Mitigation Strategies in Supply Chain Risk Management: A Literature Review

Norlaile Salleh Hudin
Hazeline Ayoup
Nurul Fadly Habidin
Priadi Surya
Kasmaruddin Che Hussin

DOI: https://doi.org/10.37178/ca-c.21.5.043

***Norlaile Salleh Hudin**, Department of Business Management and Entrepreneurship, Faculty of Management and Economics, Universiti Pendidikan Sultan Idris, Malaysia. email: norlaile@fpe.upsi.edu.my*

***Hazeline Ayoup** , Tunku Puteri Intan Safinaz School of Accountancy, College of Business, Universiti Utara Malaysia.*

***Nurul Fadly Habidin**, Department of Business Management and Entrepreneurship, Faculty of Management and Economics, Universiti Pendidikan Sultan Idris, Malaysia.*

***Priadi Surya**, Department of Educational Administration, Faculty of Education, Universitas NegeriYogyakarta, Indonesia.*

***Kasmaruddin Che Hussin**, Faculty of Entrepreneurship and Business, Universiti Malaysia Kelantan.*

Abstract

This systematic literature review aims to analyze risk mitigation studies spanning across 2004 –2019. Embarking on the PRISMA approach, studies were selected through the identification, screening, eligibility and analysis steps. The findings revealed three main themes (culture, independent response and co-operative response), and 16 sub-themes. Several recommendations for future research were underscored including the need to conduct more studies to understand the culture, independent response and co-operative response for reactivestrategies. This study could guide future researchers to augment the current literature by progressing towards the proposed recommendations.

Keywords: Supply chain risk management; mitigation strategies; literature review; Supply ChainManagement.

Introduction

Supply chain risk management (SCRM) has evolved into an interdisciplinary research field where management, mathematics, information science, and engineering scholars,

inter alia, investigate

the complexities of different scenarios in supply chain to reduce supply chain vulnerability or increase supply chain resilience. Conceptually, researchers from these diverse disciplines agreed that SCRM involves risk identification, risk assessment, risk mitigation, and risk control which are effectively supported by the companies' top management, supply chain members' coordination and collaboration, and an integrated decision-making process. To date, more than 17,000 articles on SCRM were published and since SCRM is no longer at the infancy level, a systematic literature review (SLR) seems to be the next crucial analysis to help current researchers focus on less developed areas, and mitigate supply chain risks from multiple perspectives.

SLR is (1) explicit and transparent, (2) includes a type of research, and (3) consists of a reproducible process of reviewing past studies [31]. It is an organized methodology characterized by tight focus, exhaustive search, high rejection-to-inclusion ratio and an emphasis on technical rather than interpretive synthesis method [14]. The basic principles of a systematic literature review were discussed by Thorpe, Holt, Macpherson and Pittaway [44] as stated below.

Transparency
Clarity
Focus
Unification of research and practitioner communities
Equality
Accessibility
Broad coverage
Synthesis

Transparency refers to the explicit inclusion and exclusion criteria imposed on the selection of studies. It involves stating the specific terms used during the article search to enable readers to repeat the search procedure and arriving at similar results so they can judge on the robustness of the article search. In contrast, specifying the process in conducting the SLR to evaluate the completeness and rigour is called clarity. Focus is further required in SLR where the review must be performed on a specific knowledge domain, rather than on research articles which only partially contribute to a particular domain. The unification of research and practitioner communities means that the results of the review must be useful and compelling to the interest of research scholars and corresponding practitioners. Although SLR is more commonly used to respond to researchers' agenda, considering the interest of practitioners can increase the usability and usefulness of an SLR. Next, fulfilling the principle of equality means the researcher does not discriminate any journals due to its ranking (for instance), while accessibility relates to the dissemination of the SLR results to others beyond the academic community. Broad coverage, on the other hands, refers to the use of highest number of electronic databases to support an exhaustive search of research articles. Finally, the SLR should be able to synthesize the general view of the research field to provide future direction or theoretical and methodological gaps.

Prior studies attempted to systematically review SCRM, for example, Asrol, Marimin, Machfud and Yani [3], and Kilubi [21]. Asrol et al. [3] found majority of previous researchers applied revenue and risk sharing approach with decentralized and centralized supply chain and higher attention on the application of operation research techniques, game theory and complex mathematical formulation. In consistance, Kilubi [21] synthesized that simulation/modelling were the common methodology adopted in SCRM research. Moreover, she revealed that visibility and transparency, flexibility, as well as relationship and partnership were the top three SCRM strategies frequently mentioned by scholars. Despite that, none of these studies have provided detail methodological gaps in the past SCRM studies. In specific, their SLR did not explain the types of industrial sector, firm size and the location of the study, although the current situation showed the emergence of several risks rooted from these aspects. For example, the recent supply chain disruptions which happened due to the pandemic of Covid-19 noted a pressing need to understand which countries and sectors are strongly affected and how the unique capabilities of large-, medium- and small-companies influence the SCRM mitigation strategies.

Risk mitigation, besides risk identification and risk assessment is equally vital because it determines the overall SCRM success. For that reason, several studies have investigated the different types of risk mitigation strategies applied at industrial level. However, the literature is predominated by the preventive and reactive typology. Thun, Drüke and Hoenig [45] for example, explained that companies adopted preventive instruments to reduce the probability of supply chain disruption whereas reactive instruments are adopted to decrease the negative impact of a risk event. The preventive instruments include strategic supplier development, improved tracking and tracing and information exchange whereas the reactive instruments include safety stock, overcapacity in production, dual sourcing, multi-sourcing and back-up supplier. Similarly, Sharma and Bhat [39] proposed proactive and reactive strategies. Proactive strategies refer to strategies implemented prior to risk occurrence to reduce the probability of disruptions for example through risk avoidance, investment in developmental activities, control strategy and supply chain integration. Meanwhile, the reactive strategies are further detailed into flexibility strategy, risk pooling strategy and redundancy strategy. Table 1 describes the differences between proactive and reactive strategies.

