Researchers' Perspectives on Supply Chain Risk Management

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Abstract: This paper presents our field research study of operations-and-supply-chain-management scholars to study diversity in supply chain risk management (SCRM). First, we reviewed the researchers' output, i.e., the recent research literature. Next, we surveyed two focused groups (members of Supply Chain Thought Leaders and International Supply Chain Risk Management groups) with open-ended questions. Finally, we surveyed operations and supply chain management researchers during the 2009 INFORMS meeting in San Diego. Our findings characterize the diversity in terms of three "gaps": a definition gap in how researchers define SCRM, a process gap in terms of inadequate coverage of response to risk incidents, and a methodology gap in terms of inadequate use of empirical methods. We also list ways to close these gaps as suggested by the researchers.

Keywords: Supply chain risk management, field research, survey.

I. Introduction

With company executives reporting increased concerns about the rise of supply chain risks, supply chain risk management (SCRM) is becoming increasingly attractive as a research area to academics who wish to contribute to business. However, the area is still emerging and has unclear boundaries at this stage, leading to questions about diversity among researchers in terms of the scope of SCRM. Moreover, with researchers having different domain expertise, questions naturally arise about the diversity of research tools and their appropriateness.

We used a multi-method field research study to characterize this diversity of scope and research tools in the researchers' perception of SCRM. Our findings characterize the diversity of scope and research tools as three research "gaps" in SCRM: (1) a definition gap – there is no clear consensus on the definition of SCRM (2) a process gap – there is a lack of research on an important aspect of the risk management process, namely, the response to supply chain risk incidents; and (3) a methodology gap – there is a shortage of empirical research in the area of SCRM. Then, we provided initial answers on how to close these gaps on the basis of findings of the survey of we conducted on academics.

II. Methodology

Our field research study comprises three steps:

Step 1) Direct observations: We obtained direct observations of SCRM research activities by reviewing some recent research literature so as to examine how well the SCRM literature met the needs of industry in the eyes of the researchers. This step indicated diversity among researchers and helped us to shape our perception about three "gaps" in current SCRM research; (1) a definition gap, (2) a process gap, and (3) a methodology gap – that we discuss later.

Step 2) Exploratory survey of focus groups: To further explore researcher diversity in scope, in particular in the definition of supply chain risk and of SCRM, we surveyed two focus groups, which are 1) Supply Chain Thought Leaders (SCTL) Conference in Madrid, 2008 and 2) International Supply Chain Risk Management (ISCRiM) Conference in Trondheim, 2008. We obtained 42 responses from the attendees at these two conferences.

Step 3) Survey about the three gaps: We used a presentation and a questionnaire with closed-ended as well as open-ended questions to survey a broad-based group of operations management researchers. These researchers attended our keynote speech on SCRM during the 2009 Institute of Operations Research and Management Science (INFORMS) National Meeting in San Diego. We used this survey to seek the opinion of researchers on the gaps we identified in the previous steps. We also sought views from researchers about what can or should be done to address these research gaps in SCRM. We received 133 responses albeit some with incomplete responses to the open-ended questions.

III. Step 1 Findings: Diversity in Scope and Research Tools

We first looked into the types of risks identified as supply chain risks in the previous SCRM research by reviewing only those research articles where authors specifically discussed the definition or the scope of supply chain risks and uncertainties. While the literature we surveyed is not exhaustive, it does indicate the absence of any consensus on a definition or scope for supply chain risk (Table 1).

Articles	Scope of Risk
Jüttner, Peck and Christopher (2003)	Based on sources: environmental risk sources, network risk sources, and organizational risk

