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EMPIRICAL INVESTIGATION INTO THE IMPACT OF INTER-ORGANISATIONAL INFORMATION SYSTEMS ON SUPPLY CHAIN PERFORMANCE

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Abstract. *During the past few years, the pandemic of COVID-19 has significantly disrupted supply chains. Indeed, these chains are facing multiple challenges, such as designing new products to adapt to the disruptions of their markets and to maintain their profit margins and ensure their survival. Thus, this paper aims to explore the influence of inter-organizational information systems on supply chain performance by studying the role of risk management culture, collaboration, and agility and supply chain resilience. Data was collected online using a self-administered questionnaire from company executives in the automotive industry. The findings based on structural equation modeling highlighted a number of practical recommendations for automotive company managers on how to improve the level of supply chain performance.*

Keywords: *information systems, automotive industry, risk, performance, agility.*

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Introduction

In a volatile, indecisive context of permanent crisis with multiple causes: health, economic, natural disasters; companies find themselves forced to look for solutions to adapt and maintain the level of performance that can be envisaged. More specifically, over the last few years, the COVID-19 pandemic has had a profound impact on the international economy, raising unprecedented challenges for our lives (Francis, 2020). Therefore, supply chains (SC) are facing several challenges, including the design of new solutions to adapt to the upheavals in their markets and taking the right decisions to maintain their profit margins and, in extreme cases, ensure their survival (Montoya-Torres et al. 2021). To achieve this, and in the face of this turbulent environment, most industrial companies have opted to synchronise their physical and information flows by adopting sophisticated IS, with the ultimate aim of satisfying customers, while meeting several criteria: offering the right product, in the right place, in the right condition, at the right price, and at the right time (Lin, 2022). Indeed, in recent years, companies have been investing more and more in business-oriented technological tools to boost their performance. This has led logistics managers to question the congruence of these colossal investments and their impact on overall performance.

The study of the impact of inter-organisational IS on performance continues to arouse the interest of several management science researchers and IS management professionals (Chong et al. 2019). Thus, our research is part of this perspective and is in line with research work analysing the contribution of inter-organisational information systems (IOIS) as a vector for improving the agility, resilience and performance of the supply chain (Chen, 2019; Francis, 2020; Mandal et al. 2016). In view of the above, the central question of our research is as follows: How does IOIS impact supply chain collaboration, agility, resilience and performance?

This paper is organised into four sections. The first section focuses on the literature review and justifies the choice of research hypotheses. Section 2 then presents the methodological approach used to test the hypotheses and the research model. Section 3 will be devoted to presenting and discussing the results of validating the measurement models and testing the hypotheses. The final section will conclude by highlighting the main contributions of this research, its limitations and future avenues of research.

Literature Review

Inter-organisational information systems

Management science literature offers a wide range of definitions of information systems (IS). This section presents the definitions most widely accepted by management science researchers. An information system can be defined as "an organised set of resources: hardware, software, personnel, data, procedures for acquiring, processing, storing and communicating information (in the form of data, text, images, sound, etc) within organisations" (Reix, 2004). To complete this definition, Reix (2004) has proposed a classification of IS by distinguishing, on the one hand, information systems that support operations (transaction processing, support for office and communication operations) and, on the other hand, systems that support management (report production, decision support). This definition highlights the procedural content of the information system, emphasising the interactions between its constituent elements. O'Brien (2011) defines the IS as "a structured set of human, hardware and software resources, data and communication networks which collect, transform and disseminate information within a company". Thus, in line with this work, we consider the IS to be a set of resources (material and human), in this case the interaction between these resources will enable us to gain a better understanding of how the logistics IS works.