Table 1. Proactive and reactive SCRM strategies

	Proactive strategy	Reactive strategy
Aim	To reduce the probability of risk occurrence and increase supply chainrobustness	To reduce negative impact of risks occurrence and increase supply chain resilience and agility
Planning and preparation	Devise before risk occurrence Benefit the supply chain before riskoccurs	Devise before risk occurrence, but certainrisks cannot be anticipated Benefit the supply chain after risk occurs

Strategies	Multiple sources of supply Inventory Make and buy Product design Logistical network design	Make-to-order/postponement Supplier/buyer communication Business continuity planning Visibility Assortment planning

***Adapted from Thun et. al [45]), Wieland and Wallenburg [50] and Grötsch, Blome and Schleper [15]*

Among Singaporean manufacturing companies, majority of them adopted reactive strategies as they depended on extra suppliers to meet demand risk and changing raw material cost [16]. Moreover, Blackhurst, Scheibe and Johnson [5] described a proactive disruption risk management in a US based automotive firm, where continuous tracking of risk ratings and risk indices was conducted to identify trend towards increased risk level. On the other hand, Sharma and Bhat [39] concluded that reactive strategies particularly risk pooling and flexibility strategies are commonly implemented by Indian companies but proactive control strategy seems to be the most common and most effective one across the industry. In addition, Sharma and Bhat [39] discovered two clusters of SCRM strategies; (1) companies belong to the high SCRM implementation cluster used risk proactive and reactive strategies extensively, and (2) companies belong to the low SCRM implementation cluster used reactive strategies more. Besides, Thun et. al [46] found extensive use of reactive instruments especially safety stock and overcapacity among small and medium companies whereas large enterprises preferred preventive instruments such as supplier with high quality and on-time deliveries. In addition, Angkiriwang, Pujawan and Santosa [2] discovered intense focus on buffering or reactive strategies at an Indonesian based company which produces circuit breakers for transportation and special vehicle industry.

Although preventive SCRM techniques are better in reducing the probability of risk occurrence as early as possible, research evidences repeatedly showed that SMEs implemented reactive techniques more frequently [42];[43]; [46] . Furthermore, Thun et. al [45] explained that preventive strategies such as supplier development and track and tracing are capital intensive and therefore, these strategies are relatively expensive to be implemented by SMEs. Moreover, managers of SMEs have difficulty to justify large investment for risk avoidance purpose when the effectiveness of SCRM is hardly quantifiable [8];[48]. Lending support to this argument, Jüttner

[19] reported that the lack of board level appreciation towards risk implications of supply chain strategy compared to cost-cutting inhibited proactive risk management approach. Based on the discussion above, two research questions were formulated as shown below:

RQ1: What is the dominant risk mitigation strategies investigated in SCRM research?

RQ2: What are the directions of future research in SCRM risk mitigation strategies research?

Methodology

This study is guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). This publication standard is utilized to fulfill the basic principles of SLR proposed by Thorpe et. al [44]. The review method in this study is limited to Scopus database. Scopus is a multidisciplinary database spanning over business, operations research, mathematics and other management disciplines which contains more than 60 million record of journals [4].

The systematic review process consists of four crucial steps, namely (1) identification, (2) screening, (3) eligibility, and (4) analysis. The first step, identification, required the present researchers to identify the most accurate search terms to address the research questions. In addition, the present researchers also identified similar terms used in prior studies which develop the same meaning to increase the coverage of the articles retrieved. Finally, the following Scopus search string was developed:

TITLE-ABS (("supply chain risk management" OR SCRM") AND ("riskavoidance" OR "risk-sharing" OR "risk acceptance" OR "risk transfer" OR "risk response" OR "risk retention" OR "risk reduction" OR "risk absorp*" OR "preventive" OR "reactive" OR "proactive"))

The second step in the review process is screening. The screening process involved predetermining the criteria for article inclusion and exclusion. In this study, only research articles in English were selected. Furthermore, book chapter, conference paper, review and editorial were excluded from the review. These criteria were imposed to screen empirical research. Therefore, from 74 research articles retrieved in the identification step, only 35 remained after the article screening step.

The third step is to determine the eligibility of articles. The primary contents of the articles were scrutinized to ensure that irrelevant articles were not included in the review. Eventually, 6 articles were excluded. 4 of these articles were literature review study, one article was discussing about social customer relationship management instead of supply chain risk management, and another one article focused on risk assessment only. Thus, 30 articles remained after the eligibility check. Figure 1 summarized the results from each step.

The fourth step is to analyze the selected articles by using the thematic analysis. Thematic analysis required the current researchers to code and categorizes the articles into emerging themes. As a result, three main themes and 16 sub-themes emerged.

