



Supply chain risk management: A pilot study among Moroccan manufacturing companies

Full Paper

Soukaina SAHAB

*Laboratory of LERSEM, The National School of Business and Management, Chouaib
Doukkali university, El Jadida, Morocco*

Soukaina.logis@gmail.com

Salah OULFARSI

*Laboratory of LERSEM, The National School of Business and Management, Chouaib
Doukkali university, El Jadida, Morocco*

oulfarsi.s@ucd.ac.ma

Supply chain risk management: A pilot study among Moroccan manufacturing companies

Abstract

Recently, supply Chain Risk Management (SCRM) has paying attention from academics and practitioners, especially in light of latest international occurrences like natural disasters, geopolitical tensions and the COVID-19 pandemic which has hampered interconnected and worldwide supply networks. The management of risk and disruptions in the supply chain is still a critical issue that has an impact on how well firms perform today. Based on these circumstances, the aim of this study is to examine the deployment of supply chain risk management processes among Moroccan companies to deal with disruptions in the supply chain. In this paper, we conducted a pilot study using a questionnaire to collect the data from 11 Moroccan manufacturing firms. The results indicate that the level of adoption of SCRM processes is rather high among companies surveyed. The present study makes significant contributions to the field of risk management by addressing the lack of empirical research on supply chain risk management approaches in Moroccan firms. Therefore, this research contributes to the existing literature and recommends futures directions for research.

Key words: SCRM, Moroccan firms, pilot study, risk, supply chain

Gestion des risques de la chaîne d’approvisionnement : Une étude pilote auprès des entreprises manufacturières marocaines

Résumé

Récemment, la gestion des risques de la chaîne d'approvisionnement (SCRM) a retenu l'attention des universitaires et des praticiens, en particulier à la lumière des derniers événements internationaux tels que les catastrophes naturelles, les tensions géopolitiques et la pandémie de COVID-19 qui a entravé les réseaux d'approvisionnement interconnectés et mondiaux. Aujourd'hui, la gestion des risques et des perturbations dans la chaîne d'approvisionnement reste une question cruciale qui a un impact sur la performance des entreprises. Dans ce contexte, l'objectif de cette étude est d'examiner le déploiement des processus de gestion des risques de la chaîne d'approvisionnement par les entreprises marocaines pour faire face aux perturbations de la chaîne

d'approvisionnement. Dans le présent travail, nous avons mené une étude pilote en utilisant un questionnaire pour collecter des données auprès de 11 entreprises manufacturières marocaines. Les résultats indiquent que le niveau d'adoption des processus de gestion des risques de la chaîne d'approvisionnement est assez élevé par les entreprises interrogées. La présente étude apporte une contribution significative au domaine de la gestion des risques en comblant le manque de recherche empirique sur les pratiques de gestion des risques de la chaîne d'approvisionnement dans les entreprises marocaines. Par conséquent, cette recherche contribue à la littérature existante et recommande des orientations futures pour la recherche.

Mots clés : SCRM, entreprises marocaines, étude pilote, risque, chaîne d'approvisionnement

Introduction

Many factors, including the erratic nature of the economic cycle, the rise in customer demands, the globalization trend, the short life cycle for products, and the speed at which technology is developing, have contributed to the complexity and unpredictability of current business environment.

These challenging environments make every organization in the supply chain (SC) vulnerable to disruptions. Consequently, manufacturing companies are exposed to risks associated with disasters that are both natural and human-made which are frequently unpredictable (Kristanto and Kurniawati 2023).

There are two types of supply chain risks (SCR): operational risks and disruption risks. (Fahimnia, Jabbarzadeh, and Sarkis 2018 ; Ivanov and Dolgui 2019). Operational risks include regular disruptions in the SC's operations, especially with regard to lead times and demand fluctuations, which disruption risks are referred to as high-impact, low-frequency events (Ivanov et al. 2019; Kinra et al. 2019).

Therefore, given the current highly dynamic market environment, It is recognized that vulnerabilities and disturbances in the SC are an inevitable outcomes (Um and Han 2021), which explains the extensive attention has been paid of academics and practitioners to supply chain disruptions and their impacts on supply chains (Speier et al. 2011).

To manage SCR, researchers have proposed a series of SCRM processes including four interrelated processes which are risk identification, risk assessment, risk mitigation and risk control (Chopra and Sodhi 2004; Kleindorfer and Saad 2009; Arasu et al. 2020; G. A. Zsidisin et al. 2004; Y. Fan and Stevenson 2018; Kırılmaz and Erol 2017; Wieland and Wallenburg 2012). Furthermore, SCRM becomes critical to the survival and prosperity of an organization (Wildgoose, Brennan, and Thompson 2012).

Reviewing the literature on risk management, it seems that studies related to examining SCRM practices in Moroccan firms are missing. In light of the above, the main objective of this study is to explore the SCRM practices related to managing risks in the Moroccan context in times of disruption.

By examining this objective, the present study makes significant contributions to the field by expanding the scope of exploratory research on particular supply chain risk management processes and addressing the lack of empirical research on supply chain risk management capabilities in Moroccan firms.

This article is structured as follow, the introduction is presented in section 1, section 2 provides an overview of literature, section 3 present the research methodology, Section 4 provides the results of our study, the discussion is detailed in section 5 and conclusion is drawn in section 6.

