

Supply risk management in small and medium-sized enterprises: A systematic literature review

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Abstract:

This paper reviews the extant literature relating to supply risk and its mitigation strategies in the context of SMEs. A systematic literature review approach using keyword search in the various academic databases was employed to capture, classify and summarise the main body of knowledge on supply risk management in SMEs. The findings reveal that literature of supply risk management focusing on SMEs is very limited at present. The findings also reveal that leveraging network resources is predominantly advocated by the scholars as a measure of mitigating supply risks in SMEs. Based on the findings of the existing literature, the paper also offers recommendations for future research, which can contribute to the literature on supply risk management in SMEs.

Keywords: Supply risk, supply risk mitigation, small and medium-sized enterprises, literature review

INTRODUCTION

Small and medium –sized enterprises (SMEs) are the most common business entities found across the globe. In many economies of the world, SMEs – firms having less than 250 employees and below 50 million Euros in yearly turnover (EU, 2003) – comprise around 99% of all business organisations (Mazzarol, 2014). Contribution of SMEs in most of the economies worldwide is also very significant (Burgstaller & Wagner, 2015). For instance, 99% of the economic activities of the European Union can be traced back to SMEs, which provide two-third of all job positions in the private sector (Gama & Geraldes, 2012). In many developing countries, SMEs are primarily the main source of employment and industrial output. Take the Asia-Pacific Economic Cooperation (APEC) countries as an example, SMEs comprise 90% of all business firms (Khan & Khaliq, 2014). On an average, SMEs account for 80% of the global economic growth, hence considered as the backbone of the economic growth and development in all the countries (Singh, Garg, & Deshmukh, 2009).

A survey by Hillman & Keltz (2007) found that supply risk is the number one risk factor in most supply chains, irrespective to firm size. Of those surveyed, 92% of the respondents claim that supply risks will increase or remain the same in future. A number of studies (Hendricks & Singhal, 2005a,

2005b; Kaufmann, Carter, & Rauer, 2016) reported that SMEs are more vulnerable to supply risk since the frequency and consequences of supply risks are higher in SMEs compared to larger firms. There are many reasons for this difference including limited resources and capital, inadequate negotiating power, lack of technology and imperfect strategy (Chowdhury, Lau, & Pittayachawan, 2016, 2017). Since SMEs are more vulnerable to supply risks, it is necessary for SMEs to identify the risk types that jeopardise success and variability of the firms in time to efficiently mitigate the probability and impact of them (Ellegaard, 2008). Failing or misjudging the supply risks can bring many negative consequences, ranging from loss of operating income to financial losses and possibly, even damaging brand reputation (Alcantara & Riglietti, 2015; Kim, Chen, & Linderman, 2014).

Ellegaard (2008) highlighted that little work has been performed in the area of supply risk management focusing on SMEs. Since then, volume of articles on the area of supply risk and its mitigation in SMEs has been increasing. However, the area is still fragmented, and no systematic literature review has yet been specifically concerned on supply risk management in SMEs. Given the vulnerability of SMEs in terms of supply risks, and the significant role of SMEs in the economies worldwide, a comprehensive literature review is required that can potentially offer the right directions of future research. Therefore, we aimed at reviewing the existing literature on supply risk management in SMEs to answer the following two questions: (1) What is the current state of research on supply risk management in SMEs and (2) what additional research is required on supply risk management in SMEs?

Through answering these two questions, we believe that this research provides a comprehensive understanding on what has already been done in the area and offers a clear guide to what is required (Petty & Guthrie, 2000). Moreover, it helps in avoiding the risk of wasting effort on attempting to re-investigate something that is already known (Sekaran & Bougie, 2016). We begin by outlining the concept of supply risks in section 2. Afterwards, in section 3 we discuss the methodology of this paper, the results of which are analysed and synthesised in section 4. Finally, section 5 presents the conclusion, avenues of future research and limitations of this study.

