industries on the proposed interpersonal relationships:

**Hypothesis 7:** *Interpersonal effects on relational SCD performance as proposed in H1-H3 are higher in low complex-product industries than in high complex-product industries.*

### **Research methodology**

This study applies covariance-based structural equation modelling to test the developed hypotheses. A mailing list was compiled of 1,888 purchasers at manufacturing firms from Austria, Germany and Switzerland. These purchasers were asked to fill out an online survey which focused on a specific supplier delivering a standard product, and the interaction of her/his purchasing team (addressed as 'employees') with the employees of this supplier. The survey yielded 229 usable responses.

Before sending out the questionnaire, a preliminary version of it was pretested following the process suggested in Moore and Benbasat (1991). Due to space restrictions, the developed list of items can be obtained from the authors upon request.

#### *Sample and procedure*

In screening the data, unengaged respondents and respondents with more than eight percent of item values missing in one data set were removed. Missing item values were estimated with an Expectation Maximization Algorithm. All observed variables were examined for skewness and kurtosis. No issues were detected by visual inspection. To test for non-response bias, the means of all construct items were compared via t-tests between the first and last third of responses. No statistically significant differences between these groups could be detected.

Exploratory Factor Analysis showed high factor loadings and Cronbach's alphas ranging between .856-.949. Confirmatory Factor Analysis using Amos 20 was then conducted to estimate composite reliability. Addressing the potential for common method variance (CMV), several ex-ante strategies were followed. For an ex-post diagnosis of CMV, the common latent factor method in AMOS and the confirmatory factor analysis marker technique were followed. Both tests provided no indication for CMV.

Discriminant validity on a construct level was tested using the heterotrait-monotrait (HTMT) ratio of correlations and the Fornell-Lacker test. Both test values indicated no validity concerns.

#### *Sorting high and low complex-product industries*

In order to address H7, a multi-group moderation needed to be conducted clustering the respondents into high and low complex product industries. A Q-sort exercise was done by four experienced researchers, to categorize the industry sectors according to the average complexity of its standard product. The result showed unanimous agreement over the industry classifications. Measurement invariance was tested between both groups. No significant differences in how the constructs were measured across the two groups could be identified. Due to space restrictions, the two industry groups identified won't be displayed here.

## Results and analysis

The data analysis followed the two-step modelling approach proposed in Anderson and Gerbing (1988). This approach allows testing for whether any model that is less constrained or nested within the theoretical model would give a better representation of the data. Table 1 provides an overview of the study results.

Table 1 - Standardized parameter estimates and goodness of fit indices for the three models

Standardized Estimates		Model 1 (Measurement Model)				Model 2 (Theoretical Model)				Model 3 (Best Model)			
		Dependent Variables											
		RelSCDPerf (F6)		Re-deplSCDPerf (F7)		RelSCDPerf (F6)		Re-deplSCDPerf (F7)		RelSCDPerf (F6)		Re-deplSCDPerf (F7)	
		Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2
Independent Variables	<i>Interpersonal</i>												
	SCDInvest(F1)	0.255**	0.171**	0.311**	0.209**	0.249**	0.188**	0.297**	0.252**	0.239**	0.187**	0.297**	0.252**
	SCDInfoSharing (F2)	-0.066	0.052	-0.014	0.270**	-0.048	0.065	0.028	0.302**	-0.066	0.076	0.028	0.302**
	SCDComplementarity (F3)	0.522***	0.273**	0.393***	0.267**	0.530***	0.253**	0.410***	0.213*	0.524***	0.239**	0.410***	0.213*
	<i>Interorganizational</i>												
InformalSCDGov (F4)	0.248**	0.126	0.026	-0.145	0.237**	0.180**			0.259***	0.172**			
FormalSCDGov (F5)	0.075	0.241***	0.060	0.155**	0.049	0.184**			0.044	0.189**			
Interaction Terms	F2xF5	-0.062	-0.021***			-0.062	-0.210**			-0.084	-0.229**		
	F3xF5	0.145*	0.302			0.146*	0.302***			0.137	0.337***		
	F2xF4	-0.142*	0.107			-0.142*	0.107						
	F3xF4	0.031	-0.354**			0.031	-0.354**			-0.067	-0.273***		
Controls	F8	0.141**	0.106**	0.086	0.079	0.146**	0.099**	0.098	0.061	0.146**	0.109**	0.098	0.061
	F9	-0.078	0.051	0.067	-0.049	-0.079	-0.088	0.067	0.036	-0.080	0.076	0.067	-0.088
	F10	0.076	-0.019	0.008	0.161**	0.076	-0.004	0.004**	0.201	0.073	-0.004	0.007	0.201**
Goodness of Fit Indices	GFI	0.975				0.972				0.971			
	$\chi^2/df$	1.147				1.196				1.197			
	RMSEA	0.018				0.021				0.021			
	SRMR	0.049				0.049				0.050			
	CFI	0.997				0.995				0.995			
	$\chi^2$	86.015				96.898				100.516			
	df	75				81				84			
	p	0.181				0.110				0.106			

