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# Collaborative risk management: a systematic literature review

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Collaborative  
risk  
management

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## Abstract

**Purpose** – The purpose of this paper is to identify and analyse collaborative risk management (CRM) literature to establish its current position in supply chain risk management (SCRM) and propose an agenda for future research.

**Design/methodology/approach** – A systematic literature review of 101 peer-reviewed articles over a 21-year period was employed to analyse literature and synthesise findings to clarify terminology, definitions, CRM capabilities, and underlying theory.

**Findings** – CRM as a field of research is in its infancy and suffers from imprecise definitions, fragmented application of capabilities, and diverse theoretical foundations. The term CRM is identified as a more representative description of relational risk management arrangements. Six capabilities relevant to CRM are identified: risk information sharing, standardisation of procedures, joint decision making, risk and benefit sharing, process integration, and collaborative performance systems.

**Originality/value** – The paper provides a new definition for CRM; proposes a holistic approach in extending collaboration to SCRM; identifies a new capability; and provides a range of theories to broaden the theoretical scope for future research on CRM.

**Keywords** Systematic literature review, Supply chain risk management, Collaborative risk management, Interfirm relational capabilities, Joint risk management

**Paper type** Literature review

## Introduction

Increasing frequency of risks and disruptions present unpredictable consequences for firms, supply chains, and their national/global markets. The intensity of disruptions is magnified by reconfiguring supply chain operations and resources to cope with risks emerging from volatile business environments (Canzaniello *et al.*, 2017; Christopher and Holweg, 2017; Revilla and Saenz, 2017). Innovations such as fractal manufacturing and industry 4.0 increase complexity in supply chains through proliferating decentralised autonomous sub-systems requiring high levels of interaction. Greater interactions create further difficulty in identifying and quantifying risk so the resulting complexity becomes an additional source of risk (Fawcett and Waller, 2014; Wycisk *et al.*, 2008). Limitations in conventional supply chain risk management (SCRM) techniques undermine effective responses to disruptions because they rely on individual firm action to mitigate risks and their spillover effects. Collaborative approaches to risk management are potentially more effective given their focus on interfirm relationship arrangements. However, understanding of collaborative risk management (CRM) remains fragmented with multiple definitions, conceptualisations, and underlying theories.

SCRM is “an inter-organisational collaborative endeavour utilising quantitative and qualitative risk management methodologies to identify, evaluate, mitigate and monitor unexpected macro and micro level events or conditions, which might adversely impact any part of a supply chain” (Ho *et al.*, 2015, p. 5036). Although collaboration and coordination are included in SCRM definitions, conventional SCRM techniques are not



especially effective in advancing interfirm arrangements to address risk spillover effects within firms and across supply chains (Revilla and Saenz, 2017). Conventional techniques including postponement, hedging, and avoidance (Manuj and Mentzer, 2008) are criticised for: their implementation at firm level; being more reactive than proactive; applying a narrow foci centred on risk identification and mitigation; involving cost escalations from redundancies; and being limited in increasing resilience (Christopher and Peck, 2004; Jüttner and Maklan, 2011). Optimising interfirm relationships in SCRM by adopting CRM arrangements would streamline risk and disruption management practices, perceptions, and assessment of risk sources across supply chains (Lavastre *et al.*, 2014; Revilla and Sáenz, 2014).

In the absence of a common definition, CRM generally refers to “the capacity of organisations, societies, and countries to coordinate and join efforts, prior to, during, and after major incidents, in an attempt to prevent or, at least mitigate adverse consequences through effective utilisation of technology, unique leadership, teamwork, and communications” (Salman, 2014, p. 319). Justification for CRM as an alternative for managing risks lies in transforming risk mitigation strategies at firm level into comprehensive risk management solutions with a supply chain or global outlook involving mutual participation among stakeholders (Scholten and Schilder, 2015; Singhal *et al.*, 2011). Additionally, CRM enables identifying and quantifying disruptions from causal linkages between firm actions. Causal linkage effects are difficult to mitigate using firm level techniques, given their spillover effect, and delays between cause and effect. Other benefits of CRM include: breaking down risk impact into manageable proportions; increasing visibility, cultivating a common risk management culture; and potential to mitigate disruptions in the “digital age of supply chain management” (Internet of Things, Big Data analytics, additive manufacturing, smart parts/products, smart factories, cloud computing, and cyber physical systems) (Boone *et al.*, 2017; Breuer *et al.*, 2013; Wortmann and Flüchter, 2015).

Although CRM research is evident in studies addressing joint/relational approaches in SCRM (Cannella and Ciancimino, 2010; Kache and Seuring, 2014; Wieland and Wallenburg, 2013), its conceptualisation is fragmented by multiple definitions, theories, and fractional application of relational capabilities, all of which limit understanding of the concept and its development. Thus, the purpose of this paper is to identify and analyse the CRM literature in a structured manner, establish its status in SCRM research, and propose an agenda for future research. We reviewed 101 articles using a systematic literature review (SLR) method guided by three research questions:

*RQ1.* How is CRM defined?

*RQ2.* What collaboration capabilities are required for CRM?

*RQ3.* What are the theoretical underpinnings for CRM?