SUPPLY RISK

In the classical decision theory, risk is conceptualised as “variation in the distribution of possible outcomes, their likelihood, and their subjective values” (March & Shapira 1987, p. 1404). These variations can be both positive (opportunity) and negative (danger) in outcome (Mitchell, 1995). The initial concept of risk in itself was neutral, which took account of both gains and losses in outcome (Douglas, 1990). Although, theory suggests both positive and negative variations as risk, managers only consider the negative deviations as risk (Miller & Reuer, 1996; Zsidisin, 2003). For instance, a survey conducted by Shapira (1986) found that eighty percent of managers sampled only considered negative outcomes as risk (cited in March & Shapira 1987).

Following the negative variation based definition of Kumar et al. (2010), this research defines supply risk as the *potential deviations in the inbound supply from the initial overall objective that may result in incomplete or unfinished order*. This definition allows including any kind of incident that cause negative variance of outcomes in the up-stream supply as supply risk. These deviations can be in the form of quality of products, quantity of products, time of delivery, supplier capacity and overall requirements.

METHODOLOGY

Adapted from Ho, Zheng, Yildiz, & Talluri (2015), this study conducted an exhaustive search of the scholarly articles related to supply risks of SMEs. As depicted in Figure 1, the search comprised five stages. In the first stage, a preliminary list of articles was compiled through searching the different databases using keywords. Extant literature used small business, small enterprise, small company, small firm and SME interchangeably (Burgstaller & Wagner, 2015). Therefore, five sets of keywords, including (1) ‘supply risk’ and ‘small business’, (2) ‘supply risk’ and ‘small company’, (3) ‘supply risk’ and ‘small firm’, (4) ‘supply risk’ and ‘small enterprise’, and (5) ‘supply risk’ and ‘SME’, were used to ensure that all relevant articles would be selected for review. Six large academic databases, including EBSCOhost, Emerald, ProQuest, Science Direct, Web of Science and Wiley Online Library, were chosen for searching to ensure that a wide variety of journals would be accessed. All

types of scholarly articles having any combination of the search keywords appearing ‘anywhere in the text’ were initially selected from these six academic databases. Then, two criteria were applied to filter the selection to ensure relevancy and quality of the reviewed articles. First, only peer-reviewed journal articles were included in the final selection while any other forms of articles, such as conference paper, textbooks, book chapters, dissertations and lecture notes, were excluded. Second, only articles written in English were considered, and all articles written in other languages were removed from the initial list of publications. However, unlike Ho et al. (2015) no restriction on the year of publication was imposed so as to maximize the final selection. These filtering criteria resulted in 227 unique journal articles in the search. Table 1 shows the number of articles identified from all the databases.

Insert Table 1 about here

In the second stage, the 227 articles were screened based on two criteria. First, four articles were removed because one of the search term did not appear in these papers. They were initially selected because some words, for example “assessment”, used in these articles contained the letters ‘SME’ – one of the search keyword. Another 111 articles were removed because either one or both of the search terms only appeared in the references list but not in the body text. Altogether 115 articles were removed at this stage with 112 articles retained for review.

In the third stage, all the 115 articles were thoroughly examined to determine if the content contributed information in one or more of the area of supply risk, including risk factors, risk types, risk management strategies and research gap identification in the context of SMEs. Upon a systematic review, 29 articles were identified to have provided information on at least one of the areas of supply risk and supply risk management of SMEs. In the fourth stage, the reference lists of the 29 articles were carefully checked to ensure that all relevant articles had been reviewed. In the process, another 7 articles were identified, giving a total of 36 articles, which provided useful information in the domain of ‘supply risk in SMEs’. In the final stage, these 36 articles were reviewed thoroughly and their findings were analysed and presented in the next sections.

Insert Figure 1 about here

LITERATURE ANALYSIS AND SYNTHESSES

In this section, the findings of those articles that conducted comparative analysis of supply risk between large firms and SMEs are presented. In the next section, we report the findings of the current state of literature on supply risk in SMEs. To facilitate the report of the current state of research, a framework of supply risk management adapted from Ho et al. (2015) and Tummala & Schoenherr (2011), has been created as depicted in Figure 2.

