UNDERSTANDING THE ROLE OF AGILITY AND RESPONSIVENESS CAPABILITIES IN ACHIEVING SUPPLY CHAIN PERFORMANCE: THE CASE OF MANUFACTURING COMPANIES

Aziz BARHMI

Department of Management, Sidi Mohamed Ben Abdellah University, Fez, Morocco

ABSTRACT

The supply chain agility concept has been identified as one of the most important issues in the supply chain management literature. However, despite the popularity of the concept, many concept attributes are largely unexplored. The mediating role of the operational capabilities, in particular the supply chain responsiveness, in the link between the supply chain agility and the improvement of the supply chain performance, is a field that is lacking in research. This research aims to deepen the theory by addressing this gap in the supply chain agility literature.

The data for this study were collected through a field survey from a final sample of 131 respondents from manufacturing companies in Morocco. An online questionnaire containing items measuring constructs of interest was developed. The theoretical model was evaluated using structural equation modeling.

The results indicate that supply chain agility has an indirect and positive impact on supply chain performance in the presence of supply chain responsiveness. In addition, the results provide empirical evidence for a full mediation of supply chain responsiveness in the link between supply chain agility and supply chain performance in an uncertain environment.

This study demonstrates why careful consideration should be made when deciding what dynamic capabilities should be developed and, therefore, what operational capabilities will be generated or renewed. Companies that successfully build this relationship benefit in terms of improving the performance of both the global supply chain and its members, enabling them to achieve sustainable competitive advantages.

KEYWORDS

Supply chain agility, Supply chain responsiveness, Supply chain performance, Dynamic capabilities perspective.

1. INTRODUCTION

Agility is considered one of the fundamental characteristics necessary for a supply chain to survive and thrive in a turbulent and unstable market environment (Agarwal et al., 2007; Braunscheidel and Suresh, 2009). In addition, agility has emerged as the dominant competitive vehicle for organizations operating in uncertain and constantly changing business environments. As a result, agility has been referred to as the business model of the 21st century (Tseng and Lin, 2011).

DOI:10.5121/ijmvsc.2022.13301

This agility is becoming increasingly critical due to shorter product life cycles, increased demand for customized products and services, reduced demand visibility, and constant change. Thus, organizations have recognized that agility is critical to their survival and competitiveness more than ever (Lin et al., 2006). Also, agility has been found to be an organizational catalyst for quick and effective response that enables the company to establish a competitive advantage (Swafford et al., 2006). In addition, the agility of a company's supply chain has been identified as a critical factor in its overall competitiveness (Lee, 2004).

It has been shown that firms in agile supply chains can better respond to unexpected changes because they are better able to synchronize supply with demand (Swafford et al., 2008). Synchronizing supply and demand requires the integration of the firm's internal functions as well as those of its suppliers and customers (Narasimhan, 1997). Indeed, members of a supply chain must quickly align their collective capabilities to respond to changes in supply and demand (Gligor and Holcomb, 2012a). Agility has been shown to allow firms to respond quickly to market volatility as well as other uncertainties, enabling them to achieve a competitive position (Swafford et al. 2006; Li et al. 2009).

Nevertheless, alignment between supply chain members is a necessary and insufficient criterion for success. A supply chain must be able to react to changes in a fast and flexible way. The ability to respond quickly to changing customer needs is emphasized at two levels: the enterprise and the supply chain.

Furthermore, agility has been identified as one of the most important issues in contemporary supply chain management (Gligor and Holcomb, 2012a). Although the benefits of agility have been documented in various fields (Christopher, 2000; Zhang, 2011), little empirical research has addressed the impact of supply chain agility on firm performance (Swafford et al., 2006, 2008; Gligor and Holcomb, 2012b).

In addition, to effectively respond to today's market dynamics, organizations must be operationally flexible in multiple ways. Based on previous research, four types of flexibility associated with supply chain responsiveness have been identified, specifically new product flexibility, volume flexibility, variety flexibility, and modification flexibility. These different types of flexibility allow organizations and their supply chains to align supply with demand requirements appropriately (Holweg, 2005; Reichhart and Holweg, 2007; Malhotra and Mackelprang, 2012).

However, consistent with the principles of the dynamic capabilities perspective, operational capabilities allow an organization to ensure its survival, while dynamic capabilities change the way an organization achieves its survival (Helfat and Hiver, 2011). Dynamic capabilities enable the organization to change the resource base and generate or renew operational capabilities (Teece, 2007; Helfat and Winter, 2011).

However, the contribution of supply chain agility, as a collective dynamic capability, to improving supply chain performance is still unexplored. Such ambiguity means that there is currently a need to understand the mechanisms by which supply chain agility influences supply chain performance.

Given the above, it seems appropriate to study, from a supply chain perspective, the effect of agility on performance improvement through the mediation of responsiveness. To this end, one of the current questions in contemporary supply chain management is: How does supply chain agility influence supply chain performance through the generation or renewal of supply chain responsiveness? This article aims to clarify this question.

In support of the dynamic capabilities perspective, this paper proposes that supply chain agility leads to a positive change in supply chain performance. This impact is mediated by supply chain responsiveness.

2. LITERATURE REVIEW

2.1. Supply Chain Agility

Very few studies have provided formal definitions of supply chain agility (Swafford et al., 2006; Ismail and Sharifi, 2006; Li et al., 2009). However, many authors have focused on identifying the characteristics that a supply chain must have to be effectively agile.

Sharp et al (1999) conceptualized supply chain agility as its ability to respond quickly to market changes and customer demand. Ismail and Sharifi (2006) described it as the ability of the supply chain and its members to quickly align the network and its operations with dynamic and turbulent customer needs.

Following a comprehensive review of the literature, Gligor and Holcomb (2012a) found that the concept of agility and its definition is evolving. Despite the evolution of the concept, inconsistencies in multiple definitions of agility have been highlighted by existing supply chain research. In this regard, Gligor and Holcomb (2012a) argued that little research provides a formal definition of supply chain agility (Li et al, 2009). That being said, Swafford et al. (2006) defined the concept as the ability to adapt or react quickly to a changing market environment, while Costantino et al. (2012) defined it as a network of different integrated companies with streamlined physical, informational, and financial flows focused on flexibility and performance.
Given the specifics of our research, we reiterated Sangari and Razmi's (2015) definition that agility is: "The ability of the supply chain to cope with turbulence and unanticipated changes in the competitive marketplace and business environment and to provide strategic advantage by converting uncertainties and threats into opportunities and assembling the necessary assets, knowledge, and relationships with speed and surprise."

Furthermore, the concept of supply chain agility was initially considered by Swafford et al. (2006) as a unidimensional concept, while recognizing its multidimensional nature. Subsequently, Li et al. (2009) identified dimensions related to change alertness and responsiveness. Also, Braunscheidel and Suresh (2009) treated supply chain agility as a second-order concept whose first-order dimensions are: demand response, joint planning, customer responsiveness, and visibility. Recently, Gligor et al. (2013) identified five dimensions of supply chain agility, namely alertness, accessibility, decisiveness, swiftness, and flexibility. This research recognized the multi-dimensionality of the concept, while adopting the five dimensions identified by Gligor et al. (2013).

