

# An Exploratory Study on SCRM: An Evidence from the Moroccan Automotive Industry

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**Abstract**—Supply chain risk management (SCRM) is a relatively new topic in the field of supply chain management (SCM). It has gained a growing interest in the last two decades. Nevertheless, most of the related studies have been conducted in the developed countries context. Taking into account that Supply Chain Risk (SCR) perception and management vary across countries and industries, we aim, through this qualitative study, to explore the way SCRs are perceived and managed in the Moroccan automotive industry.

**Keywords**—Supply chain risk, SCRM, automotive sector, and case study.

## 1. Introduction

During the last decades, the business environment has become more turbulent and volatile [1] [2] leading to a metamorphosis in both supply chain design and practices. Indeed, under the pressure of various factors; such as the increased globalization, the constant climate change, the focus on efficiency, the trend toward outsourcing, the continuous reduction of supply bases, the high demand variability and the short life of products [3], [4]; [5] supply chains have become more complex and more dynamic, thus more vulnerable to disruptions ([6]). Companies are facing an increasing number of risks originating from different sources and posing a serious threat to supply chain performance and business continuity [7]. Companies are called upon today to find a way to make their SCs survive, adapt, and grow. This cannot be achieved without an effective supply chain risk management (SCRM) that allows organizations to anticipate threats, respond to them promptly and effectively and recover to an equilibrium state after any disruption [8]. SCRM has gained an increasing interest since the publication of the research conducted by the eminent professors Christopher and Peck from the Cranfield University

been conducted in order to identify the main factors contributing to SC vulnerability, propose ways to assess their impact and to identify the main strategies and tactics used to manage risks and build resilient supply chains. Many authors have stated that the nature of SCR and SCRM strategies may differ across countries and industries [9]. Therefore, it is interesting to further our understanding of vulnerability and risk management by studying other contexts. In this article we aim to explore the way managers perceive supply chain risks and the strategies they implement to manage them. The remainder of this article will be organized as follow. Firstly, we will present an overview of the SCRM literature. Secondly, we will shed light on the research design and finally we will present and discuss the results of the qualitative study which has been conducted in the Moroccan automotive sector.

## 2. Literature review

### 2.1. Supply chain risk

*Supply Chain Risk Definition:* The expression SCR is used to refer to a negative deviation from the expected value of performance measures which results in undesirable impacts for the firm [2]. From all works that tried to classify the risk sources (e.g. [3]-[4]), the multi-level classification of [5] has received more attention. In this classification, the supply chain risk sources are presented in three main levels which are environmental risk sources, network-related risk sources and organizational risk sources. Several risk drivers are discussed in the literature; the major are the focus on efficiency (rather than effectiveness), the trend to globalization of the supply chains, to focused factories and to outsourcing, the lean management practices, etc. (e.g. [5]-[6]-[7]). The SCR could have a severe impact on supply chain performance indicators; it could lead to financial consequences, reputation damage and health and safety concerns [5].

*Supply Chain Risk Categorization:* In his literature review, [13] pointed out that most conceptual research has focused on the categorizations of supply chain risk considered as a starting point for risk identification. Indeed, several typologies can be found in literature ([19]; [20] [21], [15], etc.).

Nevertheless they remain incomplete. This could be due to the fact that most empirical research on the topic is context-specific and the data are collected from diverse industries and countries. In literature, we find studies that propose lists of risk types but without classification but also others that suggest categories. Thus, SCRs can be macro-risks or micro-risks [16]; catastrophic or operational risks [22] disruption or operational risks [23], endogenous or exogenous risks [24], etc. In their classification, [25] propose a three level classification distinguishing between environmental risks, network-related risks (demand-related and supply-related risks) and organizational risks. [26] separates between risks associated with goods flows, information flows and cash flows, security risks, relationship risks, and risks associated with corporate social responsibility. To fill this gap [27] explored the historical development of supply chain categorization and offered an inclusive typology by forming a level of consensus among different clusters of researchers. The authors established a new typology which separates between 1) risks internal to the firm (infrastructure, problem-specific, strategic, decision making specific, reputation, capacity, financial capacity 2) risks internal to the supply chain (supplier operational, supplier economic, cultural, relational, demand, transportation, inventory, legal, bureaucratic and regulatory, sustainability, financial capacity, consumer risks) and; 3) risks external to the supply chain (competitiveness, Input Market, Political risks, catastrophic, financial market). The authors argue that testing this new typology would be a solid step in expanding our knowledge. Therefore, it will be interesting to adopt it while conducting our empirical study.

