

Supply Chain Risk Governance: Towards a Conceptual Multi-Level Framework

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ABSTRACT

The coronavirus pandemic (COVID-19) is currently putting high pressure on most countries' critical infrastructures (not only health care), creating huge uncertainties in supply and demand, and disrupting global supply chains. The global crisis will demonstrate the extent to which different parties (countries, public authorities, private companies etc.) can work together and take holistic decisions in such situations. A core question in supply chain management asks how independent decision-makers at many levels can work together and how this joint work can be governed. Supply chain risk management (SCRM), however, has focused mostly on how focal private companies apply SCRM processes to identify, analyse and mitigate risk related to upstream and downstream flows in their supply networks. At the same time, inter-organisational collaboration to handle diverse risks is always needed. A risk that hits one organisation often affects other, interconnected organisations. This study aims to develop the term *supply chain risk governance* with an associated conceptual framework that embraces various types of supply chains and actors. In a cross-disciplinary literature study, we dissect, compare and combine *risk governance* with inter-organisational aspects of SCRM and find that the mechanisms suggested in the risk governance literature coincide with many of those in SCRM. We suggest a combination of these to govern risk processes at an inter-organisational level, regardless of the type of organisation included in the supply chain. This would be suitable for critical infrastructures that often contain a mixture of private and public actors. The scope of the literature employed is limited, and some articles have played a larger role in the framework development. The paper explores new territory through this cross-disciplinary study, extends existing multi-level frameworks with inter-organisational governance mechanisms and proposes new governance mechanisms to the field. This study could support the understanding of how critical infrastructures in our society are governed so as to increase their resilience to both smaller and larger disruptions.

Keywords: risk governance, supply chain risk management, governance mechanisms, critical infrastructure

1. INTRODUCTION

When a major incident occurs in today's interconnected society, many organisations will be either impacted by or involved in handling the risk. The current coronavirus pandemic (COVID-19) demonstrates this to an extent hardly ever observed. Putting extremely high pressure on most countries' critical infrastructures, we see that not only healthcare is affected. Ripple effects are hitting almost everything in a modern society including transportation, food, industry, education, and energy. Almost all sectors face huge supply and demand uncertainties. Local, national and global supply chains are disrupted: 'The global supply system collapsed' (DN, 2020). Cooperation and coordination constitute huge challenges, requiring interorganisational risk management. One research domain that deals with this is supply chain management (SCM), in which supply chain risk management (SCRM) has grown in response to firms' increasing need of joint strategies to manage risks. The aim is to ensure business continuity and avoid disruptive events that have costly ripple effects in the supply chain (Fan and Stevenson, 2018; Norrman and Jansson, 2004). SCRM has many definitions focusing on the use of risk management processes in an inter-organisational context, e.g., 'Supply chain risk management is to [collaborate] with partners in a supply chain apply risk management process tools to deal with risks and uncertainties caused by, or impacting on, logistics related activities or resources' (Norrman and Jansson, 2004, p. 436). Friday *et al.* (2018) argue that, although SCRM definitions contain elements of collaboration, classic risk strategies are limited with regard

to the means and intensity of collaboration. In SCM, the focus has been mostly on how private companies apply SCRM processes in their attempts to identify, analyse and mitigate risks related to upstream and downstream flows in their supply networks. Suggested mitigation strategies simply transfer the risk upwards or downwards to other actors (Fan and Stevenson, 2018), so the risk remains in the supply chain. The techniques have been criticised for being implemented only at the focal firm level (Friday *et al.*, 2018), one exception being Peck (2005), who suggests a multi-level framework for analysing risk sources and drivers. While based on a system of relationships in inter-organisational networks, logistics flows, assets and infrastructures, Peck's framework does not address how the relationships could or should be managed. To stress the inter-organisational dimension, Friday *et al.* (2018) define collaborative risk management as 'an interactive process based on mutual commitment between firms with a common objective to join effort and mitigate supply chain risks and related disruptions through co-development of strategic relational capabilities and sharing of resources'. Also, Bak (2018) brings up the importance of understanding supply chain relationships for long-term supply chain risk mitigation and suggests that future research should identify how supply chain members interact and what resources are required.

While SCRM research focuses on private companies and their risks, other domains, such as risk management and societal safety (RMSS) and humanitarian logistics, are more concerned with societal risks and how public or humanitarian organisations deal with emergencies. This relates partly to critical infrastructures, i.e., assets or systems such as electricity, health, transportation and food, in which disruptions would have significant societal impacts. Over time, critical infrastructures have developed from local systems into complex, interconnected, international and integrated systems involving both public and private actors. The risks to which they are exposed are often classified as highly complex (Bekkers and Thaens, 2005; Klinke and Renn, 2012). A breakdown in one system may cause ripple effects and spillovers to others, resulting in catastrophic situations (Bekkers and Thaens, 2005; Ouyang, 2014; Rinaldi, 2001). Due to complex relations, many of these risks cannot be managed by a single actor but require collaboration (IRGC, 2008). What previously was viewed as an intra-organisational task is now characterised by joint tasks in large supply networks of public and private stakeholders who often have competing interests and views on risk. It is therefore important to understand the relationships between such actors as traditional governmental top-down decisions no longer suffice. In response, the concept of *risk governance* (Arvidsson and Cedergren, 2016; Dubreuil, 2001; Gheorghe *et al.*, 2007; Renn, 2008; Sajeve and Masera, 2006) has emerged in the RMSS domain in cases in which multiple stakeholders are affected by risks and involved in risk management. The purpose is to enable inter-organisational risk evaluation and collective decisions and to handle complex, uncertain and ambiguous risk (Gheorghe *et al.*, 2007; Klinke and Renn, 2012; van Asselt and Renn, 2011; van der Vegt, 2018a).

Governance itself is a construct used in many disciplines, and it has diverse meanings. Broadly, it describes an institutionalised decision-making process

among many independent actors. Governance is operationalised into more detailed and concrete governance mechanisms that may direct various actors' behaviours. Similarly, SCM focuses on how decision-makers in long supply chains can work together to jointly manage and govern. To distinguish this inter-organisational dimension from standard risk management, we suggest the term *supply chain risk governance*. A dilemma from a research point of view is that domains such as SCM and RMSS have studied inter-organisational risk management separately, using different terms such as *collaborative SCRM* and *risk governance*, even though both domains developed from systems theory and attempt to describe, understand and handle systemic risk in inter-organisational contexts with multiple decision-makers and potential cascading effects. We argue that it will be easier to design proper governance mechanisms when the underlying similarities and differences in backgrounds and perspectives are understood.