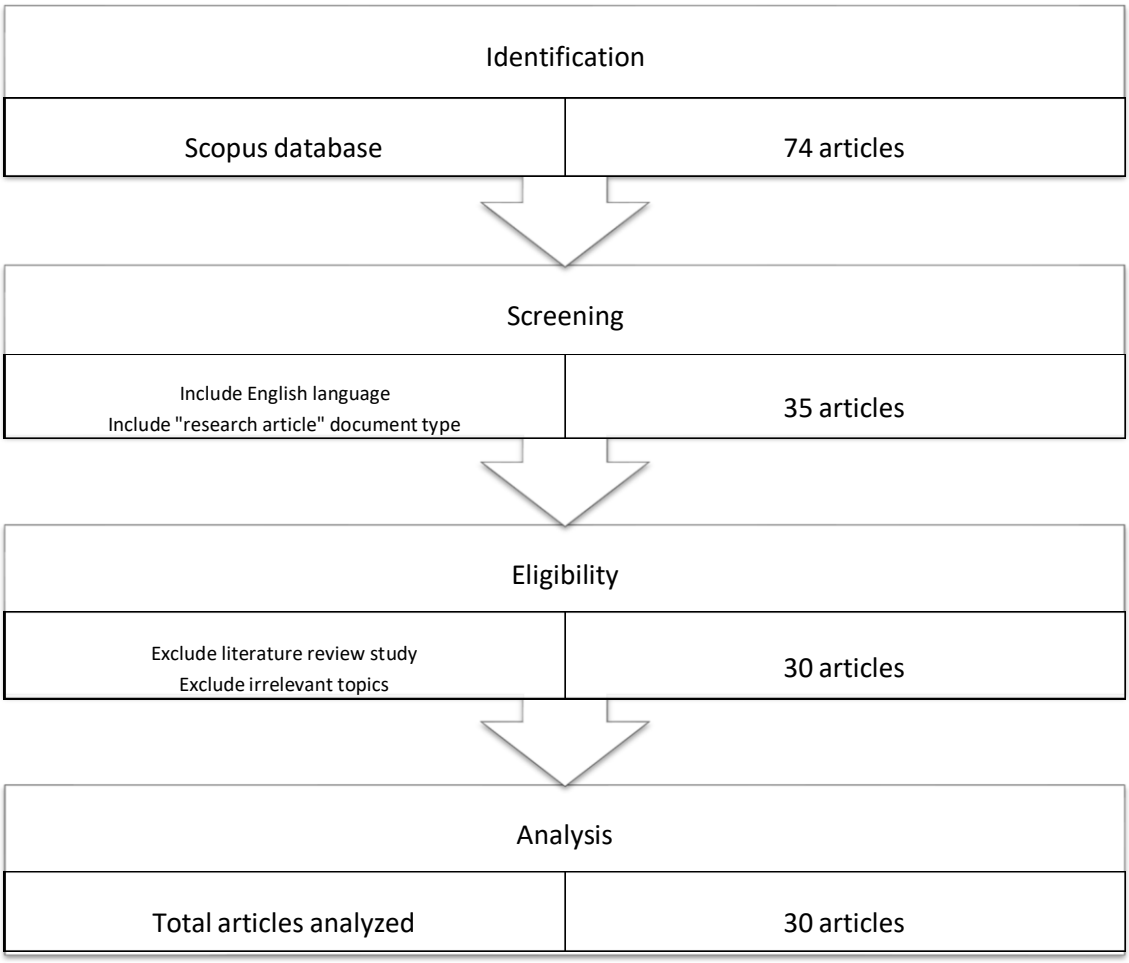

Figure 1. Systematic review process

Findings and Discussion

General findings

The literature review analysis of articles published in 2004 – 2019 resulted in 3 main themes, which are risk culture, independent response and cooperative response for proactive and reactive SCRM as shown in Table 2. Independent response refers to the mitigations strategies that are implemented internally at a company, while cooperative response is the mitigation strategies involving other supply chain members.

Table 2. The main themes and sub-themes

	Culture	Independent response	Co-operative response
Proactive	SCRM awareness (SA) Training (T) Mechanistic SCRM (MS)Cognitive style decision making (CDM) Assurance process (AP) Contingency planning (CP) Business continuity management	Supplier management (SM) Supplier monitoring Supplier risk profile measuringMarketing management (MM) Dynamic assortment planning Sales evaluation of familiar product Increase distribution channel Production management (PM)Workflow improvement Supply and demand analysis Design of product and supply chain	Collaboration (CL) Information sharing (IS) Joint planning (JP) Supplier Management (SM)Buyer-supplier relationship
Reactive	Research gap	Production management (PM)Resource adjustment Safety stock Extra capacity Dynamic plant Overcapacity in production Insurance (I)	Alternative transportation (AT) Supplier Management (SM)Backup supplier Responsive pricing (RP)

In conjunction with the types of studies, the analysis revealed that 27% (*n*=8) of prior studies usedcase study and survey respectively, while 17% (*n*=5) of the studies reviewed applied simulation/simulation case study. The rest of the articles embarked on experimental study (10%, *n*=3), conceptual study (7%, *n*=2), descriptive study (7%, *n*=2), and mixed method (7%, *n*=2). SeeAppendix 1 to identify the list of articles for each study type.

27% (*n*=8) of the past researchers conducted their studies in varied sectors, including the combination of automotive, heavy engineering, general engineering, pharmaceutical, home appliances, software services, and financial services. Automotive industry is the next sector that most frequently studied (20%, *n*=6) and followed by food industry (13%, *n*=4). However, 17% ofthe studies (*n*=5) did not mentioned the type of sectors where the study was performed. Industrialprinting, ICT, telecommunication, agriculture, chemical, electronic and pharmaceutical/healthcareindustries were studied once each as shown in figure 2.