*Supply Chain Risk Consequences:* Regardless of its origin, SCR can have major consequences for organizations (including financial, logistics and reputation impacts [28]) which may lead to business discontinuity [7]. Numerous examples have been documented in both academic and practitioner literature. [29] were among the first to examine the impact of supply chain disruptions on financial performance (in a very general way). Other scholars tried to fill the gap by focusing on specific types of disruption and by widening the scope of performance [30], [21], [31], [32]. Thus, supply chain performance can be improved by mitigating supply chain risks through implementing reactive and preventive instruments [5].

## 2.2. Supply Chain Risk Management

In the current business context, SCRM has become a key managerial challenge that guarantees organizations' performance and business continuity. The concept of SCRM has been approached in different ways by different academics leading to a lack of consensus on its definition and process [22]. For instance, [15] use the term "SCRM" to refer to "*the identification of potential sources of risk and implementation of appropriate strategies through a coordinated approach among supply chain risk members, to reduce supply chain vulnerability*". More

holistic definitions have been established recently by scholars such as [16] who define SCRM as "*the inter-organizational collaborative endeavor utilizing quantitative and qualitative risk management methodologies to identify, evaluate, mitigate and monitor unexpected macro and micro level events or conditions, which might adversely impact any part of a supply chain*" or by [9] for whom SCRM refers to "*the identification, assessment, treatment, and monitoring of supply chain risks, with the aid of the internal implementation of tools, techniques and strategies and of external coordination and collaboration with supply chain members so as to reduce vulnerability and ensure continuity coupled with profitability, leading to competitive advantage*".

In parallel with the debate on the definition of the concept, other scholars were interested in the SCRM process. Although the processes described in literature are quite different, they all refer to four basic activities which are: risk identification, risk assessment, risk treatment; and risk monitoring. Besides, they all stress the importance of risk identification considered as being critical to managing SCR in an effective way (e.g. [33]). This first step aims at discovering all potential supply chain threats and vulnerabilities [34]. It requires, thus, an early judgment to decide whether a risk is relevant and should be mitigated [35]. In SCRM field, academics interest has been focused on the study of the appropriate strategies implemented by Supply Chain members in order to reduce either the probability or the impact of SCR (e.g. [19]). Various terms for the types of risk treatment actions can be found in literature, but they all converge toward five main strategies: avoidance (eliminating the events that could trigger a risk) [36], acceptance (which may depend on risk propensity [37], sharing (share the risk with another party), transfer (assign responsibility to another party [38]; and mitigation. Avoiding SCR is suitable when it comes to high probability, high impact risks, whereas risk acceptance may be allowed to deal with trivial risk events characterized by low probability and low impact. For disruption risks with a low probability and high impact, risk transfer/sharing may seem a good solution while risk mitigation appears appropriate for high probability, low impact risks [9].

## 3. Study design

### 3.1. Morocco as a relevant field of study

It has been reported in SCRM literature that context is an important variable when it comes to risk perception and management [39], [9] [40]. Indeed, the nature of risk and the most appropriate management strategies and practices may vary across countries. At this level, it is worth mentioning that research interest seems to focus on developed country context [41]. Despite its growing role in the global economy, developing world has been understudied over the last years and there is still a poor understanding of SCRM in this context [9]. Locations such as Africa, Near East and South America have generated less research on SCRM over the last years [42]. This may be due to Data availability issues [43] but also to the limited use of

SCRM in most of developing countries [44]. Besides, many scholars argue that these countries are the most vulnerable to particular supply chain threats such as political instability, unethical business practices, etc. [45], [46]. Others believe that the most catastrophic effects of Global supply chain failures (particularly on human life) have occurred in developing countries. (e.g. [47] ; [48]). For all these reasons, we believe that there is an urgent need to conduct this research in such an under-represented context [9] and try to explore the way SCRM issue is being handled in the Moroccan context.