2.2. Supply Chain Responsiveness

The operations management literature has increasingly referred to the term responsiveness (Holweg, 2005; Donk and Vaart, 2008). Responsiveness has been defined as the ability of a manufacturing system to make rapid and balanced adjustments to the predictable and unpredictable changes characterizing today's manufacturing environment (Gindy et al., 1999).

Subsequently, Reichhart and Holweg (2007) defined responsiveness as the speed by which a system can adjust its output within the available range of four types of flexibility (product, mix, volume, and delivery) in response to an external stimulus (Shoaib-ul-Hasan, 2018). Most explicit and available definitions in the responsiveness literature contain the notion of stimuli. This component is explicit in Reichhart and Holweg's (2007) definition and implicit in terms, such as customer need or desire (Tunc and Gupta, 1993), demand (Holweg, 2005), order (Upton, 1995a) and market signal (Catalan and Kotzab, 2003).

In fact, it appears that researchers are inconsistent in the types of flexibility they associate with responsiveness of Supply Chains. For example, Reichhart and Holweg (2007) defined "product flexibility" as the ability to introduce new products and make changes to existing products, while Koste and Malhotra (1999) and the majority of other operations management researchers distinguished between "new product flexibility" and "product modification flexibility." In addition, researchers such as Reichhart and Holweg (2007) and Stevenson and Spring (2007) have addressed "delivery flexibility," while other researchers ignore this dimension.

For the sake of consistency and parsimony, we define supply chain responsiveness in terms of four types of external flexibility listed in Table 1. These four types of flexibility reflect the overall responsiveness of a supply chain to changes in demand and supply.

Table 1. External Flexibilities of Supply Chain Responsiveness

Type of Flexibility	Description
New Product	*It describes how a supply chain can introduce new products quickly and efficiently. Supporting supply chain partners who design, test, produce and position product inventory in response to potential market demands.*
Volume	*It describes how total production can be increased or decreased quickly and efficiently in response to economic and market changes.*
Variety	*It describes how a supply chain can quickly and efficiently manage manufacturing and delivery transitions across heterogeneous products. This reflects the breadth of products that the supply chain can manage with its existing resources.*
Product Modification	*It describes how quickly and efficiently a supply chain can modify the characteristics of products and services to the needs of specific customers. This includes changes made directly to the product and/or the service that delivers the product.*
Source: External flexibilities adapted from Williams et al. (2013)	

2.3. Supply Chain Performance

Organizational success depends primarily on the performance of supply chains in which the organization functions as a partner (Rosenzweig et al. 2003). Supply chain performance depends on the ability of supply chain partners to adapt to a dynamic environment (Whitten et al. 2012).
For the purposes of this study, we adopt a broad view of the supply chain, from the supplier of the supplier to the final customer, and adapt the measure of supply chain performance recently adopted by Gligor and Holcomb (2012) to better assess the ability of partners to satisfy the final customer in terms of meeting orders and delivery deadlines (Operational Performance) as well as the ability of these partners to build formal relationships with each other (Relational Performance).

3. THEORETICAL FRAMEWORK AND HYPOTHESES DEVELOPMENT

3.1. Theoretical Framework

According to the dynamic capabilities perspective, competitive advantage is based on the creative destruction of existing resources and the generation of new operational capabilities. Competitive advantage in turbulent environments depends more on dynamic capabilities than on competitive positioning or sectoral conflicts (Teece, 1990). Since managers must regularly make decisions about how to renew existing operational capabilities to better match the changing environment, dynamic capabilities represent a significant challenge for them in their quest for sustainable competitive advantage (Grewal and Slotegraaf, 2007).

On the other hand, ordinary capabilities or operational capabilities determine how a firm preserves its survival at the moment, while dynamic capabilities allow the firm to change (Zollo and Winter, 2002). Ordinary capabilities allow for operational efficiency, while dynamic capabilities allow for the detection and seizing of new opportunities in the environment (Teece, 2007).

Furthermore, dynamic capabilities cannot explain performance, but rather changes in performance (Laaksonen and Peltoniemi, 2018). Indeed, several researchers have suggested that dynamic capabilities should be observed through the changes they cause in the resource base or operational capabilities of a firm (Laaksonen and Peltoniemi, 2018). Indeed, these changes do not necessarily lead to higher performance, especially since performance depends on both the quality of the operational capabilities generated or renewed (Zahra et al, 2006) and the scalability of the dynamic capabilities (Helfat et al, 2011).

In this research, the dynamic capabilities perspective was used to explain the impact of supply chain agility on improving supply chain performance through the generation or renewal of supply chain responsiveness. Based on this theory, this research proposes that the development of dynamic agility capability leads to the generation or renewal of operational responsiveness capability and, as a result, the achievement of sustainable competitive advantage and improved performance of the firm and its supply chain as a whole. The model suggested in this study is illustrated in Figure 1.

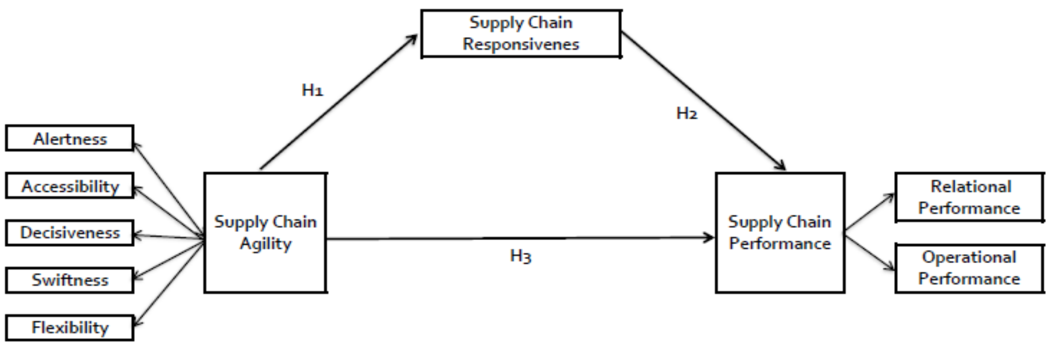

Figure 1. Research model

3.2. Hypotheses Development

3.2.1. Effect of SC Agility on SC Responsiveness

The literature review indicates that developing supply chain agility requires a combination of the capabilities to quickly detect changes in the environment, access relevant information on how to deal with changes, make decisive decisions on how to respond to changes, implement decisions made quickly, and modify the range of tactics and operations to the extent necessary (Gligor et al, 2013).

Due to the fact that alertness, accessibility, and determination are cognitive capabilities enabling information processing and timely decision making, while swiftness and flexibility form the physical capabilities reflecting action and its implementation, the dynamic capability of supply chain agility can improve supply chain responsiveness by effectively responding to uncertain market changes. Some previous studies have found a positive effect of supply chain agility on supply chain responsiveness (Qrunfleh and Tarafdar, 2013; Tarafdar and Qrunfleh, 2017). Therefore, we hypothesize the following:

H1. SCA positively affects SCR.