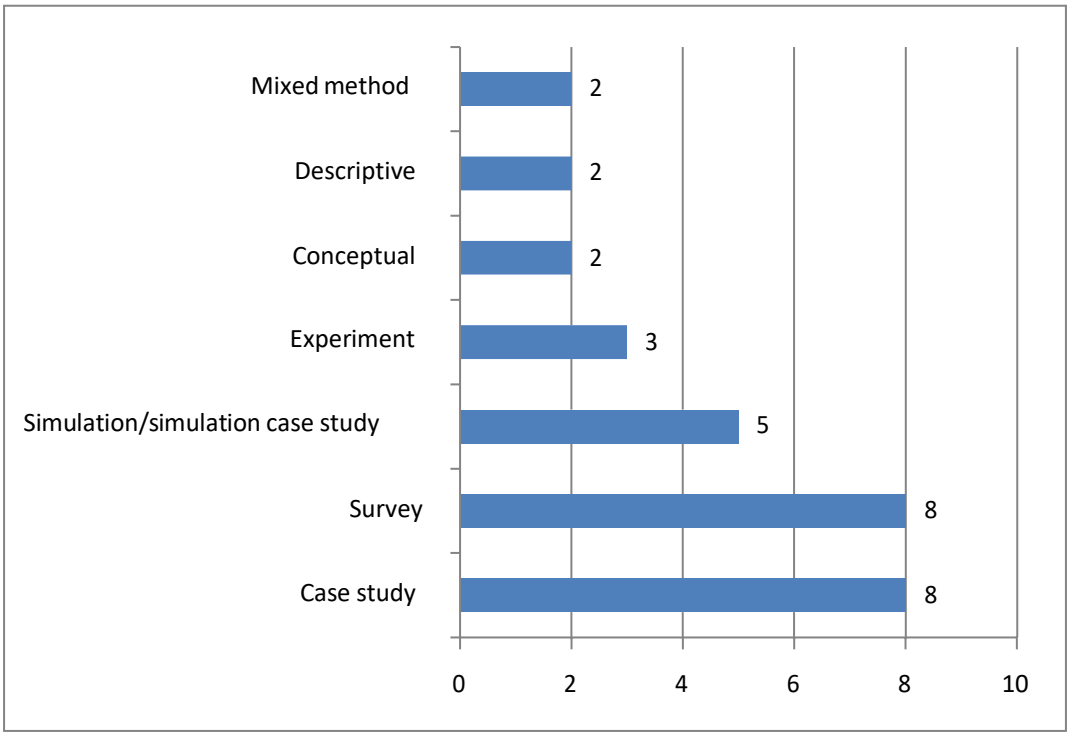

Figure 2. Types of studies conducted

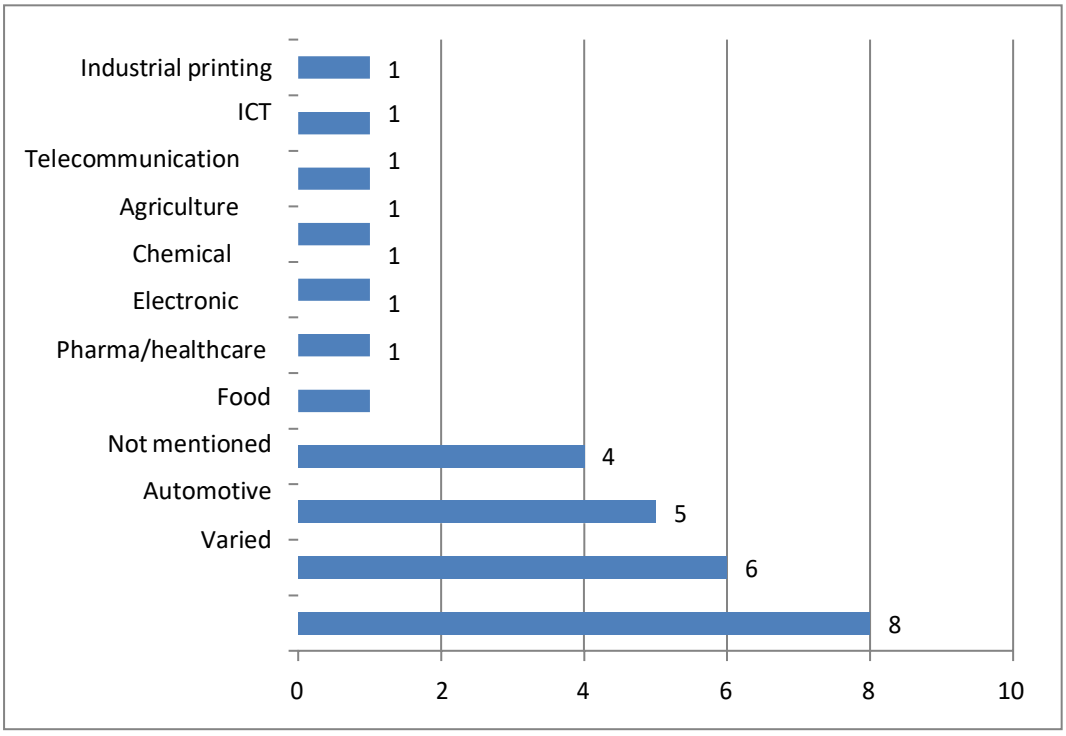

Figure 3. Types of sectors of studies conducted

In terms of the firm size, more than half of the studies did not mentioned the size of the firm (60%, *n*=18), whereas 23% (*n*=7) investigated large companies. Meanwhile, 10% (*n*=3) of the studies involved a combination of firm sizes and only 7% (*n*=2) focused on medium sized companies. None of the studies in the review specifically address risk mitigation strategies adopted by small companies, as shown in figures 3 and 4.