Our findings extend collaboration to SCRM through a holistic CRM approach encompassing six capabilities (risk information sharing, standardisation of procedures, joint decision making, risk and benefit sharing, process integration, and collaborative performance systems) underpinned by the relational view theory (Dyer and Singh, 1998). Our holistic proposition challenges the fragmented application of relational capabilities and provides future researchers with boundary conditions to enable development of complete CRM frameworks for empirical validation (Gonzalez-Mulé and Aguinis, 2017). We propose a new definition of CRM, identify a new capability (standardisation of procedures), and highlight a range of theories to broaden the theoretical scope within which future researchers may re-examine CRM. From a managerial perspective, our findings provide an aggregated insight on strategic CRM capabilities to guide decision making on relevant interfirm relational practices that enhance SCRM. The paper proceeds

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with an explanation of the SLR method, followed by presentation and discussion of findings, proposed agenda for future research, implications for practitioners, limitations of the SLR, and a conclusion.

### Methodology

SLR methods are used to manage diversity of knowledge and academic thinking, synthesise existing evidence, create new knowledge, and generalise findings. The method provides rigorous and transparent means to examine and integrate ideas from relevant literature in a way that allows replication and overcoming generalisation limitations associated with single studies (Bartunek and Rynes, 2010; Bhamra *et al.*, 2011; Elliott *et al.*, 1999; Leung, 2015; Saenz and Koufteros, 2015). The method has been applied to several aspects of supply chain management (SCM) and SCRM but not to CRM (Elram and Cooper, 2014; Wilding *et al.*, 2012). We followed five steps recommended by Denyer and Tranfield (2009): identifying research questions; locating and selecting relevant studies; selection and appraisal criteria; analysing and synthesising; and dissemination of review findings. These steps describe the explicit procedures of a SLR method that mitigate bias, legitimate evidence, enable reformulation of ideas, and ensure pragmatic reliability and validity of the method and observations.

#### *Step 1: research questions*

Research questions provide the logical context, purpose and foundation for operationalising a SLR, through increasing clarity in the presentation and discussion of findings. We arrived at three research questions after a preliminary review of literature on collaboration and SCRM. It was established that collaborative approaches are recommended to improve supply chain resilience and emergence and disaster management (Kovács and Spens, 2007; Salman, 2014; Tukamuhabwa *et al.*, 2015). However, extension of collaboration to SCRM was relatively unexplored when compared to its application in other fields such as collaborative planning, forecasting, and replenishment (Yao, 2013). Additionally, we identified variations in definitions, theoretical foundations, and fragmented applications of CRM capabilities. Based on these apparent deficiencies, we employed the following research questions to guide the SLR:

- RQ1. How is CRM defined?
- RQ2. What collaboration capabilities are required for CRM?
- RQ3. What are the theoretical underpinnings for CRM?

#### *Step 2: locating sources and relevant articles*

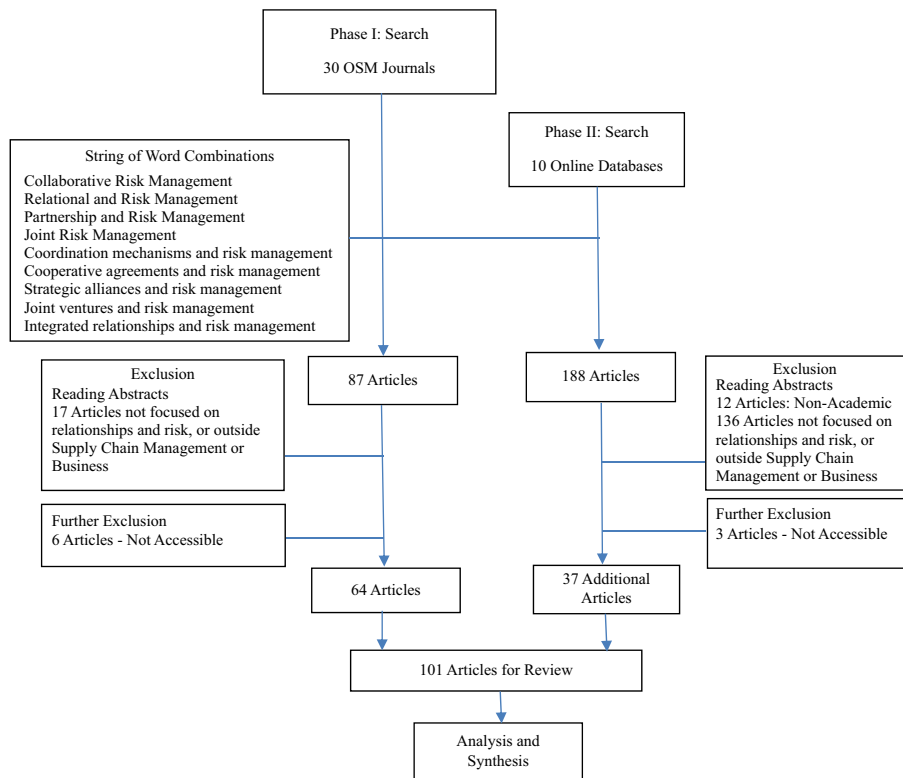
To ensure a supply chain context, we focused on operations and supply chain management (OSM) journals as the main source of CRM literature in order to situate the location of information and maintain the quality and relevance of articles (Elliott *et al.*, 1999). We began with eight journals from a list highlighted in a SLR on supply chain collaboration (Soosay and Hyland, 2015). Cross-referencing citations in articles from the eight journals resulted in the identification of an additional 22 OSM journals. In total, 30 journals were searched for CRM articles, based on their supply chain research agenda and irrespective of their impact factor (Durach *et al.*, 2015). To ensure a broader coverage, we searched ten online databases: EBSCOhost, ABI/INFORM Complete (ProQuest), Emerald plus, ScienceDirect journals, SAGE journals, SpringerLink journals, Wiley Online Library, IEEE Xplore – IEEE/IET Electronic Library, Taylor and Francis Online, and Google Scholar.

