Ambidextrous Supply Chain Strategy and Supply Chain Flexibility: The Contingent Effect of ISO 9001

Abstract

Purpose: To study the effect of an ambidextrous supply chain strategy (ASCS) – i.e. the juxtaposition of exploration and exploitation practices – on each of the four dimensions of supply chain flexibility (SCF): information system, operating system, sourcing, and distribution flexibility. Further, to evaluate the influence of implementing the ISO 9001 standard on the relationship between ASCS and SCF, and whether this certification directly affects the level of SCF. We based our model in Resource Orchestration theory.

Design/methodology/approach: To perform this study, the authors used data collected from a sample of 145 non-ISO-certified firms and 157 ISO-certified firms.

Findings: ASCS does not affect all four dimensions of SCF in the same way. Rather, its effect is contingent on the presence of the ISO 9001 certification. An ASCS is shown to have a positive effect on information system flexibility irrespective of the presence of ISO 9001 certification whereas, for the other three dimensions of SCF, the effect of ASCS is dependent on ISO 9001 implementation. Meanwhile, ISO 9001 implementation itself does not affect the level of SCF.

Practical implications: Managers can use the findings to configure their supply chain strategy based on the specific dimension(s) of SCF they seek to develop by implementing ASCS. Further, the results inform managers about the incentives for implementing ISO 9001.

Originality/value: Although prior studies have shown that an ambidextrous strategy enables firms and organizational units to adapt to the environment, there have been few prior studies on ambidexterity in a supply chain setting. Further, although the extant literature has suggested that the ISO 9001 may facilitate ambidexterity, this link has remained largely theoretical. In fact, there is very little prior evidence on how the practice of ISO 9001 affects the supply chain.

Keywords: *Ambidextrous Strategy; Supply Chain Flexibility; Information System Flexibility; ISO 9001 Standard.*

1. Introduction

In the current competitive and globalized environment, supply chain flexibility (SCF) has become a source of competitive advantage (CA) (Blome *et al*., 2014). Such continuously-changing and uncertain conditions (Li *et al*., 2020) make developing SCF crucial. More specifically, firms that develop SCF can cope with and respond to unpredictable shifts as SCF enables supply chain (SC) operations to recover from disruptions and maintain continuity of operations (Li *et al*., 2020). Recent events resulting from the COVID-19 outbreak have shown that having a flexible SC that can adapt to unforeseen circumstances is more crucial than ever to business survival. It is thus necessary and important to research the strategies that firms must adopt to develop such flexibility.

The most current and complete stream of strategic thinking used to explain how firms develop sustained CA (e.g. SCF) is Resource Orchestration Theory (RO). A theoretical heir of the Resource-Based View (RBV) and Dynamic Capabilities Theory (DCT), RO is related to but more pragmatic than its predecessors (Sirmon *et al*., 2011). Conceiving the firm in a broad sense as a set of assets, strategies, and capabilities, RO argues that practitioners and scholars should identify sets or bundles of strategies, resources, and capabilities that lead to CA. No asset or capability in itself has the potential to achieve CA; rather, we must identify complementarities among assets (Liu *et al*., 2016). Gligor *et al*. (2020) argued that the goal of RO is "to assess recipes" that can serve to develop a CA. Through this terminology, RO argues that the ingredients (i.e. firm practices, assets, resources, competences, etc.) can be imitated but that the way each firm blends them cannot, thereby creating barriers to imitation.

Pitelis and Teece (2010, p. 1254) defined asset orchestration as "the process by which managers make, build, acquire, deploy, and redeploy decisions with respect to assets/capabilities." For these authors, orchestration occurs through organizational learning processes (Winter, 2003). Based on this reasoning, we believe that the first combination of ingredients that can enable SCF is via an ambidextrous supply chain strategy (ASCS). Kristal *et al*. (2010) coined the term ASCS to indicate strategic managerial emphasis on two different types of practice for organizational learning: SC exploration and SC exploitation. Research has shown that the juxtaposition of exploration and exploitation is related to long-term survival of the organizational unit that implements it (O'Reilly and Tushman, 2013). Although abundant literature supports the conclusion that an ambidextrous strategy facilitates adaptation to the environment in all kinds of organizational units (Gupta *et al*., 2006), no research to date has analyzed the effects of

this strategy on the dimensions that comprise SCF (i.e. operating system, information system, distribution, and sourcing flexibility). Our study aims to fill this significant gap in the literature. It is difficult to model a SC at an aggregate level because it is a complex system composed of different interconnected, interdependent parts (suppliers, distributors, logistics providers, etc.) (Choi et al., 2001; Choi and Krause, 2006). When considering flexibility, firms make decisions to adapt specific parts of their SC locally, and these adaptations do not necessarily affect the firm's overall SCF capability (Gligor *et al.*, 2020). Our study thus focuses on the level of theory congruent with managerial decisions on SCF. Such an approach uses a lower level of abstraction, which provides greater insight than many previous studies (Rojo Gallego-Burín *et al.*, 2020).

The second ingredient that we believe affects the process of orchestration through ASCS, and ultimately its potential outcome (i.e., SCF), is the ISO 9001 standard. We therefore wish to analyze the effects of jointly deploying an ambidextrous strategy and this standard. Such analysis is particularly important because Hitt *et al.* (2016) argued that the way in which Quality Management (QM) practices are bundled with other assets can alter the specific effects of quality initiatives (as prescribed by RO). Our paper hypothesizes that ISO 9001 plays the role of facilitating SC resources in this context. We propose that ISO 9001 facilitates SC exploitation practices by making them more efficient and controlled, providing more time and resources available for the firm's exploration practices. In other words, the firm's ability to translate ASCS into heightened dimensions of SCF is amplified when ASCS is combined with ISO 9001. This analysis follows the lines of Prajogo *et al.* (2012), one of the first studies of the effect of ISO 9001 on SC functioning, which found evidence that the standard does not affect the different managerial dimensions of SC (i.e. internal process management, customer process management, and supplier process management) in the same way.

Our study also responds to calls for research in the QM literature. Based on a Delphi study of QM practitioners, Fundin *et al*. (2018) identified that one the most important challenges for QM research is how to adapt to rapid changes in the business environment. The field is calling for QM strategies to be identified that make an organization more agile because prior literature has questioned the relationship between QM practices and firm priorities such as flexibility and agility (Lilja *et al*., 2017). The academic literature is divided in terms of the relationship between flexibility and ISO 9001. Some authors have argued there is positive relationship between the two variables. For example, Llorens-Montes *et al*. (2004) showed that firms with QM systems are more market-

oriented and more inclined to adjust to different situations and conditions. In contrast, others have argued that there is a negative relationship between the two variables. For example, Vouzas and Gotzamani (2005) and Lundmark and Westelius (2006) suggested that the ISO 9001 standard has a detrimental effect on flexibility, as standardization and conformity lead an organization to become static. None of these studies however have examined how ISO 9001 affect *supply chain* flexibility, focusing instead on the firm level. We therefore propose extending this debate to the broader supply chain level, as advocated by El Mokadem (2016).