Literature review

Supply chain risks are among the numerous risks that an enterprise must manage, this is justified by the critical nature of supply chain partners (Narasimhan and Talluri 2009). Many approaches have been addressed when investigating SCRM. For instance, when sourcing from emerging markets, (G. Zsidisin and Ellram 2003) offered an agency perspective on supply chain risk, while, (Kull and Closs 2008) examined the risk of second-tier supplier failures in serial supply chains. (Tang 2006) provided a thorough analysis of quantitative models for supply chain risk management and created a unified framework for categorizing them. A conceptual

model for managing supply chain network risks was developed by (Trkman and McCormack 2009), while risk assessment and profit sharing in corporate networks were studied by (Lo Nigro and Abbate 2011). Additionally, (Oke and Mohan 2009) offered a case study of handling disruptions in a retail supply chain, and (Sarkar and Mohapatra 2009) concentrated on determining the ideal supply base while taking supply disruption risks into account. Table 1 provides additional recent research in this area and summarizes the methodology, focus, and main objective of the considered studies. This overview aims to give an illustrative snapshot of the field rather than being exhaustive.

Table 1. Illustrative literature.

Reference	Methodology	Focus	Supply Chain Risk Management Practices Addressed	Summary/Main findings
(Besma, Rachid, and Abdelaziz 2021)	Case study; Qualitative Approach	Pharmaceutical Sector in Constantine Region, Algeria	Risk Identification and Assessment	Identification and evaluation of risks in the pharmaceutical sector. Results prioritize critical risks and offer insights for managers to improve the organizational resilience.
(Li et al. 2021)	Literature review; Fuzzy Best-Worst Approach	Halal Fashion Supply Chain	Risk Identification and Assessment	An extensive inventory of Halal fashion supply chain risks. The study identifies and ranks risks related to manufacturing and design as most significant. The study contributes to risk assessment in Halal Fashion industry.
(Babu, Bhardwaj, and Agrawal 2021)	Case study;ISM Approach	Indian Manufacturing SMEs	Risk Identification, Assessment, and Control	Identify dominant risk variables in Indian manufacturing SMEs. Results guide managers to reach effective risk management by understanding and prioritize significant risk variables.
(Tarei, Thakkar, and Nag 2021)	Case study	Indian Petroleum Supply Chain	Risk Mitigation and Control	The research recommends effective risk mitigation strategies by introducing a Decision Support System which would contribute to risk management and control in petroleum supply chains.
(University of Oklahoma, USA et al. 2021)	Survey;Modeling	Prefabrication Supply Chain in Construction	Risk Identification and Assessment	Development of a risk exposure model to measure disruption risks in the prefabrication process and successfully identify potential disruptions in the supply chain.
(Perona 2021)	Survey Analysis	Italian Manufacturing Companies	Risk identification and assessment	The frequency and causes of supply disruptions are examined. Findings indicate frequent disruptions, with financial default by suppliers being the most common cause.

(Terblanche and Niemann 2021)	Survey; Qualitative Research	South African Pharmaceutical Industry	Risk identification, risk mitigation	The study identifies sources of counterfeiting and risk mitigation capabilities. Risk awareness, collaboration, and industry-specific enablers contribute to effective risk management in a developing country context.
(Sanci et al. 2022)	Case study; Stochastic Programming Model	Mitigation Strategies at Ford Motor Company	Risk mitigation	A decision support framework is established for mitigating supply disruption risk at Ford. Investing in specific mitigation strategies is recommended by the framework.
(Sreedevi, Saranga, and Gouda 2023)	Survey; Structural Equation Modeling	Macro-Level Logistical Capabilities and Supply Chain Risk	Supply Chain Risk identification and control	The impact of logistical capabilities of a country on supply chain risk perception and management efforts. Countries with high logistical capabilities tend to perceive lower risk and invest less in external integration.
(Sebtaoui al. 2021)	Survey; Structural Equations Modeling	JIT Implementation in Moroccan Industry	Risk assessment	The study proved that effective risk assessment is crucial for successful JIT implementation, and highlight the importance of risk management in complex strategies like JIT.
(Bag et al. 2023)	Survey; PLS-SEM Technique	Big Data Analytics in Post-COVID-19 Supply Chains	All SCRM processes	Big data analytics post-COVID-19 enhances supply chain resilience. Internal risk management processes developed during the pandemic contribute to increased external risk management capabilities resulting on resilient supply chains.
(Cao, Bryceson, and Hine 2021)	Case study; Mixed Methods Approach	Decentralized Multi-tier Global Food Supply Chains	Risk mitigation	Collaborative risk management is addressed by the study which proves the inefficiency of individual risk management strategies and highlight the value of risk-sharing contracts in mitigating risks for value creation.
(Azmi and al. 2021)	Case Study	Halal Food Supply Chain in Malaysia	Risk mitigation	Types of halal food supply risks were identified and the relationship between risks and mitigation strategy efforts was examined. Halal food supply risks significantly increase mitigation strategy efforts.
(González-Zapatero et al. 2021)	Survey; Empirical Study	Supply Chain Risk Management Efficacy	SCRM processes efficacy	The study introduces risk management incoherence (RMI) and risk management efficacy (RME) and confirm the negative impact of RMI on RME.
(Ahmed and Huma 2021)	Survey, Structural Equation Modeling	Not specified	All SCRM practices	The study examines the impact of lean and agile strategies on SCRM. The finding highlight the Market orientation drives agile strategy, while the Quality Management System drives lean strategy. Both strategies significantly impact creating a robust and resilient supply chain.
(Roscoe et al. 2020)	Survey Longitudinal Data Collection	Pharmaceutical Industry	Risk Mitigation	Mitigating supply chain risks incorporate reactive and proactive strategies. Multi-national enterprises (MNEs) used worst-case assumptions, while large firms and SMEs adopted a "wait-and-see" strategy to gather

