Supply chain risk management research: avenues for further studies

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Abstract: Organisations that are affected by supply chain risks will – if no risk-adjusting measures are available – experience more supply malfunctions or other adverse consequences. The paper at hand delivers a systematic review of the existing literature, featuring in-depth analysis and cognition on the ever-expanding supply chain risk management (SCRM) topic. The findings reveal that there is a lack of empirical evidence for the relational linkage between SCRM and performance. However, ‘top’ 24 antecedents for effective SCRM and various SCRM risk sources classified into supply-side, demand-side, external, and internal risks have been identified. The results of these useful insights allow for an identification of gaps to foster further investigations that will offer an advanced understanding of SCRM and its effect on performance. Hence, we contribute to the SCRM research stream by synthesising the highly fragmented and inconsistent literature that currently exists.

Keywords: supply chain risk management; SCRM; supply chain risk(s); supply chain disruption(s); supply chain risk sources; supply chain performance; antecedents; CIMO; systematic review; literature review; literature survey


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1 Introduction

Various business trends are leading to dynamic and complex supply chain (SC) networks (e.g., Chen et al., 2013; Cavinato, 2004; Harland et al., 2003; Zsidisin et al., 2004). One consequence is that risk is amplifying among SC networks, therefore, managers need to identify, assess and manage risks from a wider diverse range of contexts and sources (Sodhi et al., 2012; Tang, 2006; Wagner and Bode, 2006). Awareness of risks within SCs seem to have amplified as more partners are involved due to the rise globalisation, offshoring and outsourcing (Braunscheidel and Suresh, 2009). As a result, globalisation fosters risks in SCs since the resulting dependencies might lead to risks of both the supply-side the demand-side (e.g., Talluri et al., 2013; Finch, 2004; Faisal et al., 2006). Against the background of these risks affecting SCs, it can be supposed that SC performance can be negatively affected (Zhao et al., 2013; Thun and Hoenig, 2011). Therefore, many companies have recognised the need to conduct formal risk audits and to seek to manage that risk (Jüttner et al., 2003; Tang and Musa, 2011). Even though risk management in multinational companies has been examined in the past (e.g., Baird and Thomas, 1991; Carter and Vickery, 1989; Miller, 1992), research on risk management received less attention until the last decade when several researchers recreated interest in risk management, specifically addressing global SCs (Giunipero and Eltantawy, 2004; Normman and Jansson, 2004; Spekman and Davis, 2004; Zsidisin and Ellram, 2003). SCRM is still believed to be a growing and promising field by researchers (e.g., Knemeyer et al., 2009; Lavastre et al., 2012; Bogataj and Bogataj, 2007; Goh et al., 2007) but has numerous open-ended boundaries. SC strategies and their link to business performance are significant fields of research (Lynch et al., 2000; Morash, 2006).

Effective SCRM commences with the identification of possible risk sources that negatively affect performance. Researchers recommend that a risk management process should follow a formal, structured approach to identifying, quantifying, and reducing risks (Jüttner et al. 2003; Tang, 2006). Similarly, Manuj and Mentzer (2008b) indicate that identifying risks is the first iteration in generating efficacious risk management processes. To survive in a risky and turbulent business environment, it is of paramount importance for enterprises to implement SCRM. Thus, risk management is incrementally factored into decision-making today (Xia, 2011). According to Norrman and Jansson (2004), the primary focus of SCRM is the understanding and attempt to avoid or mitigate the detrimental effects that even marginal disruptions can have on SCs. Consequently, SCRM is a research field of growing importance and aims at providing approaches and practices for identifying, assessing, analysing and treating areas of vulnerability, disruption and risks in SC networks (Neiger et al., 2009). Therefore, several researchers are concerned with risk mitigation instruments that maintain resistant and efficient SCs. Furthermore, methods for evaluating potential risk sources to uphold or augment the performance of their organisation are highly demanded (Thun and Hoenig, 2011). Hence, the settings above constitute our motivation to analyse current issues and trends in SCRM linked to performance to identify possible research gaps that need further attention.