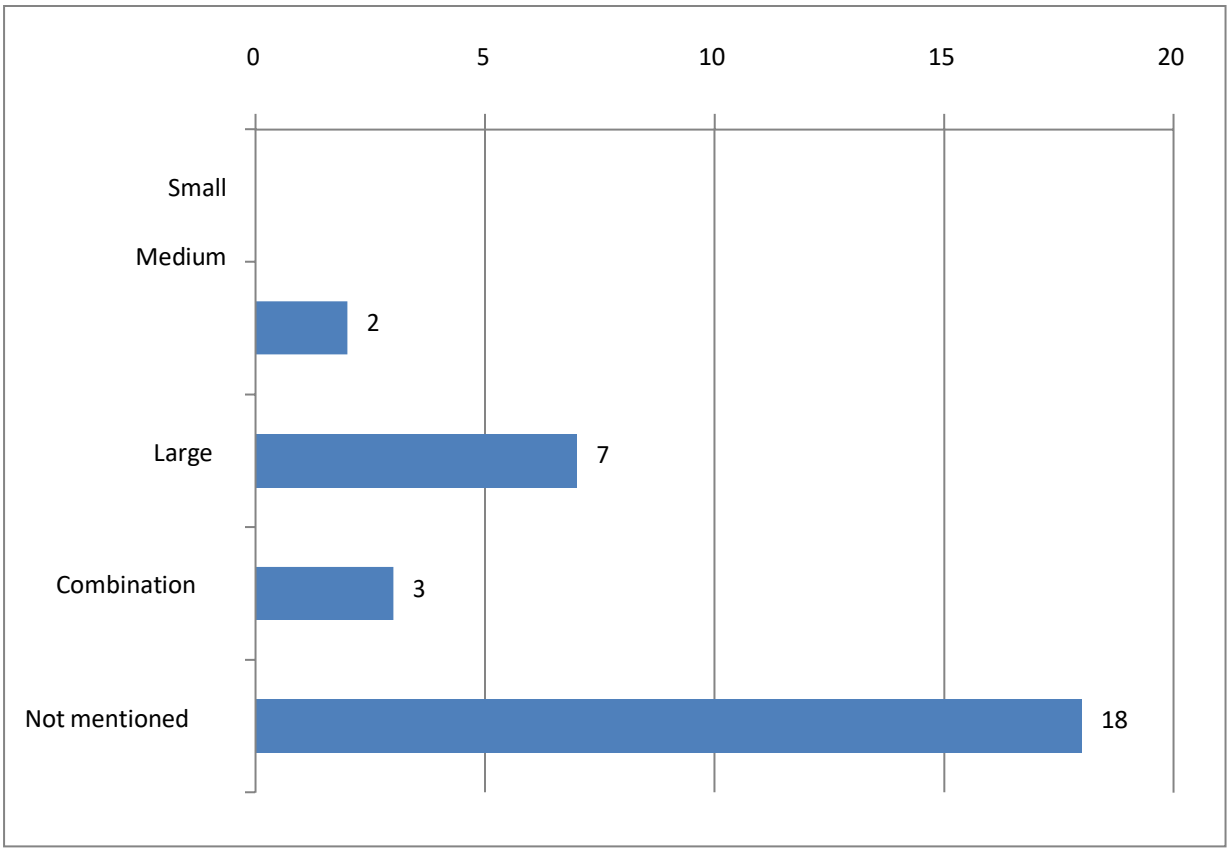

Figure 4. Firm size of studies conducted

The study location is shown to be most frequently conducted in Asia and followed by Europe. ForAsia, 3 studies (10%) were performed in China and India respectively, while 2 studies (7%) wereconducted in Thailand and one (3%) in Indonesia. 6 studies (20%) were carried out in European region including 4 studies (13%) in Germany, one study (3%) in Serbia and another one (3%) in France. 4 studies (13%) involved multiple countries, but the majority (20%, *n*=6) did not mentionthe study location, as shown in figure 5.

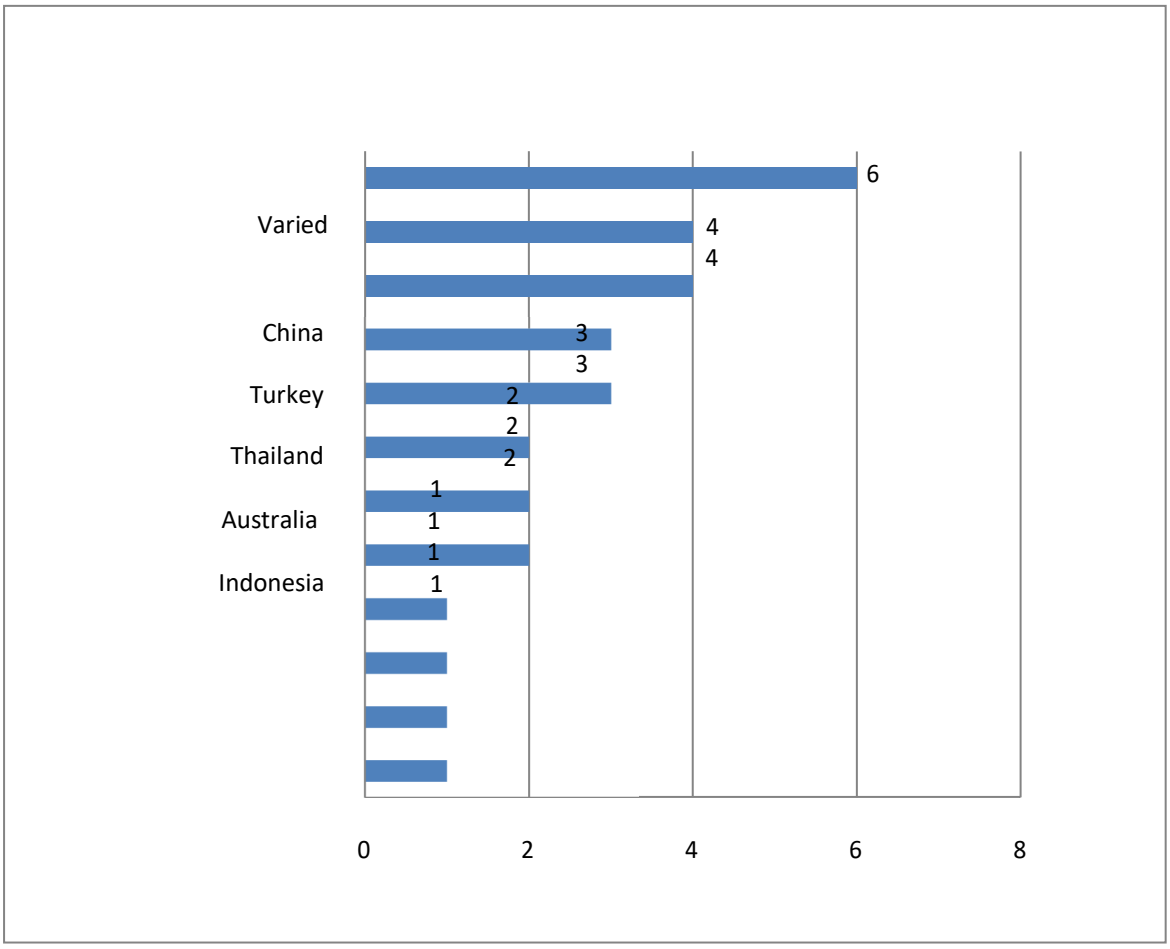

Figure 5. Location of studies conducted

Main findings

Three main themes emerged from the literature review analyses which are (1) culture, (2) independent response, and (3) co-operative response. Risk responsive culture is an imperative step towards an effective SCRM because it sets the philosophy and ways of thinking about risk. Earlier studies exhibited several companies developed false feeling of safety after conforming to formal risk management standard, thus increase the overall risk level [25]. Obviously, a thorough understanding of the purpose of conducting SCRM is a prerequisite to the overall effectiveness of risk mitigation. Our analysis found that SCRM awareness (SA), training (T), mechanistic SCRM (MS), cognitive style decision making (CDM), assurance process (AP), and contingency planning (CP) were sub-themes of risk culture. Risk culture had been studied continuously from 2004 until 2019, which further strengthen our indication that culture remains an interesting topic which required further

investigation by fellow researchers. Through the reviews, we identified that none of the studies analyze reactive risk management culture, although being reactive to a risk occurrence is equally important as proactively managing it in order to resume business activities.