The controversy surrounding ISO 9001 needs to be resolved given that it is the QM practice most commonly used around the world. Manders *et al*. (2016) reported that it has been implemented by more than one million firms in 187 different countries. ISO 9001 is the leading quality management system in the world (Prajogo *et al*., 2012). It is a QM system with the objective of improving product quality through adequate management of resources and processes (Franceschini *et al*., 2006). This goal is manifested through the establishment of quality policies and manuals, the clear determination of responsibilities, documentation, inspection, calibration, testing, data collection, and analysis within the firm (Naveh and Marcus, 2004). These factors have a direct impact on SCM, specifically in establishing criteria for the selection and evaluation of SC partners (El Mokadem, 2016).

Based on the foregoing, this study seeks to answer the following three research questions:

1: Does an ambidextrous strategy have a significant effect on the dimensions of SCF?

2: Does the implementation of ISO 9001 affect the relationship between an ambidextrous strategy and the dimensions of SCF?

3: Does ISO 9001 affect the level of SCF?

To answer these questions, we adopt a monadic perspective that examines the focal manufacturing firm's perceptions (Flynn *et al*., 2018; Roh *et al*., 2013). In doing so, we reveal how an ambidextrous strategy affects the four dimensions of SCF and, importantly, demonstrates that the effect of ambidexterity on flexibility is dependent on the implementation of ISO 9001. This is an important message for managers considering the adoption of ISO 9001 and/or the adoption of an ambidextrous strategy.

The rest of the paper is organized as follows. Next section reviews the literature and establishes the theoretical foundations for the study. Section 3 describes the survey research method before Section 4 presents the results of the data analysis. Section 5 provides a discussion of the results before Section 6 outlines the implications for theory and practice, the limitations and future research directions.

2. Literature Review and Hypotheses Development

2.1 Resource Orchestration (RO) Theory

Resource Orchestration (RO) theory is the most recent theory in contemporary strategic management thinking. It incorporates many of the larger theoretical arguments provided by the RBV and DCT into a single cohesive theory (Sirmon *et al*., 2011). The RBV argues that it is only from assets, resources, and capabilities that firms can unite valuable, rare, imperfectly imitable, and non-substitutable characteristics (VRIN) to develop strategies to achieve CA (Barney, 1991). The RBV has been criticized for its static character. DCT took the next step, proposing the concept of dynamic capabilities as a means by which the firm could maintain CA in changing environments (Teece *et al.*, 1997). Yet both theories remain vague on how firms' assets are organized and orchestrated to develop a CA (Schriber and Löwstedt, 2018). Based on the set of arguments developed by the RBV and DCT, RO proposes that possessing resources or capabilities alone is no guarantee of CA; rather, resources and assets must be accumulated, bundled, and leveraged (Sirmon and Hitt, 2003; Sirmon *et al*., 2011). For RO, the most important issue is how managers bundle capabilities and practices. RO introduces a change with respect to RBV and DCT. Whereas these two theories focus on the characteristics required for firm assets/capabilities to obtain a CA, RO argues that what is most important is how the firm combines these assets (Sirmon *et al.*, 2011). RO thus focuses on determining the processes that managers should use to capitalize on their firm's resource endowments (Ketchen *et al.*, 2014). A firm can possess all of the necessary resources and capabilities, but if it does not manage them properly, it may not achieve the expected outcomes (Ketchen *et al.*, 2014). Ultimately, RO unpacks the firm by viewing it as a set of resources and capabilities, stressing the importance of identifying the manager's role in creating synergies among the resources they manage in order to achieve CA.

Helfat *et al.* (2007) argued that orchestration consists of two processes: a) managers' search for, identification of, and selection of assets, and the development of capabilities, and b) their coordination of co-specialized assets. Managerial activity must thus identify

and create portfolios of the firm's resources that have the potential to facilitate the development of a CA, that is resources that are complementary (Sirmon *et al*., 2011). It is important that the RBV focuses only on VRIN resources as a way to achieve a CA. Yet RO stresses that non-VRIN resources, when properly combined, can be crucial to business success (Barney, 1991, 2012). Research has demonstrated that non-VRIN resource orchestration plays an even more important role in the context of the SC than it does within the firm (Priem and Swink, 2012).

Based on the foregoing, our study starts from the conceptual framework of RO and seeks to identify complementarity among strategies and practices to achieve CA by developing a flexible SC.

2.2 Ambidextrous Supply Chain Strategy (ASCS)

Exploitation and exploration – key components of an ambidextrous supply chain strategy (ASCS) – are two completely different types of learning. Whereas exploitation is based on "refinement, production, efficiency, selection, choice, implementation, and execution," exploration is grounded in "search, variation, risk assumption, experimentation, play, discovery, and innovation" (March 1991, p. 71). One can also differentiate between the two based on the origin of the knowledge that is acquired. Exploitation consists of developing the firm's knowledge from its own abilities, whereas exploration is the vehicle through which knowledge is acquired from interaction beyond the boundaries of an organization (Jansen *et al*., 2006). The exploration aim is to satisfy client needs in emerging markets, provide new designs, create new markets, and develop new distribution channels, while the goal of exploitation is to satisfy customer needs in current markets, extend current knowledge and abilities to improve current designs, and to increase the efficiency of current distribution channels (Jansen *et al*., 2006). Beyond learning, exploration and exploitation are considered key behaviors or concepts that define strategy (Tamayo-Torres *et al*., 2014b) since exploitation seeks immediate, short-term results while exploration has a long-term orientation (March, 1991).

We use the concept of ambidexterity as a metaphor (Moreno-Luzón *et al*., 2014) to refer to organizations or units capable of combining the strategic options of exploration and exploitation. It is important to stress that it is not straightforward to adopt an ambidextrous strategy. Managers must manage and allocate resources in the short and long term and continuously attempt to balance exploratory and exploitative tasks to avoid falling into the so-called "competence trap" or "failure trap" (Levinthal and March, 1993).

Further, the skills and routines that encourage exploitation are sometimes opposed to those that encourage exploration.

Despite the recent proliferation of studies on ambidexterity (Chang *et al*., 201Me9), there remains limited empirical understanding of the benefits and consequences generated for SCM (Aslam *et al*., 2018). Kristal et al. (2010) introduced the term of an ASCS, conceptualized as the managerial decision to implement, at the same time, SC exploration and exploitation practices (Kristal *et al*., 2010). SC exploration practices include the use of systems for cross-entity business intelligence information gathering to support organizational decision-making and the exchange of new ideas, supply market intelligence, and supplier innovation workshops (Kristal *et al*., 2010; Handfield, 2010). In contrast, SC exploitation practices include the use of IT to automate cross-organizational tasks (financial analysis, automated billing, inventory management, reconciliation of inventory and payments, etc.) (Kristal *et al*., 2010). For a more extensive description of SC exploration and exploitation practices, see Rojo Gallego-Burin et al. (2020).