				information and reduce supply chain uncertainty.
(Sato, Tse, and Tan 2020)	Case study, Analytic Hierarchy Process	Global Supply Chains	Risk perception	The paper quantifies managers' risk perceptions, to output a practical and structural model for managing supply disruption. The model takes into consideration subjective factors and demonstrates that risk perceptions vary depending on companies and managing divisions.
(Kumar, Garg, and Garg 2020)	Survey; Structural Equation Modeling	Indian Mechanical Industries	Risk Identification, Risk Assessment,	The study analyses the impact of e-supply chain risks on demand risk employing exploratory and confirmatory factor analysis. It identifies 38 risk factors across seven categories prioritized through a survey of 148 specialists.
(Al-Balushi and Durugbo 2020)	Multiple Case Studies	Aluminum and Oil/Gas Industries in the Gulf Cooperation Council (GCC) region	Risk Identification, Risk Assessment,	The study explores supply chain risk dependencies in regional supply networks based on resource dependency theory (RDT). First-order risk management strategies were identified. The findings offer strategic directions for risk evaluations.
(Birkel and Hartmann 2020)	Multiple Case Study	Manufacturing Industry	All SCRM practices.	The paper investigates the impact of the Internet of Things on SCRM. The study proves that IoT-supported SCRM enhances data availability, process and risk transparency.
(Panova and Hilletoft, 2018)	Quantitative Analysis and Simulation Modeling	Construction Projects	Risk Mitigation	Disruptions in construction supply chains has been assessed. The study proves the adequacy of increasing construction materials safety stock of a risk mitigation strategy.
(Sharma et al. 2017)	Survey, Empirical Study	Not specified	Risk Mitigation	The relationship between SC risk sources, drivers, mitigation strategies, and overall risk exposure has been addressed. The study identifies the most important contributors to SC risk and validates empirically the effects of the aforementioned constructs on supply chain risk exposure.
(H. Fan et al. 2017)	Empirical Study	Indian Automotive Industry	Risk Mitigation	Supply chain risk mitigation enablers are investigated. Using discriminate analysis, the study proves that information visibility is the most important enabler, followed by incentives alignment, contingency planning, and risk management governance.
(Ge et al. 2016)	Survey	Automotive industry in India	Risk mitigation	The study develops a hybrid optimization-simulation model to manage SC complexity and risks. The study recommends safety stock as a practical measure for preventing supply chain disruptions.

(Cui and Basnet 2015)	Case Study	Food industry in New Zealand	All SCRM practices	The study explores how companies identify, assess, control, and mitigate risks based on empirical insights into how fast-food chains handle supply chain risks.
------------------------------	------------	------------------------------	--------------------	---

Method

We created a survey on supply chain risk management measurement and conducted a pilot study with about 11 Moroccan manufacturing firms operating in various sectors to evaluate the adoption of SCRM processes among Moroccan firms.

As previously indicated, the goal of our research was to use a pilot study to assess how well SCRM processes were implemented in real situations. A "pilot study" is a type of research methodology that is described as an initial investigation into a specific topic with the goals of testing the validity of the protocol and the collection of data and gathering some useful data to prepare for a larger study (Hulley 2007). The pilot research is frequently minimal in size and duration, given its position as a preliminary investigation.

To explore the level of SCRM processes deployment among the firms under investigation, we designed a questionnaire with items and measurement scales validated in the literature. Thus, our survey organized as follow:

- The first section includes general information about the responder company, such as the name, size, revenue, and industry;
- The next sections include questions related to different SCRM processes : risk identification, risk assessment, risk control and risk mitigation, according to the findings of the literature review (Fan and Stevenson 2018; Kırılmaz and Erol 2017; Wieland and Wallenburg 2012), The level of adoption of each processes inside the respondents' firms was asked to be indicated on a 7 point scale system.