Our research is guided by the systematic literature review (SLR) proposed by for instance, Briner et al. (2009), Rousseau et al. (2008) and Dickersin et al. (1994) that is structured and robust. Boote and Bailey (2005) bring forward the argument that in order to promote our shared cognition; scientists must comprehend what has previously been done, the strengths and weaknesses of present research, and their underlying meaning.
Thus, a thorough literature review is a precondition for doing robust, evident, and valid research.

The organisation of the present SLR is as follows. The subsequent section deals with the elucidation of our rigorous SLR and the underlying research questions. Next, we emphasise the constitutional research setting including the criteria drawn on in selecting and evaluating scientific databases, as well as academic journals and articles. The paper closes by discussing the findings, indicating implications for managers and showing paths for further investigation.

2 Research methodology and design

In the present paper, a SLR of the SCRM field is arranged that ensures document reliability that is in line with current calls for greater methodological rigor in management literature reviews (Briner et al., 2009; Mulrow, 2001; Tranfield et al., 2003). In opposition to traditional reviews, reviews that are evidence-based like SLRs stand out because of their underlying principles, i.e., inclusivity, heuristic and explanatory nature as well as their transparency, allowing for a higher objectivity of the search results while eliminating error or bias issues. Rousseau et al. (2008) consider systematic reviews to applying critical interpretation with predefined criteria aiming to deliver the evidentiary value of previous research. Thus, evidence that has been produced from a systematic review using a methodologically rigorous approach has been found to have a high impact on scientific research and can provide a powerful tool.

Figure 1  Research methodology for SLR

Source: Adapted from Denyer and Tranfield (2009)

We adopt the rigorous SLR process suggested by Denyer and Tranfield (2009) for conducting the transparent and solid evidence-informed knowledge investigation as shown in Figure 1. This method is explicit, systematic, and replicable and is applied to identify, analyse, and report the existing confirmation from the SCRM academic literature. This method has been recently used by several other authors that conducted a
systematic literature in SCM and strategic management as well (e.g., Gimenez et al., 2012; Kilubi, 2015; Müller-Seitz, 2012; Pilbeam et al., 2012).

2.1 Formulating the research questions

Denyer and Tranfield (2009, p.682) used the expression context-intervention-mechanisms-outcome (CIMO) to lay down the four distinctive factors to be analysed in order to perform the subsequent processes of a well-designed SLR. To further determine and fix the scope of our examination, we applied the CIMO framework, utilising a series of logical questions such as context (C), interventions (I), mechanism (M), and outcomes (O) to our SLR on review questions that are well-formulated and answerable. Next, the CIMO logic in the context of SCRM is derived.

2.1.1 Context

Claims that we are surrounded by an ever-changing and uncertain world form part of almost every paper in management practice or research. Today’s marketplace is featured by though competitive pressures as well as enormous levels of disturbances and turbulences (Braunscheidel and Suresh, 2009; Christopher and Holweg, 2011). The uncertainty and complexity in a business setting can also augment the so-called termed ‘chaos’ risks within SCs (Christopher and Lee, 2004). In applying the CIMO method, we found ‘the dynamics of a competitive environment’ [Trkman and McCormack, (2009), p.249] as the context of our literature research, in which SC networks operate in an increasingly uncertain, complex and global environment with extremely fast-pacing and highly competitive markets.

2.1.2 Interventions

Researchers and practitioners are concerned with the detrimental effects of SC risks and the ways to mitigate them. Hence, the risk of disruptions triggered both from dynamics within SCs and from external environmental action is of vital interest to both practitioners and researchers (Tummala and Schöherr, 2011). In this connection, branded by an amplified degree of uncertainty and complexity, the interventions are epitomised by disruptions and risks in SCs.

