

1. Risk perception and decision making in the supply chain: theory and practice

1.1 Introduction

All courses of action are risky, so prudence is not avoiding danger (it's impossible), but calculating risk and acting decisively. Make mistakes of ambition and not mistakes of sloth. Develop the strength to do bold things, not the strength to suffer. Niccolò Machiavelli (1469–1527), *The Prince* (1532)

For over 60 years, academics and practitioners from different backgrounds, including psychology, sociology and management, have studied the perception of risk and how different decision making affects daily life and business activities. Although it is almost 600 years since Machiavelli stressed the importance of calculation of risk and effective response to it, approaches to risk measurement and assessment, and to decision making in risky situations, continue to develop and evolve. In the business world, managers strive to find ways to understand how different internal and external factors influence risk, how to judge and interpret the available evidence on the possibility of loss, and how to take individual actions to manage the risk (Slovic, 2000). In this decade, a number of risk management frameworks (e.g. ISO 31000) have been proposed and employed in different areas. These frameworks provide foundations and building blocks for managers to collect available data to analyse risk. Most importantly, such frameworks allow managers to gather knowledge intellectually, to properly judge their experience and to assess the current situation, so as to enter into the most appropriate decision.

Against a background of massive change in many different fields, innovations such as new supply chain structure (e.g. Global Supply Chain, Belt and Road opportunities, Wang, 2016), policy change (e.g. Paris Agreement, Jacobs, 2016, new tariffs in trade war) and the development of new technology (e.g. Internet of things (IoT), Ben-Daya *et al.*, 2017; AI, Gunasekaran and Ngai, 2014; block chain, Rahmadika and Rhee, 2018) are increasing the number and complexity of risk-bearing activities in the upstream supply network. These supply chain risks are diverse, and include, for example, supply interruption, product recall/withdrawal, terrorism and environmental and ethical issues. They are both complicated and very difficult to deal with, since they involve different entities in the supply chain (Tse *et al.*, 2018). As such, they present particular challenges in supply chain risk management (SCRM), and cannot be evaluated using a solely qualitative or quantitative approach. Moreover, it is important to bear in mind that the response actions should not strengthen the tolerances or the risk impact on the supply chain, but should focus on building a more resilient supply chain to improve the company competitiveness.

Driven by the awareness of and serious concerns regarding risk and decision making in supply chain research, this special issue aims to highlight the contemporary research that is using various methodologies, including mathematics modelling, survey-based research, case study-based research, panel data research, data analytics, integrated decision-making model and review studies. It includes a total of 12 research studies, which can be categorised into the following dimensions.



2. Empirical research of SCRM practices and strategies

2.1 *Risk management and firm performance: the moderating role of supplier integration*

Shou *et al.* (2018) conduct a survey-based research to investigate the performance effect of SCRM. The performance is studied in three aspects, namely, financial performance, operational efficiency and flexibility. An SCRM model is developed and examined by employing structural equation modelling techniques with 652 global samples. Shou *et al.* apply information processing theory to crystallise the performance impact of SCRM. The results indicate that SCRM positively influences flexibility and operational efficiency, and impacts indirectly on financial performance. Moreover, the supplier integration practice increases the impact of SCRM on operational flexibility, but does not moderate the relationship between SCRM and operational efficiency.

2.2 *Managing hazards of the make-buy decision in the face of radical technological change*

Park (2018) conducts a secondary data study to investigate the make-buy decision when a firm is facing radical technological change, which could represent either an opportunity or a risk to the company. The sourcing decision becomes critical, and may lead to exchange and hierarchical hazards. By evaluating 12 years' panel data, the study finds that the in-house retention of outsourced component knowledge and exploratory technological experience are important in this context, and are significant moderating factors which facilitate the improvement of the make and buy strategy.

2.3 *The role of consistency between objective and perceived environmental uncertainty in SCRM: a case study*

Yu *et al.* (2018) investigate how consistency between objective and perceived uncertainty in the environment affects the supply chain flexibility to cope with supply chain risk. They adopt the case study approach to distinguish different effects of objective and perceived environmental uncertainty on supply chain flexibility. Four in-depth Chinese case studies (two environmental instrument companies and two power generation companies) are conducted in order to understand how different types of SCRM strategies, namely, logistics flexibility and relationship flexibility, cope with complex and turbulent environments.

3. Risk management and decision support system model in supply chains

3.1 *Decision modelling of risks in pharmaceutical supply chains (PSCs)*

Moktadir *et al.* (2018) develop a decision-making model to identify risks associated with PSCs. An integrated AHP and Delphi decision-making approach is proposed and validated by a pharmaceutical case study, and finds that supply-related risks such as fluctuation in imports arrival, limited information sharing, failure of key supplier and non-availability of materials should be prioritised over other more generic risks in the supply chain, including operational, financial and demand-related risks. In order to develop resilience capabilities of PSCs, managers should consider the importance of different types of supply chain risks.