3.2.2. Effect of SC Agility on SC Performance

The study conducted by Gligor and Holcomb (2012a) conceptualized supply chain agility as a dynamic capability that generates competitive advantage and superior performance of supply chain partners due to inter-firm relationships or knowledge-sharing routines between them. Indeed, these authors postulated that a high level of supply chain agility results in higher levels of operational and relational performance of the partners.

Similarly, Blome et al. (2013) considered supply chain agility as a dynamic capability that enables effective adaptation of the resource base to market changes. This capability enables supply chain partners to seize opportunities or neutralize threats arising from a turbulent environment (Van Hoek et al. 2001) and, consequently, maintain a competitive position (Teece 1997; Eisenhardt and Martin 2000). The importance of this capability has been emphasized because these supply chain disruptions represent a significant cost factor for firms (Hendricks and Singhal 2005).

Because previous studies have shown a positive effect of supply chain agility on the performance of supply chain partners and the principle of performance improvement supported by the dynamic capabilities perspective, this research announces the following hypothesis:

H2. SCA indirectly and positively affects SCR.

3.2.3. Mediating Effect of SC Responsiveness on the SCA–SCP Relationship

Supply chain agility is one of the key requirements in turbulent and volatile markets in that it enables the focal firm's supply chain to respond to dynamic needs via customer-oriented production (Blome et al., 2013; Gligor et al., 2015). Therefore, supply chain agility enables a firm's supply chain to respond to customer needs via customer-based manufacturing, rapid response to short product life cycles and turbulent demand, rapid introduction of new products in response to dynamic customer needs (Ayoub and Abdallah, 2019), and efficient response to dynamic delivery requirements in terms of time and quantity (Chiang et al., 2012), thereby gaining a competitive advantage in turbulent and volatile markets and superior performance in these markets.

Given that the study conducted by Qrunfleh and Tarafdar (2013) showed that supply chain responsiveness positively mediated the relationship between supply chain agility and firm performance and those conducted by DeGroote and Marx (2013) and Patel et al. (2017) found that agility and responsiveness play crucial roles in improving firm performance, this research formulates the following hypothesis:

H3. SCR positively mediates the relationship SCA-SCP.

4. METHODOLOGY

4.1. Data Collection and Sample

For this research, an online survey administered via email was considered the most appropriate method for this study, given the costs and the target sample pool available for this research. In addition, by using the online survey tool on Google Drive, the data collected from the respondents could be exported, after tabulation, to SPSS Statistics and SPSS Amos.

Furthermore, the target population was considered by this research as a set of elements that share a specific set of personal, industrial, and geographic characteristics (Zikmund, 2003). This population was considered relevant to provide the information required to meet the research objectives (Lukas et al., 2004). To this end, the population for this research was targeted based on a number of personal and industrial characteristics. Indeed, respondents were targeted, on the one hand, on the basis of their current positions and functional areas within their companies and, on the other hand, on the basis of their respective companies' membership in global supply chains (import, export or both) and in industries marked by considerable value added and high or medium environmental uncertainty intensity.

The email invitation to participate in the online survey was sent to a total number of 500 people (invited sample), working for companies that had significant international trade operations in terms of value in the fiscal year 2020, after processing the data extracted from the information system of the Customs and Excise Administration. During the period from April 01, 2021 to May 31, 2021, a total of 08 daily batches were released. In addition, after one week of the initial invitation, reminders were sent. Respondents were invited to respond to the survey sent via email. Of these potential survey candidates, a total number of 135 participants completed the survey, resulting in a response rate of 27%. In addition, respondents were promised a personalized report on the results of the study. This incentive was adopted to affect the intention to participate in this study to increase the response rate.

In order to ensure effective sampling of the target group and to guarantee quality standards, in a first screening stage 11 respondents were eliminated from the target sample on the basis of a set of predefined personal criteria (current position and functional area), resulting in a first target sample of 144 qualified respondents who were therefore allowed to participate in the survey. However, a second pre-selection stage was conducted using other industrial criteria. This second screening stage resulted in a 2nd target sample of 135 respondents who were finally allowed to participate in this study, with an additional 09 respondents screened out based on industry criteria pre-defined by this research.

Following the sampling procedure, 131 key informants contributed to this survey, providing a data set on which the conceptual model was empirically tested. A detailed description of the final sample structure is detailed in Table 2.

Table 2. Profiles of Respondents

Category	Frequency	Percentage (100%)
Job Position		
CEO/Managing Director/General Manager	*8*	*6.1*
C-Level Executive (CFO, CIO, COO)	*4*	*3.1*
Senior Manager	*41*	*31.3*
Middle Manager	*59*	*45*
Other (Exclusively Senior or Middle Managers)	*19*	*14.5*
Functional Area		
General Management	*12*	*9.2*
Supply Chain Management	*60*	*45.8*
Purchasing Management	*12*	*9.2*
Commercial Management	*5*	*3.8*
Quality Management	*17*	*13*
Type of Membership in Global Supply Chains		
Export	*22*	*16.8*
Export and Import	*98*	*74.8*
Import	*11*	*8.4*
Industry of Membership		
Automotive Industry	*44*	*33.6*
Aeronautics and Aerospace Industry	*19*	*14.5*
Pharmaceutical Industry	*1*	*0.8*
Electronic and Electrical Components Industry	*2*	*1.5*
Paper and Cardboard Industry	*5*	*3.8*
Rubber and Plastic Products Industry	*1*	*0.8*
Food Industry	*21*	*16*
Other (Value Added and Uncertainty)	*27*	*20.6*

4.2. Construct Measures and Questionnaire

Operationalizing the constructs used in this research required the identification or development of appropriate measurement tools. This included decisions about: (1) whether existing scales can be used for this study, (2) whether an adaptation of these scales is necessary to fit the research context, or (3) whether measurement instruments need to be newly developed, following standard development procedures (Page and Meyer, 2000). Whenever appropriate, measurement items were adapted from existing scales validated in the available literature. All scales used were adapted to the level of analysis of this research (firm level). Once the survey measurement items were determined, the procedure proposed by Dillman (2007) for the survey design was used. All variables of interest were estimated through respondents' perceptual evaluations on a 7-point Likert scale: response categories for each item were anchored by 1 (strongly disagree) and 7 (strongly agree).

Based on these theoretical considerations and consistency with previous research (Li et al., 2009), supply chain agility was operationalized as a second-order reflexive construct with five first-order factors, including alertness, accessibility, determination, speed, and flexibility. Based on a literature review, a set of 26 items was generated to reflect each dimension of supply chain agility. To avoid proliferation of scales, where appropriate, existing scales were consulted (Bruner 2003). Alertness was operationalized by three reflective items, which were adopted from the scale by Gligor et al., (2013) and adapted from the original scale by Li et al., (2009). Accessibility was operationalized by two reflective items, which were adopted from the original scale developed by Gligor et al., (2013). Determination was operationalized by three reflective items, which were adopted from the original scale developed by Gligor et al., (2013). Speed was operationalized by three reflective items, which were adopted from the original scale developed by Gligor et al., (2013). Flexibility was operationalized by three reflective items, of which one item was adopted from the original scale developed by Gligor et al., (2013) and two items were adopted from the Gligor et al. scale, (2013) and adapted from the original Tachizawa and Gimenez scale (2010).