Articles relevant to CRM were found through searches using a string of word combinations comprising of “Collaborative Risk Management” and “Joint Risk Management”

used in titles and abstracts. Additional word combinations capturing relational descriptions on a “relationship continuum” (relational; partnership; coordination mechanisms; cooperative agreements; strategic alliances; joint ventures; and integrated relationships) (Daugherty, 2011; Power, 2005) were combined with “risk management” to form a total of nine search phrases (see Figure 1). If a title contained any of these terms, the abstracts were checked to confirm the association of relationships with risk mitigation. During the search, citations from relevant CRM articles were cross-referenced to identify further articles published outside of the 30 OSM journals. Overall, the search process produced 275 documents comprising journal articles, books, and conference papers. The search was limited to content published in English.

### Step 3: selection and appraisal criteria

The selection and appraisal process entailed inclusion and exclusion criteria to determine peer-reviewed articles for inclusion in the SLR. The inclusion criteria included: article titles with key search phrases; abstracts with reference to collaboration and risk mitigation; and accessibility of the identified article. Articles without a focus on collaboration and risk mitigation, or those with a focus on other fields such as clinical psychology or information technology systems, were excluded. Nine articles met the inclusion criteria but were inaccessible (Duhamel *et al.*, 2016; Jamieson and Briggs, 2009; Lin and Abrahamsson, 2015;



**Figure 1.**  
Flow chart:  
selection process

**Source:** Van Lankveld *et al.* (2017)

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Lizza, 2014; Mandal, 2013; Marquès *et al.*, 2010; Ntouskas and Polemi, 2012; Osipova and Eriksson, 2011; Zhang *et al.*, 2011). Ultimately, 174 articles were excluded leaving 101 articles for review: 89 journal articles and 12 conference papers (see Table I).

#### *Step 4: analysis and synthesis*

Thematic analysis and synthesis were used to analyse the data and synthesise it into meaningful themes. This involved isolating relevant data, tabulating it, tracing patterns, and aggregating common ideas (Braun and Clarke, 2006; Ghadge *et al.*, 2012). Each of the 101 articles was read by one researcher to isolate and code terms used to describe CRM, definitions, capabilities, and theories. The codes were checked by two other researchers to eliminate inconsistencies and increase the internal validity and credibility of the data (Elliott *et al.*, 1999). Broader categories were developed by grouping similar codes. For example, definitions were categorised first by their context or function (e.g. project management) and then by the most common key word (e.g. joint). Relational capabilities were grouped into one of five common categories: information sharing, incentive alignment, decision synchronisation, supply chain process integration, and collaborative performance systems (Simatupang and Sridharan, 2005). Theories were checked and tabulated against a list of 12 theories in supply chain collaboration: resource-based theory; resource-advantage theory; relational view; social exchange theory; dynamic capability view; stakeholder theory; signalling theory; force field theory; transaction cost theory; contingency theory; agency theory; and technology-organisation-environment theory (Soosay and Hyland, 2015). The reconfigured data and themes were presented as qualitative data using graphics and tabulations to facilitate verification, interpretation, discussion, and conclusions (Miles and Huberman 1984).

#### *Step 5: dissemination of review findings*

The final step in a SLR paper is dissemination through publication in the right domain without conflicting ideologies or infringing copyrights. Earlier versions of the paper were presented at symposiums and conferences to test the acceptance of CRM and generate feedback prior to revising the paper for publication.

### **Findings and discussion**

The outcomes and interpretations of the SLR are presented in the following order: publication sources, trends, and terminologies; CRM definitions; collaboration capabilities; and theoretical underpinnings.

#### *Publication sources, trends, and terminologies*

Over half (52.5 per cent) the reviewed articles are published outside of OSM journals, 35.6 per cent are in OSM journals, and 11.9 per cent as conference papers. Just under half (46.7 per cent) of the OSM journals did not include CRM articles. The distribution of articles in Table I indicates interest in CRM is widely but thinly spread over a range of journals. Furthermore, the distribution of articles published over a 21-year period suggests CRM is gaining in scholarly interest with 68 per cent of the articles published in the period 2010-February 2017 (see Figure 2). These findings indicate that CRM is in its infancy but growing in importance and deserving of attention.

Although the term “collaborative risk management” is not common (10.89 per cent), the word “collaboration” was identified in more than half (52.47 per cent) of the titles (see Figure 3). Based on the nine search phrases in Figure 1 and their positioning on a relationship continuum, the majority of articles describe relational risk management arrangements at a strategic relationship (collaboration) level. This confirmed that interfirm relationships vary, as do drivers and motivation for each relational arrangement. Thus,