Inter-organisational information systems (IOIS) represent a category of information systems that enable different organisations to communicate and collaborate with each other by sharing information and data (Kauremaa & Tanskanen, 2016). These systems are often used to improve the effectiveness and efficiency of business processes between partner organisations. They facilitate communication and collaboration between different organisations by enabling them to share information and data. IOIS are designed to support inter-organisational business processes and activities, including areas like SC management, logistics, and customer relations management (Kauremaa & Tanskanen, 2016). These IOIS can take different forms, ranging from simple data exchange mechanisms such as electronic data interchange (Klapita, 2021), to complex systems that involve multiple organisations and support complex business processes such as enterprise resource planning systems (Ahmad, 2022). IOIS can also include web-based platforms that enable organisations to collaborate and share information in real time, such as cloud-based platforms for data sharing and collaboration.

Role of inter-organisational IS in the supply chain

Christopher (2016) points out that the proper functioning of the SC depends on the proper circulation of information flows within and outside the company. Other researchers add that this is possible thanks to the use of inter-organisational IS (Bernasconi, 1996). The operation of the SC is accompanied by two types of integration. The first, known as cross-functional integration, enables the integration of all business processes from upstream to downstream (Tyndall et al. 1998). The second category, referred to as inter-organizational collaboration, relies on a network of partnerships among companies that mutually commit to exchanging information, sharing risks and rewards, ultimately resulting in a competitive edge (Cooper & Ellram, 1993). The pull-flow approach to logistics has only increased the fear of multiple hazards (late deliveries, stock-outs, etc.). In this sense, the level of logistical risk has become a key indicator to monitor, not only for the company itself, but also for those involved throughout the supply chain (Bernasconi, 1996). The SCIS is thus the nervous system of supply chains. IS are essential to the smooth running of the supply chain, enabling logistics information to be analysed quickly and collectively in order to make effective decisions (Qrunfleh & Tarafdar, 2014). Through this literature review, we can confirm the inseparable link between SCM and the use of IOIS. This link emphasises that IOIS represents an organisational component that facilitates intra- and inter-organisational coordination (Qrunfleh & Tarafdar, 2014). In this sense, the use of IT accompanied by strong collaboration leads to the joint creation of knowledge, the sharing of expertise and the understanding of the partner's strategic intentions and approaches (Sinkovics & Roath, 2004). IOIS offer several benefits to organisations, such as improving efficiency, reducing costs, improving communication and supporting innovation. They can also help organisations to better understand and manage their supply chain, streamline processes and improve competitiveness (Hannila et al. 2019).

Based on previous work (Chen, 2019; Liu et al. 2018; Lu et al., 2006; Mandal et al., 2016; Sundram et al., 2018), we proposed the following research model.

w are various concepts from the author's point of view regarding family ownership, family business, clan governance and tribal governance.

From the definitions of Table 1 and Table 2 that the authors reveal about family ownership, clan governance and tribal governance there is a related relationship. We make a groove like the one below.

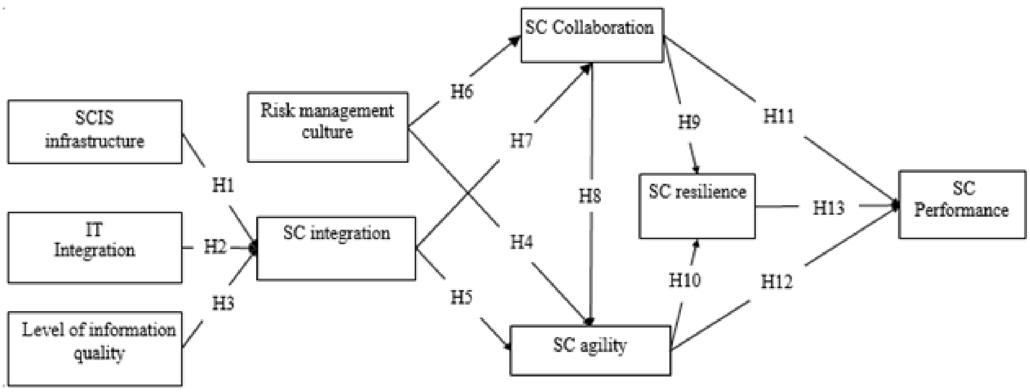

Figure 1. Conceptual research model

Methods

The choice of the automotive industry in Morocco as the field of empirical investigation can be explained by the fact that Morocco has succeeded in positioning itself as a global hub for the automotive industry. Many stakeholders interact within the automotive industry, including designers, third-tier suppliers, second-tier suppliers, first-tier suppliers, the original equipment manufacturer, transporters and distributors.