This study aims to develop the term *supply chain risk governance* with an associated conceptual framework that embraces diverse types of supply chains and involved actors by dissecting, comparing and combining *risk governance* with the inter-organisational aspects of SCRM. The study offers a multi-level analytical framework incorporating various mechanisms for inter-organisational governance related to SCRM, which contributes to previously suggested multi-level frameworks (Peck, 2005) both by adding explicit risk governance mechanisms and by taking a cross-disciplinary approach in combining the domains of SCM and RMSS. We do this by reviewing the relevant literature and, in the next section, presenting the methodology used. We then describe the two domains (SCM and RMSS), followed by a comparison of their key dimensions and characteristics. Section 4 develops the framework, and the final section summarises the conclusions and limitations and suggests areas for future research.

2. METHODOLOGY

2.1 Research Process

To compare the constructs *risk governance* and *collaborative SCRM*, the current state of understanding in the two research domains (SCM and RMSS) must be examined. Following the recommendation of Rowley and Slack (2004), this paper employs the literature review as a scoping study in line with suggestions by Arksey and O'Malley (2005) and Davis *et al.* (2009). At a general level, such scoping studies 'aim to map rapidly the key concepts underpinning a research area and the main sources and types of evidence available, and can be undertaken as stand-alone projects in their own right, especially where an area is complex or has not been reviewed comprehensively before' (Mays *et al.*, 2001, p. 194). Often performed in an iterative way, a scoping study comprises the following steps: (1) identifying the research question; (2) identifying relevant studies; (3) selecting studies; (4) charting the data; (5) collating, summarising and reporting the results. To enable a structured analysis, our literature review was combined with content analysis following Seuring and Gold's (2012) four-step model of qualitative content analysis: (1) determining the material to analyse and the unit of analysis, i.e., scoping the study; (2) assessing formal characteristics through a descriptive analysis; (3) selecting categories for analysis; (4)

analysing the material. Some of these steps overlap; the combined procedure is illustrated in **Figure 1**.

The initial literature recommended by scholars helped to formulate the research questions and define our unit of analysis (the governance of inter-organisational risk management in supply chains, which we call *supply chain risk governance*). In the next step, the literature was retrieved through keyword searches, scholar recommendations and

snowballing, resulting in 33 and 26 papers in risk governance and SCRM, respectively. The remaining steps constituted the analysis. Steps 1 to 3 were performed linearly, but an iterative process was needed between steps 4 and 5 to shape the categories for analysis. Step 5 involved separate but parallel content analysis of the respective constructs, which were summarised and compared in step 6.

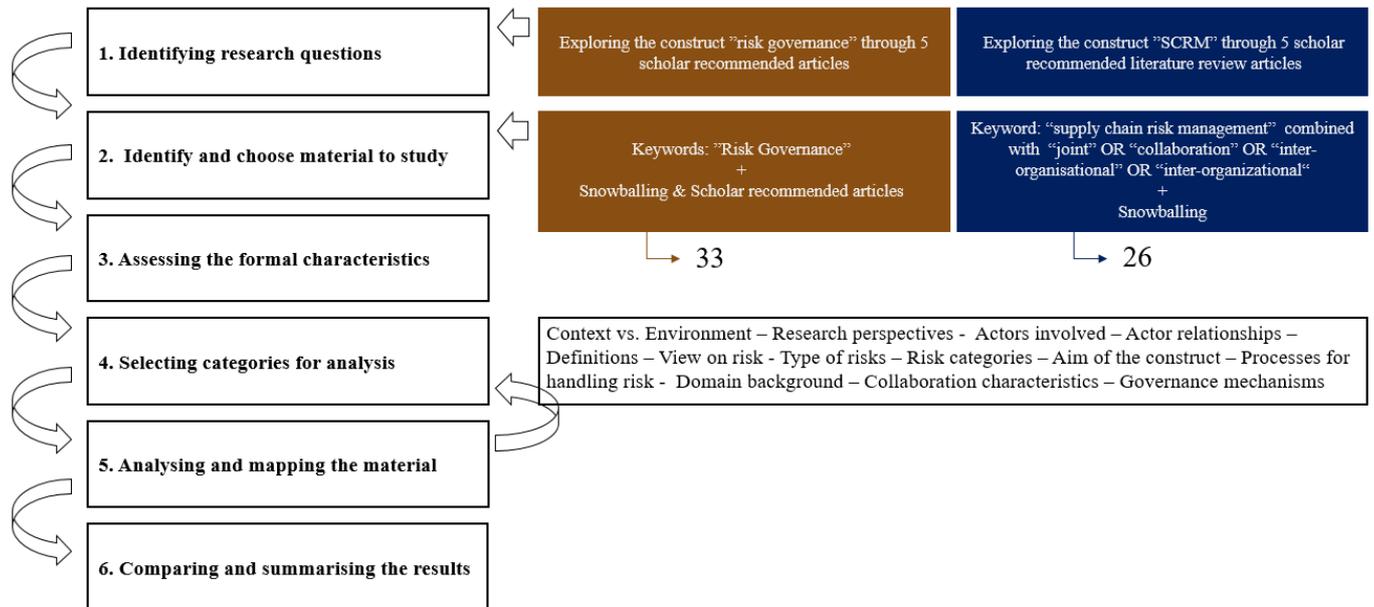


Figure 1 Outline of the research process

2.2 Exploring the Constructs and Defining the Study

To explore the constructs and their potential overlap, scholars in each research domain were asked to recommend relevant central articles. Many SCRM literature reviews have been published in recent years. Therefore, literature review articles were chosen exclusively in that construct to provide a good overview of the research frontier. Keyword searches were used to explore the breadth of existing work on each construct. These procedures confirmed the relevance of the study, defined the unit of analysis and formed the research questions. As the unit of analysis (*supply chain risk governance*) is differently termed in each domain, the units we analyse are the relevant terms for the governance of inter-organisational risk management. The following research questions were formulated:

- RQ1: What are the differences and similarities between *SCRM* and *risk governance*?
- RQ2: What are the respective constructs' views on the inter-organisational aspects of risk management?
- RQ3: How can *supply chain risk governance* be characterised?

2.3 Material Selection

Keyword searches restricted to peer reviewed articles in academic journals were performed in the EBSCOhost database. The search term *risk governance* was used to search for papers on risk governance in the following

journals: *Risk Research*, *Risk Analysis: An International Journal* and *European Journal of Risk Regulation*. We selected the journals through an iterative process in consideration of their status as the leading journals in the domain (according to researchers in RMSS) and because they had the greatest number of articles on the subject in the database. The search yielded 80 articles. To identify key papers on SCRM, the term *supply chain risk management* was combined with the additional keywords: *joint*, *collaboration*, *inter-organisational* and *inter-organizational*, in four separate searches and 37 articles were found.