Based on previous research (Chowdhury and Quaddus 2017; Kern et al. 2012); Wieland and Wallenburg 2012; El Baz and Ruel 2021), SCRM approaches were evaluated using the following four processes: risk assessment, identification, mitigation, and control. In order to

identify the SC risk, the respondents were asked to provide information on their level of knowledge about the risks in their SC (identify 1), their process for looking for short-term risk (Identify 2), the data they collect (Identify 3), and how they define early warning indications (Identify 4). The five components of SC risk assessments are as follows: The sources of SC risks (assess 1), the probability of supply risks (assess 2), the analysis of risk consequences (assess 3), the classification of supply risks (assess 4), and the urgency of SC risks (assess 5); assessing the sources and causes of potential supply chain risks (assess 6), and SC Risk mitigation is composed of three items that measure the respondents' reactive strategies to SC risks, the first item assesses the respondents' reactive strategies to SC risks (mitigate 1); the second evaluates these methods (mitigate 2); and the third measures the significance of SCRM procedures (mitigate 3). Four items are used to measure SC risk control: (control 1) measures the degree to which respondents have made employees aware of potential risks; (control 2) measures the skillful design of risk management procedures; (control 3) measures the degree to which potential risks are minimized; and (control 4), measures the degree to which potential risks are minimized. A seven-point Likert-type scale was used to rate each SCRM practice: "1 strongly disagreed" and "7 highly agreed". Initially, Five academics assessed the survey to ensure that all of the measuring items were reasonable and easy to understand. Following that, the survey was given to supply chain managers and executives along with an explanation of the study's purpose. We used the Google Docs program to build an online version of the survey in order to streamline the process of sending it to firms and gathering the responses.

To increase the generalizability of the survey results, we concentrated on a small sample of Moroccan manufacturing firms that operate in several market areas (Malhotra and Grover 1998). Initially, we sent emails to those companies explaining the goal of our study and asking if they would be interested in participating as questionnaire responders. After receiving positive responses from about 22 firms, we forwarded the link to the survey's online version to them.

The questionnaire was developed principally for SC managers at the participating organizations, but participants were encouraged to forward it to the appropriate company divisions for their responses. We obtained 11 surveys valid for the analysis.

Analysis of results

Based on the questions asked in Section 1 of the survey, the participating companies were classified into two categories “medium” or “large” companies. We found that 45, 4% of the companies surveyed are big enterprises, while 54, 5% are medium sized ones.

Table 2 provides an overview of the data collected through the answers to the survey's first section's questions, which asked about general company information.

Table 2. General information of the survey sample

Company	Sector	Compagnie size	Revenue
Ep1	Aerospace industry	Big Company (+ 500 Employees)	More than 50 million MAD
Ep2	Energy sector	Big Company (+ 500 Employees)	More than 50 million MAD
Ep3	Construction sector	Medium-Sized (51-500 Employees)	500 000 MAD - 5 million MAD
Ep4	Food industry	Medium-Sized (51-500 Employees)	500 000 MAD - 5 million MAD
Ep5	Logistics	Medium-Sized (51-500 Employees)	5 million MAD - 50 million MAD
Ep6	Automobile industry	Medium-Sized (51-500 Employees)	500 000 MAD - 5 million MAD
Ep7	Logistics	Big Company (+ 500 Employees)	More than 50 million MAD
Ep8	Automobile industry	Big Company (+ 500 Employees)	More than 50 million MAD
Ep9	Food industry	Big Company (+ 500 Employees)	More than 50 million MAD
Ep10	Health industry	Medium-Sized (51-500 Employees)	500 000 MAD - 5 million MAD
Ep11	Chemical industry	Medium-Sized (51-500 Employees)	5 million MAD - 50 million MAD

A summary of the data collected from the responses provided to the questionnaire's sections 2, 3, 4, and 5 is shown in Table 3, related to the level of adoption of four processes of SCRM; this is to respond to this question: “How much do these claims relate to your supply chain?” Concerning every item associated with the four SCRM processes (i.e., We are continuously looking for short-term risks in our supply chain; During our risk analysis, we look for potential sources of supply chain risks; During our risk analysis, we demonstrate potential reaction strategies; The perception of supply threats, which is assessed on a scale of 1 to 7 (where 7 represents "strongly agree" and 1 represents "strongly disagree").

Table 3 provides an overview of the responses obtained regarding the use of SCRM processes

(Sections 2 through 5 of the questionnaire). In particular, we present the average score for each item as well as the number of companies who did not respond to the question or that responded a specific scale (from 1 to 7).

Table 3. Overview of results- Sections 2, 3, 4 and 5 of questionnaire

	How applicable are these statements to your supply chain? 1= strongly disagree, 7 = strongly agree							Average score	Number of responses
	1	2	3	4	5	6	7		
Risk identification									
Identify 1	0	0	1	1	2	3	4	5,73	11
Identify 2	1	0	2	0	4	2	2	4,82	11
Identify 3	0	1	0	2	4	3	1	5,00	11
Identify 4	0	1	0	1	2	4	3	5,55	11
Average score of the construct								5,27	
Risk assessment									
Assess 1	1	1	1	1	3	2	2	4,64	11
Assess 2	0	0	1	0	6	2	2	5,36	11
Assess 3	0	0	0	2	2	3	4	5,82	11
Assess 4	0	0	0	0	3	2	6	6,27	11
Assess 5	1	0	0	0	2	6	2	5,55	11
Assess 6	0	0	0	1	3	2	5	6,00	11
Average score of the construct								5,60	
Risk mitigation									
Mitigate 1	0	1	2	1	2	2	3	5,00	11
Mitigate 2	0	0	2	2	3	3	1	4,91	11
Mitigate 3	1	0	0	1	4	1	4	5,36	11
Average score of the construct								5,07	
Risk control									
Control 1	1	1	1	2	2	2	2	4,55	11
Control 2	1	0	1	2	1	4	2	5,00	11
Control 3	1	0	2	1	3	2	2	4,73	11
Control 4	1	0	1	3	3	1	2	4,64	11

It is immediately evident from the Table 3 outcomes that, among the sample of companies assessed, the risk assessment process' components are among the most commonly employed SCRM processes. The risk assessment received a cumulative score of 5,60 overall, indicating that almost all of the responding companies implement likely SCRM processes. When examining individual risk assessment practices, most of them received a score higher than 4. The two processes that appear to be most commonly used by the surveyed companies are "assessing the sources and causes of potential supply chain risks" and "assessing the urgency of SC risks," as indicated by their high scores (6,27 and 6,00), respectively.