So that the items describe the essential content of the supply chain agility construct, this research adopted the original scale developed by Li et al. (2002). Knowing that this study developed and validated the measurement scale for this construct, using data from the manufacturing sector in the United States, which is similar to the context of our study.

Supply chain performance was operationalized as a second-order reflexive construct with two first-order factors, namely relational performance and operational performance. Based on a literature review, a set of seven items was generated to reflect the two dimensions of PSCE. To avoid proliferation of scales, where appropriate, existing scales were consulted (Bruner 2003). Relational performance was operationalized by four reflective items, which were adopted from Gligor and Holcomb's (2012) scale and adapted from the original scale by Stank, Goldsby, Vickery, and Savitskie (2003). Operational performance was operationalized by three reflective items, which were adopted from the Gligor and Holcomb (2012) scale and adapted from the original Stank, Goldsby, Vickery, and Savitskie (2003) scale.

5. MODEL AND HYPOTHESIS TESTS

5.1. Measurement Validity and Reliability

5.1.1. Exploratory Factor Analysis

Concept validity testing began by conducting an exploratory factor analysis (EFA). Indeed, the resulting factor structure of the EFA showed high loadings on each variable in Table 3. The factor structure refers to the inter correlations of the variables tested in the EFA with their respective factors (Gaskin, 2012b). Using an iterative process of removing items with low weights on the respective factor or weights between different factors, item 12 was subjected to elimination. Thus, the objective is to obtain a factorial structure that can be used for other analyses. The result of the EFA is a factorial matrix containing 06 factors. According to the results obtained, an ideal factor structure could be derived in that convergent and discriminant validities are evident, as all remaining variables have high factor weights on each respective factor as well as the absence of cross-weights (Gaskin, 2012b). Although only one item had to be removed in the purification process (item 12), the results show that all remaining variables are ideally loaded on the respective factors, which mainly confirms the theoretical considerations. Nevertheless, the results of the EFA showed that the items related to the three dimensions of supply chain agility, namely alertness, determination and swiftness, are statistically loaded on only one factor which can be renamed in our research by "Strategic Intelligence". Cronbach's alpha (α) has been widely recognized as a measure of internal consistency of scales (Kline, 2005), values above 0.7 are generally considered adequate. The results of the reliability test showed Cronbach's alpha (α) values above 0.7 for all latent variable measurement scales. To this end, all items were retained at this stage of the EFA.

Table 3. Factor Structure Matrix (λ) - EFA

Factors and Observable Variables	***F1***	***F2***	***F3***	***F4***	***F5***	***F6***
Factor 1: Strategic Intelligence – Supply Chain Agility						
V01003_Decisiveness_Decision_Changes	*0.938*					
V1103_Swiftness_Response_Opportunities	*0.925*					
V1101_Swiftness_Response_Threats	*0.906*					
V01002_Decisiveness_Decision_Threats	*0.891*					
V1102_Swiftness_Response_Changes	*0.887*					
V01001_Decisiveness_Decision_Opportunities	*0.803*					
V0803_Alertness_Changes	*0.754*					
V0802_Alertness_Threats	*0.731*					
V0801_Alertness_Opportunities	*0.723*					
Factor 2: Accessibility – Supply Chain Agility						
V0901_Accessibility_Information_Suppliers		*0.847*				
V0902_Accessibility_Information_Customers		*0.846*				
Factor 3: Flexibility – Supply Chain Agility						
V1202_Flexibility_Augmentation_Capacity_Production			*0.873*			
V1203_Flexibility_Orders_Specifications			*0.819*			
V1201_Flexibility_Operations_Supply_Chains			*EFA*			
Factor 4: Supply Chain Responsiveness						
V1302_Reactivity_Particular_Specifications				*0.855*		
V1301_Reactivity_Non-Standard-Orders				*0.82*		
V1304_Reactivity_Adjustment_Production_Capacity				*0.808*		
V1305_Reactivity_Improvement_Products				*0.769*		
V1303_Reactivity_Characteristics_Products				*0.617*		
Factor 5: Relational Performance – Supply Chain Performance						
V1402_Per_Rel_Exchange_Recommendations_Partners					*0.962*	
V1403_Per_Rel_ Support_ Execution_Tasks_Partners					*0.906*	
V1404_Per_Rel_Knowledge_Needs_Partners					*0.888*	
V1401_Per_Rel_Relationship_Formal_Partners					*0.71*	
V1402_Per_Rel_Exchange_Recommendations_Partners					*0.962*	
Factor 6: Operational Performance – Supply Chain Performance						

V1503_Per_Ope_Respect_Delais_Convected	*0.89*
V1502_Per_Ope_Compliant_Orders	*0.885*
V1501_Per_Ope_Intact_Orders	*0.819*

5.1.2. Confirmatory Factor Analysis

Next, confirmatory factor analysis (CFA) was run as a second step to evaluate construct validity using Amos, Version 22. The first-order measurement models were tested, while taking into account the goodness-of-fit and parsimony indices applied for evaluating the fit of these measurement models. Since the acceptable goodness-of-fit thresholds were reached by all first-order measurement models, a good fit of the said measurement models is confirmed. In addition, all the items show sufficiently high loadings and respect the recommended threshold of 0.5 (Steenkamp and van Trijp, 1991), with the exception of two items that were eliminated from their respective measurement models. Indeed, the resulting factor structure of the CFA showed high loadings on each variable in Table 4.

Table 4. Factor Structure Matrix (λ) - CFA

Factors and Observable Variables	***F1***	***F2***	***F3***	***F4***	***F5***	***F6***
Factor 1: Strategic Intelligence – Supply Chain Agility						
V01003_Decisiveness_Decision_Changes	*0.95*					
V1103_Swiftness_Response_Opportunities	*0.93*					
V1101_Swiftness_Response_Threats	*0.89*					
V01002_Decisiveness_Decision_Threats	*0.89*					
V1102_Swiftness_Response_Changes	*0.82*					
V01001_Decisiveness_Decision_Opportunities	*0.84*					
V0803_Alertness_Changes	*0.69*					
V0802_Alertness_Threats	*0.69*					
V0801_Alertness_Opportunities	*0.67*					
Factor 2: Accessibility – Supply Chain Agility						
V0901_Accessibility_Information_Suppliers		*0.77*				
V0902_Accessibility_Information_Customers		*0.76*				
Factor 3: Flexibility – Supply Chain Agility						
V1202_Flexibility_Augmentation_Capacity_Production			*0.71*			
V1203_Flexibility_Orders_Specifications			*0.78*			
V1201_Flexibility_Operations_Supply_Chains			*EFA*			
Factor 4: Supply Chain Responsiveness						
V1302_Reactivity_Particular_Specifications				*0.84*		
V1301_Reactivity_Non-Standard-Orders				*0.77*		
V1304_Reactivity_Adjustment_Production_Capacity				*0.70*		
V1305_Reactivity_Improvement_Products				*0.64*		