No. of articles	Source	References
53	Journals outside of supply chain and operations management	Ammarapala and Luxhøj (2007), Bodnaruk <i>et al.</i> (2016), Breuer <i>et al.</i> (2013), Carson <i>et al.</i> (2006), Challies <i>et al.</i> (2016), Christensen <i>et al.</i> (2016), Das and Teng (1996), Dehmer <i>et al.</i> (2015), Ding <i>et al.</i> (2016), Doloi (2009), Dyer (1997), Evers <i>et al.</i> (2012, 2016), Francesch-Huidobro (2015), Grote <i>et al.</i> (2009), Hamid Allaoui <i>et al.</i> (2015), Hélène (2005), Huang <i>et al.</i> (2013), Ivan <i>et al.</i> (2012), Kapucu (2008), Kapucu <i>et al.</i> (2010), Kapucu and Garayev (2011), Kapucu and Qian (2016), Kim and Netessine (2013), Laura <i>et al.</i> (2014), Lavender (2004), Lehtiranta (2011, 2013), Li <i>et al.</i> (2015), Mani (2016), Matsuo (2015), Maxwell and Parker (2012), May and Plummer (2011), Morose <i>et al.</i> (2011), Osipova (2014), Osipova and Eriksson (2013), Ozkan and Karabacak (2010), Qiu <i>et al.</i> (2007a, b, 2010), Quan <i>et al.</i> (2016), Rahman and Kumaraswamy (2002a, b, 2004, 2005), Reade and Hyun-Jung (2016), Salman (2014), Scudder and Byramjee (2012), Tau <i>et al.</i> (2016), Tidy <i>et al.</i> (2016), Vachon and Klassen (2008), Waugh and Streib (2006), Xu <i>et al.</i> (2015)
12	Conference proceedings	Arashpour and Arashpour (2012), Bacun (2015), Greer and Bustard (2002), Karduck <i>et al.</i> (2007), Lanne and Sarsama (2008), Marosin <i>et al.</i> (2014), Osipova and Eriksson (2009), Papadaki <i>et al.</i> (2008), Pozzebon <i>et al.</i> (2014), Silva <i>et al.</i> (2012), Thia and Ross (2012), Witkowski and Standley (2005)
8	<i>International Journal of Production Research</i>	Cannella and Ciancimino (2010), Chen <i>et al.</i> (2013), Datta and Christopher (2011), Lai <i>et al.</i> (2012), Lavastre <i>et al.</i> (2014), Li and Chan (2012), Smith <i>et al.</i> (2007), Yilmaz Borekci <i>et al.</i> (2015)
5	<i>International Journal of Physical Distribution and Logistics Management</i>	Allal-Chérif and Maira (2011), Canzaniello <i>et al.</i> (2017), Riley <i>et al.</i> (2016), Stewart <i>et al.</i> (2009), Wieland and Wallenburg (2013)
4	<i>European Journal of Operational Research</i>	Gao (2015), Talluri <i>et al.</i> (2010), Tapiero (2007), Theißen and Spinler (2014)
3	<i>Supply Chain Management: An International Journal</i>	Kache and Seuring (2014), Lindgreen <i>et al.</i> (2009), Scholten and Schilder (2015)
2	<i>International Journal of Logistics Management</i>	Croom and Watt (2000), Greening and Rutherford (2011), Jayaraman <i>et al.</i> (2008), Jia and Rutherford (2010), Lamothe <i>et al.</i> (2007), Liu <i>et al.</i> (2009), Ronchi <i>et al.</i> (2007), Tangpong <i>et al.</i> (2010)
	<i>International Journal of Logistics Research and Applications</i>	
	<i>Journal of Operations Management</i>	
	<i>Supply Chain Forum: An International Journal</i>	
1	<i>International Journal of Advanced Logistics</i>	Brüning <i>et al.</i> (2015), Choi <i>et al.</i> (2016), Newman and Krehbiel (2007), Pourakbar <i>et al.</i> (2013), Ramanathan (2012), Theißen <i>et al.</i> (2014), Toyasaki <i>et al.</i> (2016), Voss and Williams (2013)
	<i>International Journal of Operations &amp; Production Management</i>	
	<i>Journal of Business Logistics</i>	
	<i>Journal of Purchasing and Supply Management</i>	
	<i>Journal of Supply Chain Management</i>	
	<i>Journal of the Operations Research Society</i>	
	<i>Production and Operations Management</i>	

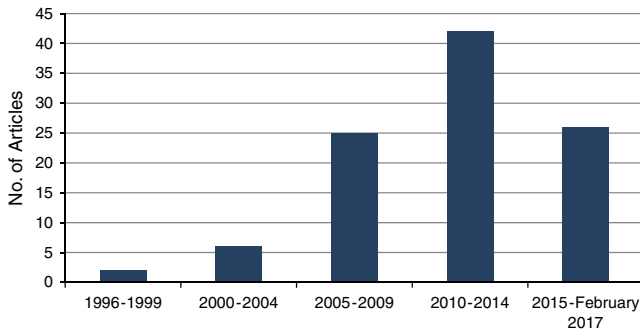
**Table I.**  
Sources of  
reviewed articles

(continued)



No. of articles	Source	References
0	<i>Research in Logistics and Production</i> <i>Decision Sciences</i> <i>International Journal of Automation and Logistics</i> <i>International Journal of Integrated Supply Management</i> <i>International Journal of Logistics Systems and Management</i> <i>International Journal of Procurement Management</i> <i>International Journal of Retail and Distribution Management</i> <i>International Journal of Services and Operations Management</i> <i>International Journal of Shipping and Transport Logistics</i> <i>International Journal of Value Chain Management</i> <i>Journal of Advanced Transportation Production and Manufacturing Research</i> <i>Production Planning and Control</i> <i>The International Journal of Logistics Management</i> <i>Transportation Journal</i>	

Table I.



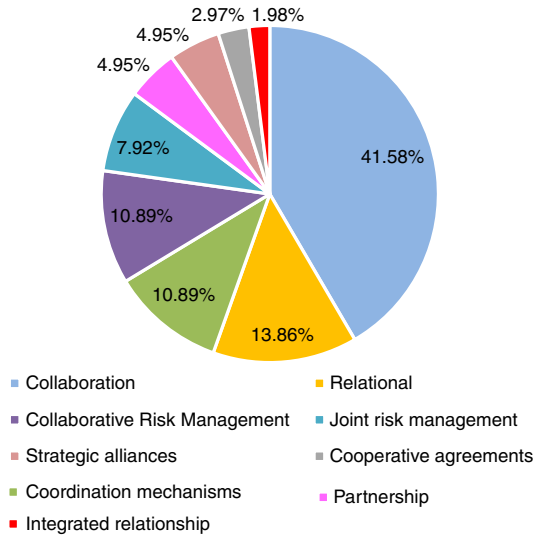
**Figure 2.**  
Number of CRM  
articles published  
from 1996 to  
February 2017

we recommend the term “collaborative risk management” because it is most descriptive and inclusive, combining both concepts of “collaboration” and “risk management”. It is an appropriate term for firms in established strategic relationships with common goals and governance processes aimed at mitigating risks and related disruptions (Barratt, 2004; Daugherty, 2011).