2.1.3 Mechanism

Understanding of the SC risk sources that damage the performance of SC networks and the gravity of their impact can help an organisations design efficient SCRM processes in order to mitigate the detrimental effects caused by these risk sources (Punniyamoorthy et al., 2013). Against this background, we define the mechanism as antecedents within SC networks that enable them to be armed for unexpected disturbances as well as to respond effectively to risks.
2.1.4 Outcomes

SC risks are jeopardising competitiveness and profitability of companies and organisations. Therefore, academics and practitioners are interested in SCRM approaches that assist the persistence and efficiency of their SC networks, as well as in practices for evaluating prospective sources of risk (Fawcett et al., 2011). The intended outcome is, therefore, increased operational and business performance.

Hence, the appointed subjects of focus are uncertainty and complexity (C), disruptions and risks in SCs (I), antecedents of SCRM (M) and increased SC performance and stability (O). Consequently, the SLR aims at answering the following research questions:

RQ1 Which are the risk sources inherent in SCs?
RQ2 What are the antecedents of SCRM suggested in the academic literature?
RQ3 What is the relationship between SCRM and performance?

2.2 Locating the studies

Our purpose was to encompass a broad range of information and sources to capture relevant studies. More specifically, to identify relevant articles that are in alignment with our research questions, our primary source was to scan the major computerised business-relevant databases databases ABI/Inform Global, SCOPUS, Taylor & Francis, Science Direct, and Business Source Complete. This searching procedure is widely accepted and has been utilised in previous literature reviews (e.g., Keller and Ozment, 2009; Winter and Knemeyer, 2013). Apart from using these databases at academic institutions, Google Scholar was used to searching for supplemental articles relevant to the present study. We used the web search option of Google Scholar entering our defined keywords in the search field. Moreover, to test the validity of Google Scholar, a search was conducted in both Google Scholar and EBSCO’s Business Source Complete. Google Scholar included all, and more, of the papers listed on EBSCO’s Business Source Complete. This is accordable with previous studies that have highlighted that Google Scholar is more complete than some other databases; however, it still suffers from limitations such as incomplete references and therefore it was decided not to rely solely on it for the literature search (Kousha and Thelwall, 2007; Walters, 2007). The authors determined a set of keywords during an intensive brainstorming session. At a second meeting, the keywords were revised and critically evaluated by an academic team to enhance the quality of the search. Next, to identify articles for inclusion, a final list of keywords was established. We thereby used the search phrases ‘SC risk’ or ‘SC risk management’ together with performance. Those keywords were selected to identify articles dealing with the relationship between SCRM on performance.

2.3 Selecting and evaluating relevant studies

Following Denyer and Tranfield (2009), a rigorous process was employed to select and retrieve papers:
I. Kilubi and H-D. Haasis

1. selection of computerised databases
2. identification of keywords for search
3. checking of selected abstracts and conclusions
4. full-text review of selected papers.

Academic journals legitimise and control the nature of what is and ought to be recognised as valid research (Rousseau et al., 2008). Therefore, in place of utilising congress records, books, doctoral theses, or non-peer-reviewed journal articles, pre-prints, working papers, newspaper articles and other ‘grey literature’, we chose to include articles published in academic journals (Light and Pillemer, 1984). The peer-review process is an indicator of quality and aims at assessing the methodological and conceptual rigor of a study (David and Han, 2004). For that reason, we consider that this approach provides a representative and accurate picture of relevant research scholar. For the present analysis only the inclusion of peer-reviewed journals with a VHB ranking of A +, A, B, or C were defined as one inclusion criteria. VHB, the Association of University Professors for Business Research (VHB), the umbrella organisation of German university professors in the field of Business Administration. The VHB ranking is based on an assessment of economically relevant journals by the members of the VHB (Adler and Harzing, 2009). Journals are ranked from A till E, where A is the best category and E the worst one. Thus, we scanned the selected electronic databases under the terms of our defined keywords, with no time restriction. The main principle was that an academic journal article had to contain the phrase ‘SC risk’ in the article search together with at least one of the keywords, for example ‘performance’. Our unit of analysis was SC risk management. In pseudo code, we used the search phrases ‘SC risk(s)’ OR ‘SC risk management’ in the article title (TI) solely as well as together with performance in the abstract (AB), keywords (KW) and title (TI) search. Next, we redefined our search; the necessary criterion was that a paper had to cover the phrase ‘SC’ with at least one of the keywords ‘risk(s)’ OR ‘risk management’; for example, ‘SC’ AND ‘risk(s)’ OR ‘risk management’. Then, every article in each of the previously 20 selected journals (from the beginning of 2000 to the end 2013) was considered. The search resulted in 1,528 articles at first; however, these numbers should not be considered as mutually exclusive as several studies were incorporated into more than one database. In this case, 1,215 duplicates were removed, and 253 articles remained. To assess the relevance of journal articles to SCRM, we read the abstracts and the conclusions. Articles that appeared irrelevant to the required criteria of the review were omitted to ensure consistent focus and reduce bias. In total, we identified 253 appropriate academic papers.