V1303_Reactivity_Characteristics_Products	*CFA*		
Factor 5: Relational Performance – Supply Chain Performance			
V1402_Per_Rel_Exchange_Recommendations_Partners		*0.84*	
V1403_Per_Rel_ Support_ Execution_Tasks_Partners		*0.90*	
V1404_Per_Rel_Knowledge_Needs_Partners		*0.86*	
V1401_Per_Rel_Relationship_Formal_Partners		*CFA*	
V1402_Per_Rel_Exchange_Recommendations_Partners		*0.84*	
Factor 6: Operational Performance – Supply Chain Performance			
V1503_Per_Ope_Respect_Delais_Convected			*0.74*
V1502_Per_Ope_Compliant_Orders			*0.89*
V1501_Per_Ope_Intact_Orders			*0.75*

Moreover, all the values of the "Normed Chi-square" index (χ2/df) are well below the critical value of 3 (Bollen, 1989). Consideration of parsimony with other goodness-of-fit indices was useful in evaluating 1st-order measurement models. In short, the overall goodness of fit, measured using a variety of absolute, incremental, and parsimonious fit indices, qualified all individual first-order measurement models to tests of second-order measurement models after respecification. A second-order confirmatory factor analysis was applied, combining the three dimensions of the supply chain agility construct and the two dimensions of the supply chain performance construct. The second order CFA performed for the supply chain agility construct allowed to attest a rather satisfactory goodness of fit. Also, the correlation coefficients between the sub-dimensions and the second order construct are also high and statistically significant. Furthermore, Table 5 shows that the relationships between the second-order construct and its dimensions are all significant with high correlation coefficients. Similarly, the second-order CFA performed for the supply chain performance construct showed a fairly good quality of fit. Also, the correlation coefficients between the sub-dimensions and the second order construct are also high and statistically significant. Furthermore, Table 5 shows that the relationships between the second-order construct and its dimensions are all significant with high correlation coefficients. Like the EFA, the CFA aims to evaluate the validity and reliability of measurement scales. To this end, confirmation of the convergent and discriminant validity as well as the reliability of said measurement scales are prerequisites for the test of the causal model (Gaskin, 2012c).

Table 5. Results of the Second Order Measurement Model Specification – CFA

First Order Factors		***Second Order***	***Correlation Coefficients***	***C.R***	***P***
		Supply Chain Agility			
Strategic Intelligence	<--	*SCA*	0.79	-----	-----
Flexibility	<--	*SCA*	0,58	3,422	***
Accessibility	<--	*SCA*	0,74	3,1	0,002
		Supply Chain Performance			
Relational Performance	<--	*SCP*	0.79	-----	-----
Operational Perf	<--	*SCP*	0,58	3,422	***

From the results contained in Table 6, it appears that convergent validity is confirmed for all measurement scales. Indeed, the convergent validity confirms that the theoretically anticipated correlations between the individual measurement items and their corresponding constructs are present. In accordance with the criterion of Fornell and Larcker, 1981, discriminant validity is given when the AVE values are greater than the values of the highest squared inter-construct correlations (λ2) of the measurement model (Hair et al., 2010). As such, the results presented in Table 6 proved the discriminant validity of all measurement scales. Reliability considers the internal consistency of the measurement and is closely related to the absence of random errors in the measurement (Zikmund, 2003). The verification of reliability at the CFA level is provided by calculating the "Jöreskog's Rhô" coefficient (ρ). As such, the results presented in Table 6 confirmed the reliability of all measurement scales.

Table 6. Validity and Reliability of Measurement Scales – CFA

Measurement Scales (MS)	***Reliability - Cronbach's Alpha (EFA)***	***Reliability - Jöreskog's Rhô (CFA)***	***Convergent Validity - AVE (CFA)***	***Discriminant Validity - AVE Greater than λ² (CFA)***	***Λ² (Higher)***
MS 1: Strategic Intelligence (VS)	*0.952*	*0.95*	*0.68*	>	*0.30*
MS 2: Accessibility (AC)	*0.739*	*0.74*	*0.59*	>	*0.29*
MS 3: Flexibility (FL)	*0.712*	*0.71*	*0.56*	>	*0.37*
MS 4: SCR	*0.815*	*0.83*	*0.50*	>	*0.37*
MS 5: Relational Performance (RP)	*0.894*	*0.90*	*0.75*	>	*0.09*
MS 6: Operational Performance (OP)	*0.836*	*0.84*	*0.63*	>	*0.23*

6. STRUCTURAL MODEL

The conceptual model and the proposed interrelationships between the endogenous and exogenous constructs, as developed from the literature review, were tested by SPSS Amos.

However, before testing the hypotheses, an evaluation of the overall fit of the model was conducted. This evaluation of the model was conducted on the basis of a variety of goodness-of-fit indices. The indices along with their acceptable thresholds were presented in Table 7, which were previously used for the evaluation of first and second order measurement models (Kurzhals, 2021).

Given that the causal relationships of the conceptual model are based on an extensive literature review, a good fit of the overall model as well as a high level of parsimony was achieved, especially for the χ^2/df (= 1, 52), TLI (= 0.95), CFI (= 0.95), and RMSEA (=0.06), while GFI (= 0.90), AGFI (= 0.80), and NFI (= 0.90) achieved acceptable levels of structural model fit. Because of a satisfactory fit of the overall model, the model could be used to test hypotheses in subsequent analyses.

Table 7. Fitting Indices of the Structural Path Model

	Absolute Indices (df for Information)								*Incremental Indices*			*Parsimonious Indices*	
	X²	*df*	*p*	*GFI*	*AGFI*	*RMR*	*SRMR*	*RMSEA*	*NFI*	*TLI*	*CFI*	*X² /df*	*AIC*
Thresholds of acceptability	*p > 0,05*			*> 0.90*	*> 0.90*	*< 0.08*	*< 0.09*	*< 0.08*	*> 0.95*	*> 0.95*	*> 0.95*	*1.0 < χ2 /df > 3.0*	*N.D*
Initial model	*325.72*	*215*	*0.000*	*0.90*	*0.80*	*0.10*	*0.07*	*0.06*	*0.90*	*0.95*	*0.95*	*1.52*	*447.78*

6.1. Hypothesis Tests

Because the fit indices revealed a good fit of the model, hypotheses could finally be tested. The proposed causality and covariance relationships between the endogenous and exogenous constructs were estimated by SPSS Amos. Indeed, the results for standardized effects and hypothesis support are provided in Table 8.

Table 8 incorporates the normalized direct effect also known as the path coefficient or beta coefficient (β) as well as the normalized indirect effect. In addition, the aggregation of the two effects yields the standardized total effect, which includes the full influence of one variable on another variable, across all conceivable relationships with additional constructs (mediating variables). Consideration of standardized total effects is considered valuable, as it allows for a better understanding of causal relationships in holistic and complex models (Jahn, 2007). In addition, the critical ratio (CR) and significance level (p) of the direct effect are presented in Table 8. In the case where there is no theorized direct relationship between two constructs (H3), only the indirect effect is reported and will be further examined in the mediation analysis.