#### *Definition of CRM*

Despite 21 years of scholarly publications, the definition of CRM remains elusive. Not only do 82.3 per cent of the articles fail to explain CRM but the remainder are biased towards

Percentage Distribution of Terminologies



**Figure 3.** Percentages of relationship descriptions referring to CRM

functional perspectives and do not capture the essence of supply chain collaboration. Except for the use of the term joint effort, the definitions are diverse in wording and foci, often referring to a specific function or goal (see Table II). Thus, the absence and variations in CRM definitions underline the need for coherence in definition.

To address the functional bias and diversity of CRM definitions, we propose a new definition representative of common themes, and incorporates insights from SCRM and relational view theory. The definition is based on the notion of two or more independent firms working together to align their SCRM processes to create higher value for stakeholders with greater success than when acting in isolation. It is unbiased to function and captures CRM at a strategic relationship level:

Collaborative risk management is 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.

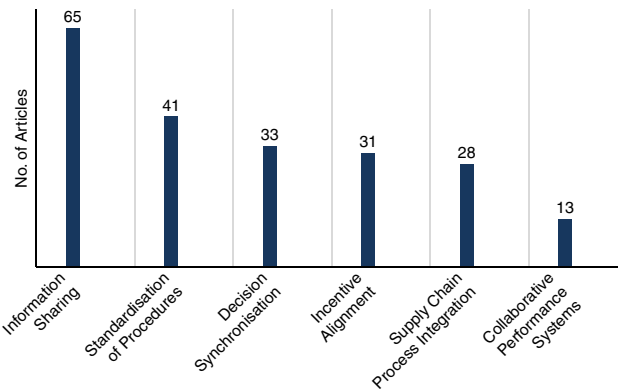
#### *Collaboration capabilities in CRM literature*

Although all five capabilities encompassing an integrated supply chain collaboration framework (Simatupang and Sridharan, 2005) were identified to varying extents in the literature, they are examined in isolation of each other with not a single article addressing the five capabilities concurrently. The terminologies used to describe the capabilities vary, with information sharing being the most common (64.4 per cent), followed by decision synchronisation (32.7 per cent), incentive alignment (30.7 per cent), supply chain process integration (27.7 per cent), and collaborative performance systems (12.9 per cent). We identified an additional capability standardisation of procedures in 40.6 per cent of the articles (see Figure 4).

Among the six capabilities, the terminology, definitions, and applications vary within the literature. Information sharing is the most common capability based on: its necessity in the early stages of CRM arrangements; its ability to predict future value of relationships; its ability to facilitate risk assessment and enable learning from past risk events (Chen *et al.*, 2013; May and Plummer, 2011; Theißen *et al.*, 2014). Different synonyms used to describe

Themes	Function	Definitions	Author	Collaborative risk management
Joint	Contract management	The managing of risks using a joint risk management strategy at the post-contract stage, with the combined efforts of all related parties, under flexible contract conditions, and using the best available options at the time of their occurrences	Rahman and Kumaraswamy (2005)	Collaborative risk management
Joint	Environmental	Inter-organisational interactions between supply chain members, including such aspects as joint environmental goal setting, shared environmental planning, and working together to reduce pollution or other environmental impacts	Ding <i>et al.</i> (2016), Vachon and Klassen (2008)	
Joint	Project management	The joint efforts extended by the partners in the process of managing risks and uncertainties in a project	Doloi (2009)	
Joint	Project management	The joint working of project stakeholders to effectively and efficiently accomplish risk management	Lehtiranta (2013)	
Joint	Resources management	The joint activity of two or more agencies that aim at working together in order to create better public good	Kapucu <i>et al.</i> (2010)	
Join effort	Teamwork	The capacity of organisations, societies, and countries to coordinate and join efforts, prior to, during, and after major incidents, in an attempt to prevent or, at least mitigate adverse consequences through effective utilisation of technology, unique leadership, teamwork, and communications	Salman (2014)	
Social interaction	Public service	Forms of social interaction that enable different individuals and groups, who are effected by an issue, to enter into dialogue, negotiation, learning, decision making and collective action about getting government staff, policy makers, community representatives, scientists, business people and NGO representatives to think and work together	Jamieson and Briggs (2009)	
Linking, pooling	Power sharing	The linking or connecting of actors into a process of exploring a shared interest and pooling resources to address a problem with a degree of power sharing and shared decision making	May and Plummer (2011)	
Combination, common goal	Resource management	The combination and utilisation of resources and management tools by several entities to achieve a common goal	Kapucu and Garayev (2011)	
Bring together	Transport	A holistic process that brings together supply chain trading partners and service providers in order to drive inefficiencies out of the transport planning and execution process	Li and Chan (2012)	
Exchange	Security	All activities that establish, cultivate, and maintain successful security exchanges between parties	Voss and Williams (2013)	
Collaborative	Planning and control	A collaborative and structured approach to risk management, embedded in the planning and control processes of the supply chain, to handle risks that might adversely affect the achievement of supply chain goals	Breuer <i>et al.</i> (2013)	
Collaborative	Uncertainty	Joint risk management is a powerful collaborative strategy for addressing inefficient risk allocation and identifying closer to optimal ways of dealing with unforeseen events	Osipova (2014)	
Coordination	Organisation	A set of methods to manage interdependence between organisations	Toyasaki <i>et al.</i> (2016)	
Working together	Teams	Collaborative risk management defines requirements and activities to allow both teams to work together, thus reducing the risk of possible misunderstandings	Witkowski and Standley (2005)	
Sharing	Value-added processes	The ability to work across organisational boundaries to build and manage unique value-added processes to better meet customer needs involving the sharing of resources, that is, CO <sub>2</sub> data, CO <sub>2</sub> management knowledge, people, and assets	Theißen <i>et al.</i> (2014)	