Insert Figure 2 about here

Supply risk of SMEs vs large enterprises

Among the 36 articles reviewed, 9 articles conducted a comparative analysis of supply risk management between SME and large enterprises. Through an empirical survey, Thun, Drüke, & Hoenig (2011) reported that SMEs regard themselves as more vulnerable than larger enterprises in terms of supply risk. A recent study (Kaufmann, Carter, & Rauer, 2016) also supported the view that SMEs are more vulnerable than larger firms. One study (Park, Min, & Min, 2016) that was designed to identify the reasons of such differences found that larger firms comply with more security and safety standard rules during inbound sourcing than SMEs. However, Wagner & Neshat (2012) found that supply risks seem to be positively related to firm size, which means that larger enterprises face more supply risks.

In terms of effect of supply risk, Hendricks & Singhal (2005) reported that similar supply risk reduces operating income of SMEs by 75.77% more than that of large enterprises. They also found that impacts of supply risks on return on sales and return on assets for SMEs are also significantly more negative than that for larger enterprises. Another couple of studies (Hendricks & Singhal, 2003, 2005a) also reported that SMEs experience a more negative stock price reaction than larger firms due

to announcement of supply risks. However, Thun et al. (2011) did not find the support for similar hypothesis that ‘supply risk affects SMEs more strongly than larger firms’.

In terms of supply risk mitigation strategies, Lavastre, Gunasekaran, & Spalanzani (2012) mentioned that SMEs attempt to individually mitigate supply risks, as they are less structured and have smaller management team, while larger firms utilise joint approaches involving other network members. Recently, another study (Adams, Kauffman, Khoja, & Coy, 2016) also reported similar findings. Thun et al. (2011) reported that larger firms use preventive techniques to mitigate supply risks through direct communication with suppliers and strategic sourcing. SMEs, in contrast, employ primarily reactive strategies through creation of redundancies, such as multi sourcing, dual sourcing and safety stock, in reducing the impact of supply risks. These findings are contradictory with the findings of a couple of other studies (Ellegaard, 2008; Prasad, Tata, & Guo, 2012) wherein the authors mentioned that SMEs very seldom use redundancies and multi sourcing to mitigate supply risks.

Finally, in regards to implementation of the supply risk mitigation strategies, Thakkar & Deshmukh, (2008) reported that SMEs’ implementation of supply risk mitigation strategies differs from that of larger enterprises. This is because owners/managers of large enterprises are more experienced and skilled than SMEs in applying supply risk mitigation strategies (Kaufmann et al., 2016; Larson, Carr, & Dhariwal, 2005).

Supply risk management of SMEs

Risk identification

Risk identification, which is the first step of risk management, involves a comprehensive identification of risk factors. Proper identification of supply risk is specifically important for SMEs because SMEs need to adopt supply risk mitigation strategies based on the risk factors they face (Kumar, Singh, & Shankar, 2014). With regard to the content of the reviewed papers, only three articles (Faisal, Banwet, & Shankar, 2006; Kozaryn & Wasilewski, 2012; Kumar et al., 2014) devoted to identify the supply risks in the context of SMEs. Kozaryn & Wasilewski (2012) pointed out a few supply risk types for SMEs (see Table 2). However, the findings were derived from a single case study of a small

enterprise. Therefore, the risks identified could be neither exhaustive nor representative. Kumar et al. (2014) reported several supply risks (see Table 2) in the context of Indian SMEs operating in semi-urban areas. SMEs in other countries may face different supply risks given that supply risks vary across different countries (Paik, Bagchi, Skjott-Larsen, & Jeffery, 2009). In another paper, Faisal et al. (2006) explored several risk types under in the category of ‘information risk’ in the relationship between SME and their suppliers. The authors found that SMEs face several information risks, such as information security risks, information distortion and bullwhip risks, intellectual property rights risks, information system breakdown risks and IT/IS outsourcing risks, in the network between SMEs and their suppliers.