### 3.2. The Moroccan automotive sector

In Morocco, the automotive sector is considered as the backbone of the country's industrial development with more than 150 companies located mainly in Tangier, Casablanca, and Kenitra. Taking advantage of its multiple comparative advantages, this sector has achieved remarkable performances in recent years by recording an important growth reflected by increased production volumes (402,000 cars in 2018), increased job creation (the sector employs more than 100,000 persons) and increased exports (accounting for 27% of total exports in 2018). Regarding its position in the international automotive value chain, Morocco is mainly present in the traditional value chain, focusing on (1) components and other inputs, (2) car assembly (which has witnessed a significant development in recent years with the introduction of two major car makers, i.e. Renault and PSA) and (3) the distribution and some related activities. The automotive supply chain is one of the most complex and the most vulnerable in the world. Globalization and increased complexity are the main risk drivers that accentuate its risk exposure. Natural disasters, terrorism, workforce issues, the inaccuracy of sales forecasts, the dependence on partners and suppliers and so forth, are just some areas of automotive supply chain risks. With its extended, complex and global supply chain, Ford is an illustrative example of many companies of the sector. The company maintains more than 50 plants worldwide, has up to 10 tiers of suppliers and deals with more than 1,400 suppliers Tier 1 across more than 4,000 manufacturing sites [49]. In such a context, risk occurrence may lead to serious SC disruptions. In 2011, Flooding in Thailand ruined the automotive industry. Ford was obliged to cut production due to supplier issues. Likewise, Toyota Motor Corporation and Nissan Motor Company were both forced to stop operations due to a lack of parts from suppliers with huge financial losses as a result [50]. In such a context, managing SCRs should be the top priority for automotive supply chain managers and has to be considered as the key of SC competitiveness and performance. Research on SCRM in the automotive sector has flourished during the last years (e.g. [44], [34], [51]). Nevertheless, it remains poor in the Moroccan context. To the best of our knowledge, this issue has been addressed only by few researchers (e.g. [52]). Therefore, Moroccan automotive sector represents a fertile field of study for researchers who want to explore the way SCRs are perceived and managed.

## 4. Methodology

Selecting a research method implies tradeoffs in realism and generalizability. Quantitative methods, despite allowing the optimization of external validity, have proved to be less suitable in the current supply chain context characterized by increasing complexity and volatility [53]. By contrast, qualitative methods seem to be more appropriate when it comes to maximizing internal validity and when exploring new topics in their context. Considered as a relatively new discipline [15], SCRM has been a fertile field for qualitative methods. In his literature review, [54] point out that SCRM research is dominated by qualitative research. Indeed, many scholars have applied qualitative methods for risk identification (e.g. [44]; [55]), risk assessment (e.g. [56]), and risk mitigation (e.g. [57] with an emphasis on case studies (e.g. [54]). Case study is defined as "*an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident*" [58]. Therefore, and taking into account 1) the nature of modern SC environment (increasing complexity and dynamism), 2) the novelty of the topic under study (SCRM), 3) the exploratory nature of our investigation; and 4) the absence of distinct boundaries between the phenomena under study (SCR perception and management) and their context [58], we decided to adopt a case study approach in this empirical investigation. This decision was guided by two main research questions: 1) how do equipment manufacturers perceive the risks related to their supply chain? 2) What strategies do they implement in order to manage these risks? Three companies were selected to be part of this study. They were selected based on two criteria: small- medium size companies and equipment manufacturers based in Morocco. Contacts were made by telephone first and then by e-mail with a formal letter providing all the details of the research. The table below shows the main information about the companies, the participants and the method of data collection. Regarding data gathering, it was based on 6 semi-structured interviews and secondary data (information from companies' home-pages and from archival information). All interviews were conducted between November and December 2018 using the face to face data collection tool. Interviews lasted around two hours each, and were recorded and transcribed for further analysis. The data were analyzed qualitatively based on the content analysis method using Nvivo Software. This research is based on a content-directed analysis; codes were defined before and during data analysis and derived from theory and relevant research findings [1]. Following the recommendations of [27], the various supply chain risks were organized in 3 categories namely 1) risks internal to the firm, 2) risks internal to the supply chain and, 3) risks external to the supply chain. SCRM strategies were organized in 5 categories which are: avoiding, sharing, accepting, mitigating and transferring risk. An interview protocol was developed, allowing for comparability of answers and improving the reliability of the study.