The second theme is independent response. Although past literature frequently divided risk mitigation strategies into proactive versus reactive strategies, we believe that discussing from a slightly different point of view may help in identifying gap in the current literature. Independent response is strategies performed within a company to proactively or reactively manage risks. The synthesis of past study produced four sub-themes related to independent response i.e. supplier management (SM), marketing management (MM), production management (PM), and insurance (I). There is some evidence of a risk management progression pathway leading from the more individualistic and independent responses (e.g. insurance, establishing supplier service levels) to the more co-operative responses (e.g. sharing strategic information, relationship development) [36]. However, our results indicated that the researchers are still paying greater attention to independent response in mitigating supply chain risks. In specific, production management continues to be a popular topic, which among other discuss about flexibility, buffering, and hedging in proactive SCRM.

The third theme is co-operative response, which involves building stronger relationship and trust with supply chain members in addressing supply chain risks. Six sub-themes for co-operative response are collaboration (CL), information sharing (IS), joint planning (JP), supplier management (SM), alternative transport (AT), and responsive pricing (RP). This finding is in line with Kilubi [21] who also found visibility and transparency, flexibility, relationship and partnership as the top three SCRM strategies investigated in past researches. Nevertheless, in comparison with independent response, the review of these Scopus articles implied that more studies should be conducted to understand the co-operative response in more detail. Today's supply chain has rising complexity where supply chain members are located in different parts of the world. 3PLs and other outsourced services which had never been part of the supply chain before, become determining factors in achieving supply chain effectiveness. In another extent, very limited number of studies had discussed about information sharing between companies' subsidiaries as highlighted by Hudin, Hamid and Chin [17] and Hudin, Hamid and Chin [18]. In addition, studies should also be conducted on the contrasting concept of supplier insecurity and risk information sharing in table 3.

Table 3. Risk mitigation strategies

Author(s)	SA	T	MS	CDM	AP	CP		SM	MM	PM	I		CL	IS	JP	SM	AT	RP
Boonyanusith & Jittamai [6]										x			x	x				
Schätter, Hansen, Wiens, &																		
Schultmann [38]						x				x								
Shenoi, Dath, Rajendran, &																		
Shahabudeen [41]										x				x				
Bugert & Lasch [7]																		x
Sáenz, Revilla, & Acero [37]	x					x				x								
Conklin, Shoemaker, & Kohnke																		
[10]					x													
Nakandala, Lau, & Zhao [29]																		
Qazi, Quigley, Dickson, & Ekici[33]			x															
Sharma, Bhat, Kumar, & Agarwal [40]															x			
Fan, Li, Sun, & Cheng [12]														x				
Anđelković [1]	x	x	x			x												
Kırılmaz & Erol [22]																x		
Revilla & Saenz [35]						x							x			x		
Trkman, de Oliveira, & McCormack [47]	x																	
Rajesh & Ravi [34]								x	x	x								
Li, Fan, Lee, & Cheng [27]	x																	
Kasemset, Wannagoat, Wattanutchariya, & Tippayawong [20]									x	x								
Liu, Li, & Wu [28]			x															
Kurano, McKay, & Black [24]								x		x								
Grötsch, Blome, & Schleper [15]			x	x				x										

Lavastre, Gunasekaran, & Spalanzani [26]										x				x		x		
Kumar & Harrison [23]										x	x						x	
Wever, Wognum, Trienekens, & Omta [49]									x									x
Colicchia, Dallari, & Melacini [9]						x				x							x	
Thun, Drüke, & Hoenig [45]										x								
Thun & Hoenig [46]										x								

Author(s)	SA	T	MS	CDM	AP	CP	SM	MM	PM	I		CL	IS	JP	SM	AT	RP
Elangovan, Sundararaj, Devadasan, & Karuppuswamy [11]	x	x															
Pujawan & Geraldin [32]			x														
Gaonkar & Viswanadham [13]							x										
Norrman & Jansson [30]			x							x			x				

Culture	Independent response	Co-operative response
SA = SCRM awareness	SM = Supplier management	CL = Collaboration
T = Traininig	MM = Marketing management	IS = Information sharing
MS = Mechanistic SCRM	PM = Production management	JP = Joint planning
CDM = Cognitive style decision making	I = Insurance	SM = Supplier management
AP = Assurance process		AT = Alternative transport
CP = Contingency planning		RP = Responsive pricing

Direction for Future Research

Based on the literature review analysis, a few directions of future research could be proposed. First, from the methodological view, many prior studies were conducted by using case study, thusmuch diverse research design could be adopted to gain enriching results. Second, small companieshave been neglected from the literature, despite the common belief that small companies are more susceptible to business failure. Third, current research focus was driven towards automotive and food industries, which are known to be highly regulated. Without established standards to guide risk management, investigating less regulated industries could offer better understanding on risk mitigation strategies implemented. Fourth, Asia and Europe dominated the present risk mitigation research, thus studies in other continents open up a fertile ground, not only in the classicmanufacturing supply chain, but also in emerging fields of humanitarian or halal supply chain. Fifth, scant evidence was found on reactive risk mitigation in comparison with proactive risk mitigation, in terms of culture, independent response and co-operative response. Future research could be directed towards exploring these especially on the rise of pandemic crisis and global risksthreatening supply chain worldwide.