To assess the relevance of the articles, the titles, keywords and, in some cases, abstracts were screened, yielding 21 papers on risk governance for analysis. To ensure that no important or key papers in the field were neglected, scholars in the domain were asked to suggest articles that they deemed relevant. This, in combination with citation pearl-growing/snowballing to capture frequently cited articles, yielded an additional 12 articles. In total, 33 articles were used for the content analysis of risk governance (**Table 1**). The 37 articles identified on the SCRM construct were screened in a similar manner and two papers were also excluded during the full paper review. The remaining set of articles were combined with previously read literature review articles and articles retrieved through citation pearl-growing/snowballing, leaving 26 articles for the final analysis.

Table 1 Articles read and analysed in the study

Risk governance literature	Supply chain literature
Arvidsson & Cedergren 2016	Bak 2018
Aven 2011	Cantor <i>et al.</i> 2014
Bekkers & Thaens 2005	Cao <i>et al.</i> 2010
Boholm & Corvellec 2011	Chen <i>et al.</i> 2013
Boholm <i>et al.</i> 2012	Cruz & Liu 2011
Brown & Osborne 2013	Fan & Stevenson 2018
Cedergren & Tehler 2014	Friday <i>et al.</i> 2018
de Vries <i>et al.</i> 2011	Ghadge <i>et al.</i> 2017
Dubreuil 2001	Govindan & Chaudhuri 2016
Dubreuil <i>et al.</i> 2002	Grötsch <i>et al.</i> 2013
Escuder-Bueno & Halpin 2018	Ho <i>et al.</i> 2015
Florin 2013	Kache & Seuring 2014
Gheorge <i>et al.</i> 2007	Kilubi & Rogers 2018
Hanssen <i>et al.</i> 2018	Lavastre <i>et al.</i> 2012
Klinke & Renn 2012	Lavastre <i>et al.</i> 2014
Lansink <i>et al.</i> 2018	Li <i>et al.</i> 2015
Lindoe & Kringen 2015	Manuj & Mentzer 2008
Lindskog & Sjödin 2016	Norman & Jansson 2004
Lindskog <i>et al.</i> 2011	Ojala & Hallikas 2005
Renn 2008	Revilla & Saenz 2017
Renn <i>et al.</i> 2011	Urciuoli <i>et al.</i> 2014
Rooderijns <i>et al.</i> 2014	Wieland & Wallenberg 2013
Rübing 2012	Zeng & Yen 2017
Sajeva & Masera 2006	Zhu <i>et al.</i> 2016
Stone <i>et al.</i> 2018	
Tehler 2012	
van Asselt & Renn 2011	
van Asselt & Van Bree 2011	
van Asselt <i>et al.</i> 2015	
van der Vegt 2018a	
van der Vegt 2018b	
Wachinger <i>et al.</i> 2013	
Wong 2015	

2.4 Studying and Analysing the Material

The following preliminary categories were set when exploring the two constructs in the initial step of this study:

- Year of publication
- Journal of publication
- Research methodology
- Purpose of the study
- Unit of analysis
- Type of industry or organisation in focus

These were mapped to identify potential patterns and to provide a background for the content analysis. Initial

categories for content analysis were also established. These were kept broad and unspecific to ensure that nothing was overlooked. A selection of the articles was then read in full to add new categories and divide existing categories into sub-categories. **Figure 1** depicts the full set. Deriving the categories to be used in the literature review from the literature itself is often required to increase openness to new input (Rowley and Slack, 2004). Thus, the sub-categories were derived inductively by studying the literature in both domains.

The material was read a second time with a focus on coding the categories. The content analysis had two foci. First, we searched for key characteristics to better understand the context of the two constructs and their comparability, enabling us to deduct the differences identified when comparing categories related to relationship interfaces and activities. Second, we described each domain's understanding of inter-organisational mechanisms and activities to manage risk.

The two constructs were initially analysed separately to summarise their views on the respective categories. Afterwards, the categories were systematically compared in terms of both their overriding key characteristics and their operational governance mechanisms before being synthesised in the framework.

3. LITERATURE

3.1 From Governance to Supply Chain Governance Mechanisms

Governance refers to all processes of governing, whether conducted by a government, a market or a network of organisations (Bevir, 2012). The existing literature uses the governance construct in very diverse ways. It may focus on a particular governance level associated with a type of organisation (such as public, global, nonprofit, corporate and project governance) or a specific field of governance associated with an activity or outcome (such as environmental or information technology). Governance is discussed in a broad range of theoretical domains, including political science, public administration, economics and corporate strategy.

Governance in general relates to 'the processes of interaction and decision-making among the actors involved in a collective problem that lead to the creation, reinforcement, or reproduction of social norms and institutions' (Hufty, 2011). The most formal governing body is a government that makes binding decisions in a given geopolitical system by establishing laws. Governance also refers to social systems, such as families, tribes, territories and formal or informal organisations. Governance may be conducted through the laws, norms, power or language of an organised society (Bevir, 2012). In business and supply chain relationships, governance may be built into relational contracts that foster long-term collaboration and innovation. In business, much attention has been directed at corporate governance theory, influencing research in a wide variety of disciplines (Keasey *et al.*, 2005), which is broadly viewed as how firms should be governed to run effectively and efficiently (Strange *et al.*, 2009).

The governance of inter-organisational relationships has received considerable attention from a variety of theoretical perspectives, e.g., new institutional economics

literature (including transaction cost analysis) (Wathne and Heide, 2004), strategy, marketing and SCM. The degree of formality of governance depends on the internal rules of a given organisation and, externally, on those shared with its business partners.

Governance is often distinguished from governance mechanisms. While governance is a higher-level construct describing an organisational construction or, in broader terms, institutional framework, governance mechanisms are the underlying and concrete management and control activities. Governance mechanisms describe in detail how the required behaviour of the organisation will be motivated, influenced and established. They are thus more ‘administrative tool[s]’ (Martinez and Jarillo, 1989). A governance mechanism represents an actual operative practice between the parties. Obviously, the two constructs are related; governance is supported by governance mechanisms that allow companies to solve the problems of safeguarding, cooperation and coordination (Hoetker and Mellewigt, 2009).