Furthermore, given that the organizations surveyed adopted risk identification techniques quite frequently, as seen by their overall score of 5,27. Then, the majority of practices in this category (i.e., "the gathering of data," "the definition of early warning indicators," and "the degree of information on risks in the supply chain") received a score greater than 5. "Researching short-term risks" is the only omission, with a score of 4,82, which considering their significance, suggests that the companies surveyed frequently implement these practices. As regards the risk mitigation practices, the most relevant practices turned out to be "the significance of SCRM procedures" as a reactive strategy for SC risk, this practice had an score of 5,36. "The definition of possible reactive strategies to risk," which has an average score of 5, is the second most crucial practice. The average score for this category of processes was 5,07 overall.

As shown by the average score of 4,72 in this category, risk control processes are important for SCRM operations in the companies studied. Furthermore, the relevance of this type of practice for the companies under investigation was confirmed by the fact that three of the four metrics in this category, "which relates to respondents' sensitization of employees to the perception of SC risks," "which measures the minimization of the probability of SC risks

occurring," and "which measures the minimization of the impacts of SC risks"—got scores higher than 4.

Discussion

In the academic literature, supply chain risk management is a hot topic currently. Effective supply chain management is recognized as an extremely efficient means for providing and optimizing value to the end user (Lambert and Enz 2017). Any interruption during the SC's process could have an impact on the organization's ultimate goal. Identifying SC risks, estimating their likelihood, and assessing how they can impact the operations of the company can be complicated. By examining the adoption of supply chain risk management processes among companies, this research adds to the discussion on SCRM. Specifically, we identified a set of 17 metrics associated with the majority of the four SCRM processes (i.e., risk identification, risk assessment, risk mitigation, and risk control) based on the literature on SCRM. Then, as part of a pilot study, a questionnaire was created with those indicators included and sent to a sample of 11 Moroccan manufacturing enterprises.

Based on the pilot study's results, some initial conclusions can be drawn. First, among the organizations surveyed, we discovered that a comparatively high degree of SCRM process implementation exists. In fact, every process category had an average score greater than 4. Fortunately, regarding the companies surveyed, methods for risk assessment are the most frequently employed; therefore, the results show that companies engaging in thorough risk analysis will demonstrate accuracy in evaluating the probability and potential impact of risks on their supply chain. Through effective classification, prioritization, and active assessment of the urgency of risks, these companies will enhance their responsiveness to potential threats. Additionally, they will also demonstrate a greater comprehension of the entire risk landscape by analyzing the origins and causes of potential risks in the supply chain.

Followed by the risk identification, the study explores the aspects of identifying risks, where companies evaluate how well specific risk-relevant statements pertain to their supply chains. The results show the different levels of engagement, which reflect diverse approaches to identifying potential risks.

The third process adopted by companies surveyed is risk mitigation, indeed, companies proactively defining and rigorously evaluating the effectiveness of reactive strategies during risk analysis will demonstrate enhanced preparedness and success in mitigating supply chain risks.

Then, risk control got a significantly lower score. Besides, companies fostering employee awareness, maintaining professionally designed risk management processes, and achieving historical success in minimizing the frequency and the impact of risks will exhibit a more mature and effective risk control strategy.

Finally, our findings could indicate that the companies investigated give the SCRM issue more consideration. Thus, companies use a variety of practices to manage supply chain risks, including risk identification, assessment, mitigation and control. Indeed, in order to assess supply chain risks, these later should first be identified, moreover, their likelihood and potential impact should be quantified (Hajiagha et al. 2022).

Given the current economic and global disruptions, SCRM has emerged as an important issue for organizations. The present paper analyzed this issue based on pilot study with about 11 Moroccan manufacturing firms operating in various sectors to evaluate the adoption of SCRM processes in the Moroccan context. Our empirical findings were supported by theoretical insight from the review of literature.

This article offers a number of contributions in this area. Initially, we presented an overview analysis of SCRM processes examined in the current literature.

Second, this research fills the gap in empirical research in Moroccan context about the question of the adoption of SCRM practices by companies in time of crisis.

Then, more specifically, we analyzed the level of deployment of SCRM processes by Moroccan companies in time of disruptions and we described the most practices used by companies related to the four processes of SCRM.

Our research has also important implications for practice. As such, our findings may encourage businesses to implement SCRM processes or enhance current processes in order to improve their performance.

Our work presents some limitations like any research, which present opportunities for future studies, We have earlier mentioned that this paper describe the finding of our pilot study, future research, hence, will focus on some following points such as developing preliminary model for SCRM processes in times of disruption and extending the pilot study, by investigating the use of SCRM processes in a large sample of companies, through a survey questionnaire.