Notes: \*\*\* p-value < .01; \*\* p-value < .05; \* p-value < .10

### Two Step Modeling Approach

Three models were built to assess the structural model. Model 1 is the measurement model and relates all independent and dependent constructs to one another. Model 2 is the theoretical model and nested within Model 1, only including the hypothesized relationships. Model 3 is the most parsimonious model and nested within Model 2. The lower part of Table 1 displays a list of various fit indices, indicating an acceptable fit for all three models. Conducting a  $\chi^2$ -difference tests between the alternative models showed that Model 3 is the 'best model.'

### Model analysis and moderated moderation

The following analysis refers to the results of Model 3. The effect of SCDInvest on both dependent variables is positive and significant for both industry groups, supporting H1a and H1b. Contrary to H2a, SCDInfoSharing has no significant effect on RelSCDPerf. H2b was supported for industry group 2, though not for group 1. Supporting H3a and H3b, a strong positive relationship between SCD Complementarity and the dependent variables could be detected for both industry groups. H4 is largely supported by the model, with the exception that FormalSCDGov does not have a significant effect on RelSCDPerf for group 1.

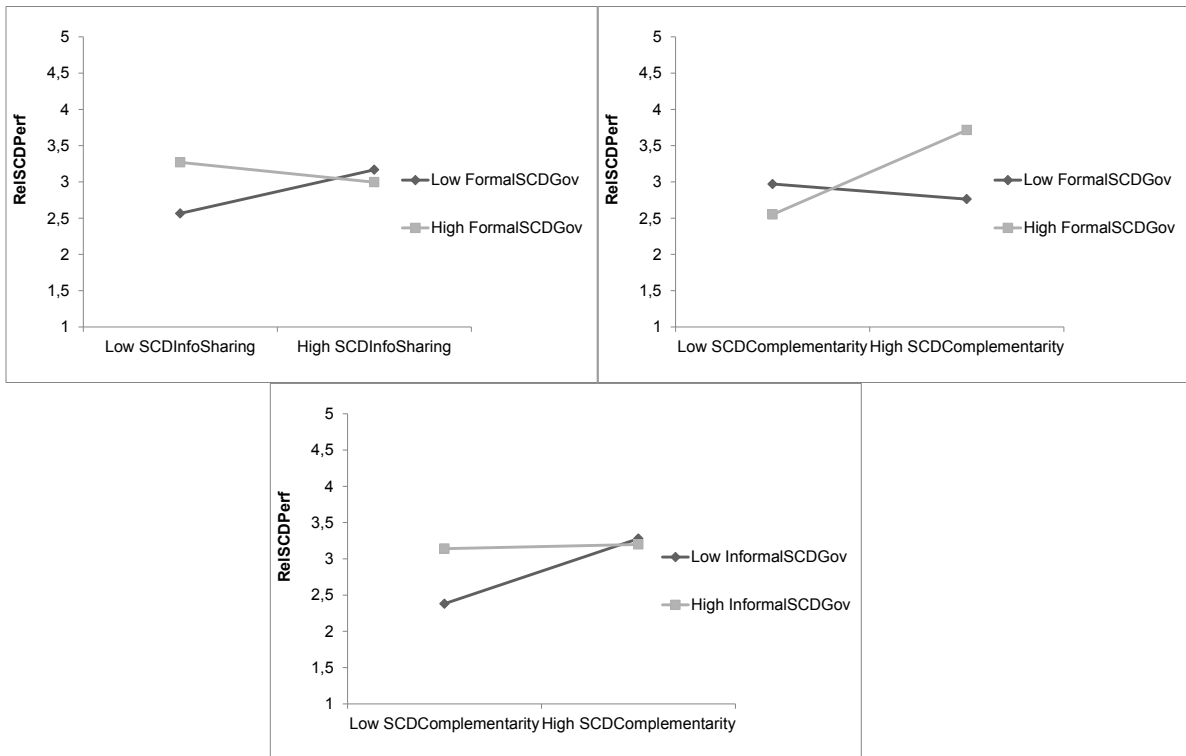


Figure 2 - Two-way interaction effects for unstandardized variables (industry group 2)

In order to retain the full information contained in the continuous moderator variables of this study (InformalSCDGov, FormalSCDGov), the moderated variable effects were modeled as multiplicative interactions. The interaction moderation test confirmed H5a for group 2. The interaction effect for industry group 2 was significant to a  $p < .05$  level with S.E. -.210, supporting our initial assumption.

All significant two-way interaction moderation results are depicted in Figure 2. They support H5a, H6a and H6b for industry group 2.

Testing for H7, we looked at significant group differences in model 3. While the standardized estimates of H1a and H3a were found to be higher in group 1, a group difference ( $z = -1.797$ ) could only be detected for H3a with a significance level of  $p < .10$  for non-standardized path coefficients. This indicates that SCDComplementarity has a stronger impact on RelSCDPerf in low complicated product industries (S.E. +.524;  $p < .01$ ) than in high complicated product industries (S.E. +.239;  $p < .05$ ). We therefore partially accept H7.