3.2 *Managing supply chain risks and delays in construction projects*

Panova and Hilletoth (2018) develop a simulation model to investigate how construction delay is influenced by supply chain disruption risk. Their study also includes a qualitative and quantitative method for risk assessment. The findings indicate that construction delays are influenced by the two traditional risk dimensions, i.e., the magnitude and the probability of disruption, but also that the researcher should not overlook the time factor. Based on an empirical analysis, the study proposes increasing the safety stock of construction materials at the distribution centre as one of the key risk mitigation practices in a construction supply chain.

3.3 An IoT-based risk monitoring system for managing cold supply chain risks

Tsang *et al.* (2018) propose an Internet of Things-based risk monitoring system (IoTRMS), which is aimed at controlling product quality and occupational safety risks in the cold chain. This system involves the integration of sensor network, cloud database and fuzzy logic algorithm to collect and analyse the product degradation risk and cold-associated occupational risk (e.g. accidents and injuries in the extreme cold environment) in different entities in the cold chain. The proposed intelligent system involves risk monitoring by means of the IoT application and artificial intelligence techniques. Facilitated by IoTRMS, the risk assessment and identification can be effectively established, so as to assure the product quality and appropriate occupational safety management in the cold chain environment.

3.4 A fuzzy-based House of Risk assessment method for manufacturers in global supply chains

Ma and Wong (2018) propose a fuzzy-based House of Risk assessment method for manufacturers to model risks existing in global supply chains. In order to improve the modelling precision and enable the modelling approach to reflect the real situation in terms of qualitative decision making, they apply the fuzzy logic modelling approach rather than the traditional deterministic House of Risk modelling approach. Based on their case study of a leading manufacturer in small household electronic appliances, they find that the fuzzy logic modelling approach can influence the inputs the risk events, risk agents and its occurrence. Moreover, this approach would be able to prioritise the risk agents, which benefit in deciding the proactive decisions.

4. Risk mitigation modelling

4.1 Using put option contracts in supply chains to manage demand and supply uncertainty

Luo *et al.* (2018) study the optimal ordering policy for a manufacturer and the optimal production policy for the corresponding supplier. Based on a supply chain model with one component supplier and one end-product manufacturer with the existence of a spot market, they study the advantages of both centralised and decentralised model with put option contracts. The study finds that put option can benefit the manufacturer's order as well as the supplier's production. Risks can be more effectively managed, and meanwhile higher profits can be obtained. In addition, the authors find that a single put option contract is not suitable for this supply chain model. They also demonstrate the conditions for achieving further improvement.

4.2 Minimising the risk of seaport operations efficiency reduction affected by vessel delay

This paper studies the risk of vessel arrival delay to the operations efficiency of a seaport terminal. In a traditional modelling approach, vessel arrival time is usually assumed to be deterministic. However, according to this paper, vessel arrival delay is common in the shipping industry. The authors propose a conditional probability modelling approach to capture the risk of vessel arrival delay. The study finds that by considering vessel arrival delay in berth allocation problems, the impacts of these problems on the operations efficiency can be minimised significantly.

4.3 Managing bioethanol supply chain resiliency: a risk-sharing model to mitigate yield uncertainty risk

Ye *et al.* (2018) study the decision-making behaviour of bioethanol manufacturers and cassava planting farmers on the cooperation of contract farming scheme. They consider and conduct analysis based on two decision models – centralised and decentralised approaches – and propose a risk-sharing model to coordinate the two parties. The study finds that use

of the risk-sharing model helps to mitigate the yield uncertainty risk, while improving the resiliency of the cassava bioethanol supply chain in an environment of yield and demand uncertainties. They further categorise different conditions which may benefit the cooperation in both centralised and decentralised approaches.

5. Reviews in SCRM

5.1 *Strategies and effective decision making against terrorism affecting SCRM and security: a novel combination of triangulated methods*

Khan *et al.* (2018) propose a research model related to risk management strategies and effective decision making in the context of terrorism risks in the supply chain. To construct the research model they adopt a triangulated approach comprising a systematic literature review, text mining and network analysis. By reviewing and text mining 64 research articles, they develop a strategies and decision making against terrorism model. The model provides new insights for managers and academics so that they might have in-depth understanding about the key themes of decision making in the area of terrorism risk and security in supply chains.

5.2 *Procurement risk management under certainty: a review*

Hong *et al.* (2018) is a review paper on SCRM and procurement risk management from 1995 to 2017. The authors have reviewed a total of 156 papers in several major databases, including Science Direct, Emerald, Scopus, Springer and Google Scholar, with the keywords risk management, supply chain management, supply risk, procurement, contract, and sourcing. They categorise the papers into five main risks and discuss seven major future challenges in the field of study.

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