	sources
Spekman and Davis (2004)	Six dimensions of supply chain as risk sources, 1) inbound supply, 2) information flow, 3) financial flow, 4) the security of a firm's internal information system, 5) relationship with partners, and 6) corporate social responsibility
Chopra and Sodhi (2004)	Categorize supply chain risks at a high level as disruptions or delays. These risks pertain to 1) systems, 2) forecast, 3) intellectual property, 4) receivable, 5) inventory and 6) capacity risk
Christopher and Peck (2004)	Categorize supply chain risks as 1) process, 2) control, 3) demand, 4) supply and 5) environmental
Kleindorfer and Saad (2005)	Based on the sources and vulnerabilities of risks, 1) operational contingencies, 2) natural hazards, and 3) terrorism and political instability
Sodhi and Lee (2007)	Categorize supply chain risks in the consumer electronics industry broadly as those requiring strategic decisions and those requiring operational decisions, in three categories: 1) Supply, 2)Demand, and 3) and Contextual risks.
Tang and Tomlin (2008)	Categorize supply chain risks as 1) supply, 2) process, and 3) demand risks, 4)intellectual property risks, 5) behavioural risks, and 6) political/social risks
Manuj and Mentzer (2008)	Categorize supply chain risks as 1) supply, 2) operations, 3) demand and 4) other risks including security and currency risks.
Rao and Goldsby (2009)	Categorize supply chain risks as 1) framework and 2) problem specific and 3) decision making risk.

Table 1: The example of diverse views of supply chain risk in articles that aim to look at SCRM comprehensively.

Next, we reviewed a sample of papers to understand the different SCRM process elements and how these were covered in the literature. We classified the existing SCRM literature according to four key elements for managing supply chain risks: (1) risk identification; (2) risk assessment; (3) risk mitigation; and (4) responsiveness to risk incidents, including responsiveness to (a) operational risks (frequent risk events stemming from inherent supply-demand uncertainty); and (b) catastrophic risks (caused by natural or man-made disasters). In our sample, only a few articles covered the response element of SCRM, with only three considering catastrophic risks although there are some more about response to "operational" (Table 2). As such, we formed a perception regarding the SCRM process: researchers do not cover the response element.

	SCRM Elements				
Author(s)	**I**	**A**	**M**	**RO**	**RC**
Treleven & Schweikhart (1988)	X	X			
Johnson (2001)			X		
Hendricks & Singhal (2003)		X			
Chopra & Sodhi (2004)	X	X	X		
Christopher & Lee (2004)			X		
Giunipero & Eltantawy (2004)		X	X	X	
Norrman & Jansson (2004)	X	X	X		X
Spekman & Davis (2004)	X		X		
Zsidisin *et al*., (2004)	X	X	X	X	
Blackhurst *et al*., (2005)			X		
Hendricks & Singhal (2005a)		X			
Hendricks & Singhal (2005b)		X			
Kleindorfer & Saad (2005)	X	X	X		X
Brun *et al*. (2006)		X			
Choi & Krause (2006)			X		
Cucchiella & Gastaldi (2006)			X		
Gaudenzi & Borghesi (2006)		X			
Bogataj & Bogataj (2007)		X			
Sodhi & Lee (2007)	X		X		
Cheng & Kam (2008)	X	X	X		
Manuj & Mentzer (2008)	X	X	X	X	
Wagner & Bode (2008)		X		X	
Braunscheidel & Suresh (2009)			X		
Jiang *et al*., (2009)			X		
Knemeyer *et al*. (2009)	X	X	X		X
Nieger *et al*. (2009)	X				
Oke & Gopalakrishnan (2009)	X		X		
Rao & Goldsby (2009)	X				
Trkman & McCormack (2009)	X	X			

Table 2: The elements of SCRM covered by the literature, (I: identification, A: assessment, M: mitigation, RO: responsiveness to operational risks and RC: responsiveness to catastrophic risks).

Finally, we categorized SCRM articles into three groups: conceptual, quantitative empirical (statistical analysis of empirical data) and qualitative empirical (case studies). Notably, more than half the papers in our sample are conceptual or framework-type papers (Table 3). Also, most of the chapters in the books edited by Brindley (2004) and by Zsidisin and Ritchie (2008) are conceptual. Although we found some industry studies, for instance, one of the retail sector [27] and one of the consumer electronics industry [29], we formed a perception that empirical work is not extensive in the area of SCRM.