**Table1.** Companies' profile

| Case                     | Activity & Main characteristics   | Interviewees  |
|--------------------------|---|---|
| Com<br>pany<br>ZAK       | Automotive wiring systems-Established in Morocco since October 2000 as the first plant in Africa of a Japanese leading international group. The plant employs more than 2500 persons and it specialises in wiring systems   | Supply manager (ZAK1)-<br>Plant manager (ZAK2)      |
| Com<br>pany<br>P R<br>M- | Inductive components -Established in Morocco since 2006 (Tangier Free Zone). It belongs to an international Spanish Leading Inductive components manufacturer established since 1962. The plant employs more than 100 persons and has an R&D center. Main customers: Audi, Mercedes, Chrysler & Renault   | Logistics manager (PRM1),<br>supply manager (PRM2)  |
| Com<br>pany<br>TAK       | Automotive safety systems (steering wheels) - Established in Morocco since April 2010 (in Tangier free zone). It is the second plant in Africa of a leading Japanese group specialized in automotive safety systems and present in more than 16 countries all over the world. The plant employs more than 800 persons. Main customers: Ford, Seat, Volkswagen, Renault. | Supply manager (TAK1) –<br>Assistant manager (TAK2) |

## 5. Results and discussion

*Risks internal to the supply chain:* The results show that companies are more concerned about this category of SCR. All interviewees assert that the most serious threats could originate from customers or/and suppliers. Demand volatility and the changes in customer preferences and specifications are the main demand-related risks "[...] in the automotive sector; the demand is very volatile. The quantities ordered by our customers change regularly. For instance, FORD which is one of our major customers, changes his orders on a regular basis. This leads to serious problems in inventory management [...]" TAK. "In our sector; Demand volatility is very high compared with other manufacturing industries. It is something we have to deal with" [...] "we have got two alternatives: either to be reactive or to lose projects. We must be able to continuously respond to ever-changing ordered quantities and we have to deal with very urgent orders » ZAK. Furthermore, the study reveals that strong automotive constructors have an increasing power on component manufacturers (which are often small or medium-sized businesses) "Car makers can even interfere in our suppliers' selection process; they impose on us the majority of suppliers we deal with. There are powerful and we have to obey since we are small and easily interchangeable" ZAK.

As for supply-side risks, the ones that are mostly mentioned by interviewees are those related to the "quality of inputs": "We have to deal with quality problems. Even if our suppliers are carefully selected, quality problems are very common in our industry.

Last month, the rejection rate reached 80% for leather" TAK. "Our suppliers are all highly qualified, they are chosen according to a very rigorous selection procedure and they are all certified. Nevertheless, quality problems and returns are very frequent" PRM.

Other risks originate from mono-sourcing strategy, especially for some key components (the lack of alternative suppliers) "For some key components, we rely on single suppliers. Thus, we are highly vulnerable. Even a minor problem in our supplier's plants can negatively impact us and lead to major problems with our customers" TAK. "For strategic components, we do not have alternative suppliers" PRM.

Mistakes in order fulfillment pose also a serious threat to supply chain functioning "Recently, we had to stop production due to a mistake committed by a supplier who delivered us 104 items instead of the 400 items we had ordered " PRM. An emergent issue that came out from this study is related to the lack of competitive local suppliers. This finding is very interesting and needs to be explored further in future research. "Unfortunately, local suppliers are far less competitive than foreign ones" ZAK. "Lately, we have run out of cardboard (due to some issues with our Chinese supplier), and as you know, no cardboard means no packaging which means no order fulfillment. The only option we had was to use a local supplier located in the Tangier Free Zone. We were shocked to learn that the price he was charging us was twice higher than average.