In the context of inter-organisational relationships, two common approaches to achieving coordination are discussed: formal governance mechanisms and relational governance mechanisms (Dekker, 2004; Martinez and Jarillo, 1989; Poppo and Zenger, 2002). Formal mechanisms are generally understood to include ‘depersonalised exchanges, a reliance on financial parameters, and the drafting and implementation of formal contracts’ (Ferguson *et al.*, 2005, p. 217). Relational governance mechanisms, on the other hand, are generally understood to include people- or social-based mechanisms that enhance open communication and the sharing of information, trust, dependence and cooperation (Eisenhardt, 1985). Unfortunately, the precise terminology of governance mechanisms varies considerably, reflecting the range of scholars studying the topic (Hoetker and Mellewigt, 2009). In their empirical study, Hoetker and Mellewigt (2009) contribute by describing formal governance mechanisms that specify each party’s role, performance expectations and dispute resolution mechanisms, such as business plans, service level agreements, prices and performance indices as well as ways of monitoring the partners, such as profit and

loss accounts, economic efficiency calculations and reporting requirements. Further, they provide examples of relational governance mechanisms, such as: establishing teams, task forces and committees; direct managerial contact through trips, meetings, and even the transfer of managers; mechanisms for shared decision-making; and formal systems for conflict resolution that rely on two-way communication and joint problem-solving. These relational governance mechanisms mitigate potential opportunism by building trust and social identification.

Although inter-organisational coordination between distinct actors in supply chains (or networks) is one of the key ideas of SCM, the SCM domain does not often use the term *governance*. Among the few who use the term, Ghosh and Fedorowics (2008, p. 454) define (and explain) supply chain governance as ‘a number of critical relationships [that] must be in place between sets of chain members (partners). Partners in the chain must agree on a common governance structure that will direct their relationship and reduce the threat of opportunism in an exchange. Governance is the structure that ensures that decisions are made that lead to long-term, sustainable value for an entity such as a corporation or, in this case, a formal collaboration between multiple organisations. Governance mechanisms must be designed to accommodate potential conflicting goals of independent members’ (p. 454). Mechanisms and activities to manage, control and coordinate inter-organisational relations, however, are often discussed and termed differently. Influenced by organisational economics theories (e.g., agency theory and transaction cost economics), Simatupang and Sridharan (2005) provide a framework of inter-organisational interface variables (or antidotes) that should support SCM and coordination. They argue that mutual strategic objectives, appropriate performance measurement, synchronised decision-making, information sharing and incentive alignment (**Figure 2**) will lead to more streamlined business processes between organisations. At a high level, this model includes both formal mechanisms (goals and objectives, performance measures and incentive alignment including contracts) and relational mechanisms (decision-making, information sharing).

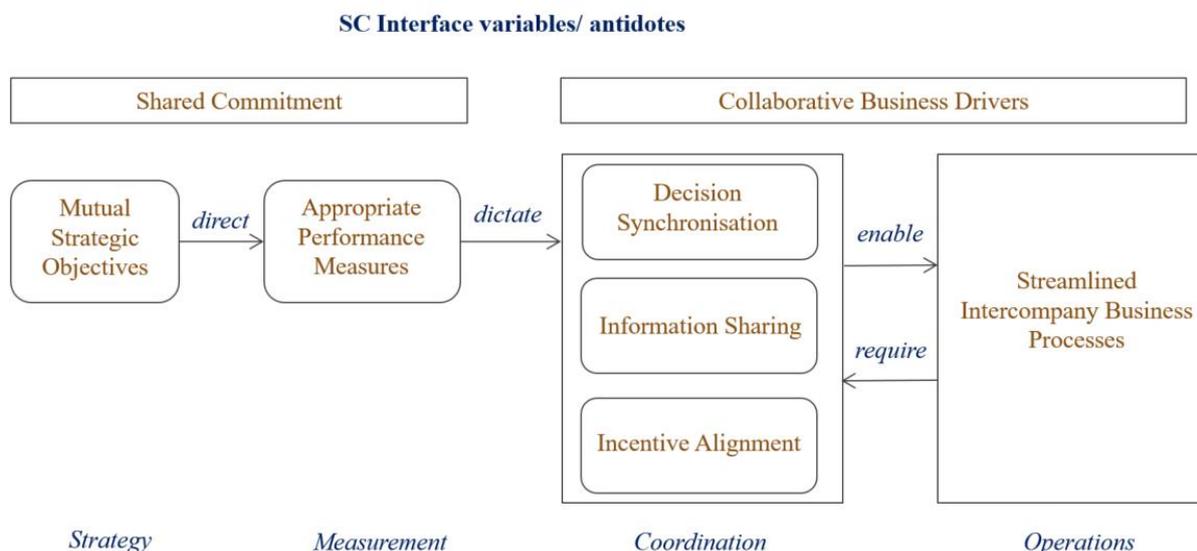


Figure 2 Inter-organisational interface variables to prevent supply chain discontent (Simatupang and Sridharan, 2005, p. 357).

3.2 Overriding Key Characteristics of the Governance Context

Our initial screening and comparison of the two constructs identified similarities and differences in the key characteristics and governance contexts they address (**Table 2**). First, the *context* addressed and the *perspective* taken are broader and more inclusive in the RMSS domain, which discusses *risk governance*, compared to SCRM. This difference seems to explain many others identified in our analysis. With its societal focus, *risk governance* includes a greater variety of actors, such as public agencies, private companies and others. On the other hand, SCRM, which primarily focuses on the risks in private companies' supply chains, views the surrounding societal and public environment as containing external risks that organisations cannot control. Whether the context determines the perspective or vice versa is not clear. What we can conclude is that risk governance considers societies' and policy-

makers' perspectives on how to handle risk while, in SCRM, risk mitigation strategies and processes are formed with a focal private firm's perspective in mind.

The *aim* of both domains can be deduced from their distinct perspectives. In *risk governance*, achieving public safety and compliance (Stone *et al.*, 2018) is viewed as success. The aim is to efficiently create and implement policy and regulations to reduce risk and create public safety and trust. In SCRM, business continuity are often mentioned as key success factors (Fan and Stevenson, 2018; Zhu *et al.*, 2017). This, combined with financial performance and customer satisfaction, seem to be the primary goals while public safety comes second. Simultaneously, governmental policies and legal restrictions are often judged as external risks (Manuj and Mentzer, 2008). Interestingly, matters seen in risk governance as restraints (finance) are an aim in SCRM and vice versa (see **Table 2**).

Table 2 Comparison of the constructs' backgrounds and perspectives.