Author(s)	**CF**	**EQN**	**EQL**
Treleven & Schweikhart (1988)	X		X
Johnson (2001)			X
Hendricks & Singhal (2003)		X	
Chopra & Sodhi (2004)	X		
Christopher & Lee (2004)	X		
Giunipero & Eltantawy (2004)	X		
Norrman & Jansson (2004)			X
Spekman & Davis (2004)	X		
Zsidisin *et al*., (2004)			X
Blackhurst *et al*., (2005)			X
Hendricks & Singhal (2005a)		X	
Hendricks & Singhal (2005b)		X	
Kleindorfer & Saad (2005)	X	X	
Brun *et al*. (2006)	X		X
Choi & Krause (2006)	X		
Cucchiella & Gastaldi (2006)	X		
Gaudenzi & Borghesi (2006)			X
Bogataj & Bogataj (2007)			
Sodhi & Lee (2007)	X		X
Cheng & Kam (2008)	X		
Manuj & Mentzer (2008)	X		X
Tang & Tomlin (2008)	X		
Wagner & Bode (2008)		X	
Braunscheidel & Suresh (2009)		X	
Jiang *et al*., (2009)		X	
Knemeyer *et al*. (2009)	X		
Nieger *et al*. (2009)	X		
Oke & Gopalakrishnan (2009)	X		X
Rao & Goldsby (2009)	X		

Trkman & McCormack (2009)	X		

Table 3: Research methodologies used in the research literature, (CF: conceptual/framework, EQN: empirical quantitative and EQL: empirical qualitative).

IV. Step 2 Findings: The Definition Gap

To investigate scope diversity further, we focused on the definition of supply chain risk and of SCRM in the two focus groups. The first question (Q1) is about the respondent's definition of SCRM (Table 4). The results show that one-third of the respondents take a probabilistic approach and define SCRM as dealing with probabilities related to supply-demand matching. About the same number take an operations view in suggesting that SCRM deals exclusively the risks stemming from supply chain operations. About 7% of the respondents believe that SCRM deals with risks arising from not only the operational aspects, but also the strategic aspects of supply chain.

No.	Questions
Q1	What is supply chain risk management (SCRM)?
Q2	How is SCRM different from supply chain management?
Q3	What is the link between SCRM and Enterprise Risk Management (ERM)?

Table 4: Questionnaire for the first survey (SCTL and ISCRiM)

The second question (Q2) in our open-ended survey (Table 4) was to find out the link between SCRM and supply chain management. Indeed, as already speculated, about half (52.4%) participants view SCRM as a subset of supply chain management, an already established area of research and business practice. More than half of these (28.6% of the total) believe that SCRM is part of supply chain management, but with additional focus on risk elements. On the other hand, half the respondents believe SCRM as having elements outside supply chain management with 16.7% of the respondents regarding SCRM as being entirely outside of supply chain management.

With the third question (Q3) about "the link between SCRM and enterprise risk management" (Table 4), we intended to find out how SCRM differs from enterprise risk management (ERM). Nearly three-fourths (74.2%) of the respondents believe SCRM to be a subset of ERM or an extension of it. Also, 13.0% of these respondents underlined that the boundary of the traditional ERM tend to limit to the focal firm and the immediate surroundings but the boundary of SCRM is more extensive. Importantly, nearly a fifth the respondents believe that SCRM is separate from ERM (19.4%) while a tenth of the respondents place SCRM at the intersection of supply chain management and ERM (9.7%).

V. Step 3 Findings: Three Gaps

At the 2009 INFORMS San Diego meeting, we posed three sets of questions about the definition gap, process gap, and the methodology gap. Responding to the first question Q1 (Table 5), more than four-fifths of the respondents agreeing (score of 5 or more on a 7-point Likert scale) that "there is no clear consensus on the definition of supply chain management".

Q1	Gap 1: There is no clear consensus on the definition of supply chain risk management. (7 point Likert-scale, strongly disagree – strongly agree)
Q2	In what terms do you think SCRM should be primarily defined (select one)? - Dealing with unknown, disruptions/disasters/low-prob, high impact events - Dealing with supply-demand stochastic (probability-based approaches) - Dealing with risk within supply chain operations - Dealing with risk within supply chain strategy - Other: (Please write)
Q3	What should we do to address this gap?
Q4	Gap 2: There is a lack of emphasis on research on response to risk incidents. (7 point Likert-scale, strongly disagree – strongly agree)
Q5	What should we do to address this gap?
Q6	Gap 3: there is a shortage of empirical research in the area of SCRM. (7 point Likert-scale, strongly disagree – strongly agree)
Q7	What should we do to address this gap?