From the results in Table 8, it appears that the structural path analysis supported all of the hypotheses. Therefore, all of the proposed causal relationships between the constructs: SCA, SCR and SCP were confirmed.

Table 8. Standardized Effects, Critical Ratios and Hypothesis Testing

Hypotheses	***Independent Variable (Exogenous)***	***Dependent Variable (Endogenous)***	***Standardized Effect***			***CR***	***P***	***Support***
			Direct	***Indirect***	***Total***			
H1	*SCA*	*SCR*	*1.07*	*0.00*	*1.07*	*5.13*	*****	*Yes*
H2	*SCR*	*SCP*	*0.96*	*0.00*	*0.96*	*6.38*	*****	*Yes*
H3	*SCA*	*SCP*	*0.00*	*1.03*	*1.03*	*----*	*----*	*Yes*

**** p<0.001; ** p<0.01; 95% Confidence Level*

6.2. Mediation Analysis

However, in order to determine and prove the significance of the suggested mediation relationship, several authors have suggested further test the significance of the indirect effect using the bootstrap technique (Gaskin 2011d). Examining the two-sided significance level for the standardized indirect effect presented in Table 9, this indirect effect is significant (β = 1.86) for

CAS on PCS. To this effect, the results provide statistical support for H3a and H3b and, therefore, SCR completely influences the effect of SCA on SCP (p <0.05).

Table 9. Results of the Mediation Analysis

Hypotheses	***Causal Chain***	***Model (A) without***	***Model (B) with Mediation***		***Type of Mediation Observed***	***Support***
		Direct βyx without Mediation	***Direct βyx.m with Mediation***	***Indirect βmx * βym.x with Mediation***		
H3a H3b	*SCA→SCR→SCP*	*1.05 *** (p<0.001)*	*-0.81 (p=0.549 - ns)*	*1.86*	*Total Mediation with Moderate and Significant Effect*	*Yes*

**** p<0.001; ** p<0.01; 95% Confidence Level*

7. DISCUSSION

After a quantitative analysis of the data concerning the respecification of the structural model, hypothesis testing and mediation analysis, a detailed discussion of the theoretical and managerial implications of the present research can indeed be addressed.

7.1. Theoretical Implications

First, it answers the queries posed for the examination of the question: what are the mechanisms by which dynamic capabilities improve performance? Specifically, the dynamic capabilities perspective has provided a framework for understanding how SCA generates and/or renews SCR and, therefore, indirectly impacts SCP. Thus, our results show the full mediating effect of SCR in the relationship between SCA and SCP.

Secondly, our results show that SCA has a positive, direct and significant contribution on the generation or renewal of SCR, as indicated by hypothesis H1, knowing that SCA has no direct effect on SCP according to hypothesis H3. The results also imply that SCR has a positive, direct, and significant effect on SCP on the one hand, and a total mediation effect between SCA and SCP on the other. In addition, the results of this research revealed three dimensions or first-order factors or sub-capabilities of SCA, namely the strategic intelligence sub-capability, the flexibility sub-capability and the accessibility sub-capability, which allow for the continuous generation or renewal of the operational capability base, including SCR, in response to changes, threats and opportunities characterizing the business environment. Thus, firms that are able to develop dynamic capabilities, in this case SCA, will be able to generate or renew their operational capabilities, especially the SCR, and thus will always remain up to date with the satisfactory needs of customers, which leads to an improvement of their performance. Furthermore, our results demonstrate the importance of SCA development for companies to allow the generation or renewal of SCR and, consequently, the adjustment of the output of the productive systems of the companies in question in terms of four types of flexibilities to respond to external stimuli.

Third, the fact that there is no direct relationship between SCA and SCP leads us to conclude that a company that focuses solely on developing dynamic capabilities without considering their deployment for the generation or renewal of operational capabilities related to, among other things, SCR can in no way achieve superior performance and, therefore, competitive advantage. However, while SCA is directly and positively associated with operational capabilities, they can only have a pathway to partner company performance in global supply chains through the continuous generation or renewal of these operational capabilities in response to changes, threats and opportunities in the environment. Such SCR can enable the anticipation, monitoring and adaptation of productive systems to the environment in terms of four types of flexibilities (volume, variety, new product and product modification), leading to greater customer satisfaction and, ultimately, to superior operational and relational performance. To this end, we suggest that companies aiming to foster the SCR should first engage in the development of higher order dynamic capabilities, which will increase their ability to effectively respond to changes, opportunities and threats emanating from their respective environments. These results provide an interesting theoretical extension to the evolving literature on the concept of agility, examining the mediating effect of responsiveness on improving the operational and relational performance of manufacturing firms and partners to global supply chains.

Fourth, the result for hypothesis H3 indicates that SCR is fully involved in the relationship between SCA and SCP. In other words, if an SCA improves SCP, the simultaneous presence of the SCR strengthens this relationship, as it adds an additional indirect pathway between the SCA and SCP improvement. The agility and responsiveness of firms' global supply chains lead to a better understanding of customer needs and thus improve flexibility to external stimuli, which ultimately translates into superior operational and relational performance. While the literature provides some indication of the importance of SCA, it does not indicate the mediating role of responsiveness in improving SCP in the context of manufacturing firms and partners in global supply chains.

Fifth, the results of the structural model suggest that SCA by itself is insufficient to improve SCP. Furthermore, the first-order factor test, which encompasses SCA in the context of manufacturing firms based in Morocco and partners to global supply chains, allowed us to find that three dimensions, including strategic intelligence, accessibility, and flexibility, are positively correlated with SCA as a first-order factor, in contrast to the Gligor et al. (2012) study postulating five dimensions. This finding provides an important contribution to the implications derived from testing SCA as a second-order construct.

Sixth, the model that was introduced and tested in this research considers SCA as a dynamic capability essential to the generation or renewal of operational capabilities, including SCR, without the consideration in the model of other so-called antecedent or facilitating dynamic capabilities.

Seventh, we explored the role of SCR as a key mediator between SCA and SCP. The results indicate that SCR is capable of transforming SCA into higher value for a global supply chain. Thus, by developing dynamic capabilities, including SCA, manufacturing firms belonging to global supply chains will be able to adjust their productive systems into four types of flexibilities. Therefore, generating or renewing the operational capability related to SCR through the development of SCA enables manufacturing companies to respond to market changes faster and more effectively than its competitors.

7.2. Managerial Implications

Given the absence of any empirical evidence in the literature review that dynamic capability development impacts the performance of global supply chain partner firms through the generation or renewal of operational capabilities in response to environmentally induced changes, opportunities, and threats. From a manager's perspective, this study demonstrates why careful consideration should be applied when making decisions about which dynamic capabilities should be developed and, therefore, which operational capabilities will be targeted for generation or renewal. Companies that succeed in establishing this relationship benefit in terms of improved performance of both the global supply chain and its partners, enabling them to achieve sustainable competitive advantages.