An ambidextrous strategy has been shown to be widely beneficial at both a strategic and an organizational level. This includes effects on the development of CA (O'Reilly and Tushman, 2013), increased dynamism (Ricciardi *et al*., 2016), and performance (Ramachandran *et al*., 2019). Knowledge of its effects on the SC is, however, much more limited. Most studies to date focus on analyzing its positive effect on firm performance (Aslam *et al*., 2018). Lee and Rha (2016), however, have shown that this strategy helps to mitigate the effects of SC disruptions; and Aslam *et al*. (2020) have empirically shown that ASCS improves SC resilience. Further, in the literature that seeks to identify the antecedents of ASCS, Aslam *et al*. (2018) identified SC dynamic capabilities as precursors of this strategy; and Ojha *et al*. (2018) explained that top management transformational leadership helps support ASCS implementation. Of all the studies cited to have tackled ASCS, we especially point to Aslam *et al*. (2018), which, while not explicitly adopting an RO approach, aimed to identify sets/clusters of capabilities that ultimately enable an organization to achieve a CA, thus following our line of theoretical argumentation.

It is also important to mention Nambisan and Sawhney (2011) who analyzed the orchestration processes that firms use to manage the networks to which they belong. Among the orchestration processes examined, we focus on the process that these authors termed "managing innovation leverage," as ASCS can be seen as a mode of this process

in the specific context of the supply network. The process of innovation leverage has two distinct components. One consists of "establish[ing] a common repository leverage for partners to share their proprietary tools, technologies, and other assets with one another with the objective of minimizing design/development redundancies and facilitating faster product development" (p. 43). The other component consists of leveraging, reusing, or redeploying the technologies, processes, and other assets in the network to facilitate innovation with them. The network orchestration process presented above involves characteristics or elements of both exploitation and exploration practices, since the process combines elements of modularity, innovation, choice of standards, novelty, and risk. From the perspective of RO, ASCS can thus be viewed as a strategy for orchestrating resources in the supply network. This strategy forms a bundle of practices that prior literature has shown to be potentially complementary and interdependent. As Stadler *et al.* (2014, p. 174) explained: "organizations need to explore to create new opportunities to exploit, and they need to exploit to generate income to invest in exploration." March (1991, p. 71) argued that "adaptive systems that engage in exploration to the exclusion of exploitation are likely to find that they suffer the costs of experimentation without gaining many of the benefits… conversely, systems that engage in exploitation to the exclusion of exploration are likely to find themselves trapped in suboptimal stable equilibria." Cao *et al.* (2009) explained this complementarity by affirming that the repeated use of existing knowledge (exploitation) creates better understanding of where resources are and facilitates both their reconfiguration and the creation of new knowledge.

2.3 Supply Chain Flexibility (SCF)

Various definitions of SCF can be found in the literature but all have two common features: first, they characterize SCF as the SC's ability to adjust and react to shifts and uncertainties in the environment (Vickery *et al.*, 1999); and second, they unanimously consider SCF as a complex, multi-dimensional concept (Duclos *et al.*, 2003). They disagree however on the dimensions that make up this construct (Garavelli, 2003). In this paper, we adopt the typology introduced by Moon *et al.* (2012), which is made up of four dimensions: sourcing, operating system, distribution, and information system flexibility.

Although the literature unanimously agrees that SCF has a positive effect on organizational performance (Blome *et al.,* 2013; Martínez Sánchez and Pérez Pérez, 2005), the mechanisms underlying this capability have hardly been researched. Since SCF has been shown to precede firm benefits and provide a source of CA, there is a need for

research to focus on determining what strategies and mechanisms encourage these results (Rojo *et al.*, 2018).

Ultimately, if we start from the assumption that SCF is a source of CA for firms, the immediate question that applying RO raises in this context concerns how firms should orchestrate their resources to develop these dimensions of SCF and obtain CA. This article seeks to fill this research gap.

2.4 Relationship between an ASCS and SCF

The theoretical framework provided by RO permits us to view SC exploration and SC exploitation together as a combinative pair of practices – that is, as a bundle of complementary practices, or even a orchestration network process – which prior literature has shown can ensure survival of the organizational unit (Rojo *et al*., 2016). This pair forms a synergistic combination of learning processes and practices. The exploitation of existing resources is needed to explore new capabilities and resources, while the exploration of new capabilities and resources enhances a firm's current knowledge base (Katila and Ahuja, 2002). For Teece (2014), this strategy is merely the combination of various SC resources and practices in an entrepreneurial fashion based on their integration and coordination.

SC exploitation enables SC process efficiency through cooperation and coordination across functions. It also serves production scheduling, demand planning, and material management (Li *et al*., 2020), enabling the firm to build SCF. SC exploration enables the firm to determine customer requirements and collect information from suppliers and distributors by coordinating tasks with upstream and downstream SC partners (Wong *et al.*, 2011). This efficiency, on the one hand, and greater knowledge and collaboration with SC members, on the other hand, leads firms to respond to marketplace changes, thereby building SCF.

Meanwhile, the communication and knowledge shared among SC members and functions, obtained via exploration and exploitation, reduce redundancy and waste and improve delivery performance (Li *et al.*, 2020), which is an indicator of SCF. In line with RO, bundling and leveraging resources across internal and external (supplier and distributor) functions through the exploration and exploitation of SC resources enables their orchestration.

RO addresses the question regarding what allows firms to develop sustained CA, that is, how firms adjust their resources and assets to cope with environmental dynamism

(Schriber and Löwstedt, 2018). These authors showed that developing flexibility is not the only result of good resource orchestration. Resource orchestration involves a specific pattern for the development of flexibility, and this managerial pattern is the combination of different ways of managing resources (as occurs with exploration and exploitation). Achieving flexibility thus requires an equilibrium and a balance to be struck in resource management. Following this logic, Gligor (2018) empirically demonstrated that the development of buyer-supplier flexibility fit is attributed to the orchestration of interconnected resources. Finally, Tamayo-Torres *et al.* (2017) recently showed that the implementation of an ambidextrous strategy causes a cascading chain of capabilities to develop, including flexibility. Based on these recent findings, we propose ASCS as a good candidate strategy that enables a firm to build SCF, since this strategy requires managers to manage the difficulties generated by simultaneously implementing exploration and exploitation practices that involve SC resources. Taking all of this into account, our first hypothesis is:

H1: An Ambidextrous Supply Chain Strategy (ASCS) is positively related to Supply Chain Flexibility (SCF).

We will analyze the effect of an ASCS on each dimension of SCF rather than treating SCF as a second-order construct or a single entity. Since the literature is unanimous in recognizing that SCF is a multidimensional concept (Stevenson and Spring, 2007; Moon *et al.*, 2012), most empirical studies on the antecedents or enablers have chosen to analyze the effect on each dimension that comprises SCF. It has been shown that the potential sources of SCF act differently across each of the dimensions of SCF (see Tachizawa and Gimenez, 2009; Vickery *et al*. 1999). Further, Liu *et al.* (2019) reviewed the concept of SCF and found that prior studies tend to treat SCF as a single integrated construct. This essentially ignores the different theoretical dimensions of SCF and the different roles that its antecedents and consequences can play depending on the dimension considered. Studying SCF's different theoretical dimensions would provide a more detailed and nuanced insight. Thus, we break H1 down into H1a to H1d according to the four dimensions of SCF proposed by Moon *et al*. (2012).