Key Characteristics	Risk Governance	Collaborative SCRM
Context	Public agencies & private companies, society, global systems	Private companies, global system
Perspective	Society & Policy makers	Focal firm
Aim	Public safety, trust & compliance (finance constraint)	Financial results & customer satisfaction first, (public safety later)
Actors	Governmental agencies, Public sector, Civil society (the public), Scientists, Private sector, NGOs etc.	Supply chain actors (mainly private sector)
Relationship	More based on regulations and policies, the public's trust	More based on supply chain transitions
Focused risks	Systemic risk affecting society	Business risks
View on risk	Perception + Probability × Impact	Probability × Impact
Risk categories	Risk sources are analyzed differently dependent on known risk uncertainty	More instrumental analysis of risk sources
Ambition	Descriptive & Normative, Joint approach, Collaborative relationship	Normative, mutual commitment, strategic relationship
Design of Risk Management Process	Application of RM-process based on pre-estimation of actor's value & risk characteristics	Instrumental application of a traditional RM-process
Applied	When traditional RM loose efficiency due to interconnections	When there is a high level of interdependencies in the SC

Another difference, shown in **Table 2**, is the *actors* involved in the risk management process. Risk governance embraces more stakeholders than does SCRM. In risk governance, there is consensus that various types of stakeholders must be involved to address the interconnections between parties and in light of the impact of diverse values and perspectives on the success of the management strategy (Arvidsson and Cedergren, 2016; Gheorghe *et al.*, 2007; Klinke and Renn, 2012; Renn, 2008). Depending on the type of risk, various types of stakeholders, e.g., scientists, the private sector, civil society, the public and governmental agencies, must be involved in the process. In SCRM, the focus is on the supply chain actors that are

directly involved in physical flows, typically private companies.

Further, what constitutes an inter-organisational *relationship* differs, as actors' relationships are dictated by different means in the domains (**Table 2**). While we find that relationships in risk governance are based more on policies, legal frames or public trust, SCRM focuses on relationships between the actors partaking in such activities as transactions and the flow of goods (Lavastre *et al.*, 2014).

The *type of risk* emphasised is also different. While risk governance is concerned with systemic risk, defined as risk threatening crucial societal systems (Aven, 2011), SCRM focuses on the risks impacting a company's logistics flows and resources. A key difference seems to be the *view of risk*

and how it is defined. In risk governance, it is commonly considered that risk is socially constructed (Brown and Osborne, 2013; Klinke and Renn, 2012; Renn, 2008; Sajeve and Masera, 2006) but that it can be scientifically defined and calculated when uncertainty and complexity are reduced. Hence, this view follows recent risk research in which the lines between subjective and objective types of risk are blurred and depend on risk uncertainty and complexity. This subsequently influences how the risk management process is designed. SCRM uses both (Tse *et al.* 2018), with focus on the engineering approach, the more traditional, typical for the oil industry, assuming risk to be objective and measurable. The social science approach, on the other hand, assumes that where people are involved, as in supply chains, objective and perceived risk become inseparable (Mangan and Lalwani, 2016), and has more recently picked up in SCRM research and practice. Amor and Ghorbel (2018) exemplifies the first, Adeseun *et al.* (2018) the latter.

The differing definitions of risk influence how risk sources are categorised (**Table 2**), which in turn influences how risk is handled, e.g., mitigated. The *risk categories* mentioned in the risk governance literature depend on the amount and type of uncertainty associated with the risk. Van Asselt and Renn (2011, p. 432) define *risk governance* as 'the various ways in which many actors, individuals, and institutions, public and private, deal with risks surrounded by uncertainty, complexity, and/or ambiguity'. Such distinct contextual characteristics (uncertainty, complexity and ambiguity) have impacted the main framework (International risk governance council, IRGC) on how to govern risks depending on the type of risk (Renn, 2008). Van Asselt and Renn's (2011) classification has been criticised for not accounting for the evolving nature of risk (de Vries, 2011). SCRM literature, on the other hand, often classifies risk sources based on their origin in relation to the material flow, e.g., supply, demand, operations, internal, network, external and so on (Jüttner *et al.*, 2003; Manuj and Mentzer, 2008). Similarly, the mitigation strategies chosen for a given risk will often be associated with its origin.

Both domains have the *ambition* of providing normative advice. Risk governance, as clearly demonstrated in its definition, wishes to be both descriptive (studying interacting networks that are executing risk decisions) and normative (advising societal actors on how to deal with risk) (van Asselt and Renn, 2011). This deviates to some extent from SCRM, which aims to implement actions and thus represents a normative research field (Lavastre *et al.*, 2014).

There are clear similarities in how the *risk management process* is designed in each domain. Both are based on the traditional risk management process, normally divided into three to six steps, including risk identification, assessment, mitigation and monitoring. Although the representation of the process and each step's definition may differ, the main attributes are consistent. Even though the suggested risk management processes in both domains are based on identical ideas, several differences are apparent. In the *risk governance* process, the term *risk perception* plays a much

bigger role, probably because risk is considered to be socially constructed. Thus, added to the classical risk management process is a pre-assessment state that aims to clarify how the stakeholders' different perceptions of risk and the context (e.g., social, legal, economic) will influence and restrain the risk assessment through bias (Renn, 2008). The risk perceptions thus determine which actors to involve, what knowledge to retrieve and what organisations should be responsible for risk mitigation. SCRM takes a more instrumental approach to the risk management process to proactively manage risk. Some authors include risk monitoring (e.g., Ho *et al.*, 2015; Norrman and Jansson, 2004) as a key step while others do not (e.g., Manuj and Mentzer, 2008). Also, reactive SCRM processes are discussed (e.g., by Grötsch *et al.*, 2013). Lavastre *et al.* (2014), however, propose a deviating model that focuses on understanding rather than on implementing action. Their identification phase is replaced by a less restrained risk-perception phase. While rare in SCRM, this is far more common in risk governance. Debatable risk perception may have influenced the development of SCRM, which deals with risk across organisations whose actors may have different views on risk sources and events. However, this seems not to influence how risk is addressed; once a risk is identified, a more straightforward application of a traditional risk management process is implemented in SCRM. This lack of more customised processes for different risk types and underlying values is the main difference between the two domains.

Finally, the two constructs are both *applied* in an inter-organisational context in which interconnections and interdependencies increasingly complicate how the organisations manage their individual risk management processes. The more that public and private organisations are part of the same supply chains, the more important it will be to find governance mechanisms to improve coordination and collaboration across sectors and disciplines. Our claim is that it will be easier to design proper governance mechanisms when the underlying similarities and differences in backgrounds and perspectives are understood.

3.3 Governance Mechanisms

To identify the prerequisites of supply chain risk governance, the study focused on identifying which are the aspects that the respective domains claim will facilitate the inter-organisational governance of SCRM processes. By studying the two domains and constructs, we established that multiple variables influence the interface between organisations (see **Figure 3**). However, neither domain presents a homogenous picture of how to design inter-organisational risk management strategies. To compare the two and aggregate all the discussed aspects, we distinguish between their perspectives on: (1) who is involved in the interface, (2) what overall approach guides the collaboration, (3) what processes should be governed and, finally, (4) what mechanisms influence inter-organisational collaboration.