Insert Table 2 about here

Risk Analysis

Risk analysis, second step of supply risk management, involves the sub-steps of risk measurement and risk assessment. Risk measurement is concerned with the determination of the consequence of several potential supply risk factors, and risk assessment is concerned with the determination of the probability of each risk factor (Tummala & Schoenherr, 2011). Both of the sub-steps of risk analysis have received less attention in the context of SMEs although several quantitative and intelligent models have been developed in the context of large enterprises (Tummala & Schoenherr, 2011). Following a popular model of risk analysis provided by Crockford (1986), only one article (Lee & Drake, 2010) has provided a supply risk scoring matrix in the context of SMEs where consequences are classified under small, medium and large. The authors advocated that ‘size of supplier’ and ‘monopoly condition of supply marked’ should be considered in analysing the supply risks of SMEs. However, they did not consider frequency and predictability of risk as suggested by Crockford (1986).

Risk Evaluation

Risk evaluation is concerned with prioritising the risk factors to select between ‘avoiding risk’ and ‘mitigating risk’, together with formulating the risk mitigation strategies for several risks that need to be mitigated. Through an exploratory case study, Kozaryn & Wasilewski (2012) emphasized the importance of thoroughly addressing the previous two steps – risk identification and risk analysis – for

ranking/evaluating the supply risks in the context of SMEs. However, no study was found discussing the supply risk ranking for SMEs. Some argue that SMEs tend to evade supply risk although they know that these risks will negatively affect their quality and delivery performance (Ellegaard, 2006). Others contend that SME entrepreneurs can handle risk well, and risk handling ability of SME entrepreneurs positively influence in taking and implementing supply risk mitigating strategies (Hsu, Choon, Laosirihongthong, & Leong, 2011). In a recent study, using multiple case studies, Simangunsong, Hendry, & Stevenson, (2016) pointed out that unavailability of simple supply risk measurement model for SMEs is one of the main reasons for their avoidance of supply risks. The authors mentioned that SME owners and managers do not know how to analyse the cost and benefits of selecting between 'avoiding risk' and 'mitigating risk'. Current models for ranking supply risks are only available for large enterprises, and are difficult for SME owners and managers to implement in their business (Prasad et al., 2012). In regards to planning the risk mitigation strategies, Ketkar & Vaidya, (2012) mentioned that SMEs do not plan well in selecting risk mitigation strategies. They prefer and practice risk mitigation strategies, irrespective of risk types, that assist them to ensure symmetric information and coordination with their suppliers because SMEs believe that sharing symmetric information and proper coordination with the suppliers are most critical to successful risk mitigation (Faisal, Banwet, & Shankar, 2007a).

Risk Mitigation

Supply risk mitigation strategies involve the several risk response action plans that strive to save firms from the supply risk and their negative consequences. A number of studies discuss supply risk mitigation strategies for SMEs as depicted in Table 3, although only one article (Ellegaard, 2008) has specifically devoted to reveal the supply risk mitigation strategies of SMEs. Ellegaard (2008) reported that SMEs mainly adopt defensive strategies to mitigate supply risk whereby they utilise different dimensions – structural, relational and cognitive – of social capital to achieve the mitigation. SMEs use unplanned, coincidental network information through personal interaction in different settings – which popularly termed as structural capital (Chow & Chan, 2008; Villena, Revilla, & Choi, 2011) - and different relational capitals, such as fairness, loyalty, to seek out responsive, dependable suppliers.

Moreover, SMEs leverage cognitive – common understanding between network members (Gao, Sung, & Zhang, 2011) – such as developing like-minded supplier to mitigate supply risks. Four other studies (Gao et al., 2011; Kam, Chen, & Wilding, 2011; Prasad et al., 2012; Riccobono, Bruccoleri, & Perrone, 2013) also agreed that SMEs can use all three dimensions of social capital to improve supply risk management capability. However, Gao et al. (2011) reported that cognitive capital plays more influential role than structural and relational capital. This finding aligns with the findings of other two papers (Ellegaard, 2006; Lavastre et al., 2012) wherein the authors mentioned that SMEs prefer known and local sources to ensure common perspectives between buyer and suppliers. Moreover, SMEs practice single sourcing practices to improve coordination with suppliers, thereby reducing supply risks (Mikalef, Pateli, Batenburg, & Wetering, 2015).