ASCS is composed of two interdependent components and we are interested in how these work together; therefore, we examine the effects of SC exploration and SC exploitation on each dimension of SCF Thus, we break H1 down into H1a to H1d according to the four dimensions of SCF proposed by Moon *et al.* (2012).

2.4.1 Relationship between ASCS and Sourcing Flexibility (SF)

SF is defined as achieving the availability of materials and services of the necessary quality, and having the ability to acquire them effectively, in response to changes in requirements (Moon *et al*., 2012). A company must be ready to encounter new suppliers easily to minimize the risk of delays caused by an interruption in supply (Moon *et al*., 2012); and the supplies must be of the requisite quality to satisfy the changing needs of the environment. We argue that an ASCS can improve this dimension by helping the firm to manage its supply flow. First, exploration enables the search for alternative paths and new modes of performing processes (March, 1991). In a SC context, this facilitates the search for new suppliers, new forms of cooperation with existing suppliers, and the adoption of different logistical strategies. This can help to ensure that the firm has a sufficient number of suppliers such that flow is uninterrupted. Second, exploitation practices improve efficiency (Baum *et al*., 2000) and reliability (Kristal *et al*., 2010) due to the experience that is accumulated. This can enable the consistent flow of components whilst maintaining quality standards, thereby reducing uncertainty (Lummus *et al*., 2003). We thus propose that:

H1a: An ASCS is positively related to SF.

2.4.2 Relationship between ASCS and Operating System Flexibility (OSF)

OSF is the ability to adequately exploit resources to produce a range of products and services that enable a firm to satisfy market demand. Patel *et al*. (2012) empirically showed that ambidexterity improves a firm's ability to change its product mix and develop new products. We propose, however, that the effect of ambidexterity on this dimension of SCF can be even greater. Exploration practices seek the development of new technologies, products, services, and systems, which are usually identified as radical innovations. Exploitation practices, in contrast, seek incremental improvements to products, services, operations, quality, and efficiency (Baum *et al*., 2000). If the firm focuses on exploitation practices only, it will be able to change the existing product mix but unable to recognize the need to develop new products or incorporate new technologies into SC processes (Koberg *et al*., 2003). If, in contrast, the firm opts exclusively for implementing exploration practices, it may seek out new opportunities, but it will not be able to eliminate redundancies or improve current processes (Tamayo-Torres *et al*., 2014b). Thus, an ASCS permits improvements to current SC operating processes whilst

simultaneously incorporating new ones (Patel *et al*., 2012). An ASCS can thus improve OSF through reduced installation time, improved quality and efficiency of processes, an enhanced ability to develop new products and services, and a greater ability to change the product mix (Patel *et al*., 2012). We thus propose:

H1b: An ASCS is positively related to OSF.

2.4.3 Relationship between ASCS and Distribution Flexibility (DF)

DF makes reference to a company's ability to control the movement and storage of materials, components, finished products, and/or services under continually changing market conditions (Moon *et al*., 2012). Developing DF requires both exploration and exploitation practices to be implemented in the SC. Implementing exploitation practices can enable a firm to avoid stock-outs and foresee changes in market demand (Vickery *et al*., 1999). Meanwhile, exploration practices enable a firm to increase the range of options available to satisfy changing customer needs, such as those described by Zhang *et al*. (2002). DF is to SCF what routing flexibility is to manufacturing flexibility (Garavelli, 2003). It refers to the various alternative pathways for distributing products whereas routing flexibility refers to the different pathways for manufacturing a component. Tamayo-Torres *et al*. (2014b) demonstrated empirically that ambidexterity is positively related to routing flexibility insofar as it facilitates the search for alternative pathways/sequences for manufacturing a component while at the same time permitting improvements to current paths and sequences through better cost allocation, the elimination of redundancies, and specialization. We therefore logically expect ASCS to help a firm enhance its DF, facilitating the development of different logistical strategies for launching and distributing products on the market, whether this be via improvements to current strategies and modes of distribution or by developing other, completely different forms of distribution. Likewise, an ASCS can facilitate the search for distributors with which to contract new modes of delivery whilst simultaneously improving and specializing current delivery modes (Moon *et al*., 2012). We thus propose that:

H1c: An ASCS is positively related to DF.

2.4.4 Relationship between ASCS and Information System Flexibility (ISF)

ISF refers to the competence of a company's IS to adapt to unstable situations, including substantial, unexpected changes, and the ability of the firm to operationalize these systems through the use of IT to share information among functions and departments and with SC members (Moon *et al*., 2012). Improving this dimension of SCF requires ambidexterity. First, exploitation practices enable the reduction of work time in the system and of connection time between SC members, as well as improving the work rhythm by providing greater efficiency (Lucas and Olson, 1994). Second, exploration practices are necessary to achieve synchronization among SC members after one member updates a technology or adopts a new technical functionality. Further, these practices enable the synchronization of hardware and software architectures between firms in the SC (Lummus *et al*., 2003). We thus propose that:

H1d: An ASCS is positively related to ISF.

2.5 Relationship between an ASCS, SCF, and the ISO 9001 Standard: The role of ISO 9001 as a Facilitator of Resource Orchestration

A recent case study by Trisnawati and Rosiawan (2018) identified how ISO 9001 implementation facilitates intra-firm resource orchestration, revealing that the standard improves the management of processes, which become more coordinated and controlled. Most importantly, the authors described how the greater coordination and control achieved enables a firm to develop new activities. Translating this argumentation and applying RO theory, we hypothesize that ISO 9001 facilitates exploitation practices, making them more efficient and controlled because the certification provides a standardized means of communication through which everybody speaks the same language (Prajogo et al., 2012). Firms thus have more time and resources to invest in exploration practices. The improved efficiency and coordination they gain through ISO 9001 is not an obstacle to exploration, rather it frees up resources (time, administration, organization) from more routine tasks to enable the firm to perform more exploration activities.

Further, this view of ISO 9001 as a facilitator of resource orchestration in the context of ASCS complements the traditional QM literature. Continuous improvement and market orientation are two basic principles upon which all QM systems are grounded, including the ISO 9001 standard (Hackman and Wageman, 1995). These principles are linked to both exploration and exploitation (Corso and Pellegrini, 2007) and thus to

ambidexterity. Li *et al*. (2008) showed that market-oriented firms are capable of exploring and exploiting simultaneously. That is, they have a greater likelihood of being ambidextrous. Meanwhile, Fernández-Pérez and Gutierrez-Gutierrez (2012) contrasted empirically whether the QM practices involved in ISO 9001 foster the development of the organizational networks to which a firm belongs, especially in terms of enabling access to the information contained within them. We can thus expect the implementation of an ASCS to have a greater effect on SCF if a firm has adopted the ISO 9001 standard.