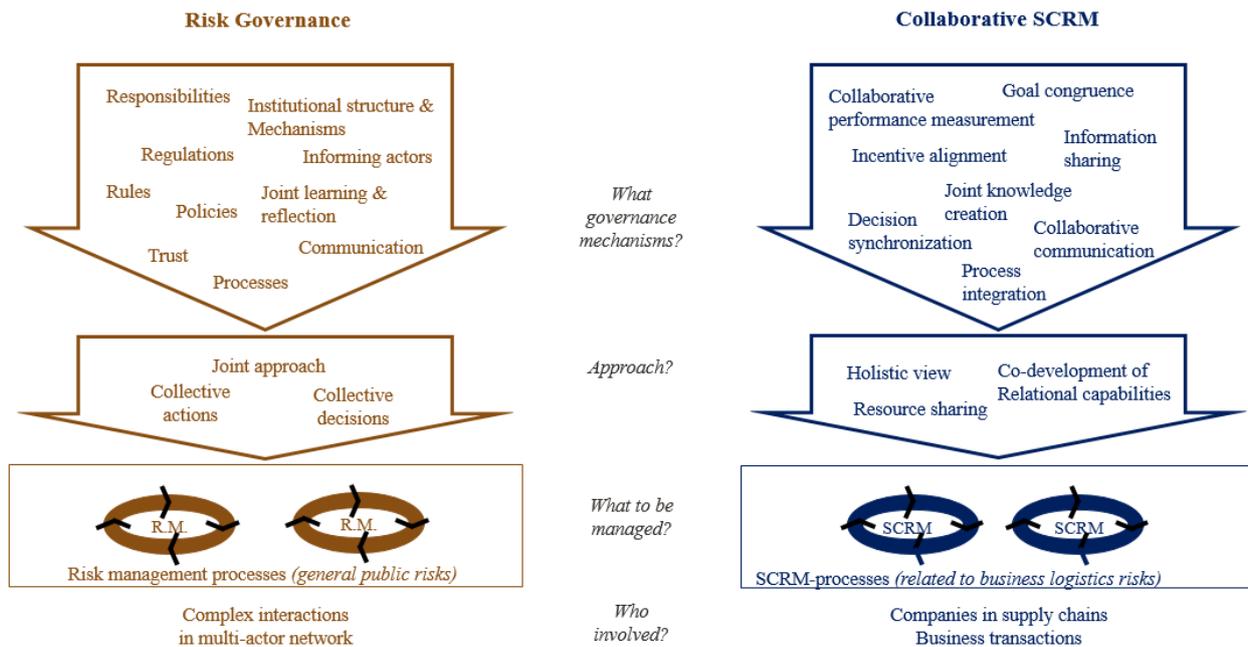


Figure 3 Comparison of governance mechanisms/interface variables

While both domains deal with complex inter-organisational systems of multiple actors, the types of actors that their constructs have in focus differ today (society and the public vs. private companies in supply chains) (see **Table 2**) but grow increasingly similar. These actors are also the ones expected to be involved in the collaboration.

The focused goal for governance comprises the inter-organisational risk management processes. As discussed in section 3.2, the risk management processes are quite similar in terms of steps and concrete activities but differ in risk type and scope. The risk governance construct aims to implement a joint risk management process while the SCRM literature discusses how to integrate and align individual SCRM processes.

The risk governance literature highlights the need for a joint approach (Sajeva and Masera, 2006), collective activities to handle risks (Klinke and Renn, 2012) and collective decisions (van der Vegt, 2018a). These collective decisions are encouraged through policy so that no individual stakeholder is prioritised (Klinke and Renn, 2012; Sajeva and Masera, 2006). The SCRM literature also insists on the need for some collaboration as soon as a business transaction exists between two stakeholders. Increasing attention is directed at joint efforts through resource sharing and joint development of relational capabilities to mitigate risks so as to address them from a more holistic perspective.

When it comes to interface variables and governance mechanisms, we find both similarities and differences. Many differences can be explained by the domains' inherent perspectives (**Table 2**). The societal perspective of risk governance highlights the role of institutional structures and mechanisms while SCRM relies on formal and relational mechanisms that are collaboratively developed between business partners. The governance mechanisms (**Figure 3**) observed in the risk governance literature vary, and definitions of the construct often incorporate policies, rules and processes. Van Asselt and Renn (2011) argue that three principles dictate how risk governance is pursued, the first being *communication and inclusion*, which is understood as

joint approaches in our conceptual framework (**Figure 4**). This provides a joint basis for governing risks, meaning that all relevant stakeholders should be included in the entire risk governance process with communication between the actors to increase their understanding and trust. However, guided by the context, the degree of inclusion will vary. The second principle is *integration*, which looks back to the underlying view of risk in risk governance. It highlights the importance of having values and concerns affecting risk perception that complement the scientific knowledge. Further, it stresses the integration of the various steps in the risk governance model to prevent information loss. Finally, the principle of *reflection* should prevent repetition through the actors' jointly reflecting upon and learning from previous experiences. Learning, both from one's own experiences and those of others, is a recurring feature of risk governance. One should be open to communication between risk managers, scientific experts and the public to learn from one another (Lindskog and Sjödin, 2016; Renn, 2008) and to jointly create knowledge (van Asselt and Renn, 2011). Boholm *et al.* (2012) propose trust, legitimacy, a personal network and a sense of responsibility as key attributes of successful governance. Dubreuil *et al.* (2002) also mention the need for trust and responsibility assumed by the involved actors as well as the need for informal and formal networks to facilitate the interactions between actors.

Six capabilities are frequently mentioned in the SCRM literature as key enablers of inter-organisational action against risk: information sharing, standardisation of procedures, decision synchronisation, incentive alignment, supply chain process integration and collaborative performance systems (Friday *et al.*, 2018, inspired by Simatupang and Sridharan, 2005). These collaborative mechanisms can take many forms, often related to information, resource and risk sharing and congruous goals. Important elements include the integration of relational and strategic information (Zhu *et al.*, 2017) and communication and cooperative competencies (Wieland and Wallenberg, 2013). Wieland and Wallenberg (2013) note that

communication will affect a system's agility as well as its robustness by minimising information asymmetry. Instead of policies and rules dictating the premises of the interface, mutually agreeable incentive alignment, contracts and collaborative performance systems are used (Friday *et al.*, 2018; Norrman and Naslund, 2019; Norrman and Jansson, 2004). Norrman and Jansson (2004) cite the example of how Ericsson tried to spread its SCRM approach through its supply chain both by sharing knowledge and training suppliers as well as through formal contract requirements on how suppliers should work with SCRM and set requirements for their own suppliers. Collaborative relationships deviate from more transactional ones through their increased focus on joint knowledge creation (Cao *et al.*, 2010). Cao *et al.* (2010) shed light on the fact that collaborative communication is often set aside despite its importance. Lavastre *et al.* (2014) discuss the importance of inter-organisational relationship characteristics and state that formalised relationships can reduce ambiguity. However, there is limited research to date on the joint governance of distinct companies' risk management processes. Policies and regulations will, of course, also have an influence. The difference between the constructs is that SCRM views policies and regulations as external constraints and risk sources in themselves because they are determined by the surrounding environment and are therefore seen as non-controllable from the private actor perspective. SCRM seems to go deeper than the risk governance literature into interface variables in operations, such as standardisation of procedures to minimise variation and ensure the continuity of collaborative risk management agreements (Friday *et al.*, 2018). Process integration is also seen as a tool used to reduce variability by eliminating process variations and stock outs (Friday *et al.*, 2018).