Although none of the above studies consider individual risk types in developing mitigation strategies, SMEs should adopt tailored strategies for each risk because each risk factor needs its own specific risk mitigation strategy (Fischl, Scherrer-rathje, & Friedli, 2014; Kumar et al., 2014). For instance, natural hedging protects SMEs when they face price vulnerability risks from suppliers (Hofmann, 2011). In order to reduce informational risk in supply management, Faisal et al. (2006) suggest the use of compatible information technology (IT) and improved top management supports, in addition to leveraging several network resources. However, Caldwell, Harland, Powell, & Zheng (2013) found that even though IT has the potential to reduce several supply chain risks, SMEs still prefer to adopt a ‘watching brief’ rather than to implement compatible IT.

Insert Table 3 about here

Risk Monitoring and control

Risk monitoring and control, the final step of supply risk mitigation, involves examining the outcome of implemented risk mitigation strategies and taking necessary correction actions to achieve the desired results. Among the 36 articles reviewed, none is specifically devoted to explore how SMEs perform with risk mitigation strategies in place. However, a related study (Faisal, Banwet, & Shankar, 2007b) reported that SMEs are far from implementing proper supply risk mitigation strategies,

although Adams, Kauffman, Stading, & Kauffman (2013) mentioned that efficient management of supply risks can assist SMEs in strategically leveraging suppliers. Faisal, Banwet, & Shankar (2007b) reported 11 barriers, such as lack of trust, lack of agility, and information distortion, to implementing risk mitigation strategies by SMEs. Most firms learn how to overcome these barriers from the experiences of other established SMEs as firm age usually influences the level of supply resiliency positively (Maloni, Hiatt, & Astrachan, 2017). Older firms are more resilient than younger firms since firms' age moderate the strength of integration and relationship with network members.

RESEARCH AGENDA AND CONCLUSIONS

From the analysis of the different risk management steps in the context of SMEs, it is clear that there are ample opportunities for future research in the area of supply risks in SMEs. For example, extant studies covering comparative analysis of supply risk between SMEs and large enterprises fail to provide consistent findings. One of the reasons for such inconsistency might be due to the fact that SMEs vary across different contexts and cultures (Tang, Wang, & Zhao, 2015). Therefore, further studies in different contexts can be conducted to explore whether, why and how SMEs are more vulnerable in terms of supply risks.

Proper identification of supply risks is very important for adopting the appropriate strategies to mitigate the risks. However, neither risks types nor the factors of supply risks have been explicitly examined in the context of SME in the existing literature. This is an area that scholars in this domain can consider for further research. Exploratory research, such as case study and focus groups discussion with SME practitioners, are necessary to identify different factors and types of supply risks. Additional research is also required to identify the frequency of each risk types and their impact. Given that objective information, such as quantitative data, is usually unavailable from SMEs, researchers can use subjective data, such as belief and judgement of the expert in the industry, to analyse the supply risks (Tummala & Schoenherr, 2011). Techniques such as Delphi method or focus group with industry experts can be used as a method of data collection.

As regards risk mitigation measure, leveraging network resources/social capital is often advocated by scholars but has not been empirically tested. Firms need to adopt different strategies to leverage each dimension of social capital. Therefore, an empirical survey study can be conducted to examine to what extent different dimensions of social capital mitigate supply risks of SMEs. The findings can assist SME practitioners to develop and implement strategies to leverage various dimensions and types of social capital in reducing their supply risks. Researchers also could reveal supply risk mitigation strategies by considering the risk factors. Only two articles are found that have considered risk types in developing risk mitigation strategies. Additional research is required to explore the appropriate risk mitigation strategies for each of the risk types given that each risk factor requires its own mitigation measures. Finally, it would be worthwhile to examine the benefits of implementing risk mitigation strategies. A longitudinal study can be taken to investigate the impact of implementing risk mitigation strategies on firm performance. Findings with positive impacts can encourage SME practitioners to implement such strategies in future endeavours, while findings with little impact can assist SME practitioners to revise their risk mitigation strategies.