One area of the literature however has questioned the potential role of ISO 9001 as a facilitator of RO. More specifically, some authors have argued that ISO 9001 will affect exploitation only, thus blocking exploration and ambidexterity. This is because implementing ISO 9001 has been linked, on occasions, to excessive formalization and proceduralization (Roldan Bravo *et al*., 2017). Since the standard is based on rules and procedures, one could conclude that it inhibits experimentation and innovation. Likewise, the inspection and control of processes – a characteristic of ISO 9001 – and standardization, might hinder creativity (Moreno-Luzón *et al*., 2014). But this is a minority view in the literature. ISO 9001 requires, for example, a list of detailed product requirements to be specified meaning work is rejected if these are absent. Specifying these requirements can promote attention to detail (exploitation) and adherence to rules and procedures (Naveh and Erez, 2004); but the continuous improvement that underpins ISO 9001 can also stimulate creativity and generate new ideas (Prajogo and Sohal, 2001). Thus, it does not necessarily impede exploration and may even foster it. Exploration activities must be cultivated, and norms and regulations can, to some extent, create an environment that is favorable to innovation. Procedures and norms can also improve exploration at the implementation phase because, without procedures and norms, new ideas can have disastrous results (Craig, 1995). The process management introduced by the ISO 9001 standard can also expand the effect of an ASCS on SCF. Theodorakioglou *et al*. (2006) showed empirically that ISO 9001 process management provides a useful system for managing suppliers and distributors since it improves communication processes between the firm and its SC members via the clear specification and documentation of questions related to product supply, transportation, delivery, and handling.

In summary, by implementing ISO 9001, managers can better allocate SC resources, dedicating them more efficiently to exploration and exploitation activities to achieve efficiency and balance, and to focus on the needs and expectations of customers (Sirmon

et al., 2011). In other words, the firm's ability to translate ASCS is amplified when this strategy is combined with ISO 9001. Based on the foregoing, we formulate the following hypothesis:

H2: The ISO 9001 standard facilitates the relationship between ASCS and SCF.

2.6 Relationship between the ISO 9001 Standard and SCF

The effect of ISO 9001 has been debated in the literature. Some authors view its implementation as beneficial, claiming that the certification increases employee awareness of quality and fosters continuous improvement through quality audits. Others argue that it leads to firms focusing on obtaining the certification rapidly and easily without developing a genuine deep-rooted commitment to quality. Further, its practices can result in reduced flexibility and innovation (Kuo *et al*., 2009). More empirical research is therefore required to resolve this controversy (Roldan Bravo *et al*., 2017)

Llorens-Montes *et al*. (2004) found that firms with some kind of quality initiative have greater flexibility than firms not partaking in these initiatives. The former should be more flexible than the latter since they are oriented to the market and will respond better to changes in the environment (Tamayo-Torres *et al*., 2014b). Moreover, QM practices reduce process variance, directly impacting various SC performance variables, including inventory levels and measures related to time, such as cycle time and delivery reliability (Flynn *et al*., 1995). Possessing a QM system also means that raw materials have a zero-defect orientation, enabling a manufacturing firm to further reduce safety stock, thereby enabling a more flexible SC (Kaynak and Hartley, 2008).

More recently, El Mokadem (2016) empirically demonstrated that ISO 9001 can help to align SC activities with the environment. Likewise, Sila *et al*. (2006) found that implementing quality practices serves to align the actions of the firm, its suppliers, and customers. Meanwhile, Theodorakioglou *et al*. (2006) proposed that QM practices lead to better alignment between a firm and its suppliers. More specifically, they found that firms with QM practices obtain greater SC performance since these practices encourage intra-organizational integration amongst operating processes, facilitating inter-organizational integration via closer relationships with suppliers and distributors. The authors concluded that the implementation of QM practices facilitates SC management since these practices provide internal integration, which is a prerequisite for the ability to manage relationships with suppliers and distributors. We therefore propose our final hypothesis:

H3: The ISO 9001 standard has a positive and significant influence on SCF.

3. Methodology

3.1 The Sample

The sample of manufacturing firms was chosen randomly from the Iberian balance sheet analysis system (SABI) database, which includes information on the main firms operating in Spain. The final population contained 2,517 firms. Data were collected through computer-assisted telephone interviews (CATI), and the informants were the general manager or the person in charge of the firm's SC. We obtained 302 answers, i.e. a response rate of twelve per cent. Appendix A of the supplementary material shows the characteristics of our sample.

We evaluated the risk of non-response bias by comparing the demographics and size variables of respondents and non-respondents. The results show that non-respondent bias is not a concern. To reduce the possibility of common method bias (CMB), a set of procedures were implemented prior to data collection (Podsakoff *et al*., 2003). CMB was also tested statistically following the procedure of Williams *et al*. (2003). Accordingly to it, the risk of CMB is not a concern in this study.

3.2. Measurement Scales

To test our hypotheses, a questionnaire was developed following the procedure of Moore and Benbasat (1991) to establish content validity. The scales used were adapted from prior literature: ASCS is measured following Kristal *et al*. (2010). The four dimensions of SCF were measured using scales developed by Moon *et al*. (2012). The items were answered using a 7-point Likert scale. And, finally, the ISO 9001:2015 standard was analyzed using a categorical variable that measured whether or not the firm had implemented this standard (Tamayo-Torres *et al*., 2014a, 2014b). The researchers controlled for several variables that could confound the relationships of interest. Following Martinez Sanchez and Perez Perez (2005), we used the following as control variables: firm size (measured by employee number) and the type of industry. Both variables were categorized, as shown in Appendix A.

3.2.1 Measurement Scale Properties

Both the measurement and the structural model were assessed using EQS 6.2 software. A confirmatory factor analysis was performed to assess the measurement model.

Convergent validity of the scales was also evaluated through the CR, AVE, and Cronbach's alpha (Hair *et al.*, 2008) (see Table I).

[Take in Table I]

We performed a second CFA to demonstrate the multi-dimensionality of the second-order construct employed in the study: ASCS. To evaluate the measurement model for ASCS, we reported widely-used fit indicators (see Table II). As NFI, CFI, IFI, AGFI, and GFI produced values above the cut-off of 0.90; and a RMSEA value lower than 0.08 was recorded (Byrne, 2001), it can be concluded that the measurement model indicates good model fit.

[Take in Table II]

To evaluate the discriminant validity of the constructs, we followed, firstly, Fornell and Larcker's (1981) procedure, by comparing the construct correlations and the square root of the AVE. As all the construct correlations are lower than the square root of the AVE (see Table III), the results confirm discriminant validity. Secondly, we calculated the HTMT ratios for each pairing (Henseler et al., 2015). All of the ratios, displayed in Table IV, take values below 0.85 thereby also confirming discriminant validity.