Operationalization of the constructs and development of the questionnaire

The measurement model comprises various key variables, each assessed through a specific set of items and associated with relevant authors' work. These variables include SC information system infrastructure (ISICA) with five items identified by Sundram et al. (2018), IT integration (ITICA) assessed by five items from Chen (2019), level of information quality (NQI) gauged through five items as outlined by Ragu-Nathan et al. (2006), SC integration (ISA) with five items by Sundram et al. (2018), risk management culture (CGR) evaluated through six items based on Liu et al.'s (2018) research, SC collaboration (CCA) assessed using five items derived from Salam's (2017) work, SC agility (ACA) measured by eight items proposed by Chen (2019), SC resilience (RCA) with four items associated with Mandal et al. (2016), and finally, SC performance (PCA) evaluated with five items from the research conducted by Chowdhury et al. (2019). Thus, a set of 48 items measuring the 8 latent variables was selected. these measurement scales were translated from english to french. Forr all the questions, we used the Likert scale with seven intervals. Given the impossibility of carrying out face-to-face data collection due to the pandemic crisis caused by COVID-19, we opted for online data collection. To ensure that respondents understood the questions during the data collection phase, we undertook a pre-test. This test as carried out with two teacher-researchers in management sciences, and ten SC professionals. This pre-test was conducted to ensure that the questionnaire is easily understood by the survey participants. On the basis of the comments raised, we were able to make changes to the questionnaire.

Sampling method

Since they do not require a sampling basis, management science researchers often use purposive sampling methods to constitute the study sample. Compared to our study, where access to a sampling base of all the logistics managers and directors of companies belonging to the automotive supply chain remains an impossible task, we have chosen non-probability sampling methods. At this stage, the convenience sampling method was chosen for our study, in an attempt to distribute the questionnaire to professionals in automotive supply chain companies.

Questionnaire administration and data collection

Given the impossibility of carrying out face-to-face data collection due to the pandemic crisis caused by COVID-19, we preferred to administer the questionnaire electronically via online data collection. At this stage, the questionnaire was put online using Google forms. The questionnaire was administered between January and May 2021. During this period we collected 185 responses, including 4 that could not be used, giving a total of 181 valid and usable responses. From Table 1, it is clear that the majority of responses came from men (76.8%). In terms of the position held by the participant in our survey, it appears that the data collected comes from different decision-making levels. The majority of respondents are logistics coordinators (20.44%), production planners (16.57%), and logistics managers (16.20%). In terms of level of education, the descriptive statistics show that the majority of respondents have a master's degree (61.88%).

Table 1
Characteristics of the study participants

Measures	Categories	Headcount	Percentage
Gender	Woman	42	23,20%
	Man	139	76,80%
Formation	Bachelor +2	1	0,55%
	Bachelor +3 (Licence)	67	37,02%
	Bachelor +5 (Engineer, Master)	112	61,88%
	MBA	1	0,55%
City	Tangier	168	92,82%
	Casablanca	10	5,52%
	Kenitra	3	1,66%
Experience	Less than a year	7	3,87%
	From 1 to less than 3 years	38	20,99%
	From 3 to less than 5 years	61	33,70%
	From 5 to less than 7 years	49	27,07%
	Over 7 years old	26	14,36%

In this study, we employed partial least squares structural equation modeling (PLS-SEM) to assess hypotheses. This technique is well suited for investigating the impact of Inter-organisational Information Systems (IOIS) on supply chain performance due to its proficiency in handling complex, multifaceted relationships even when dealing with limited sample sizes (Hair et al., 2021).