Finally, the last step involved reading all 122 articles in their entirety. All those articles that seemed non-relevant to the necessary criteria of the SLR were taken out to ensure an even focus. Here again, 69 articles excluded after reading the full text. As a result, 53 items were identified after reading the full text. By skimming the reference lists, we noticed a few papers that might be of high relevance but were published under a different term (e.g., logistics) or in an academic journal outside the 21 selected. Therefore, seven additional items were included as part of the cross-referencing approach to guarantee the comprehensiveness of the present literature review. The final result of 60 journal articles on the topic of SCRM was then analysed in-depth to answer the fundamental research questions of the present systematic review (cf. Figure 2).
3 Scope of research: systematic review of the SCRM literature

3.1 Analysing and synthesising the findings

The output of a synthesis is a well-informed elucidation of what the academic evidence says regarding the research questions including its related issues that arose in the process (Rousseau et al., 2008). The sample of 60 selected journals in this SLR was published in 21 interdisciplinary academic journals. In detail, the greatest number of articles appeared in the International Journal of Physical Distribution & Logistics Management (n = 12),

There are obviously years that yield larger numbers of publications, which may be resulting from the fact that certain academic journals have been releasing call for papers on the topic of SCRM. The development of literature over time shows that the year 2004 (n = 10) marked the peak in number of articles published, followed by 2009 (n = 6), 2012 (n = 6), and finally the years 2006 and 2011 (each n = 5). Against this background, the significance of the SCRM topic and the need for further expanding research in this field is clearly revealed.

**Figure 3** Number of articles by journal publications (only those with at least two have been displayed) (see online version for colours)
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<td>European Journal of Operational Research</td>
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<td>International Journal of Logistics Research and Applications</td>
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<td>International Journal of Operations and Production Management</td>
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<td>International Journal of Production Research</td>
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<td>Journal of Operations Management</td>
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<td>Journal of Purchasing and Supply Management</td>
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<td>Journal of Supply Chain Management</td>
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<td>Production and Operations Management</td>
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<tr>
<td>Supply Chain Management: An International Journal</td>
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Table 2
Synthesised categories of SC risk sources