[Take in Table III and Table IV]

4. Results

4.1 Structural Equation Modeling: Testing H1

To test H1, the hypothesized structural model was evaluated using structural equation modelling (SEM). We thus estimated a single model for the whole sample. The global fit indices for the model and the Chi-square value (404.643, $p<0.001$) indicate that the data fits the model. Figure 1 presents the results of the relationships between ASCS and the four dimensions of SCF (SF, DF, OSF, and ISF). All proposed structural paths were statistically significant. These results indicate that H1a, H1b, H1c, and H1d are all supported. None of the control variables were found to be significant. In addition, a test of robustness (Rojo *et al.*, 2016) was performed to avoid endogeneity problems.

4.2. Multi-group Analysis: Testing H2

To test the moderating effect of ISO 9001, the sample was divided into two groups. The first group was comprised of firms that had not implemented ISO 9001 (145 firms) and

the second group of firms that had implemented ISO 9001 (157 firms). The testing strategy followed Byrne (2006), i.e. first determine the measurement invariance; after determining that the measurement model is equivalent across groups, test the equivalence of the structural relationships across groups.

4.2.1. Invariance of the Measurement Model

A multi-group measurement invariance analysis was performed to assess whether the measurement models were equivalent across the two groups (ISO and non-ISO). The $\chi 2$ difference test is generally used to assess invariance between two groups (Byrne, 2006). If measurement invariance is acceptable, the factor loadings do not vary across the two groups and the structural invariance test can proceed (*Ibid*). To examine invariance, we compared a non-restricted model (Model 1) with a factor loadings restricted model (Model 2). As Table V shows, the $\chi 2$ difference between the non-restricted model and the full metric invariance model is not significant $\chi 2_{.05}(14) = 15.627 < \chi 2_{.05}(14) = 23.68$, indicating that the measurement model has equivalent factor loadings across the two groups (ISO *vs.* non-ISO).

[Take in Table V]

4.2.2. Multi-group Path Analysis

A multi-group path analysis was performed to test the moderating role of ISO 9001 in the relationship between ASCS and SF, DF, OSF, and ISF. To examine structural invariance, we compared a non-restricted model (Model 1) with a second model in which we restricted the path coefficients between ASCS and SF, OSF, DF, and ISF so that they were equal across the two groups. Further, we also restricted the path coefficients between the control variables and the dependent variables of the model. First, we examined the $\chi 2$ difference test between the model with the restricted paths and the model with the unrestricted paths. The $\chi 2$ difference between the non-restricted model and the restricted-paths model is significant, $\chi 2_{.05}(13) = 24.433 > \chi 2_{.05}(13) = 22.35$. This result denotes the source of significant differences across groups. To find the source of these differences, we examined the critical ratios for the parameter difference of the structural relationships of the model. The ratios are shown in Table VI. When the critical ratio for the difference of two parameters is outside the values between (-1.96, 1.96) there is a statistically significant difference between the parameters. Thus, there are significant differences in the paths ASCS→SF, ASCS→OSF, and ASCS→DF across groups but not in the path

ASCS→ISF. More specifically, the path coefficient values between ASCS and SF, and DF are positive and significant in non-ISO firms and non-significant in ISO-certified firms. At the same time, the path coefficient value between ASCS and OSF is positive and significant for ISO-certified firms but not significant for non-ISO certified firms. We did not find differences for the relationship between ASCS and ISF (its critical ratio is 0.070); and we also found no significant differences for the relationships between the variable controls and the SCF dimensions. Based on these results, H2 is partially supported. ISO 9001 thus facilitates the effect of ASCS on OSF only and not on the other three dimensions of SCF.

[Take in Table VI]

4.3 Multivariate Analysis of Variance (MANOVA): Testing H3

To evaluate H3, we performed an analysis of variance to evaluate whether the degree of SCF varies based on the adoption of ISO 9001. Such analysis has been widely used in the prior literature and is a good test for comparing the mean that a variable takes in two different groups (Tamayo-Torres *et al.*, 2014b).

Table VII displays the results, which demonstrate that the ISO 9001 standard does not have a significant effect on any dimension of SCF or any combination of dimensions. We do not, therefore, obtain empirical evidence to support H3.

[Take in Table VII]

5. Discussion

Our results strengthen and refine prior empirical research that has started to study the effect of an ambidextrous strategy in a SC context (e.g. Kristal *et al.*, 2010; Patel *et al.*, 2011). In fact, the joint evaluation of the results obtained from testing H1 and H2 reveals a more complicated and nuanced view of the relationship between ASCS and SCF than has been established in prior literature (Rojo *et al.*, 2016; Rojo Gallego-Burín *et al.*, 2020), which seems to indicate that an ambidextrous strategy improves SCF. Our study provides greater insight into this relationship by considering the dimensions of SCF and by drawing on RO to study the effects of the combinations of resources and practices.

As mentioned above, the RO approach seeks to identify and evaluate recipes that serve to achieve CA, based on the premise that what one does with the ingredients – that is, what they are combined with (as well as what one does not do) – is more important than

the ingredients themselves (Gligor *et al.*, 2020). Following this premise, our results confirm that the effect of ASCS on the development of CA in the form of SCF does in fact depend on the configuration or bundle of resources that the firm creates. In other words, the presence or absence of a single practice (in this case, ISO 9001) contributes to the outcome produced by ASCS. Our results thus reveal three distinct "recipes" or different combinations of strategies (or practices).

The first recipe serves to develop OSF. A firm that wishes to develop OSF must combine ASCS and ISO 9001. Yet merely opting to implement ASCS is insufficient; the firm will not have orchestrated this network process sufficiently. That is, the absence of ISO 9001 changes the expected effect of an ambidextrous strategy. Our study argues that this result occurs because ISO 9001 creates a continuous improvement culture and perfects firm processes, enabling ASCS to develop OSF. Process management, which is central to ISO 9001, can systematize activities, improving and rationalizing the firm's processes (Llorens-Montes and Fuentes-Fuentes, 2008). This effect enables ASCS to have a positive effect on OSF, a result related to intra-organizational processes.

Our second recipe is oriented to developing SF and DF. In this case, as expected, ASCS as a combinative and coordinated pair of practices indeed fosters this development, confirming the results of prior studies (Adler *et al.*, 2009; Rojo *et al.*, 2016; Tamayo-Torres *et al.*, 2017). The strangest or most surprising outcome is that the positive effect of an ambidextrous strategy disappears when ASCS is combined with the implementation of ISO 9001. This result confirms one of the premises of RO, that the presence of a single practice has the potential to contribute to a strategy's results (Gligor, 2018; Gligor *et al.*, 2020). We argue here that the ISO 9001 standard requires an organization to capture information on the requirements for any items procured and to establish systems that verify purchases. The standard also sets criteria for the selection, evaluation, and re-evaluation of suppliers and distributors (El Mokadem, 2016). Introducing this level of formalization into a buyer-supplier relationship impedes the ability of an ASCS to improve SF and DF. The very combination of practices that is beneficial in the context of OSF becomes problematic in the context of SF and DF, both of which involve inter-organizational processes.