Results

***Measurement models model testing result*s**

The level of convergent validity is verified by checking a set of indices: the factor contribution, the average variance extracted (AVE) and the composite reliability (CR). As shown in the table below, the factor contribution of the various indicators is well above the recommended value of 0.7 (Table 2). Likewise, Cronbach's alpha values are above 0.7, confirming that all the measurement models are reliable. In addition, for all constructs the value of the composite validity is well above the minimum threshold of 0.7. Finally, the value of the average variance extracted from all the measurement models is well above the pre-requisite threshold of 50%.

Table 2
Convergent Validity Assessment

Constructs	Factor contribution (>0.7)	α	CR	AVE
Supply Chain information system infrastructure	0.919 0.955	0.964	0.972	0.875
Supply chain IT integration	0.894 0.959	0.961	0.970	0.866
Level of information quality	0.956 0.974	0.982	0.986	0.933
Supply chain integration	0.898 0.981	0.979	0.983	0.922
Risk management culture	0.929 0.966	0.979	0.983	0.907
Supply Chain Collaboration	0.905 0.957	0.967	0.974	0.883
Supply chain agility	0.891 0.970	0.986	0.988	0.914
Supply Chain Resilience	0.872 0.953	0.946	0.962	0.862
Supply Chain Performance	0.740 0.928	0.912	0.935	0.744

Table 3 shows the results of the discriminant validity test using the Fornell-Larcker criterion. Based on the results obtained, it appears that the root square of the AVE of the constructs is significantly higher than the correlations of this construct with the other constructs.

Table 3
Assessment of discriminant validity based on Fornell-Larcker criterion

Variables	1	2	3	4	5	6	7	8	9
Supply chain agility (1)	**0.956**								
Collaboration (2)	0.780	**0.940**							
Risk management culture (3)	0.788	0.768	**0.952**						
IS infrastructure (4)	0.791	0.674	0.700	**0.936**					
Supply chain integration (5)	0.834	0.738	0.778	0.817	**0.960**				
IT integration (6)	0.761	0.669	0.725	0.769	0.846	**0.931**			
Information quality (7)	0.785	0.721	0.706	0.767	0.830	0.702	**0.966**		
Supply Chain Performance (8)	0.794	0.787	0.969	0.706	0.780	0.737	0.693	**0.863**	
Supply chain Resilience (9)	0.734	0.841	0.753	0.666	0.697	0.680	0.598	0.788	**0.929**

Henseler et al (2015) indicate that HTMT values should be less than 0.90 to judge discriminant validity. According to Table 5, the measurement models in our model research pass this test since the highest HTMT value was 0.89. This confirms the constructs discriminant validity.

Table 4
Assessment of discriminant validity based on HTMT

Variables	1	2	3	4	5	6	7	8	9
Supply chain agility (1)									
Collaboration (2)	0.797								
Risk management culture (3)	0.802	0.787							
IS infrastructure (4)	0.811	0.697	0.718						
Supply chain integration (5)	0.849	0.757	0.794	0.841					
IT integration (6)	0.776	0.690	0.744	0.796	0.867				
Information quality (7)	0.797	0.739	0.720	0.785	0.846	0.719			
Supply Chain Performance (8)	0.835	0.837	**0.896**	0.750	0.824	0.782	0.732		
Supply chain Resilience (9)	0.760	0.879	0.781	0.696	0.724	0.714	0.618	0.847	

Structural model testing results

After validating the measurement models for the different latent variables, the second phase consists of verifying the internal model, with reference to several criteria. Table 6 shows that the coefficient of determination (R^2) values for the various endogenous latent variables in our study are greater than 0.67. This reflects a high level of determination for these variables.

The f^2 index is an indicator that measures the size effect of an exogenous latent variable on an endogenous latent variable. The results obtained show that the f^2 values of the exogenous latent variables on the endogenous latent variables (Table 6) are acceptable (Cohen, 1988).