<table>
<thead>
<tr>
<th>Categories of risk sources</th>
<th>Sub-level risk sources</th>
<th>Description</th>
<th>Examples</th>
<th>Frequency</th>
<th>Author(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Demand-side risks</td>
<td>Demand risks involve disturbances on behalf of the consumer. These risks are interrelated to losses caused by processing errors, technical failures, and quality problems.</td>
<td>New product introductions, variations in demand, reputation risks, receivables risks, product shortages, product recalls, industry or market risks (e.g., volatility of customer demand), etc.</td>
<td>10</td>
<td>Johnson (2001), Goh et al. (2007), Manuj and Mentzer (2008a, 2008b), Wagner and Bode (2008), Tang and Tomlin (2008), Wever et al. (2012), Tummala and Schönherr (2011), Zsidisin and Smith (2005), Punniyamoorthy et al. (2013); Schönherr et al. (2008)</td>
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<td></td>
<td>External risks</td>
<td>External risks are all the risks that lie outside of the boundaries of supply chain networks and which cannot be directly influenced by the organisational actors. There are thus outside the control of supply chain entities. Consequently, there are in general harder to control.</td>
<td>External risk sources are for instance, natural risks, social risks, wars, political risks, crimes, economic upheaval, etc.</td>
<td>16</td>
<td>Christopher and Lee (2004), Lockamy and McCormack (2010)</td>
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<td></td>
<td>Disruption risks</td>
<td>Disruption risks refer to unforeseen discontinuities. That can be risks arising from political and economic instability, and operational risks (parts and materials shortages, equipment and machinery malfunctions, and quality problems).</td>
<td>Examples for disruption risks are natural, single source of supply, labour disputes, disasters, strikes, economic instability, natural hazards, terrorism and wars, human-related issues – from fraud to strikes, duties delays.</td>
<td></td>
<td>Kleindorfer and Saad (2005), Tang (2006), Goh et al. (2007), Tummala and Schönherr (2011)</td>
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<td></td>
<td>Policy risks (including, fiscal, legal, and bureaucratic risks)</td>
<td>Exposes the companies with alterations in regulations derogating the organisation’s business, such as environmental regulation. Most notably, legal alterations are often abrupt and hard to anticipate.</td>
<td>Governmental barriers (e.g., customs, trade regulations, duties) may limit the design and impact the operational performance of supply chain networks.</td>
<td></td>
<td>Harland et al. (2003), Tang and Tomlin (2008), Wagner and Bode (2008), Manuj and Mentzer (2008a), Vilko and Hallikas (2012)</td>
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<tr>
<td>Categories of risk sources</td>
<td>Sub-level risk sources</td>
<td>Description</td>
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<td>Environmental risks</td>
<td>cf. organisational risks</td>
<td>Examples for internal risks are for instance, financial insolvency, lack on equipment, resources and equipment (see also organisational risks).</td>
<td>18 Christopher and Lee (2004), Yu et al. (2009)</td>
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<td>Internal risks</td>
<td>cf. organisational risks</td>
<td>Examples for internal risks are for instance, financial insolvency, lack on equipment, resources and equipment (see also organisational risks).</td>
<td>18 Christopher and Lee (2004), Yu et al. (2009)</td>
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<td>Process risks</td>
<td>Internal operations (including in- and out-logistics) that are susceptible to issues that can cause fluctuations in effective capacity and quality.</td>
<td>Process risks specify disturbances within an organisation’s operational activities with regard to increase in value, e.g., production delay or failing operating resources, etc.</td>
<td>Norman and Jansson (2004), Tang and Tomlin (2008)</td>
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<td>Organisational risks</td>
<td>Organisational risks are related to risks that reside within organisational boundaries of supply chain members.</td>
<td>Organisational risks range from IT-system insecurity or operations and production malfunctions (e.g., machine failure).</td>
<td>Jüttner et al. (2003), Finch (2004), Faisal et al. (2006)</td>
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<td>Operational risks</td>
<td>Operational risks encompass the way organisations operate their business. Those risks are interrelated to losses caused by processing errors, technical failures, and quality problems caused by production errors.</td>
<td>Breakdown of operations; inadequate processing or manufacturing capability; high degrees of process variation; changes in operating exposure; changes in technology, etc.</td>
<td>Kleindorfer and Saad (2005), Hoffmann et al. (2013), Manuj and Mentzer (2008a, 2008b), Tang (2006), Lockamy and McCormack (2010), Sodhi et al. (2012), Vilko and Hallikas (2012)</td>
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<td>Financial (cost-related) risks</td>
<td>Financial risks refer to the possibility of a supply chain to default on its bonds or may also entail the risks that the financial flow of an emitter will not be sufficient to meet its financial liabilities.</td>
<td>Investing in wrong suppliers, poor investment decision, supplier bankruptcy, misuse of funds, damage of physical assets, low inventory turnover, obsolescence of goods and materials are just a few examples of financial risks.</td>
<td>Zsidisin et al. (2000), Hoffmann et al. (2013), Cavaino (2004), Christopher and Lee (2004)</td>
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3.2 Risk sources inherent in SCs