Our third and last recipe serves to develop ISF. In this case, the result is the same whether or not ASCS is blended with ISO 9001. ISO 9001 neither amplifies nor negates the effect of ASCS on ISF. Contrary to the previous recipe, neither the absence nor the presence of the certification is an ingredient enabling or impeding the greater

development of ISF. This result does not align with the premises of RO but instead agrees with studies from the traditional QM literature. Casadesus and De Castro (2005) found that ISO 9001 does not affect the degree to which automated system management is integrated between a firm and its SC members, and this influence may not occur because the standard's level of formality and standardization (Kuo *et al*., 2009) cancels out the positive effect of standardizing and specifying processes.

Finally, regarding RQ3, our results show that the ISO 9001 standard itself has no significant effect on SCF. This provides a SC contribution to the debate concerning the relationship between ISO 9001 and flexibility. The extant literature can be divided into those studies that have found a positive relationship and those that have found a negative relationship between ISO 9001 and flexibility. In the first group, Llorens-Montes *et al.* (2004) found that QM initiatives positively affect organizational and operational flexibility. Firms that had made improvements in quality were more market-oriented and more inclined to adjust to shifts in the environment; and the continuous improvement and customer orientation emphasized in QM contributed to this effect. In the second group, Vouzas and Gotzamani (2005) and Lundmark and Westelius (2006) suggested that ISO 9001 has a detrimental effect on flexibility, as standardization, and conformity lead an organization into becoming static. Our study falls into neither group as it found no significant relationship between ISO 9001 and SCF. Our paper however is in the context of *supply chain* flexibility, not manufacturing flexibility. We argue that the lack of a significant relationship is because ISO 9001 exerts its strongest effect on intra-organizational processes. Its effect at the inter-organizational level is more limited, and non-significant. This result makes perfect sense if we interpret it through the RO approach instead of according to the traditional debate in the QM literature. According to RO, a single attribute (resource, practice, capability) is necessary but insufficient to develop a CA (Gligor *et al.*, 2020). As seen above, when ISO 9001 is combined with ASCS, it helps to develop a CA in specific circumstances (basically, circumstances involving the flexibility of intra-organizational processes). Alone, however – i.e. when not configured with other resources – the standard has absolutely no effect in terms of producing a source of CA (in this case, SCF).

6. Concluding Remarks: Implications for Theory and Practice

6.1 Theoretical Implications

This paper makes three main research contributions. First, and to the best of our knowledge, this is the first paper to analyze the impact of ambidexterity and ISO 9001 in the area of SCM, with a particular focus on the dimensions of SCF. We have developed an integrative and cohesive theoretical framework that has enabled us to interpret ASCS, SCF, and ISO 9001, and their relationships through the theoretical lens of RO.

In accordance with RO, the outcomes in terms of SCF dimensions depend on the joint effect of combining ASCS and ISO 9001. Significantly, as RO predicts, the effects of implementing a strategy stem not only from the strategy itself, but from its combination with other resources (Zaefarian *et al.*, 2012). The prior literature shows that ASCS enables SCF (Rojo Gallego-Burín *et al.*, 2020). But when this relationship is subjected to less-abstract analysis (here, via the analysis of the dimensions of SCF, not a second-order aggregate construct) that includes other practices (in this case, the ISO 9001 standard), the relationship is more complex than revealed by prior studies (Rojo *et al.*, 2016; Rojo Gallego-Burín *et al.*, 2020; Tamayo-Torres *et al.*, 2011; 2014). Specifically, our study demonstrates that an ambidextrous strategy does not function uniformly in all dimensions of SCF. More importantly, by including the two potential enablers analyzed (ambidexterity and ISO 9001), our study reveals that all dimensions of SCF cannot be developed simultaneously with the same combination of resources and strategies. This important insight reveals the difficulty of managing SCF and the absence of any one recipe for developing this source of CA.

It is worth noting that RO is usually summarized based on the assertion that "the whole is greater than the sum of its parts." Our results seem to contradict this characterization (since ISO 9001 prevents ASCS from developing SF and DF), indicating that it is not the right perspective for interpreting RO in combination with our results. A firm may possess the right resources but not obtain the expected results because it does not combine these resources properly. Our study thus underscores the need to take the presence and absence of certain assets into account when identifying combinative and synergistic bundles of practices. This approach provides a complete and comprehensive view of the puzzle of how to develop SCF thereby achieving a more holistic perspective that sheds light on the complex interplay between ASCS and ISO 9001.

Second, this is also the first study to validate the scales for ASCS (Kristal et al., 2010) and SCF (Moon et al., 2012) in the specific context of ISO 9001-certified firms. We find no moderating role for ISO 9001 among the sub-dimensions of either ASCS or SCF. This insight provides empirical evidence in support of the robustness of these measurements.

Finally, our study is the first to analyze the effect of ISO 9001 on SCF, showing empirically that it has, on average, no significant effect on this variable. Our findings thus contribute to resolving the controversial debate on the relationship between flexibility and ISO 9001 (e.g. Llorens-Montes *et al.*, 2004; Casadesus and De Castro, 2005) in the specific context of the SC. We provide a theoretical explanation based on RO, which is an alternative to the explanation based on the traditional QM literature.

6.2 Implications for Practitioners

The results also provide insights to practitioners on how to adapt their SCs to the environment. Managers can use the findings to configure their SCF strategy based on the specific dimension they seek to develop by implementing ambidexterity. More specifically, we provide managers with a framework for action to enable them to configure SC resources and ISO certification (or non-certification) to develop the dimensions of SCF that are important to them. This framework cautions managers that they cannot use the same strategy to develop each single dimension of SCF. That is, the same combination of resources and assets does not work to develop each of different dimensions. Further, the results enable managers to evaluate the incentives for implementing ISO 9001 appropriately in the context of SC management. The differences found between the two groups of firms analyzed confirm the need to integrate QM into SC management (Flynn and Flynn, 2005) and demonstrate the influence of ISO 9001 on the development and results of strategies in the SC. When making the business decision to adopt ISO 9001, managers must take into account that this standard can help an ASCS to influence the development of SCF, specifically OSF, since formalization facilitates the more efficient management of intra-organizational processes. It is also true, however, that such formalization standardizes relationships with suppliers and distributors, and thus hinders an ASCS from developing SF and DF. What the firm gains in OSF may thus be lost in SF and DF. Therefore, to prevent ISO 9001 from interfering with the relationship between ASCS and SCF, managers must accompany its implementation with careful and efficient process management to avoid increasing the complexity of relationships with other SC members.

Finally, the finding that ISO 9001 certification has no significant effect on any of the dimensions of SCF builds on prior literature and is important in practice for two reasons. First, Tamayo-Torres *et al.* (2014a) showed that ISO 9001 implementation has no impact on manufacturing flexibility. Our study extends this to the supply chain flexibility level. Second, authors such as Casadesus and De Castro (2005) indicated that ISO 9001 increases formalization and rigidity. In contrast, our study has demonstrated that this does not occur at the SC level. Thus, our study provides guidance on the decision to adopt the ISO 9001 standard relative to its effects on the SC. Managers who are committed to the flexibility of the SC should not perceive ISO certification to be a hindrance to this goal. In fact, they should be aware that ISO 9001 can even facilitate the development of some dimensions of SCF in combination with an ASCS.