In addition, global supply chain managers should realize the importance of dynamic capabilities to generate or renew the base of operational capabilities directly related to performance improvement. In addition, managers could decompose the dynamic capability related to SCA into three sub-capabilities, including strategic intelligence, flexibility and accessibility.

Similarly, our results support the fact that the SCR fully influences the agility effects of this supply chain in terms of performance improvement. Also, the dynamic capability inherent in agility is not sufficient to improve the performance of global supply chains as well as the performance of the firms that partner with these supply chains. Therefore, SCA must go through SCR to achieve superior performance of partner companies in global supply chains. To this end, managers must be convinced of the importance of creating "best value to the supply chain" (Ketchen and Hult, 2007), making strategic decisions to develop and generate the necessary capabilities, which results in improved performance and, therefore, the best value of the supply chain could be achieved. It is the aggregate success of an entire global supply chain that counts and takes precedence over the individual success of each member of the supply chain (Burke and Vakharia, 2007).

Although SCA has been identified as being of particular importance for the generation or renewal of SCR and the achievement of superior performance, managers might consider our results only in dynamic environments. Especially since several research studies have shown the moderating effects of environmental factors on the relationship between agility and performance.

8. CONCLUSIONS AND RECOMMENDATIONS

Our study provides a modest methodological contribution to measurement approaches used in the literature. A second order model was designed and tested to measure SCA with three dimensions instead of five dimensions (Gligor et al., 2012). Our results also contribute to studies that have been conceptualized but have not measured SCA as a second-order construct with three first-order factors. This nuanced measure of SCA provides a deeper understanding of the relationships with other factors, testing SCA at the aggregate second-order level as well as the decomposed first-order level.

For practitioners, the results of the total mediation model provide important insights. It is shown that SCR requires the prior development of a dynamic supply chain agility capability. Our results suggest that deploying operational capabilities, including SCR, in isolation can reduce success. This indicates that achieving superior performance is more closely linked to generating or renewing operational capabilities through dynamic capabilities, suggesting that operational responsiveness should be preceded by the development of dynamic capabilities.

For the researchers, this study did not extend the model to contain lower-order dynamic capabilities assumed to be generated by higher-order dynamic capabilities, particularly information technology capabilities, logistics capabilities, and global supply chain flexibility capability. Since the integration of higher-order dynamic capabilities, lower-order dynamic capabilities, and operational capabilities into one model could make a future research model more comprehensive and integrated. Thus, studying the different types of capabilities in the same theoretical model will help researchers and managers to better understand the interaction between these different capabilities to improve the performance of manufacturing companies and their global supply chains.

REFERENCES

[1] Agarwal, A., Shankar, R., and Tiwari, M.K. (2007) "Modelling Agility of Supply Chain", Industrial Marketing Management, Vol. 36, No. 4, pp 443-57.

[2] Ayoub, H. F., and Abdallah, A. B. (2019) "The effect of supply chain agility on export performance: The mediating roles of supply chain responsiveness and innovativeness", *Journal of Manufacturing Technology Management*.

[3] Blome, C., Schoenherr, T., and Rexhausen, D. (2013) "Antecedents and enablers of supply chain agility and its effect on performance: a dynamic capabilities perspective", *International Journal of Production Research,* Vol. 51, No. 4, pp 1295-1318.

[4] Braunscheidel, M.J., and Suresh, N.C. (2009) "The Organizational Antecedents of a Firm's Supply Chain Agility for Risk Mitigation and Response", *Journal of Operations Management*, Vol. 27, No. 2, pp 119-40.

[5] Catalan, M. and Kotzab, H. (2003) *Assessing the responsiveness in the Danish mobile phone supply chain, International Journal of Physical Distribution & Logistics Management*, Vol. 33, No. 8, pp 668-685.

[6] Chiang, C., Kocabasoglu-Hillmer, C. and Suresh, N. (2012) "An empirical investigation of the impact of strategic sourcing and flexibility on firm's supply chain agility", *International Journal of Operations & Production Management*, Vol. 32, No. 1, pp 49-78.

[7] Christopher, M. (2000) "The Agile Supply Chain", *Industrial Marketing Management*, Vol. 29, No. 1, pp 37-44.

[8] Costantino, N., Dotoli, M., Falagario, M., Fanti, M.P., and Mangini, A.M. (2012) "A Model for Supply Management of Agile Manufacturing Supply Chains", *International Journal of Production Economics*, Vol. 135, No. 1, pp 451-57.

[9] DeGroote, S. E., & Marx, T. G. (2013) "The impact of IT on supply chain agility and firm performance: An empirical investigation. International", *Journal of Information Management*, Vol. 33, No. 6, pp 909-916.

[10] Eisenhardt, K. M., and Martin, J. A. (2000) "Dynamic capabilities: what are they?", *Strategic Management Journal*, Vol. 21, No. 10/11, pp 1105-1121.

[11] Gindy, N. N., Saad, S. M., and Yue, Y. (1999) "Manufacturing responsiveness through integrated process planning and scheduling", *International Journal of Production Research*, Vol. 37, No. 11, pp 2399-2418.

[12] Gligor, D.M., and Holcomb, M.C. (2012a) "Understanding the Role of Logistics Capabilities in Achieving Supply Chain Agility: A Systematic Literature Review", *Supply Chain Management: An International Journal*, Vol. 17, No. 4, pp 438-53.

[13] Gligor, D.M., and Holcomb, M.C. (2012b) "Antecedents and Consequences of Supply Chain Agility: Establishing the Link to Firm Performance", *Journal of Business Logistics*, Vol. 33, No. 4, pp 295-309.

[14] Gligor, D. M., Holcomb, M. C., and Stank, T. P. (2013) "A multidisciplinary approach to supply chain agility: Conceptualization and scale development", *Journal of Business Logistics*, Vol. 34, No. 2, pp 94-108.

[15] Gligor, D. M. (2013) *The concept of supply chain agility: Conceptualization, antecedents, and the impact on firm performance,* Marketing and Supply Chain Management Publications and Other Works.

[16] Gligor, D. M., Esmark, C. L., and Holcomb, M. C. (2015) "Performance outcomes of supply chain agility: when should you be agile?", *Journal of Operations Management*, Vol. 33, pp 71-82.

[17] Grewal, R., and Slotegraaf, R. J. (2007) "Embeddedness of organizational capabilities". *Decision Sciences*, Vol. 38, No. 3, pp 451-488.

[18] Helfat, C. E., and Winter, S. G. (2011) "Untangling dynamic and operational capabilities: Strategy for the (N) ever-changing world", *Strategic Management Journal*, Vol. 32, No. 11, pp 1250-1243.

[19] Hendricks, K. B., and Singhal, V. R. (2005) "An empirical analysis of the effect of supply chain disruptions on long-run stock price performance and equity risk of the firm", *Production and Operations Management*, Vol. 14, No. 1, pp 35-52.