This paper aims at reviewing the current state of existing literature on supply risk management in SMEs. Literature of supply risk and its mitigation focusing on SMEs is very limited at present. In fact, reference to enterprise resilience, only about 7% of the studies investigate resilience in the context of SMEs (Kamalahmadi & Parast, 2016). It is hoped that the review and the suggestions for future research will inspire further studies on supply risk management of SMEs. It is believed that by undertaking the suggested studies, academia will be able to offer more precise suggestions on supply risk mitigation of SMEs, which, in turn, can improve the performance and survival of SMEs

Like any other research, this study has a number of limitations. First, although this study has follow a rigorous procedure in selecting articles for review, only six databases were used. While these six databases may have included the majority of the relevant articles, papers contained in other databases, such as Scopus, JSTOR, Ingenta, Metapress, and Taylor and Fancis, may also need to be explored. Second, the search in this study has only limited to academic journal articles. Findings appeared in other types of publications, such as conference papers, trade journals, and book chapters, are not

covered in this paper. Finally, only one keyword ‘supply risk’ was used in the search even though five keywords representing SME was incorporated. In practice, supply risk might have been referred to using other keywords, such as ‘purchasing complexity’ and ‘supply complexity’, in some studies. Therefore, future research may use a large set of keywords to launch an exhaustive search.

Tables and Figures

Table 1: Result of the keyword search

Sl. No.	Databases	Search Terms*					Unique Articles	Total Unique Articles
		1	2	3	4	5		
1	EBSCOhost	36	2	1	5	26	51	227
2	Emeraldinsight	4	0	5	2	10	17	
3	ScienceDirctet	6	0	4	9	23	28	
4	Web of Science	0	1	1	0	0	2	
5	ProQuest	64	6	28	14	51	110	
6	Wiley online library	24	6	12	32	16	50	

* Note: Search Terms (1) ‘supply risk’ and ‘small business’, (2) ‘supply risk’ and ‘small company’, (3) ‘supply risk’ and ‘small firm’, (4) ‘supply risk’ and ‘small enterprise’, and (5) ‘supply risk’ and ‘SME’

Table 2: Supply risk types

Kozaryn & Wasilewski (2012)	Material/Stock destroyed at factory; Wrong calculation of the material (shortage or time out problem); Computer system breakdown; Bad quality of the material; Supplier missed deadline of the supply; Higher (fluctuation of) price of the commodity; No options of returning to the aftermarket and Poor quality of packages
Kumar et al., (2014)	Delay in receiving material (lead time problem); vulnerability of price of material; information distortion; over dependence on suppliers; macro environmental risks (terrorist attack, changing policy and political instability)
Faisal et al. (2006)	Information risk

Table 3: Supply risk mitigation strategies for SMEs

Authors	Corresponding strategies for mitigating supply risks
(a) General supply risks	
Ellegaard (2008)	<ul style="list-style-type: none"> • Unplanned, coincidental information from personal network • Personal interaction with the suppliers and seeking out similar attitude from suppliers • Exchange fairness of transactions and knowledge • Seeking out dependable and responsive suppliers • Source loyalty • Like minded suppliers • Local sourcing
Gao et al. (2011); Prasad et al. (2012)	Cognitive, structural and relational capital with network members
Ellegaard (2006)	Local sourcing
Lavastre et al., (2012)	<ul style="list-style-type: none"> • Local sourcing • Relational capital with suppliers
Thun et al., (2011)	<ul style="list-style-type: none"> • Safety stock and keeping overcapacity in storage • Multiple/dual sourcing or keeping backup suppliers
Mikalef et al., (2015)	<ul style="list-style-type: none"> • Single sourcing/small supplier base
(b) Specific types of supply risks	
Hofmann (2011)	Natural Hedging
Faisal et al. (2006)	<ul style="list-style-type: none"> • Information sharing • Collaborative relationship • Top management and partner support • Compatible IS/IT infrastructure