References

- Ahmed, W., et S. Huma. 2021. " Impact of lean and agile strategies on supply chain risk management ". *Total Quality Management and Business Excellence* 32 (1-2): 33-56. <https://doi.org/10.1080/14783363.2018.1529558>.
- Al-Balushi, Z., et C.M. Durugbo. 2020. " Management strategies for supply risk dependencies: empirical evidence from the gulf region ". *International Journal of Physical Distribution and Logistics Management* 50 (4): 457-81. <https://doi.org/10.1108/IJPDLM-06-2019-0201>.
- Arasu, Thanigai, Manavalan Ethirajan, Jayakrishna Kandasamy, K.E.K. Vimal, Simon Nadeem, et Anil Kumar. 2020. " Analyzing the risks of adopting circular economy initiatives in manufacturing supply chains". *Business Strategy and the Environment* 30 (août). <https://doi.org/10.1002/bse.2617>.
- Azmi, F.R., H. Musa, B.C. Chew, et I.P. Jagiripu. 2021. " Supply risk management: A case study of halal food industry in Malaysia ". *Uncertain Supply Chain Management* 9 (2): 501-12. <https://doi.org/10.5267/j.uscm.2021.1.001>.
- Babu, Harish, Prabhas Bhardwaj, et Anil K. Agrawal. 2021. " Modelling the supply chain risk variables using ISM: a case study on Indian manufacturing SMEs ". *Journal of Modelling in Management* 16 (1): 215-39. <https://doi.org/10.1108/JM2-06-2019-0126>.
- Bag, S., P. Dhamija, S. Luthra, et D. Huisingh. 2023. " How big data analytics can help manufacturing companies strengthen supply chain resilience in the context of the COVID-19 pandemic ". *International Journal of Logistics Management* 34 (4): 1141-64. <https://doi.org/10.1108/IJLM-02-2021-0095>.
- Besma, Saker, Chaib Rachid, et Kahlouche Abdelaziz. 2021. " For an Effective Management of the Functional Capacities of Companies: A Study of Pharmaceutical Companies ". *International*

- Journal of Safety and Security Engineering* 11 (5): 557-63. <https://doi.org/10.18280/ijssse.110507>.
- Birkel, H.S., et E. Hartmann. 2020. "Internet of Things – the future of managing supply chain risks ". *Supply Chain Management* 25 (5): 535-48. <https://doi.org/10.1108/SCM-09-2019-0356>.
- Cao, S., K. Bryceson, et D. Hine. 2021. " Collaborative risk management in decentralised multi-tier global food supply chains: an exploratory study ". *International Journal of Logistics Management* 32 (3): 1050-67. <https://doi.org/10.1108/IJLM-07-2020-0278>.
- Chopra, Sunil, et Manmohan Sodhi. 2004. " Managing Risk to Avoid Supply-Chain Breakdown ". *MIT Sloan Management Review*, septembre.
- Chowdhury, Md Maruf H., et Mohammed Quaddus. 2017. " Supply Chain Resilience: Conceptualization and Scale Development Using Dynamic Capability Theory". *International Journal of Production Economics* 188 (juin): 185-204. <https://doi.org/10.1016/j.ijpe.2017.03.020>.
- Cui, Y., et C. Basnet. 2015. " An exploratory study of supply chain risk management in the New Zealand fast food industry ". *International Journal of Logistics Systems and Management* 20 (2): 199-215. <https://doi.org/10.1504/IJLSM.2015.067256>.
- El Baz, Jamal, et Salomé Ruel. 2021. "Can Supply Chain Risk Management Practices Mitigate the Disruption Impacts on Supply Chains' Resilience and Robustness? Evidence from an Empirical Survey in a COVID-19 Outbreak Era ". *International Journal of Production Economics* 233 (mars): 107972. <https://doi.org/10.1016/j.ijpe.2020.107972>.
- Fahimnia, Behnam, Armin Jabbarzadeh, et Joseph Sarkis. 2018. " Greening versus Resilience: A Supply Chain Design Perspective ". *Transportation Research Part E: Logistics and Transportation Review* 119 (C): 129-48.
- Fan, H., G. Li, H. Sun, et T.C.E. Cheng. 2017. " An information processing perspective on supply chain risk management: Antecedents, mechanism, and consequences". *International Journal of Production Economics* 185: 63-75. <https://doi.org/10.1016/j.ijpe.2016.11.015>.
- Fan, Yiyi, et Mark Stevenson. 2018. " A Review of Supply Chain Risk Management: Definition, Theory, and Research Agenda ". *International Journal of Physical Distribution & Logistics Management* 48 (3): 205-30. <https://doi.org/10.1108/IJPDLM-01-2017-0043>.
- Ge, H., J. Nolan, R. Gray, S. Goetz, et Y. Han. 2016. " Supply chain complexity and risk mitigation – A hybrid optimization–simulation model ". *International Journal of Production Economics* 179: 228-38. <https://doi.org/10.1016/j.ijpe.2016.06.014>.
- González-Zapatero, C., J. González-Benito, G. Lannelongue, et L.M. Ferreira. 2021. " Using fit perspectives to explain supply chain risk management efficacy ". *International Journal of Production Research* 59 (17): 5272-83. <https://doi.org/10.1080/00207543.2020.1776412>.
- Hajiagha, Seyed Hossein Razavi, Hannan Amoozad Mahdiraji, Maryam Behnam, Boshra Nekoughadirli, et Rohit Joshi. 2022. " A Scenario-Based Robust Time–Cost Tradeoff Model to Handle the Effect of COVID-19 on Supply Chains Project Management ". *Operations Management Research* 15 (1): 357-77. <https://doi.org/10.1007/s12063-021-00195-y>.
- Hulley, Stephen B., éd. 2007. *Designing Clinical Research*. 3rd ed. Philadelphia, PA: Lippincott Williams & Wilkins.
- Ivanov, Dmitry, et Alexandre Dolgui. 2019. " New disruption risk management perspectives in supply chains: digital twins, the ripple effect, and resilience ". *IFAC-PapersOnLine*, 9th IFAC Conference on Manufacturing Modelling, Management and Control MIM 2019, 52 (13): 337-42. <https://doi.org/10.1016/j.ifacol.2019.11.138>.
- Ivanov, Dmitry, Seyedmohsen Hosseini, et Alexandre Dolgui. 2019. " Review of quantitative methods for supply chain resilience analysis ". *Transportation Research Part E Logistics and Transportation Review* 125 (mars): 285-307. <https://doi.org/10.1016/j.tre.2019.03.001>.
- Kern, Daniel, Roger Moser, Evi Hartmann, et Marco Moder. 2012. " Supply Risk Management: Model Development and Empirical Analysis ". *International Journal of Physical Distribution & Logistics Management* 42 (janvier): 60-82. <https://doi.org/10.1108/09600031211202472>.