[20] Holweg, M. (2005) "The three dimensions of responsiveness", *International Journal of Operations and Production Management*, Vol. 25, No. 7, pp 622-603.

[21] Koste, L. L., and Malhotra, M. K. (1999) "A theoretical framework for analysing the dimensions of manufacturing flexibility", *Journal of operations management*, Vol. 18, No. 1, pp 75-93.

[22] Kurzhals, K. (2021) *Resource recombination in firms from a dynamic capability perspective*, Springer Fachmedien Wiesbaden GmbH.

[23] Laaksonen, O., and Peltoniemi, M. (2018) "The essence of dynamic capabilities and their measurement", *International Journal of Management Reviews*, Vol. *20, No.* 2, pp 184-205.

[24] Lee, H.L. (2004) "The Triple-A Supply Chain", *Harvard Business Review*, Vol. 82, No. 10, pp 102-12.

[25] Li, X., Goldsby, T.J., and Holsapple, C.W. (2009) "Supply Chain Agility: Scale Development", *International Journal of Logistics Management*, Vol. 20, No. 2, pp 408-24.

[26] Lin, C.T., Chiu, H., and Chu, P.Y. (2006) "Agility Index in the Supply Chain", *International Journal of Production Economics*, Vol. 100, No. 2, pp 285-99.

[27] Lukas, B., Hair, J., Bush, R., and Ortinau, D. (2004) *Marketing Research*, North Ryde: McGraw-Hill Australia.

[28] Malhotra, M. K., and Mackelprang, A. W. (2012) "Are internal manufacturing and external supply chain flexibilities complementary capabilities?" *Journal of Operations Management*, Vol. 30, No. 3, pp 200-180.

[29] Narasimhan, R. (1997) "Strategic supply management: a total quality management imperative", *Advances in the Management of Organizational Quality*, Vol. 2, No. 1, pp 86–39.

[30] Page, C. and Meyer, D. (2000) *Applied Research Design for Business and Management*, Sydney: McGraw-Hill Companies Inc.

[31] Patel, B. S., Samuel, C., and Sharma, S. K. (2017) "Evaluation of agility in supply chains: a case study of an Indian manufacturing organization", *Journal of Manufacturing Technology Management*, Vol. 28, No. 2, pp 212-231.

[32] Qrunfleh, S., and Tarafdar, M. (2013) "Lean and agile supply chain strategies and supply chain responsiveness: the role of strategic supplier partnership and postponement", *Supply Chain Management: An International Journal*, Vol. 18, No. 6, pp 571-582.

[33] Reichhart, A., and Holweg, M. (2007) "Creating the customer-responsive supply chain: a reconciliation of concepts", *International Journal of Operations and Production Management*, Vol. 27, No. 11, pp 1172-1144.

[34] Rosenzweig, E. D., Roth, A. V., and Dean Jr, J. W. (2003) "The influence of an integration strategy on competitive capabilities and business performance: an exploratory study of consumer products manufacturers", *Journal of Operations Management*, Vol. 21, No. 4, pp 437-456.

[35] Sangari, M.S. and Razmi, J. (2015) "Business intelligence competence, agile capabilities, and agile performance in supply chain: An empirical study", *The International Journal of Logistics Management*, Vol. 26, No. 2, pp 356-80.

[36] Sharifi, H., Ismail, H. S., and Reid, I. (2006) "Achieving agility in supply chain through simultaneous "design of" and "design for" supply chain", *Journal of Manufacturing Technology Management*, Vol. 17, No. 8, pp 1098-1078.

[37] Sharp, J.M., Irani, Z., and Desai, S. (1999) "Working towards Agile Manufacturing in the UK Industry", *International Journal of Production Economics*, Vol. 62, No. 1/2, pp 155-69.

[38] Shoaib-ul-Hasan, S. (2018) *The pursuit of responsiveness in high variety manufacturing environments. Towards building the Dynamic Response Capabilities*.

[39] Stevenson, M. and Spring, M. (2007) "Flexibility from a supply chain perspective: definition and review", *International Journal of Operations & Production Management*, Vol. 27, No. 7, pp 685-713.

[40] Swafford, P.M., Ghosh, S., and Murthy, N. (2006) "The Antecedents of Supply Chain Agility of a Firm: Scale Development and Model Testing", *Journal of Operations Management*, Vol. 24, No. 2, pp 170-88.

[41] Swafford, P.M., Ghosh, S., and Murthy, N. (2008) "Achieving Supply Chain Agility through IT Integration and Flexibility", *International Journal of Production Economics*, Vol. 116, No. 2, pp 288-97.

[42] Tarafdar, M., and Qrunfleh, S. (2017) "Agile supply chain strategy and supply chain performance: complementary roles of supply chain practices and information systems capability for agility", *International Journal of Production Research*, Vol. 55, No. 4, pp 925-938.

[43] Teece, D. J., Pisano, G., and Shuen, A. (1997) "Dynamic capabilities and strategic management", *Strategic Management Journal*, Vol. 18, No. 7, pp 509-533.

[44] Teece, D. J. (2007) “Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance”, *Strategic Management Journal*, Vol. 28, No. 13, pp 1319-1350.

[45] Tseng, Y., and Lin, C. (2011) “Enhancing Enterprise Agility by Deploying Agile Drivers, Capabilities and Providers”, *Information Sciences*, Vol. 81, No. 17, pp 3693-3708.

[46] Tunc, E.A. and Gupta, J.N.D. (1993) “Is Time a Competitive Weapon among Manufacturing Firms?”, *International Journal of Operations & Production Management*, Vol. 13, No. 3, pp 4-12.

[47] Upton, D. M. (1995) “What really makes factories flexible?”, *Harvard Business Review*, Vol. 73, No. 4, pp 74-84.

[48] Van Hoek, R.I. (2001) “Epilogue – moving forward with agility”, International Journal of Physical Distribution and Logistics Management, Vol. 31, No. 4, pp 301-290.

[49] Whitten, G. D., Green, K. W., and Zelbst, P. J. (2012) “Triple-A supply chain performance”, *International Journal of Operations & Production Management*, Vol. 3, No. 1, pp 28-48

[50] Zahra, S. A., Sapienza, H. J., and Davidsson, P. (2006) “Entrepreneurship and dynamic capabilities: A review, model and research agenda”, *Journal of Management Studies*, Vol. 43, No. 4, pp 917-955.

[51] Zhang, D.Z. (2011) “Towards Theory Building in Agile Manufacturing Strategies-Case Studies of an Agile Taxonomy”, *International Journal of Production Economics*, Vol. 13, No. 1, pp 303-12.

[52] Zikmund, W. G. (2003) *Business Research Methods*, 7th edn. Mason Ohio: Thomson South-Western.

[53] Zollo, M. and Winter, S. (2002) “Deliberate learning and the evolution of dynamic capabilities”, *Organizational Science*, Vol. 13, No. 2, pp 339-351.

AUTHOR

Aziz BARHMI is a professor of supply chain management and expert consultant in international trade and logistics. He is currently a permanent professor of management at Sidi Mohammed Ben Abdellah University in Fez, Morocco.