Testing for H7, we found an interesting moderated moderation effect between the two industry clusters. That is, while the interpersonal effects are higher in low complex product industries, the lower effects in highly complex product industries can still be significantly influenced by a manager's appropriate choice of an interorganizational governance mechanism.

### Discussion and implications

The main aim of this study was to research established interorganizational viewpoints on SCD management on an interpersonal level. The study results provide new and interesting insights into the role of interpersonal relationships in SCDs. Managers from different industry sectors are provided with insights on how formal and informal interorganizational governance mechanism can amplify or mitigate the proposed relationships. Theoretically and empirically, this article represents a significant addition to SCD literature by adding insights to the field regarding the level of measurement.

### *Contribution to literature*

The analysis shows that investments in interpersonal skills and interpersonal complementarity are strong and significant determinants of RelSCDPerf. It also shows that the benefits from these determinants cannot be tied to a single supplier relationship alone, but that a buying-firms' employees can make use of them in other supplier relationships as well. The study also busts the myth of the unambiguous usefulness of information sharing in SCD management. We measured the amount of interpersonal information sharing routines. The model then tested for whether changes in this construct will result in linear changes in the dependent variables. Surprisingly, the data showed no statistical support for this hypothesis. Clearly, information sharing is incorporated in any relationship whether interorganizational or interpersonal, and it is an important part of general SCM. However, while previous SCD studies have shown in their statistical models that a "the more the merrier" assumption holds true in their interorganizational view (Wieland and Wallenburg, 2012), we could show that on an interpersonal level this relationship is a non-linear one. This may add to Wakolbinger and Cruz (2011) who have highlighted that information sharing in supply chains does not always enhance the firms' performance. We interpret our findings as showing that employees who prepare for disruptions may experience no additional linear value in an increased sharing of information, as the right information at the right time might be enough to appropriately implement mitigation measures.