Table 5
Coefficient of determination for endogenous latent variables

Endogenous latent variables	R Square	R Square Adjusted	Interpretation
Supply chain agility	0.771	0.767	Strong
Supply Chain Collaboration	0.640	0.636	Moderate
Supply chain integration	0.838	0.835	Strong
Supply Chain Performance	0.731	0.727	Strong
Supply Chain Resilience	0.723	0.720	Strong

Table 6
Size effect values of exogenous variables on endogenous variables

Exogenous variable		Endogenous variable	Value	Interpretation
Information System Infrastructure		SC integration	0.075	Weak
IT Integration			0.430	Strong
Level of information quality			0.334	Moderate
SC Integration		SC Collaboration	0.138	Weak
		SC agility	0.328	Moderate
Risk management culture		SC Collaboration	0.266	Moderate
		SC agility	0.067	Weak
SC Collaboration		SC agility	0.111	Weak
		SC Resilience	0.665	Strong
		SC Performance	0.038	Weak
SC Agility		SC Resilience	0.056	Weak
		SC Performance	0.213	Moderate
SC Resilience		SC Performance	0.108	Weak

The findings displayed in Table 7 provide confirmation that all Q^2 index values surpass zero, signifying the predictive significance of the constructs for the endogenous construct. In addition, the GoF index stands at 0.806, indicating a notably high level of model fit quality, well exceeding the recommended threshold of 0.36 set by Henseler, Ringle, and Sinkovics (2009).

Table 7
Predictive power of the model

Constructs	SSO	SSE	QI	Validity
Supply Chain Agility	1448.000	439.638	0.696	Acceptable
Supply Chain Collaboration	905.000	403.186	0.554	Acceptable
Risk management culture	1086.000	1086.000		
SC Information System infrastructure	905.000	905.000		
Supply Chain Integration	905.000	214.429	0.763	Acceptable
IT Integration	905.000	905.000		
Level of information quality	905.000	905.000		
Supply Chain Performance	905.000	426.216	0.529	Acceptable
Supply Chain Resilience	724.000	277.092	0.617	Acceptable

The results of testing the research model and the hypotheses using the SmartPLS software led to the acceptance of eleven (11) hypotheses and the rejection of two hypotheses. As shown in Table 8, our results display the non-significance of the relationship between IS infrastructure and SC integration (H1. β = 0.198; t= 1.940, p= 0.053). SC integration is influenced mainly by the two variables: IT integration in the supply chain (H2. β = 0.429, t = 3.946, p = 0.000) and the level of information quality (H3. β = 0.377, t = 4.331, p = 0.000). Thus, technology integration contributes more (β = 0.429) to the determination of SC integration, than the level of information quality (β = 0.377). These variables contribute up to 0.838 (R^2 = 83.8%) to the explanation of supply chain integration. In short, we can conclude by rejecting the first hypothesis (H1), and validating the second and third hypotheses (H2 and H3). The tests show a positive relationship between supply chain integration and collaboration between supply chain participants (H4. β = 0.355). The relationship between these two variables is significant (t = 3.398, p= 0.001). This fourth hypothesis is therefore accepted. The level of collaboration within the supply chain is determined at 0.640 (R^2

= 64%). The fifth hypothesis, which assumes a significant and positive effect of supply chain integration on SC agility, was confirmed (H5. β = 0.465, t = 4.378, p = 0.000). The results confirm the positive impact of risk management culture on supply chain collaboration (H6. β = 0.492, t = 5,209, p = 0.000) and supply chain agility (H7. β = 0.222, t = 2,730, p = 0.007*). The β coefficient of the effect of risk management culture on SC collaboration (H6. β = 0.492) is higher than its effect on SC agility (H7. β = 0.222). The level of supply chain agility is determined to be 0.771 (R^2 = 77.1%).