Conclusion

This systematic literature review analyzes risk mitigation studies spanning across 2004 – 2019. Byusing PRISMA approach, three main themes (culture, independent response and co-operative response), and 16 sub-themes emerged. Several recommendations for future research were underscored including the need to conduct more studies to understand the culture, independent response and co-operative response in reactive strategies. This study is limited to 30 articles listed in Scopus database. An addition of WoS database with similar search terms is expected to add 37articles prior to qualitative exclusion. However, the findings of this study could guide future researchers to expand the current literature by progressing towards the proposed recommendations.

References

[1]. Anđelković, A. Proactive supply chain risk management approach: The case of Serbia. Economic Annals, 62(214), 121-137, 2017.

[2]. Angkiriwang, R., Pujawan, I. N., & Santosa, B. Managing uncertainty through supply chain flexibility: reactive vs. proactive approaches. Production & Manufacturing Research, 2(1), 50-70, 2014.

[3]. Asrol, M., Marimin, Machfud, & Yani, M. Method and approach mapping of fair and balanced risk and value-added distribution in supply chains: A review and future agenda. [Article]. International Journal of Supply Chain Management, 7(5), 74-95, 2018.

[4]. Bakri, A., Azura, N. M., Nadzar, M., Ibrahim, R., & Tahira, M. Publication productivity pattern of Malaysian researchers in scopus from 1995 to 2015. Journal of Scientometric Research, 6(2), 86-101, 2017.

[5]. Blackhurst, J. V., Scheibe, K. P., & Johnson, D. J. Supplier risk assessment and monitoring for the automotive industry. International Journal of Physical Distribution & Logistics Management, 2008.

[6]. Boonyanusith, W., & Jittamai, P. Blood Supply Chain Risk Management using House of Risk Model. Walailak Journal of Science and Technology (WJST), 16(8), 573-591, 2019.

[7]. Bugert, N., & Lasch, R. Effectiveness of responsive pricing in the face of supply chain disruptions. Computers & Industrial Engineering, 124, 304-315, 2018.

[8]. Chakravarty, V. Managing a supply chain's web of risk. Strategy & Leadership, 2013. [9]. Colicchia, C., Dallari, F., & Melacini, M. A simulation-based framework to evaluate

strategies for managing global inbound supply risk. International Journal of Logistics Research and Applications, 14(6), 371-384, 2011.

[10]. Conklin, W. A., Shoemaker, D., & Kohnke, A. Building Control into the Supply Chain Risk Management Process. EDPACS, 56(2), 6-12, 2017.

[11]. Elangovan, D., Sundararaj, G., Devadasan, S., & Karuppuswamy, P. Analysis of time delays for loss reduction in an automobile component manufacturing organisation using a proactive supply chain risk management model. International Journal of Services, Economics and Management, 2(3-4), 385-411, 2010.
[12]. Fan, H., Li, G., Sun, H., & Cheng, T. An information processing perspective on supply chain risk management: Antecedents, mechanism, and consequences. International Journal of Production Economics, 185, 63-75, 2017.
[13]. Gaonkar, R. S., & Viswanadham, N. Analytical framework for the management of risk in supply chains. IEEE Transactions on automation science and engineering, 4(2), 265-273, 2007.

[14]. Greenhalgh, T., Thorne, S., & Malterud, K. Time to challenge the spurious hierarchy of systematic over narrative reviews? European journal of clinical investigation, 48(6), 2018.
[15]. Grötsch, V. M., Blome, C., & Schleper, M. C. Antecedents of proactive supply chain risk management–a contingency theory perspective. International Journal of Production Research, 51(10), 2842-2867, 2013.
[16]. Gupta, S., Meng, F., Goh, M., & de Souza, R. Understanding Supply Chain Risk Management: An In-depth Analysis. In M. Garg & S. Gupta (Eds.), Cases on Supply Chain and Distribution Management: Issues and Principles (pp. 349-372): Hershey: IGI Global, 2012.
[17]. Hudin, N. S., Hamid, A. B., & Chin, T. A. Case Studies of Risk Communication in Automotive Part Manufacturers. Advanced Science Letters, 21(5), 1575-1578, 2015.
[18]. Hudin, N. S., Hamid, A. B. A., Chin, T. A., & Habidin, N. F. Exploring Supply Chain Risks among Malaysian Automotive SMEs. International E-Journal of Advances in Social Sciences, 3(8), 666-674, 2017.
[19]. Jüttner, U. Supply chain risk management: Understanding the business requirements from a practitioner perspective. The International Journal of Logistics Management, 16(1), 120-141, 2005.
[20]. Kasemset, C., Wannagoat, J., Wattanutchariya, W., & Tippayawong, K. Y. A risk management framework for new product development: A case study. Indus. Eng. Manag. Syst, 13, 203-209, 2014.
[21]. Kilubi, I. The strategies of supply chain risk management–a synthesis and classification.
International Journal of Logistics Research and Applications, 19(6), 604-629, 2016. [22]. Kırılmaz, O., & Erol, S. A proactive approach to supply chain risk management: Shifting
orders among suppliers to mitigate the supply side risks. Journal of Purchasing and Supply Management, 23(1), 54-65, 2017.
[23]. Kumar, S., & Harrison, G. Expect the Unexpected: Supply Chain Disruption and Opportunity for US Companies—A Business Case. Transportation journal, 51(1), 118-136, 2012.
[24]. Kurano, T., McKay, K., & Black, G. Proactive inventory policy intervention to