*Risks internal to the firm:* Interviewees agree that the most serious risks are those related to human resources. Key employees' turnover is a big concern for automotive SC members "[...] to this day, we continue to operate without a logistics manager (the former one was fired a few months ago), our department is going through a tough time" TAK. "Staff turnover poses a major risk for our company; it is common for our key employees to be headhunted by our competitors" ZAK. Another serious risk is related to internal communication "problems may stem from poor internal communication. The other day, a big order was not shipped on time because the driver was not notified "ZAK. Furthermore, the incompetence of some employees turns out to be a real threat for the smooth running of operations "Despite the fact that our company always tries to attract the most efficient profiles, it still has to deal with some incompetency issues. Most storekeepers, for instance, cannot use the computer well. "There are more and more intermittent employees who join the company. I think that the short period of training (few hours sometimes) does not allow them to master the tasks they have to perform. Furthermore, the interviewees pointed out to quality issues which may lead to a fall in market share «We must admit that a lot of products are damaged during the production process" TAK. "Receiving a lot of customer complaints is shameful for a company like ours. In such a competitive market, this may lead to the loss of big projects and to a real damage of our brand image" ZAK.

*Risks external to the supply chain:* It is believed that

port congestion is one of the most threatening external risks in the Moroccan automotive supply chain. *"Last August, a trailer coming from Italy was stuck up in traffic at Port Med for 4 days. As you know, in Summer the priority is always for passengers [...] the repetitive strikes of trailer driver at port level lead to serious disruptions of import-export operations"* TAK. *"During Summer, a simple Customs Clearance Procedure may last many days instead of one hour and a half in normal circumstances. This must be taken into account by managers in order to avoid inventory shortages"* ZAK. Another issue that concerns components manufacturers based in Morocco is "global terrorism" and "political instability" which negatively impact the ability of foreign suppliers to respect lead times *"In Morocco, we are indirectly affected by global terrorism as border controls multiply in some countries. This leads to increased delivery lead-time"* PRM. *"Thanks God, we are safe from terrorism that menaces some neighboring countries. Our political environment offers the required stability for doing business. I think this is why foreign investors have a growing interest in our country. Nevertheless, as our partners are spread all over the world, any terrorist attack in any country may lead to increased delays"* ZAK. An emergent risk source revealed by this study is related to "refugees' crisis". Some interviewees consider that the multiplication of border controls especially in some European countries could be responsible for increasing lead-times. This risk source has never been highlighted in previous research and has to be taken into account while identifying potential threats and risks in global supply chains. *"a trailer's driver had to wait 48 hours at the Ukrainian borders until the end of the control operations"* TAK. Other issues related to "the input market" were highlighted by interviewees. *"We have to deal with the fluctuation of Copper price"* PRM. *"The liberalization of the oil market in Morocco has allowed the country to reduce its budget deficit. Nevertheless, this liberalization occurred when the oil prices were very low. Once they began to rise again, our competitiveness has been seriously affected"* ZAK. In the automotive sector, "competitiveness" poses also a significant threat to companies *"the fierce competition and the entry of new competitors can cause us the loss of big projects so we have to be very vigilant"* PRM.

*Supply chain risk management strategies:* The findings of this study show that, except for few answers that allude to some risk avoidance practices (e.g. avoiding some suppliers with financial issues, avoiding some third party logistics providers having a bad reputation), all the mentioned SCRM practices were referring to risk mitigation. Firstly, many of flexibility practices found in the literature have been highlighted in this research. Indeed, interviewees pointed out to: 1) flexible and multi- skilled workforce [...] *"Our employees are very flexible and adapt easily to changes in specifications and ordered quantities. They are ready to work overtime in order to respond to important or urgent orders"* PRM. 2) Flexible transportation *"In case of urgent orders, we use express delivery service. If it is less urgent we use a second driver so we can deliver our products on time"*

TAK. And 3) component commonality *"30% of the components we use are common to more than one product. This gives us a margin of maneuver and increases flexibility"* TAK.