Table 8
Hypothesis testing results

Associations		β	T Statistics	P Values
H1 SCIS infrastructure	SC Integration	0.198	1.940	0.053 NS
H2 IT Integration	SC Integration	0.429	3.946	0.000***
H3 Level of information quality	SC Integration	0.377	4.331	0.000***
H4 SC Integration	SC Collaboration	0.355	3.398	0.001***
H5 SC Integration	SC Agility	0.465	4.378	0.000***
H6 Risk management culture	SC Collaboration	0.492	5.209	0.000***
H7 Risk management culture	SC Agility	0.222	2.730	0.007**
H8 SC Collaboration	SC Agility	0.266	2.272	0.024*
H9 SC Collaboration	SC Resilience	0.686	5.799	0.000***
H10SC Agility	SC Resilience	0.200	1.572	0.117NS
H11SC Collaboration	SC Performance	0.208	2.186	0.029*
H12SC Agility	SC Performance	0.393	4.225	0.000***
H13SC Resilience	SC Performance	0.325	3.495	0.001**

Data analysis based on structural equation modelling indicates that collaboration within the supply chain has a positive and significant effect on supply chain agility (H8. β = 0.266; t = 2.272; p = 0.024). Thus, this eighth hypothesis is confirmed. The level of SC resilience was determined to be 0.723 (R^2 = 72.3%). The results identify a positive and significant relationship between SC collaboration and SC resilience (H9. β = 0.686; t = 5.799; p = 0.000). The ninth hypothesis is therefore confirmed. The PLS analysis shows that there is no significant relationship between supply chain agility and supply chain resilience (H10. β = 0.200; t = 1.572; p = 0.117). As a result, this tenth hypothesis is rejected. Based on the results obtained, we can identify that collaboration between supply chain members, supply chain agility and resilience strongly contribute to the explanation of SC performance. Collaboration within the supply chain has a positive and significant effect on SCperformance (H11), with a beta coefficient of 0.208 and a significance level of 0.029. According to the PLS analysis, it is evident that SC agility has a direct and substantial impact on SC (H12. β = 0.393; t = 4.225; p = 0.000). As a result, this twelfth hypothesis is confirmed. Finally, resilience contributes positively and significantly to the explanation of automotive SC performance (H13. β = 0.325; t = 3.495; p = 0.001). SC collaboration, agility and resilience contribute to the explanation of SC performance with a level of determination of 73.1%.

Discussion

Contrary to previous work that has concluded that the supply chain IS infrastructure (H1) is an essential element to ensure supply chain integration (Sundram et al., 2018), our results highlight the lack of relationship between these two variables. The results allow us to identify the integration of IT (H2) and the level of information quality (H3) as two determinants of supply chain integration. These results are in strong agreement with previous research which suggests that IT integration can improve SC agility (Li et al., 2009). At this point, Cooper and Tracey (2005) have asserted that IT integration plays a crucial role in promoting efficient interaction and collaboration, thereby facilitating genuine business process integration among SC partners.

The association between the level of information quality and SC integration (H3) was confirmed. As a result, companies in the automotive industry can work together to improve the level of information quality in order to facilitate supply chain integration. As previous work indicates, information sharing is an essential element in relationship building and an organisation's willingness to share proprietary information is often seen as a good indication of its readiness to develop integrated decision making. Thus, improving the quality of information encourages companies to trust each other, which leads to better SC integration (Vivek et al. 2011).

Analysis of the data using PLS modelling allowed us to accept the hypothesis linking SC integration and collaboration within the supply chain (H4). These results are in accordance with previous research which generally supports that supply chain integration can lead to the establishment of inter-firm collaborations (Pagell, 2004).

The research results confirm the relationship between SC integration and supply chain agility (H5). These results are in accordance with previous works that indicate that both internal and external integration constitute a basis for establishing an agile SC (Shukor et al. 2020).

The results confirm the hypothesis that risk management culture has a direct and positive influence on inter-organisational collaboration (H6) and SC agility (H7). Several previous studies have confirmed the importance of risk management culture as a determinant of SC agility (Liu et al., 2018). As Sheffi and Rice (2005) suggest, the establishment of a risk management culture enables risk management procedures to be effectively incorporated throughout an organisation's operational structure, ensuring the normal functioning of the supply chain. Liu et al (2018) have empirically confirmed that risk management culture can help enhance business agility, enabling companies to easily respond quickly to market changes.