mitigate risk within cooperative supply chains. International Journal of Industrial Engineering Computations, 5(2), 249-264, 2014.
[25]. Lalonde, C., & Boiral, O. Managing risks through ISO 31000: A critical analysis. Risk management, 14(4), 272-300, 2012.
[26]. Lavastre, O., Gunasekaran, A., & Spalanzani, A. Supply chain risk management in French companies. Decision Support Systems, 52(4), 828-838, 2012.
[27]. Li, G., Fan, H., Lee, P. K., & Cheng, T. Joint supply chain risk management: An agency and collaboration perspective. International Journal of Production Economics, 164, 83- 94, 2015.
[28]. Liu, L., Li, S., & Wu, Y. Supply chain risk management in Chinese chemical industry based on Stochastic Chance-Constrained Programming Model. Applied Mathematics & Information Sciences, 8(3), 1201, 2014.
[29]. Nakandala, D., Lau, H., & Zhao, L. Development of a hybrid fresh food supply chain risk assessment model. International Journal of Production Research, 55(14), 4180-4195, 2017.
[30]. Norrman, A., & Jansson, U. Ericsson's proactive supply chain risk management approach after a serious sub-supplier accident. International journal of physical distribution & logistics management, 34(5), 434 – 456, 2004.
[31]. Pluye, P., Hong, Q. N., Bush, P. L., & Vedel, I. Opening-up the definition of systematic literature review: the plurality of worldviews, methodologies and methods for reviews and syntheses. Journal of Clinical Epidemiology, 73, 2-5, 2016.
[32]. Pujawan, I. N., & Geraldin, L. H. House of risk: a model for proactive supply chain risk management. Business Process Management Journal, 15(6), 953-967, 2009.
[33]. Qazi, A., Quigley, J., Dickson, A., & Ekici, Ş. Ö. Exploring dependency based probabilistic supply chain risk measures for prioritising interdependent risks and strategies. European Journal of Operational Research, 259(1), 189-204, 2017.
[34]. Rajesh, R., & Ravi, V. Modeling enablers of supply chain risk mitigation in electronic supply chains: A Grey–DEMATEL approach. Computers & Industrial Engineering, 87, 126-139, 2015.
[35]. Revilla, E., & Saenz, M. J. The impact of risk management on the frequency of supply chain disruptions. International Journal of Operations & Production Management, 2017.
[36]. Ritchie, B., & Brindley, C. Supply chain risk management and performance. International Journal of Operations & Production Management, 2007.
[37]. Sáenz, M. J., Revilla, E., & Acero, B. Aligning supply chain design for boosting resilience. Business Horizons, 61(3), 443-452, 2018.
[38]. Schätter, F., Hansen, O., Wiens, M., & Schultmann, F. A decision support methodology for a disaster-caused business continuity management. Decision Support Systems, 118, 10-20, 2019.
[39]. Sharma, S. K., & Bhat, A. Supply chain risk management dimensions in Indian automobile industry. Benchmarking: An International Journal, 2014.
[40]. Sharma, S. K., Bhat, A., Kumar, V., & Agarwal, A. Path analysis model for supply

chain risk management. International Journal of Information Systems and Supply Chain Management (IJISSCM), 10(2), 21-41, 2017.
[41]. Shenoi, V. V., Dath, T. S., Rajendran, C., & Shahabudeen, P. Strategic action grids: a study on supply chain risk management in manufacturing industries in India. Benchmarking: An International Journal, 2018.
[42]. Smit, Y., & Watkins, J. A literature review of small and medium enterprises (SME) risk management practices in South Africa. African journal of business management, 6(21), 6324, 2012.

[43]. Sunjka, B. P., & Sklar-Chik, M. Supply chain risk and small and medium manufacturing enterprises in South Africa. CIE42 Proceedings, Cape Town., 2012.
[44]. Thorpe, R., Holt, R., Macpherson, A., & Pittaway, L. Using knowledge within small and medium-sized firms: A systematic review of the evidence. International Journal of Management Reviews, 7(4), 257-281, 2005.
[45]. Thun, J.-H., Drüke, M., & Hoenig, D. Managing uncertainty–an empirical analysis of supply chain risk management in small and medium-sized enterprises. International Journal of Production Research, 49(18), 5511-5525, 2011.
[46]. Thun, J.-H., & Hoenig, D. An empirical analysis of supply chain risk management in the German automotive industry. International journal of production economics, 131(1), 242- 249, 2011.
[47]. Trkman, P., de Oliveira, M. P. V., & McCormack, K. Value-oriented supply chain risk management: you get what you expect. Industrial Management & Data Systems, 2016.
[48]. Waters, D. Supply chain risk management: vulnerability and resilience in logistics: Kogan Page Publishers, 2011.
[49]. Wever, M., Wognum, N., Trienekens, J., & Omta, O. Managing transaction risks in interdependent supply chains: an extended transaction cost economics perspective. Journal on Chain and Network Science, 12(3), 243-260, 2012.
[50]. Wieland, A., & Wallenburg, C. M. Dealing with supply chain risks. International Journal of Physical Distribution & Logistics Management, 2012.
[51]. Mohamed, O., Abd-Karim, S.B., Roslan, N.H., Danuri, M.S.M. & Zakaria, N. Risk management: looming the modus operandi among construction contractors in Malaysia, International Journal of Construction Management, 2014.

Appendix 1

Types of studies	Authors
Mixed method	Trkman, de Oliveira, & McCormack [47], Lavastre, Gunasekaran, & Spalanzani [26]
Descriptive	Conklin, Shoemaker, & Kohnke [10], Grötsch, Blome, & Schleper [15]
Conceptual	Sáenz, Revilla, & Acero [37], Wever, Wognum, Trienekens, & Omta [49]
Experiment	Liu, Li, & Wu [28], Gaonkar & Viswanadham [13], Kurano, McKay, & Black [24]
Simulation/simulation case study	Schätter, Hansen, Wiens, & Schultmann [38], Bugert & Lasch [7], Qazi, Quigley, Dickson, & Ekici [33], Kumar & Harrison [23], Colicchia, Dallari, & Melacini [9]

Survey	Shenoi, Dath, Rajendran, & Shahabudeen [41], Sharma, Bhat, Kumar, & Agarwal [23], Fan, Li, Sun, & Cheng [12], Anđelković [1], Revilla & Saenz [35], Li, Fan, Lee, & Cheng[27], Thun, Drüke, & Hoenig [45], Thun & Hoenig [46],
Case study	Boonyanusith & Jittamai [6], Nakandala, Lau, & Zhao [29], Kırılmaz & Erol [22], Rajesh & Ravi [34], Kasemset, Wannagoat, Wattanutchariya, & Tippayawong [20], Elangovan, Sundararaj, Devadasan, & Karuppuswamy [11], Pujawan & Geraldin [32], Norrman & Jansson [30]