Secondly, two redundancy practices were highlighted by the interviewees: 1) all the companies maintain backup suppliers (if only for non- strategic components) *"Last June, and following a technical problem at our Chinese supplier's plant, we had to contact our Filipino backup supplier who was ready to deliver us the specified items in a 45 days deadline"* ZAK. 2) Safety stock which is believed to be essential in the automotive industry because it allows components manufacturers to maintain the normal flow of activities in case of delivery delays or demand increase. *"Safety stock allows us to avoid disruptions and to mitigate the risk of shortfall of both raw material and other items. We always maintain a stock that covers 7 days for products coming from Europe and 30 days for items coming from China"* PRM.

Finally, it has been reported that collaboration is vital for effective SCRM. Indeed, all the interviewees asserted that their companies are fully aware of the benefits of: 1) information sharing *"information sharing among our supply chain partners is a way to reduce many risks [...] we share information about potential risks and threats"* PRM. It is worth mentioning that communication within the companies' supply chains is essentially based on traditional tools such as telephone and emails. Only one company has an EDI that allows it to facilitate the contact with suppliers and customers. Besides, differences in languages are believed to be a serious barrier to communication in many cases. The study also shows that collaboration entails also 2) customer involvement in product development *"We regularly involve our key customers in new product design and development processes. It is crucial to developing loyalty and minimizing misunderstanding risks"* TAK.

The first objective of this study was to explore the way SCR are perceived in the Moroccan automotive supply chain context. The results show that companies are more concerned about operational risks characterized by their chronic nature and low impact (e.g. supplier quality problems, suppliers reliability, raw material delivery delays, human resources problems, demand volatility, etc.) rather than by large-scale events (such as natural disasters, political risks, terrorism, etc.). This means that even minor events, when they are chronic, may increase SC vulnerability and menace its performance. Therefore, these results are consistent with the findings of previous studies conducted in the developed country context. Indeed, [2], in a study conducted in Sweden, asserted that most serious risks for Volvo's managers are rising raw material prices, machinery breakdowns, suppliers' failure and suppliers' quality problems. Likewise, [5] pointed out that suppliers' quality problems are the most important risks since they have both high probability and high impact. For [59], risks derived from supply-side risk sources are considered to be a real threat to the German automotive companies. As for human resources related risks, our

findings are similar to those highlighted by [60] for whom employees' turnover negatively affects suppliers' performance and seriously menaces the supply chain's functioning. Furthermore, the study shows that some of the supply chain risks detected in previous studies conducted in the context of developing countries (corruption, national policies and theft) were not identified in the automotive Moroccan context (e.g. [39]).

As for SCRM strategies, the results of this investigation are consistent with those of many scholars who stressed the role of risk mitigation strategies in the industrial context and especially, the importance of flexibility, redundancy and collaboration. Nevertheless, despite increasing awareness of supply chain vulnerability, interviewees assert that their companies do not systematically think about SCRM strategies. The few practices which have been cited, despite their role in building less vulnerable and more resilient supply chains, remain insufficient. This is consistent with the findings of many studies which highlighted the lack of understanding of SCRM tools, techniques and strategies (e.g. [61]).

## 6. Conclusion

Through this research, we have tried to explore the way SCR are perceived and managed in the Moroccan automotive context. The results clearly showed the importance of all categories of SCR with an emphasis on internal risks (network-related ones). The findings have also shown the way SCR mitigation practices (flexibility, redundancy and collaboration) allow the automotive supply chain operators to reduce the negative impact of SCR and increase supply chain performance. This study is certainly interesting. However, it is only a tentative analysis which needs to be refined and elaborated by further research: 1) Future studies investigating the topic in some understudied sectors would be very interesting. 2) More broadly, research using mixed methods is highly recommended in order to overcome the multiple shortcomings of the current study exclusively based on a case study design. 3) Further research could be done to explore the potential link between SCR perception, SCRM strategies and outcomes. 4) The use of "Supply chain perspective" (instead of "focal firm one") is strongly recommended in order to address the impact of the full complexity of inter-organizational relationships on SCRM and highlight the importance of coordination among supply chain partners when it comes to effectively identify, assess and mitigate SCR. 5) Finally, taking into account the cost/benefit tradeoff would be interesting while exploring supply chain risk management practices [62].

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