The research results affirm that collaboration between SC members has a positive impact on the level of SC agility (H8). The validation of this discriminating hypothesis is aligned with several previous research studies (Dubey et al., 2021). Lee (2004) supports the idea that collaboration is an essential element of SC agility. Furthermore, these results support hypothesis (H9) which suggests that collaboration positively and directly affects the level of SC resilience. Several empirical research studies have confirmed this relationship (Kang & Moon, 2016).

In a supply chain, it is necessary to align the activities, routines and processes of individual companies in a synchronised way to reap the benefits of collaboration. In particular, in the event of disruption, the resilience of a supply chain can only be achieved if all the companies involved in a supply chain collaborate and react synergistically (Jüttner & Maklan, 2011). This indicates that supply chain collaboration is a prerequisite for SC resilience. Mandal et al (2016) confirmed the direct influence of collaboration between SC members and SC resilience. Contrary to previous works that confirm the positive influence of agility on supply chain resilience (Fayezi et al. 2015), the results of our research invalidate the relationship between these two variables (H10).

Our results confirm the positive and direct impact of collaboration on SC performance (H11). As emphasised by management studies, inter-organisational collaboration is an important factor in performance (Boubker et al. 2023; Mofokeng & Chinomona, 2019). These results also confirm the relationship between SC agility and SC performance (H12). The confirmation of this hypothesis aligns with the findings of previous research (Naoui et al. 2023; Blome et al. 2013). Likewise, the last hypothesis, which assumes the influence of resilience on SC performance (H13), was accepted. These results are in line with previous studies that support that developing tangible and intangible resilience capacities will lead to better SC performance (Wieland et al. 2013).

Conclusion

The objective of this study was to investigate the impact of inter-organizational information systems on enhancing supply chain performance. The findings have enabled the formulation of a user-friendly model, providing automotive supply chain managers with a practical tool to devise and execute action plans. These plans are founded on the validated measures developed, aiming to facilitate the enhancement of the automotive supply chain's overall performance. Consequently, this study provides numerous contributions, encompassing both theoretical and practical dimensions.

Implications of the study

The primary theoretical contribution lies in the formulation and validation of a research model designed to scrutinize the nexus between IT integration within the supply chain, information quality levels, risk management culture, inter-organizational collaboration, agility, resilience, and the performance. The findings suggest that incorporating IT into the supply chain and maintaining high information quality within it can enhance inter-organizational integration. Notably, supply chain integration and cultivating a risk management culture emerge as pivotal factors for successful collaboration within the automotive SC in Morocco, aligning with previous research (Kang & Moon, 2016; Mofokeng & Chinomona, 2019). Moreover, our research underlines the importance of collaboration as a prerequisite for bolstering the agility and resilience of the automotive supply chain. Consequently, this study significantly contributes to elucidating the interplay among these three variables. Another theoretical advancement is the clarification of the link between collaboration, agility, resilience, and supply chain performance. The study underscores that the performance of the automotive SC hinges on inter-organizational collaboration, SC agility, and resilience.

In practical terms, the research outcomes offer substantial insights for automotive supply chain managers in Morocco. They can leverage the relationships outlined in the proposed model to enhance the performance of the automotive supply chain. Rather than being susceptible to potential disruptions arising from an unstable environment, SC leaders and managers are encouraged to implement practices that identify and address operational and strategic risks, thereby fostering a risk management culture.

Limitations and perspectives

Regarding the limitations of our study, it can be noted that our research model's development relied solely on prior research, constituting a theoretical constraint. To address this, forthcoming investigations will employ a hybrid exploratory qualitative approach to situate the research model in context and devise scales tailored to measure various constructs within the study's framework. Furthermore, adopting action research would be advantageous for thoroughly examining the connections among the research variables.

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