**Table II.**  
Definitions/  
explanations of  
collaborative risk  
management



**Figure 4.** Number of articles identifying collaboration capabilities

information sharing include: communication, information exchange, and risk information sharing. Standardisation of procedures addresses the uniqueness of firms and their SCRM operations by standardising processes to achieve a balance between flexibility and common risk management arrangements across supply chains (Grote *et al.*, 2009; Jayaraman *et al.*, 2008). Terms referring to decision synchronisation include participatory, collective, or joint decision making. Incentive alignment is referred to as risk allocation, a risk sharing mechanism, or risk and benefit sharing. Supply chain process integration is referred to as vertical/horizontal integration or operational linkages. Although overlooked by over 87 per cent of the articles, collaborative performance systems, also referred to as partnership performance, is recommended for its value in minimising variations in supply chain operations (Theißen and Spinler, 2014; Theißen *et al.*, 2014).

#### *Theoretical underpinnings of CRM*

A common theoretical perspective for examining a phenomenon is a sign of maturity within a field. In the case of CRM, two-thirds of the articles fail to refer to theory, and, among those that do, there is little commonality. We identified 28 theories of which eight encompass a “relationship” element to explain CRM based on harnessing relational capabilities. The theories include: social exchange theory; game theory; relational theory; agency theory; network theory; social capital theory; leader-member exchange theory; and complexity theory (see Table III). Theory identification was guided by questioning their association with “a competency theoretical orientation” and focus on relationship optimisation (Hodgson, 1998).

Theories encompassing arguments for interfirm relationship optimisation provide a foundation for re-examining and advancing CRM in different contexts. For example, fields like third and fourth party logistics management that are vulnerable to interdependence risks from outsourcing services and delegation of decision-making authority, could explore the benefits of CRM in an agency or social exchange theory context. Furthermore, we noted the absence of relevant theories such as institutional theory that could provide complementary perspectives in understanding CRM.

Among the theories used, the relational view theory is most appropriate for CRM given the significance of relational dimensions (Carey *et al.*, 2011; Villena *et al.*, 2011). The theory has four strengths in relation to CRM. First, the theory argues that firms gain higher performance against vulnerability to risks and disruptions when they invest in interfirm relational arrangements across entire supply chains. Second, interfirm relational arrangements allow idiosyncratic firms to mitigate risks through collaborative

Theory	No. of articles	References
Transaction cost theory	5	Allal-Chérif and Maira (2011), Dyer (1997), Lai <i>et al.</i> (2012), Liu <i>et al.</i> (2009), Theißen <i>et al.</i> (2014)
<i>Social exchange theory</i>	4	Greening and Rutherford (2011), Lai <i>et al.</i> (2012), Liu <i>et al.</i> (2009), Yilmaz Borekci <i>et al.</i> (2015)
<i>Game theory</i>	4	Choi <i>et al.</i> (2016), Ding <i>et al.</i> (2016), Matsuo (2015), Qiu <i>et al.</i> (2007a), Toyasaki <i>et al.</i> (2016)
<i>Agency theory</i>	3	Laura <i>et al.</i> (2014), Li <i>et al.</i> (2015), Osipova (2014)
<i>Relational theory</i>	2	Brüning <i>et al.</i> (2015), Wieland and Wallenburg (2013)
Contingency theory	2	Osipova and Eriksson (2013), Tangpong <i>et al.</i> (2010)
<i>Network Theory</i>	2	Croom and Watt (2000), Kapucu <i>et al.</i> (2010)
<i>Complexity theory</i>	2	Kapucu (2008), Lehtiranta (2013)
Dynamic capability view	1	Greening and Rutherford (2011)
Signalling theory	1	Theißen <i>et al.</i> (2014)
Resource-based theory	1	Allal-Chérif and Maira (2011)
<i>Social capital theory</i>	1	Theißen <i>et al.</i> (2014)
<i>Leader-member exchange theory</i>	1	Jia and Rutherford (2010)
Neyman-Pearson theory	1	Tapiero (2007)
Personality trait theory	1	Tangpong <i>et al.</i> (2010)
Financial theory	1	Allal-Chérif and Maira (2011)
Theory of swift even flow	1	Chen <i>et al.</i> (2013)
Normal accident theory	1	Voss and Williams (2013)
Organisational theory	1	Osipova and Eriksson (2013)
Quantitative graph theory	1	Dehmer <i>et al.</i> (2015)
Sense-making theory	1	Kapucu (2008)
Organisational learning theory	1	Kapucu (2008)
Organisational information processing theory	1	Canzaniello <i>et al.</i> (2017)
Modern theory	1	Bacun (2015)
Theory of bureaucracy	1	Christensen <i>et al.</i> (2016)
Equity theory	1	Das and Teng (1996)
Modern portfolio theory	1	Karduck <i>et al.</i> (2007)
Total systems intervention theory	1	Papadaki <i>et al.</i> (2008)