Finally, both domains mention collaborative decision-making. However, SCRM views it as a variable affecting the outcome of inter-organisational risk management (e.g., through limiting spill-over effects) rather than as a part of the overall approach (Friday *et al.*, 2018).

4. TOWARDS A CONCEPTUAL FRAMEWORK

Based on the analysis above, this chapter presents a conceptual framework for supply chain risk governance. Our multi-level framework (Figure 4) has three layers and combines the structures of Peck (2005) and Simatupang and Sridharan (2005). To simplify, Peck's (2005) four levels are combined in our bottom level, illustrating the supply chain flows where risks must be managed to avoid disruption (e.g., those related to critical infrastructures, emergency flows or fashion industry flows). Hence, actors may be public organisations or private companies—normally a combination—connected to the supply chain in various ways. They can be physically related to the critical flows directly or indirectly, as in the case of institutions that create platforms for interactions (e.g., industry and trade associations) and organisations that intervene through policies and decisions (e.g., various authorities at the sector, regional and local levels). To understand which actors are directly and indirectly involved in the supply chains (in normal situations as well as in times of crisis), the starting point is to map and understand this 'ultimate supply chain'

(Mentzer *et al.*, 2001) of flows, actors, resources and activities at a high level. This mapping and understanding of the network structure and physical flows will help to identify who is involved (or should be involved) in the operative SCRM processes and in their inter-organisational coordination and governance.

The risk management processes themselves are part of the second level and may be used separately by diverse actors, both public and private. While the framework does not describe or develop those processes, it highlights that they should be better governed inter-organisationally. As discussed in both domains, there is an increased need for collaboration when managing risks in an interconnected supply chain. The focus of the multi-level framework is the upper level, which operationalises the supply chain risk governance structure into distinct mechanisms and interface variables. These mechanisms should, in turn, facilitate and encourage inter-organisational SCRM. This upper layer is influenced by Simatupang and Sridharan's (2005) SCM framework, and we propose that the governance structure will improve the coordination of separate risk management and SCRM processes.

Although the framework aims to be useful to various kinds of complex, multi-actor supply chains (containing only private actors, only public actors or a mix), this paper's context relates to critical infrastructures or emergency supply chains containing a mix of private (coloured blue in Figure 4) and public actors (coloured brown in Figure 4). While we found different supply chain risk governance elements suggested in the SCM literature (blue frames) and in the risk governance literature (brown frames), the majority overlapped. In general, we found that the risk governance literature focuses more on societal elements at a higher level while the SCRM literature focuses more sharply on operational mechanisms for process integration. However, many of the suggested governance mechanisms are common although different terms may be used.

We identified three formal governance mechanisms, two of which (strategic alignment and collaborative performance measurement systems) aim to ensure a shared commitment between the supply chain actors. Firstly, it seems important to understand whether and how the SCRM processes are aligned to other important elements in the context. This may be alignment to other strategies (public authorities' as well as private firms' strategic goals), to other stakeholders' values or to society, political ambitions, ethical and legal issues and so on (Cao *et al.*, 20109; Manuj and Mentzer, 2008; Sajeve and Masera, 2006; van Asselt and Renn, 2011). While the two domains both find strategic alignment important, what should be aligned differs. The second formal mechanism—collaborative performance measurement systems—follows from the strategic intentions (Friday *et al.*, 2018; Simatupang and Sridharan, 2005). These could have various purposes, for example, to drive collaboration as well as to monitor and drive behaviour so that it aligns with existing strategies. Whether and how joint key performance indicators are developed, implemented, and used between actors should be understood. If these two formal governance mechanisms support various actors in aiming at shared commitment, the remaining formal governance mechanism aims to increase collaboration and coordination (Simatupang and Sridharan, 2005). This may be understood as the set of formal governance mechanisms

that we have clustered in the model under the term *inter-organisational institutional mechanisms*. Legal frameworks, policies and contracts (Dubreuil, 2001; Fan and Stevenson, 2018; Renn, 2008; Urciuoli *et al.*, 2014), for example, are

tools that assist in defining accountability and responsibility as well as aligning incentives and creating goal congruence among the actors.