Several scientific researchers have taken on different perceptions in categorising risks in SCs (e.g., Sodhi et al., 2012; Vilko and Hallikas, 2012; Yu et al., 2009; Zsidisin et al., 2000). Most of them classify SC risks as a first step to managing them but do so from widely diverse perspectives (e.g., Manuj and Mentzer, 2008a; Neiger et al., 2009). The categorisation of various kinds of SC risks is a difficult endeavour since each entity of a SC faces different types of risks. Through the identification of potential risks in their SC environment, decision-makers receive awareness about phenomena or events that cause disruptions (Skipper and Hanna, 2009). SC risks can be mitigated by understanding the diversity and interconnectedness of risks in SCs and knowing the elements having an impact on SCs. A synthesis of SC risk sources mentioned in the articles reviewed is described in Table 2.

3.3 SC risk sources

Effective SC risk management starts with the identification of possible risk sources that negatively affect performance. One principal prerequisite is to understand the sources of SC risks sufficiently to establish responsibility for the management of risks. Not accordingly, several inconsistencies were found in terms of terminologies used in the identified literature; 45% (27 out of 60 articles) provided different categories of SC risks. Risks may be grouped into a various of categories as:

a. the ones that reside inside the SC or outside the SC
b. the ones with short-term or long-term impacts
c. the ones with minor or major impact to SC (Waters 2011).

However, many scientific researchers have different perceptions in terms of categorising SC risks (Vilko and Hallikas, 2012; Yu et al., 2009; Sodhi et al., 2012; Ritchie and Brindley, 2007a, 2007b). For example, Faisal et al. (2006) follows the same approach as Jüttner et al. (2003) in categorising SC risks, whereas Johnson (2001) merely classifies SC risk sources as supply-related or demand-related. Spekman and Davis (2004), as well as Tang and Musa (2011), classify SC risk sources into the three distinct SC flows. Finch (2004) takes an entirely different angle grouping risks into three general categories that encompass the three levels of coverage. In the same vein, Hoffmann et al. (2013) assigning risk sources four different dimensions, namely, environmental, financial, operational, and strategic risks. In the present systematic review, we found 27 different classifications of SC risk sources made by several authors. We categorise the SC risk sources into supply-side risks, demand-side risks, external, and internal risks. In particular, the arrangement was guided by the classifications of Norrman and Jansson (2004), Lockamy and McCormack (2010), Yu et al. (2009), and Punniyamoorthy et al. (2013). Each of the SC categories has been assigned their corresponding sub-level SCR sources as presented in Table 3.
### Table 3  Summary of research linking SCRM to performance

<table>
<thead>
<tr>
<th>No.</th>
<th>Year</th>
<th>Academic journal</th>
<th>Industry studied</th>
<th>Region (country)</th>
<th>Focus</th>
<th>Research method</th>
<th>Author(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2006</td>
<td><em>SCMJ</em></td>
<td>PC manufacturer</td>
<td>Taiwan</td>
<td>Financial performance</td>
<td>Event study</td>
<td>Papadikis (2006)</td>
</tr>
<tr>
<td>4</td>
<td>2008</td>
<td><em>JBL</em></td>
<td>Cross-sectoral (e.g., 71.1% industrial, 19.5% service, 8.8 service firms)</td>
<td>Germany</td>
<td>Supply chain performance</td>
<td>Survey, OLS regression</td>
<td>Wagner and Bode (2008)</td>
</tr>
<tr>
<td>6</td>
<td>2012</td>
<td><em>IJPDLM</em></td>
<td>Manufacturing (e.g., 24% machinery, 22% automotive, 15% electronics)</td>
<td>Germany</td>
<td>Supply chain performance</td>
<td>Survey, path analytical modelling</td>
<td>Kern et al. (2012)</td>
</tr>
</tbody>
</table>