Table 5: Questionnaire for the INFORMS survey

Responding to the question about the terms in which SCRM should be primarily defined, (Q2, Table 5), nearly half (47%) of the respondents agreed that SCRM is about dealing with low-probability and high-impact events. On the other hand, a tenth (10%) of the respondents chose to point out the risks stemming from supply-demand stochastic. Some preferred to think in terms of supply chain strategy (10%) while others emphasized supply chain operations (20%). Of the remaining 13% who selected "other", more than half (7.5% of all the respondents) suggested that SCRM to encompass all of these risks.

To confirm researchers' perception of the process gap, we posed two questions in the survey, Q4 and Q5 (Table 5), about the lack of emphasis on research on response to risk events. Nearly 70% of the respondents confirmed that there is a lack of the research on response relative to prevention and mitigation.

We then sought to verify the perception of the methodology gap in our survey of operations management scholars at INFORMS with two questions, Q6 and Q7 (Table 5). A majority of the respondents agreed with this statement with nearly four-fifths of the respondents giving a score of 5 or higher as their response.

VI. Addressing the Gaps

In the INFORMS survey, we also asked three open-ended questions about how to close the stated gaps (questions Q3, Q5 and Q7 in Table 5). These responses can provide guidance to researchers and to journal editors and reviewers.

Closing the Definition Gap: We received many interesting

suggestions from 122 respondents regarding ways to close the definition gap of SCRM. Broadly speaking, the respondents' suggestions fall into five categories (Table 6). These categories indicate the broad range of approaches suggested.

Categories of responses regarding closing the definition gap
1. As the field of SCRM mature, this gap will close itself naturally
2. More research such as survey-based papers on the definition of SCRM is needed
3. More discussions in academia as well as industry are needed to close this gap
4. There should be an official definition of SCRM by an organization such as INFORMS
5. SCRM should be limited to quantifiable risks

Table 6: Response to Q3. What should we do to address the definition gap?

Although SCRM will naturally become better defined over time naturally, the process could take a long time. It took almost 20 years for the field of supply chain management to mature enough in order to obtain a clear definition. With SCRM, arguably the need is much greater. Moreover, senior managers from Cisco [24], also perceive a definition gap of SCRM among company executives and highlight the need to develop a clear definition of SCRM.

An interesting picture emerges that could become the basis for defining SCRM while satisfying most of the respondents of the last two questions in our focus groups (Q2 and Q3): SCRM has traits of supply chain management and enterprise management but is not a subset of either (Figure 1).

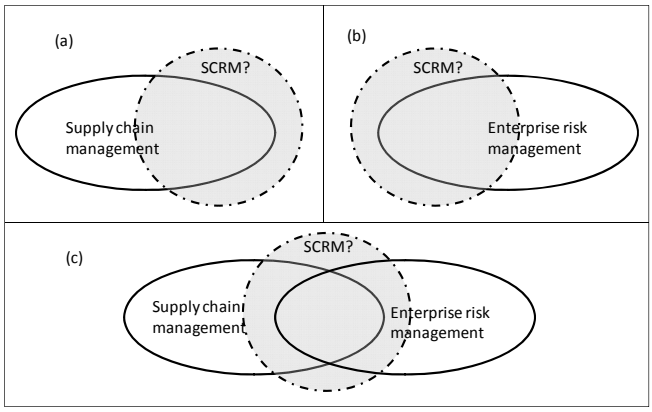

Figure 1: A possible scope for SCRM combining diverse views of respondents.

Closing the process gap: We categorized the response to the open-ended question (Q5) (Table 5) regarding the process gap into three types (Table 7).

Categories of responses regarding closing the process gap
1. More effort is needed for building a foundation for SCRM research.
2. Closer industry collaboration and case-study-based research
3. Need better ways to publish and share research.

Table 7: Response to Q5. What should we do to address the process gap?

The first category covers what to do research on: many believe that more effort is needed for building a foundation for SCRM research. These works involve "defining the spectrum of types of supply chain risks that require responses", "building frameworks for responses in SCRM", "developing methodology and models for responding", and "developing proper measure of scope of the risk and mathematically estimating the sequence of catastrophe". The responses in this category also include learning from the research in related areas such as "defense and military studies", "natural disasters", and "humanitarian disasters" where the focus of research is very much on response rather than on mitigation.