**Note:** Italics represent relationship optimising theories

**Table III.**  
Theories in  
CRM literature

advantages, synergies, and optimisation of resources using unique combinations that are unachievable to individual firms in arm's length relationships. Third, the theory embraces collaborative arrangements as being at the higher end of the relationship continuum and entailing principles that capture effectiveness in deployment of resources, development of competencies, processes, and governance structures, to address potential risks. Fourth, the theory argues that investment in interfirm relation specific assets, interfirm knowledge sharing routines, complementary resource endowment, and effective governance, enable supply chains to mitigate interdependence risks (Dyer and Singh, 1998). Overall, the relational view theory is more specific, relevant to addressing the fragmented application of CRM capabilities problem, and has been tested across inter-organisational relationship research centred on building competitive advantage and supply chain resilience (Wieland and Wallenburg, 2013).

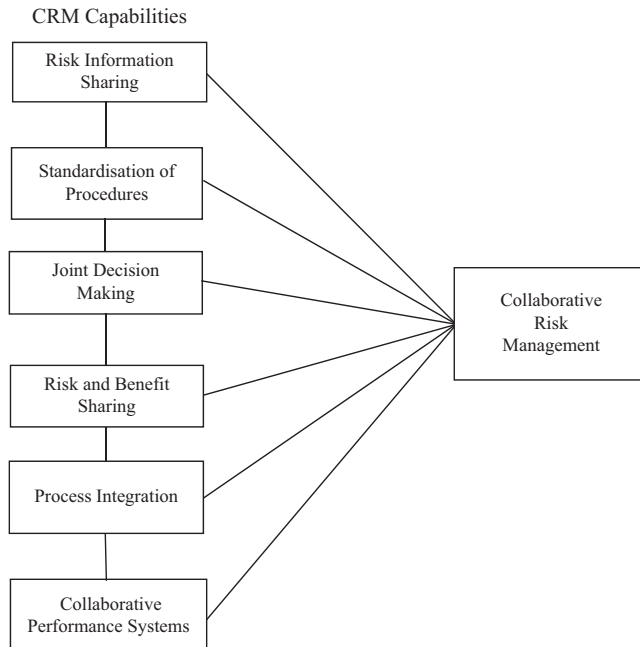
### Future research agenda

Building on the above findings, we identify directions for research to enable further advancement of CRM in SCRM. While acknowledging the contribution of studies examining collaboration capabilities (Flynn *et al.*, 2010; Koufteros *et al.*, 2010; Riley *et al.*, 2016),

future research in CRM would benefit from establishing holistic commonalities in definition, relational capabilities, and underlying theory. In addition to a new definition offered earlier, we identify six capabilities to comprise CRM (risk information sharing, standardisation of procedures, joint decision-making, process integration, and collaborative performance systems). We propose CRM be modelled as a higher order construct (see illustration in Figure 5) to enable summarising of capabilities into a single multidimensional construct to reduce complexity, achieve parsimony, and maintain representativeness of relational capabilities (Becker *et al.*, 2012).

Although we recognise that complex relationships between CRM and other variables could be explored than indicated in Figure 5, we leave such exploration to future research. For example, studies testing CRM frameworks might consider the influence of contextual variables within institutional environments as well as theory boundaries that could affect the direct relationships between CRM and other phenomena (Boyd *et al.*, 2011; Dyer and Singh, 1998). In redefining theory boundaries, research might explore the role of intervening variables such as: relational factors (trust, commitment, power, and governance mechanisms); change management; corporate focus; technology advancements; and global megatrends (Barratt, 2004). A potentially more complex avenue for examining CRM might be to employ “risk identification” and “alignment of risk management practice” approaches to mitigate bullwhip effects across supply chains in consideration of signalling theory (Connelly *et al.*, 2011). CRM provides an alternative lens through which to further examine the “signalling effect” among supply chain members in interfirm relational risk management arrangements. Research might also examine how CRM capabilities reinforce the “signalling environment” through enabling the sensing of risk hotspots and the seizing of opportunities to increase supply chain resilience.

CRM capabilities include routines, practices, and predictable patterns of activity, employed to increase capacity in reshaping and reconfiguring assets to enhance a supply



**Figure 5.**  
An illustration of  
CRM as a higher  
order construct

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chain's ability to mitigate disruptions and their spillover effects through sequences of coordinated interfirm actions (Augier and Teece, 2008; Craighead *et al.*, 2007; Hodgson, 1998; Wang and Ahmed, 2007). For coherency in conceptualisation, we propose the following explanations of the six capabilities to form part of the boundary conditions in future research advancing CRM (Gonzalez-Mulé and Aguinis, 2017):