### 3.4 Antecedents of SC risk management

To examine how SC risks can effectively be managed, the present paper found several inconsistencies in terminologies among the selected papers. Some authors refer, for instance, to activities (Sinha et al., 2004), elements (Christopher and Lee, 2004), or principles (Kleindorfer and Saad, 2005). Moreover, academics propose several diverse strategies, processes, approaches, methods, practices, tools and techniques for SCRM (e.g., Skipper and Hanna, 2009; Tomlin, 2006; Yang and Yang, 2010). Taking into account that the expression capability has various meanings in literature, we stay impartial concerning the descriptive analysis. Thus, following Braunscheidel and Suresh (2009), and Jüttner et al. (2003,) we will use term ‘antecedents’ in the following. However, there are numerous diverse antecedents for effective SCRM mentioned in the literature.
We found that the postponement was mentioned 11 articles as a SCRM antecedent, followed by information sharing – guided by nine articles (n = 9), risk assessments and risk monitoring were each mentioned eight times (n = 8). Furthermore, flexibility and multiple sourcing appeared in seven articles followed by risk identification (n = 6). Next, risk integration along with partnerships, relationships, avoidance, and contingency planning were mentioned each five times (n = 5). Moreover, continuity planning, cooperation, responsibilities, risk awareness, transferring risks have also been identified as most frequently used antecedent (each n = 4). Further antecedents named were agility, collaboration, coordination, demand management, flexible supply base, flexible transportation, trust, and visibility (each n = 3). However, softer factors such as the element of trust appeared three times, at least. Some antecedents mentioned are pretty vague, without deeper specifying the domain such as mobility, speculation, imitation, formal procedures, risk acceptance, and training (each n = 1). The following 24 antecedents have been acknowledged as the most repeated ones, namely, postponement (n = 11), information sharing (n = 9), risk assessments (n = 8), flexibility (n = 7), multiple sourcing (n = 7), risk identification (n = 6), avoidance, integration, contingency planning, monitoring, relationships (each n = 5), continuity planning, cooperation, responsibilities, risk awareness, transferring risks (each n = 4), agility, collaboration, coordination, demand management, flexible supply base, flexible transportation, risk monitoring, trust, and visibility (each n = 3) (see Figure 4).

**Figure 4** Most frequently mentioned SCRM antecedents (see online version for colours)

3.5 **SC management and performance**

Hendricks and Singhal (2005) proved that SC disruptions severely impact the health of affected organisations concerning their profitability. They further found out that those
firms concerned do only slowly recover from the detriments caused by those disruptions. Papadakis (2006) examined the impact SC disruptions have on the financial performance of enterprises. His empirical findings proved the decrease in firm’s stock price due to SC risks. He further declares that risk exposure makes it difficult for companies to anticipate SC disruptions, like, for instance, those arising from human-made or natural disasters. Wilson (2007) analysed the effect of disruptions during transportation on SC performance. Briefly, a transportation disruption between the 1st tier supplier and the warehouse has the utmost downside impact on the SC, resulting in a high increase in inventory levels and materials in transit. Wagner and Bode (2008) have executed a large-scale research investigating the impact of SCRs on SC performance. They revealed that 6% of the variance of the performance of SCs is due to the adverse effect of SC risks and concluded that SCRM is of paramount importance in both managing demand- and supply-side risks. In their study, Thun and Hoenig (2011) study revealed that firms with a higher level of SCRM implementation degree yield a superior SC performance and those using preventive SCRM methods show greater flexibility and are better at planning safety stocks. Moreover, Kern et al. (2012) have empirically validated the continuous effect of three basic risk management steps risk identification, risk assessment, and risk mitigation on business performance. Their research clearly demonstrates that firms with high expertise in those three SCRM phases render excellent performance in mitigating SC risks. An investigation conducted by Wieland and Wallenburg (2012) showed that SCRM positively affects organisational performance. Their evidence provides insights on the fact that agility is essential to cope with customer-related risks while robustness is necessary premise to handle supplier-related risks. An overview of the research that studied the relational linkage between SCRM and performance herein reported is presented in Table 3.