The second category comprises responses about how to carry out research. Many respondents suggested closer research collaboration with industry is one way to address this issue because of two major reasons: (1) many companies have experienced of responding supply chain related disruptions and delays, and (2) many companies have (or should have) detailed contingency plans for catastrophic events. Respondents also recommended "more empirical research based on case method".

The third category of the responses is about sharing and publishing SCRM research on responses. Some respondents pointed out that one way to encourage more research on this is starting a special issue on the response aspect of SCRM.

Overall, to learn about response to supply chain risk first-hand, collaboration with industry is essential. Also, responding to supply chain disruptions shares features with response to natural disasters by means of rescue and relief efforts [33].

Closing the methodology gap: The response to the open-ended question (Q7) (Table 5) in our INFORMS survey indicates ways for closing the methodology gap. Some respondents pointed that the nature of SCRM -- data on rare catastrophic events is not easy to collect -- is the major reason for the methodology gap and there is no easy solution for this. We categorized respondents' suggestions into the five categories (Table 8). Interestingly, many responses are cautionary in suggesting that more conceptual work is needed before we start doing empirical work. In similar vein, others suggest doing case studies on catastrophic events before embarking on similar empirical work in SCRM. Close collaboration with industry and establishing event-study-type research are deemed important as well. Finally, there are suggestions about editorial policy asking for editors to be more open to less-than-conventional research designs in the area of SCRM owing the to nature of the field and to the paucity of hard data.

Categories of responses regarding closing the methodology gap
1. More conceptual work is needed before proceeding to empirical research on SCRM
2. More case studies on catastrophic events is needed before conducting

empirical research on SCRM
3. Establish close collaboration with industry for data collection
4. Establish event-specific research (similar to event study in finance) as an approach for studying major catastrophic events
5. Journal reviewers should be more receptive on various research designs on SCRM where data collection is difficult

Table 8: Response to Q7. What should we do to address the methodology gap?

The responses highlight several major challenges for conducting empirical research on SCRM at this point. First, besides the fact data that on catastrophic events is not easy to collect, it is not clear what kind of data to collect unless there is a well defined conceptual framework. Second, as expressed by Meredith (1998), Flynn *et al*. (1990), and Voss *et al*. (2002), empirical research is perceived to be riskier than conceptual or mathematical research.

Still, empirical work in SCRM can pay dividends. SCRM being not only an emerging field but also an important one, many journals are developing special issues as of this writing. Based on our discussion with various editors, good empirical studies are in short supply. As such, there is a greater opportunity now to publish empirical results, thus providing motivation to collaborate with industry for empirical studies in SCRM.

VII. Conclusions and Further Work

SCRM being an emerging area, we followed a field research approach to study the area in its nascent stage. We first carried out direct observations by studying the researchers' output, i.e., the extant literature, to form our perceptions about SCRM research, then gathered additional evidence through two focus groups of supply chain researchers (SCTL 2008 participants and ISCRiM 2008 participants), and finally sought confirmation through a survey of a larger and broader audience of operations management scholars during the INFORMS Conference (2009).

We found there are three "gaps" pertinent to future research in SCRM: (1) no clear consensus on the definition of SCRM; (2) lack of commensurate research on response to supply chain risk incidents; and (3) a shortage of empirical research in the area of SCRM. The INFORMS respondents also provided initial answers on how to go about closing these gaps. Taken together, their suggestions point to the need for more involvement with industry for case-study and event-study based research, while at the same time pointing out the need for more conceptual work on which to base this empirical research. Their suggestions are also aimed towards journal editors and reviewers in being more open-minded to research methodology for SCRM.

Future work should include a similar study of practitioner communities to determine the particular risks in their respective companies, the type of data they can provide regarding risk events and what type of collaborations they want to have with academic researchers. The present study combined with such a practitioner study would help create a research agenda for SCRM researchers and journal reviewers. Furthermore, in our review of the syllabi of MBA core courses at top-50 US business schools, we found that the topic of SCRM is rarely covered [30]. Given that many academic researchers also teach, we could additionally expand our study to establish a teaching agenda for SCRM, possibly from an employer as well as researcher viewpoint. Finally, there are other nascent areas in operations management, such as sustainability, that could benefit from a study of scope and methodology diversity within the researcher community.

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