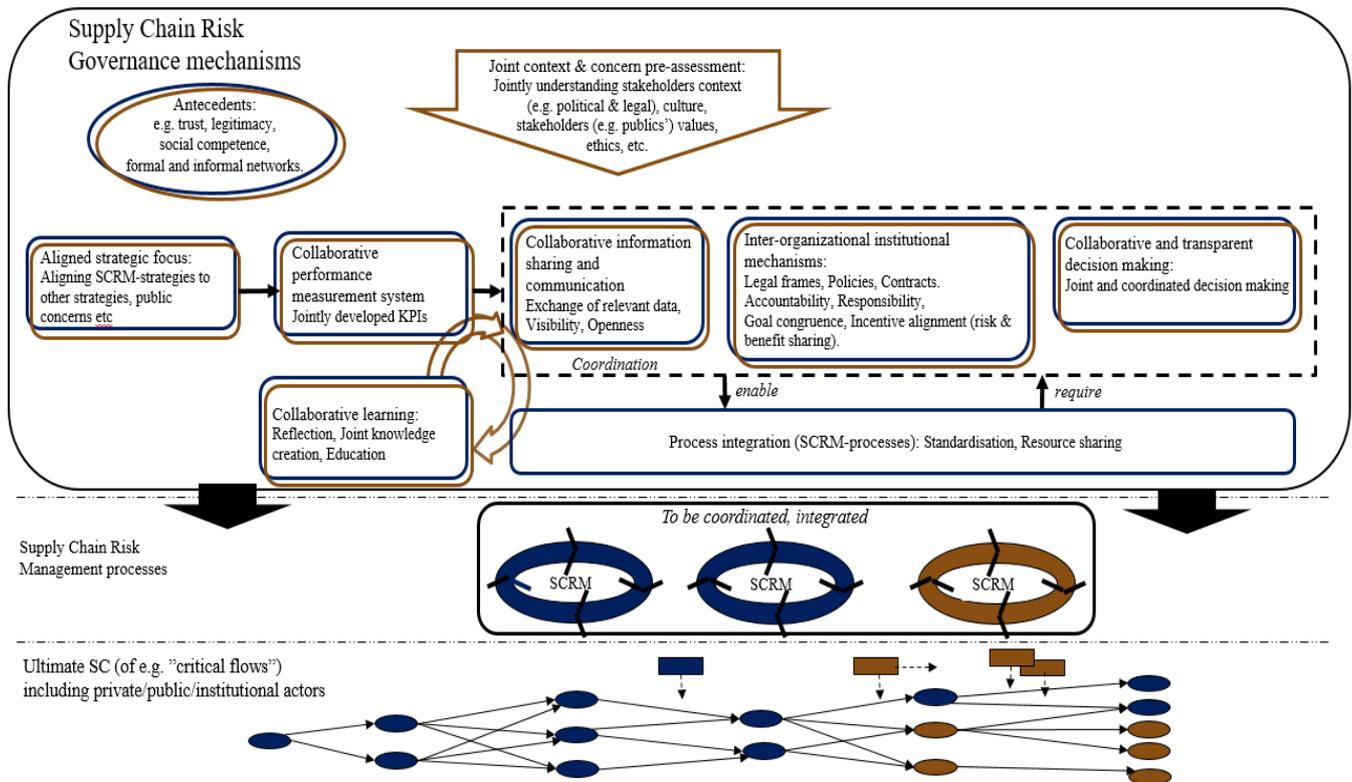


Figure 4 Conceptual multi-level framework for supply chain risk governance

The majority of the governance mechanisms illustrated in this framework are relational. Two of these mechanisms (collaborative information sharing and communication as well as collaborative and transparent decision making) should increase collaboration and coordination (Simatupang and Sridharan, 2005) in parallel with the inter-organisational institutional mechanisms. First, collaborative information sharing and communication are, in both domains, proposed as important relational governance mechanisms and are characterised by openness, visibility and the exchange of relevant data (related to both critical flows and risk management processes) (Bak, 2018; Cao *et al.*, 20109; Govindan and Chaudhuri, 2016; Li *et al.*, 2015; van Asselt and Renn, 2011). Second, collaborative and transparent decision-making (Dubreuil, 2001; Friday *et al.*, 2018; Sajeva and Masera, 2006) describes how joint and coordinated decision-making can be facilitated and take place both proactively and reactively. This includes the platforms that are available for coordinated decision-making. While these *supply chain risk governance* mechanisms should enable more integration of the previously segregated SCRM processes, it is also of interest to consider how the integrated SCRM processes could be developed and defined (Friday *et al.*, 2018). This more operational dimension and the related practices are less discussed in the risk governance literature. The SCRM literature, however, proposes standardisation and resource sharing, for example.

At a higher level, the risk governance literature suggests the importance of having mechanisms for a joint

pre-estimation of the context (Klinke and Renn, 2012; Renn, 2008; Renn *et al.*, 2011). This could influence the aligned strategic focus in particular. The involvement of many actors with presumably different perspectives makes it important to jointly understand various stakeholders' political and legal contexts, cultures, values, ethics and so on. The public constitutes an important stakeholder as its 'votes' can be very important for other stakeholders and decision-makers, such as politicians. This type of governance mechanism is hardly discussed in the SCRM literature. The risk governance literature, creating a better joint understanding of the societal context, also contributes important antecedents for a more coordinated and joint SCRM, characterised by level of trust, legitimacy, social competence and formal and informal networks (Boholm *et al.*, 2012; Dubreuil, 2001). Many such antecedents were also found in the SCRM literature. Finally, mechanisms for collaborative learning are important to developing and improving SCRM processes both internally and between actors (Cao *et al.*, 20109; Dubreuil, 2001; Kache and Seuring, 2014; van Asselt and Renn, 2011). Their development could be based on experiences from both proactive and reactive SCRM work. Learning, characterised by mechanisms for reflection, joint knowledge creation and education, seems more frequently discussed in articles related to the term *resilience* and can be found in both domains. Although we did not identify many articles on this in our initial search, we suggest that collaborative learning is an inter-organisational governance mechanism. This governance mechanism builds on an iterative loop related to

collaborative performance measurement, collaborative information sharing and experiences from the actual process integration.

5. CONCLUSIONS, LIMITATIONS, AND FUTURE RESEARCH

Many supply chains in the multi-actor, private-public partnership context face inter-organisational challenges regarding risk management. Handling the risks arising in or disrupting these supply chains requires extensive collaboration between the actors. Because these actors have different characteristics, governance mechanisms relevant to them all need to be in place. SCRM was established to address risk in supply chains consisting mainly of private companies, but that leaves a large part of society's stakeholders outside the risk appraisal. In a similar vein, research in RMSS focusing on risk governance normally neglects private supply chain flows and focuses on the high-level context. We claim that it will be easier to design proper governance mechanisms when the underlying similarities and differences in backgrounds and perspectives are understood.

We have thus compared and combined *risk governance* in the RMSS domain with collaborative *SCRM* in a multi-level framework that includes the supply network, risk management processes and inter-organisational governance mechanisms that could drive increased collaboration in SCRM. This extends previous multi-level frameworks that do not discuss collaboration mechanisms. Further, we extend the mechanisms proposed in Simatupang and Sridharan's (2005) framework by adding societal variables, such as policies and legal frameworks, as well as learning, contextual pre-assessment and antecedents. Our multi-level framework contributes a new set of governance mechanisms that future research should empirically test on diverse types of supply chains. To do this, the governance mechanisms as well as their potential effects must be further operationalised. Another interesting matter is the question of which mechanisms function well in normal situations, in times of crisis and in transitions from normal to crisis and back again. Future empirical research could also explore whether and how national cultures impact the effects of various governance mechanisms.

This study aimed to lay the groundwork for future research in the field and to explore the possibilities offered by interdisciplinary research across these domains. The ambition was to compare important concepts and develop a tentative framework. Some articles (e.g., Friday *et al.*, 2018; Peck, 2005; Simatupang and Sridharan, 2005; van Asselt and Renn, 2011) were more influential than others. Additionally, the literature review was more of a scoping study than a systematic literature review (see, e.g., Durach *et al.*, 2017). Future research should complement this work especially by extending the SCRM review, thus increasing its validity. At time of printing the world has been hit by the coronavirus to an extent we could never have imagined. We hope to have contributed with a framework that will support cross-disciplinary efforts and learning, thus improving supply chain risk governance for critical infrastructures.

ACKNOWLEDGEMENTS

This project was partially supported by the European Union's Horizon 2020 Research and Innovation Programme RISE under grant agreement no. 823759 (REMESH). The authors also wish to acknowledge the civil contingency agency of Sweden (MSB) for its financial support of the cross-disciplinary project CRITFLOWS, which integrates knowledge from political science, SCM and RMSS.

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