3.6 Reporting and using the results

Since our aim is to advance knowledge in the significant topic of SCRM and to contribute to its progression, the present systematic review revealed some inconsistencies and research gaps through in-depth analyses. We noticed that research interest in SCRM was sparked after detrimental natural and industrial disruptions like the USA terror 9/11 in 2001 with a severe impact on the global economy (Barry, 2004). As a result, we can experience a growing number of papers focusing on SCRM. In fact, more than 90% of the surveyed journal articles (52 out of 60) were published from 2003 onwards, providing evidence to the fact that research interest in SCRM is still further growing. Based on the reviewed journal publications, more than 50% of the articles in our systematic review were contributed by the following leading academic journal publishers, *International Journal of Physical Distribution and Logistics Management* (n = 12), *International Journal of Production Economics* (n = 9), and *Supply Chain Management: An International Journal* (n = 9). This indicates high interest among peer-reviewed academic journals in this highly relevant research domain.

Considering the high number of publications from 2011 onwards a plausible explanation may be that the 9/11 attacks revealed the vulnerability of globally interconnected SCs so that this led to an increase in conducting research on SCRM (Christopher and Peck, 2004; Rice and Caniato, 2003; Sheffi and Rice, 2005). Above all we suppose that many companies exploit many of the available SC principles such as JIT,
outsourcing, lean manufacturing, offshoring and conduct other global activities to gain a competitive advantage and thus improve firm performance (e.g., Lai et al., 2009; Tang and Musa, 2011). But at the same time, those are exactly the reasons for the appearance of disruptions and risks as a consequence of higher vulnerability and complexity (Christopher and Lee, 2004; Narayanan and Raman, 2004). Therefore, strategies to prevent, mitigate, or avoid those harassments are highly demanded (Ritchie and Brindley, 2007a).

4 Practical and theoretical implications

The findings of the present paper clearly manifest the high relevance of the SCRM field for both researchers and practitioners. During the last decades, we have been witnesses of many disruptive events with detrimental effects, such as the economic and financial crisis, natural disasters or supplier bankruptcies which have caused cumulative risk exposures to organisations. As a result, managers are asked to translate the suggestions from the literature into practice whereas scientists may contribute to SCRM research as a business process to further deepen its understanding and its influence on organisational performance. Companies may jeopardise their global competitiveness if they do not learn how to cope with SC risks. There is at least partial evidence that SCRM and performance are positively linked to each other – although we have only identified a few numbers of studies focusing on the relationship between both of them. Indeed, this is an important argument for practitioners who consider the introduction of SCRM and provides them a crucial argument to invest in SCRM initiatives. The design of the SC has an influence on the appropriateness of the different SCRM antecedents. Hence, firms have to make a decision with the help of cost-benefit-analyses what implementation level they desire for their SC. Organisations need fully to comprehend the eligibility of the different antecedents, especially when they are suitable. Thus, they must select among the different antecedents and have to verify which of them they need to activate for mitigating risks and thus in turn improve performance.

As aforementioned, the findings also demonstrate clear implications for academics. We know that risks have strong perceptive elements in managing risk situations and have a significant influence on strategic decision-making (Hallikas et al., 2004). First, behavioural elements such as human/organisational risk propensity can be integrated with the conventional risks models to get more realistic solutions (Ritchie and Brindley, 2007b; Singhal et al., 2011). Second, since SCRM is a multidimensional construct the role of various personality traits, context and experience can also be incorporated into risk management models (Khan and Burnes, 2007; Sodhi et al., 2012). Third, the examination of the systematic review clearly demonstrates a lack of consistency regarding specific terms that may hinder the ability to implement SCRM effectively. Hence, the results indicate that a greater consensus on particular notions and terms concerning SCRM antecedents is undoubtedly required. Fourth, empirical research investigating the relationship between SCRM and performance is certainly on the agenda. Corresponding firms of SCs thus need to establish a common understanding of SC risks and agree upon a coherent risk assessment and evaluation standard, which enables to evaluate the identified risks irrespective of the company’s specific preparedness to take risks (Kleindorfer and Saad, 2005; Manuj and Mentzer, 2008a). The paper at hand provides a SLR on SCRM including 60 academic journals. It acts as the foundation for an
understanding of the major risk sources, antecedents as well as research on the linkage between SCRM and performance. We hope that our study will motivate to further pursue research on the areas discussed.

References


Supply chain risk management research