- Kinra, Aseem, Dmitry Ivanov, Ajay Das, et Alexandre Dolgui. 2019. " Ripple effect quantification by supplier risk exposure assessment ". *International Journal of Production Research* 58 (octobre): 1-20. <https://doi.org/10.1080/00207543.2019.1675919>.
- Kirilmaz, Oguzhan, et Serpil Erol. 2017. " 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. <https://doi.org/10.1016/j.pursup.2016.04.002>.
- Kleindorfer, Paul R., et Germaine H. Saad. 2009. " Managing Disruption Risks in Supply Chains". *Production and Operations Management* 14 (1): 53-68. <https://doi.org/10.1111/j.1937-5956.2005.tb00009.x>.
- Kristanto, D., et D.A. Kurniawati. 2023. " Development of halal supply chain risk management framework for frozen food industries ". *Journal of Islamic Marketing*. <https://doi.org/10.1108/JIMA-04-2022-0112>.
- Kull, Thomas, et David Closs. 2008. " The Risk of Second-Tier Supplier Failures in Serial Supply Chains: Implications for Order Policies and Distributor Autonomy ". *European Journal of Operational Research* 186 (février): 1158-74. <https://doi.org/10.1016/j.ejor.2007.02.028>.
- Kumar, A., R.K. Garg, et D. Garg. 2020. " Development of a structural model of risk issues involved in e-supply chain adoption in indian mechanical industries ". *International Journal of Supply and Operations Management* 7 (3): 242-60. <https://doi.org/10.22034/IJSOM.2020.3.3>.
- Li, Tieke, Bailin Wang, Elie Sumarliah, et Indriya Indriya. 2021. " An Examination of Halal Fashion Supply Chain Management Risks Based on the Fuzzy Best-Worst Approach ". *Inf. Resour. Manage. J.* 34 (4): 69-92. <https://doi.org/10.4018/IRMJ.2021100104>.
- Lo Nigro, Giovanna, et Lorenzo Abbate. 2011. " Risk Assessment and Profit Sharing in Business Networks ". *International Journal of Production Economics* 131 (1): 234-41.
- Malhotra, Manoj K, et Varun Grover. 1998. " An assessment of survey research in POM: from constructs to theory". *Journal of Operations Management* 16 (4): 407-25. [https://doi.org/10.1016/S0272-6963\(98\)00021-7](https://doi.org/10.1016/S0272-6963(98)00021-7).
- Narasimhan, Ram, et Sri Talluri. 2009. " Perspectives on Risk Management in Supply Chains ". *Journal of Operations Management* 27 (avril): 114- 18. <https://doi.org/10.1016/j.jom.2009.02.001>.
- Oke, Adegoke, et Gopalakrishnan Mohan. 2009. " Managing Disruptions in Supply Chains: A Case Study of a Retail Supply Chain". *International Journal of Production Economics* 118 (mars): 168-74. <https://doi.org/10.1016/j.ijpe.2008.08.045>.
- Panova, Y., et P. Hilletofth. 2018. " Managing supply chain risks and delays in construction project ". *Industrial Management and Data Systems* 118 (7): 1413-31. <https://doi.org/10.1108/IMDS-09-2017-0422>.
- Perona, M. 2021. " Supply Risk Management: an empirical perspective on the Italian manufacturing sector ". *Sinergie* 39 (3): 99-121. <https://doi.org/10.7433/S116.2021.06>.
- Roscoe, S., H. Skipworth, E. Aktas, et F. Habib. 2020. " Managing supply chain uncertainty arising from geopolitical disruptions: evidence from the pharmaceutical industry and brexit ". *International Journal of Operations and Production Management* 40 (9): 1499-1529. <https://doi.org/10.1108/IJOPM-10-2019-0668>.
- Sanci, E., M.S. Daskin, Y.-C. Hong, S. Roesch, et D. Zhang. 2022. " Mitigation strategies against supply disruption risk: a case study at the Ford Motor Company ". *International Journal of Production Research* 60 (19): 5956-76. <https://doi.org/10.1080/00207543.2021.1975058>.
- Sarkar, Ashutosh, et Pratap Mohapatra. 2009. " Determining the optimal size of supply base with the consideration of risks of supply disruptions ". *International Journal of Production Economics* 119 (mai): 122-35. <https://doi.org/10.1016/j.ijpe.2008.12.019>.
- Sato, Y., Y.K. Tse, et K.H. Tan. 2020. "Managers' risk perception of supply chain uncertainties ". *Industrial Management and Data Systems* 120 (9): 1617-34. <https://doi.org/10.1108/IMDS-01-2020-0049>.
- Sebtaoui, F.E., A. Adri, S. Rifai, et K. Sahaf. 2021. " The impact of risks management in the success of JIT implementation: Structural equations modeling for relational analysis in the Moroccan