Figure 1. Flowchart of the research process

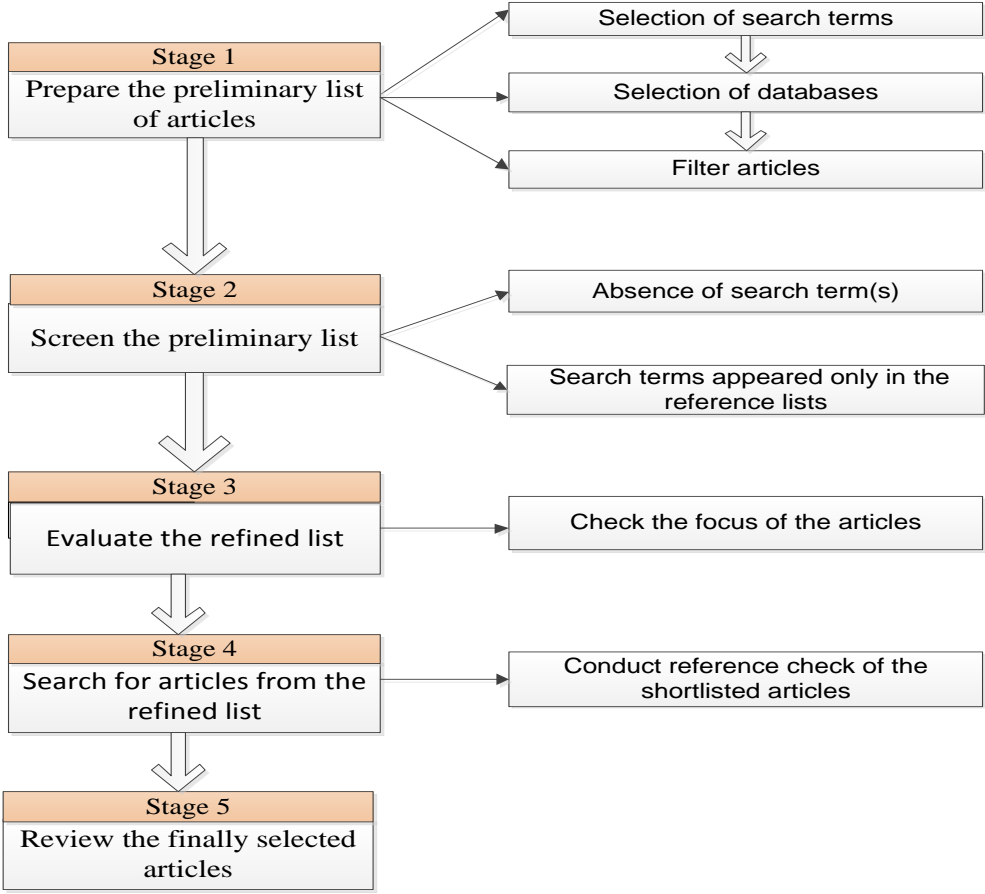
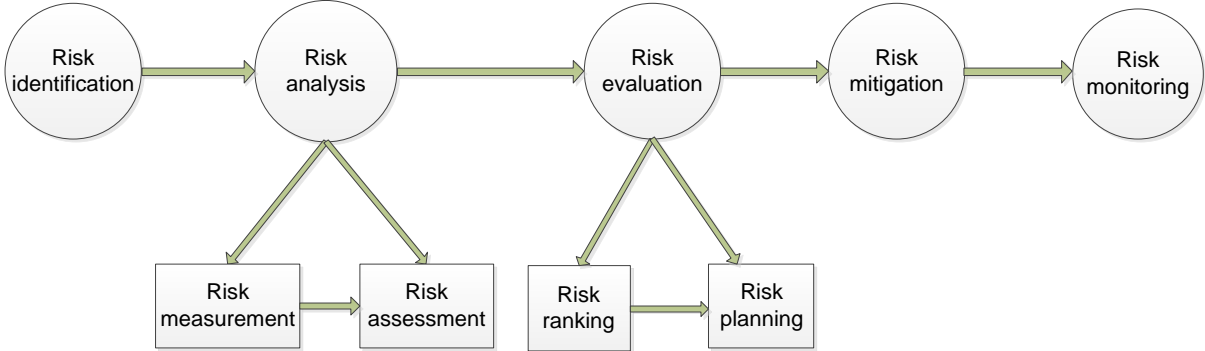


Figure 2: Framework of supply risk management



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