- (1) Risk information sharing is the exchange of data relevant for enabling the monitoring of supply chain process flows and making timely interventions against potential risks and their related disruptions (Chen *et al.*, 2013; Ellram and Hendrick, 1995; Li *et al.*, 2015). The capability's potential to mitigate risk is embedded in its ability to: reduce information asymmetry; increase visibility regarding the identity, location and status of flows transiting in supply chains; prevent demand amplification (bullwhip effect) and unnecessary interventions; and minimise uncertainties and opportunistic behaviour. Supply chains that do not share risk information are deemed more likely to create gaps and misalignments in their CRM processes (Salman, 2014).
- (2) Standardisation of procedures encourages adherence to procedures to minimise ambiguity and guide SCRM processes in reducing variation, monitoring and analysing work processes, and documenting retrospectives while maintaining consistency and stability in operations (Carson *et al.*, 2006; Dehmer *et al.*, 2015; Grote *et al.*, 2009). It enables flexibility and compatibility in reconfiguring resources and ensuring continuity of CRM arrangements by allowing for changes in interfirm agreements (terminating supply contracts) without incurring excessive switching costs or disruptions in operations (Tangpong *et al.*, 2010).
- (3) Joint decision making is the extent to which firms are able to coordinate the decision-making process from planning to the execution of risk management strategies across the supply chain (Ammarapala and Luxhøj, 2007). The capability mitigates vulnerabilities relating to the "butterfly effect" by limiting amplification of small degrees of error among individual firm decision-making processes that spillover and create unpredictable effects across supply chain networks (Ozkan and Karabacak, 2010; Wilding, 1998). It enhances optimisation of resources across the supply chain during disruption management by ensuring compatibility in decision-making processes and control systems.
- (4) Risk and benefit sharing requires the development of formal policies and agreements to share liability and benefits from joint effort among firms in CRM arrangements (Li *et al.*, 2015). The capability allows members to apportion the risk burden in a way that reduces the risk impact encountered by individual firms. The capability is mandated by risk sharing agreements to enable risk dispersion and is anchored in principles of exchange and reciprocity to emphasise collaboration and reduction in duplication of effort, and effective pursuit of mutual risk mitigation objectives (Levine and White, 1961; Oliver, 1990). Misalignment of incentives leads to escalation of opportunistic behaviour and risks relating to amplification of inventory and false forecasts.
- (5) Process integration is the degree to which firms align and manage intra- and inter-supply chain processes to mitigate disruptions and satisfy end user requirements in a timely manner at a lower cost (Flynn *et al.*, 2010). The capability mitigates disruptions by smoothening process flows to minimise redundancies, conflicts, and information asymmetry disrupting production and delivery of goods. A lack of integration increases vulnerability to interdependence risks, supply chain complexity and uncertainty, and the likelihood of disruption from process variations and stock outs.

- (6) Collaborative performance systems are jointly developed key performance indicators and metrics to monitor variation in process flows to mitigate supply chain risks and related disruptions (Simatupang and Sridharan, 2005). The capability monitors variation in sensitive processes such as inventory statuses and quality levels, and warns firms of latent risks arising from individual variation in performance indicators. Performance systems are a key source of data for capabilities such as information sharing and joint decision making.

A holistic approach that includes all six capabilities is necessary for three reasons. First, an application of all CRM capabilities takes advantage of reciprocity and synergies generated from inherent overlaps and concurrent application of capabilities (Simatupang and Sridharan, 2005). Second, a simultaneous application of the capabilities enables CRM to address disruptions emerging from properties of complexity inherent in supply chain systems and networks (Choi *et al.*, 2001). Third, the relational view theory supports a comprehensive application of capabilities by arguing that firms will not participate in relational routine-practices if they cannot see how the likely benefits are shared (Dyer and Singh, 1998).

Overall, concurrent application of the capabilities is an opportunity to re-examine the interaction effects among the capabilities, leading to new interpretations on relational propositions in SCRM. In addition, a simultaneous examination can be extended to other fields such as humanitarian logistics, supply chain resilience, environmental sustainability, and emergency and disaster management, where collaboration is employed to explain aspects including: adaptation; readiness; responsiveness; and social responsibility (Kovács and Spens, 2007; Reade and Hyun-Jung, 2016; Salman, 2014). Furthermore, alternative collaboration frameworks such as that suggested by Cao *et al.* (2010) provide future researchers with additional relational capabilities that could further broaden understanding of CRM.

### Managerial implications

Advancements such as industry 4.0 and the increasing frequency/intensity of disruptions from risk sources like natural calamities and global wars require coordinated responses, and are forcing a re-evaluation of how logistics, humanitarian aid, and disaster relief managers respond to disruptions (Yates and Paquette, 2011). Practical concerns for managers include identification of sources and locations of risks, assessing the degree of vulnerability at different decoupling points, and aligning mitigation strategies across supply chains operating in disruptive environments (Christopher and Holweg, 2017; DuHadway *et al.*, 2017). Managers could reinforce disruption management by optimising synergies in interfirm relationships through adopting CRM. Collaborative approaches are embedded with a “supply chain outlook” and “signalling potential” to increase supply chain resilience by: enabling identification of risk hotspots vulnerable to disruptions; increasing visibility and risk awareness; and nurturing a risk management culture (Wieland and Wallenburg, 2013). In addition, CRM offers a strategic alternative for mitigating disruptions eminent in the “digitalized supply chains of the future” (SCM 4.0) which require high levels of cooperation, integration and alignment of SCRM processes (Hofmann and Rüsçh, 2017).

### Research limitations

Although the review is based on an exhaustive search of studies extending collaboration to SCRM, we acknowledge the probability of having overlooked relevant studies due to search variations, language controls, and deliberate exclusion of non-supply chain/business articles and books/book chapters (Lagorio *et al.*, 2016). While the classification of definitions and theoretical orientations was carried out with rigour, there is always a level of subjectivity based on the authors’ understanding (Prakash *et al.*, 2017).



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## Conclusion

Despite the support for collaborative approaches as an important means to enhance conventional SCRM techniques, CRM remains in its infancy, its advancement hindered by lack of consensus on key conceptual and theoretical foundations. In this SLR, we identify, analyse and synthesise literature to establish CRM's current position in SCRM research, and provide an agenda for future research based on a new definition, six CRM capabilities, and supporting theories. Our findings reinforce the need for consolidation of CRM capabilities and empirical testing of conceptual models to address deficits and ambiguities identified in the literature.

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