The findings also show that untangling the performance construct into RelSCDPerf and Re-deplSCDPerf provides new fine-grained insights into the mechanisms that generate benefits from interpersonal interactions. For example, while a linear increase in the interpersonal information exchange of information is not significantly related with supplier specific performance, it still supports overall Re-deplSCDPerf of the firm in complex-product industries, as it significantly increases the performance with other suppliers. It is reasonable to assume that the ratio of RelSCDPerf to Re-deplSCDPerf will be higher when the employees have more opportunities to apply what they learn to suppliers outside of the scope of the particular relationship, as it is the case within industry group 2. The data further shows a very strong relationship between SCDComplementarity and both performance variables. We think this may be a valuable contribution to the supplier selection literature, where interpersonal complementarity has not yet been explicitly regarded as a selection criterion (e.g. Ho *et al.*, 2010). It also provides supplemental perspectives to complementarity theory as propagated in psychology (Fiske, 2000), adding to previous SCM related studies that have borrowed from this theory (Blome *et al.*, 2013).

Methodologically, the study dissents with the research from Priscila *et al.* (2014) who argued that relational complementarity cannot be measured individually in structural equation models but should be considered as part of relational governance mechanisms. We could identify a clear difference between these constructs in the context of SCD. Discriminant validity could be established on an item and on a construct level. We could further show that the level of measurement is highly important in our field. The moderated moderation effects in our model have shown that interorganizational governance mechanisms significantly moderate the proposed interpersonal relationships. This finding supports Whipple *et al.* (2013) who have identified multi-level research as a critical area of research in our field.

### *Managerial implications*

Interesting contextual insights could be derived from this study, providing valuable managerial guidance. Less complex products usually mean fewer supplier relationships that need to be orchestrated in order to manufacture the product. Managers from less complex-product industries can learn from this study that there is no significant SCD value of having ironclad SCD contracts with their suppliers. If feasible, the best option for firms from this cluster is to have their purchasing personnel develop close personal relationships with their counterparts. If they



manage to do so, a quick, non-formal adjustment in case of SCDs is more likely and changing processes can be better aligned.

The study data also indicates that across all participating companies in this study, benefits can be detected from relation-specific investments in interpersonal SCD skills. And these investments are well-invested even in short-lived supplier relationships. It could be shown that employees' learnings derived from such investments can be reused across other supplier relationships. That is, employees are capable of extracting important knowledge and capabilities even from supplier-specific investments, and re-deploying those with other suppliers.

The data further shows the importance of interpersonal complementary in supply chains. These findings again show the need for conducting a thorough supplier selection process. This process should not just consider the supplier organization, but look at the individual employees with whom their company will interact. This will certainly make the supplier selection process much more challenging than it is today. However, as the data demonstrates, the SCD benefit from finding the right supplier with the right personnel is exceptionally high.

### **Limitations and future research directions**

The study has limitations which may provide directions for future research. First, this study has only considered one side of the dyadic relationship. Although this is a common practice in Operations Management (e.g. Bode and Wagner, 2015; Mesquita *et al.*, 2008), collecting data from both sides would be an interesting and potentially fruitful task for future research. A variety of factors can be examined only by using dyadic data. For example, this study's analysis has focused on buyer's investments in interpersonal skills, leaving the effects of supplier's asset investments open for future research attempts. Further, the dependent variables have looked at the relational and re-deployable SCD performance enhancements of the buying-firm, while future research could also try to integrate the suppliers' perspectives.

As discussed, no significant linear positive relationship between interpersonal information sharing and relational SCD performance could be identified. The multiple ways of interpreting this finding may hopefully spark subsequent research efforts to investigate both the interpersonal information sharing investigated in this article and the interorganizational and impersonal types such as information technology in one study.

Finally, the authors acknowledge that industry sector codes are just a proxy and not a perfect metric for the average product complexity. Future research efforts could and should take a closer look at the moderating effects of this context.

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<sup>1</sup> A more complete set of references will be provided in case the paper is chosen for a SI.

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