- industry ". *Quality Management Journal* 28 (4): 190-204. <https://doi.org/10.1080/10686967.2021.1962772>.
- Sharma, S.K., A. Bhat, V. Kumar, et A. Agarwal. 2017. " Path analysis model for supply chain risk management ". *International Journal of Information Systems and Supply Chain Management* 10 (2): 21-41. <https://doi.org/10.4018/IJISSCM.2017040102>.
- Speier, Cheri, Judith M. Whipple, David J. Closs, et M. Douglas Voss. 2011. " Global supply chain design considerations: Mitigating product safety and security risks ". *Journal of Operations Management*, Special Issue: Product Safety and Security on the Global Supply Chain, 29 (7): 721-36. <https://doi.org/10.1016/j.jom.2011.06.003>.
- Sreedevi, R., H. Saranga, et S.K. Gouda. 2023. " Impact of a country's logistical capabilities on supply chain risk ". *Supply Chain Management* 28 (1): 107-21. <https://doi.org/10.1108/SCM-09-2020-0504>.
- Tang, Christopher S. 2006. " Perspectives in Supply Chain Risk Management ". *International Journal of Production Economics* 103 (2): 451-88. <https://doi.org/10.1016/j.ijpe.2005.12.006>.
- Tarei, Pradeep Kumar, Jitesh J. Thakkar, et Barnali Nag. 2021. " Development of a decision support system for assessing the supply chain risk mitigation strategies: an application in Indian petroleum supply chain ". *Journal of Manufacturing Technology Management* 32 (2): 506-35. <https://doi.org/10.1108/JMTM-02-2020-0035>.
- Terblanche, C., et W. Niemann. 2021. " Counterfeiting: Exploring mitigation capabilities and resilience in south african pharmaceutical supply chains ". *Acta Commercii* 21 (1). <https://doi.org/10.4102/ac.v21i1.963>.
- Trkman, Peter, et Kevin McCormack. 2009. " Supply Chain Risk in Turbulent Environments—A Conceptual Model for Managing Supply Chain Network Risk ". *International Journal of Production Economics* 119 (juin): 247-58. <https://doi.org/10.1016/j.ijpe.2009.03.002>.
- Um, Juneho, et Neungho Han. 2021. " Understanding the Relationships between Global Supply Chain Risk and Supply Chain Resilience: The Role of Mitigating Strategies ". *Supply Chain Management: An International Journal* 26 (2): 240-55. <https://doi.org/10.1108/SCM-06-2020-0248>.
- University of Oklahoma, USA, Somik Ghosh, Mustafa Hamad, et McCarthy Building Companies, USA. 2021. " A Model for Measuring Disruption Risk in the Prefabrication Supply Chain ". *International Journal of Construction Supply Chain Management* 11 (2): 69-88. <https://doi.org/10.14424/ijcscm110221-69-88>.
- Wieland, Andreas, et Carl Marcus Wallenburg. 2012. " Dealing with Supply Chain Risks: Linking Risk Management Practices and Strategies to Performance ". *International Journal of Physical Distribution & Logistics Management* 42 (10): 887-905. <https://doi.org/10.1108/09600031211281411>.
- Wildgoose, Nick, Patrick Brennan, et Simon Thompson. 2012. " Understanding Your Supply Chain to Reduce the Risk of Supply Chain Disruption ". *Journal of Business Continuity & Emergency Planning*, mai. <https://hstalks.com/article/4458/understanding-your-supply-chain-to-reduce-the-risk/>.
- Zsidisin, George A., Lisa M. Ellram, Joseph R. Carter, et Joseph L. Cavinato. 2004. " An analysis of supply risk assessment techniques ". *International Journal of Physical Distribution & Logistics Management* 34 (5): 397-413. <https://doi.org/10.1108/09600030410545445>.
- Zsidisin, George, et Lisa Ellram. 2003. " An Agency Theory Investigation of Supply Risk Management ". *Journal of Supply Chain Management* 39 (juin): 15-27. <https://doi.org/10.1111/j.1745-493X.2003.tb00156.x>.