6.3 Limitations and Suggestions for Future Lines of Research

The results of this investigation must be considered in the context of its limitations. First, our study is based on cross-sectional data. It could be complemented in the future by longitudinal data to permit causal inferences. Second, the ISO variable has been recorded as a categorical variable, only measuring whether or not the firm possesses the certification. Third, our study is restricted to the country of Spain, making it necessary to test our hypotheses in other geographical areas. Further, we have used only one informant per firm. Future studies should incorporate more informants, including the perspectives of suppliers and distributors. Nevertheless, we should note that it is incorrect to assume that the use of a single method entails the existence of systematic bias (Spector, 2006).

Finally, we call for research to continue the line of research initiated here, in two directions. First, it is important to analyze the effects of QM practices in the light of RO theory, as such investigations will permit a more accurate interpretation of firm performance. Second, to ensure the validity of future QM research, it is important that studies that use the measurement instruments from non-QM literature demonstrate their invariance or equivalence across firms that have not implemented QM practices and firms that have implemented these practices.

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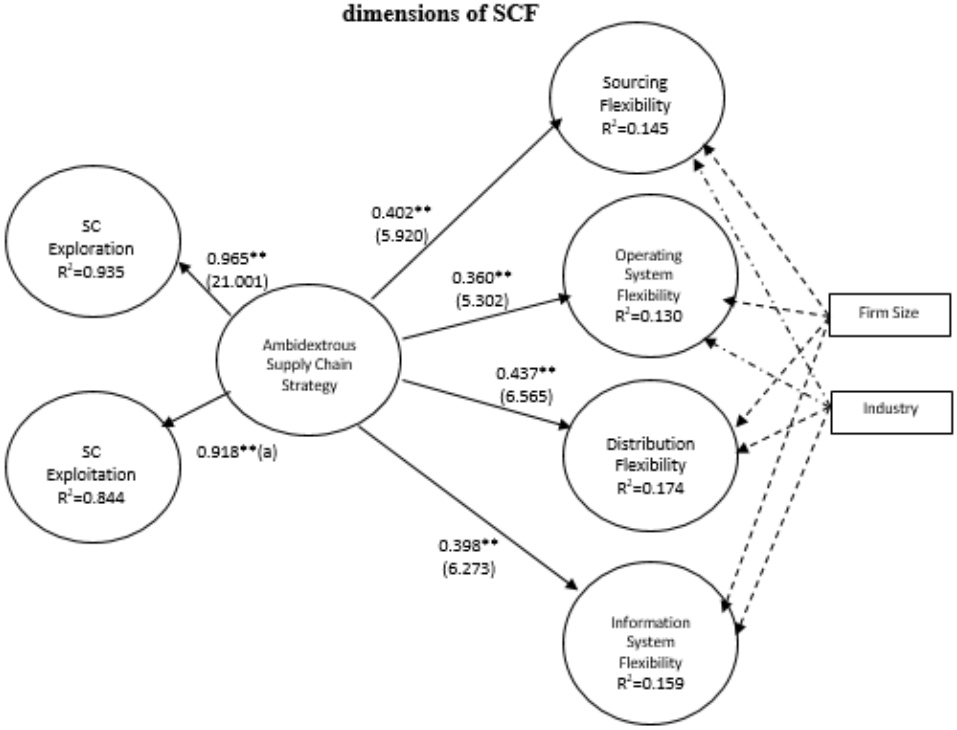
Figure 1: Structural modelling for the relationships between ASCS and the dimensions of SCF



NFI=0.920, NNFI=0.950, CFI=0.955, RMSEA=0.053

**significant at a significance level of 0.05

a indicates that the parameter was set at 1.0. However, setting a parameter different from 1.0, also produced statiscally significant scale indicators.

- - - - → indicates a non significant relationship

Table I: CFA for First-Order Constructs

Item	Factor Loading	t-value	R^2	Scale Reliability
SC Exploration				
Exlr1	0.764	a[1]	0.584	CR: 0.895 AVE: 0.683 α: 0.863
Exlr2	0.810	14.620	0.655	
Exlr3	0.807	14.567	0.651	
Exlr4	0.918	16.491	0.843	
SC Exploitation				
Exlp1	0.915	a	0.837	CR: 0.958 AVE: 0.852 α: 0.945
Exlp2	0.915	26.890	0.837	
Exlp3	0.951	30.182	0.903	
Exlp4	0.912	24.525	0.832	
Sourcing Flexibility				
SF1	0.821	a	0.674	CR: 0.884 AVE: 0.717 α: 0.816
SF2	0.834	15.993	0.696	
SF3	0.884	16.584	0.782	
Operating System Flexibility				
OSF1	0.925	a	0.855	CR: 0.967 AVE: 0.878 α: 0.950
OSF2	0.943	31.257	0.890	
OSF3	0.970	34.678	0.940	
OSF4	0.909	27.605	0.827	
Distribution Flexibility				
DF1	0.825	a	0.680	CR: 0.931 AVE: 0.818 α: 0.863
DF2	0.953	21.384	0.909	
DF3	0.931	20.945	0.867	
Information System Flexibility				
ISF1	0.911	a	0.830	CR: 0.714 AVE: 0.556 α: 0.871
ISF2	0.915	11.083	0.831	

[1] a indicates that the parameter was set at 1.0. However, setting a parameter different from 1.0 also produced statistically significant scale indicators.

Table II: CFA for Second-Order Construct

Factors	Standardized Parameters	t-values	R^2	Scale Reliability
Ambidextrous SC Strategy				
SC Exploitation	0.918	a[1]	0.844	CR:0.940
SC Exploration	0.965	21.001	0.931	AVE: 0.887 α: 0.901
CFI 0.964; NFI 0.957; IFI 0.964; GFI 0.921; AGFI 0.942; RMSEA 0.05				

[1] a indicates that the parameter was set at 1.0. However, setting a parameter different from 1.0 also produced statistically significant scale indicators.

Table III: Correlation Matrix

	1	2	3	4	5	6
1.Exlr	**0.826**					
2.Exlp	0.590***	**0.923**				
3.SF	0.405***	0.365***	**0.847**			
4.OSF	0.421***	0.427***	0.373***	**0.937**		
5.DF	0.455***	0.347***	0.402***	0.448***	**0.904**	
6.ISF	0.511***	0.410***	0.430***	0.408***	0.350***	**0.746**

*** Significant at 0.01.

Table IV: HTMT Ratio

HTMT	Exlr	Exlp	SF	OSF	DF	ISF
Exlr						
Exlp	0.837					
SF	0.639	0.499				
OSF	0.593	0.521	0.506			
DF	0.682	0.451	0.581	0.577		
ISF	0.744	0.517	0.603	0.511	0.467	

Table V: Measurement Invariance Analysis

	$\chi 2$	df	$\Delta\chi 2$ / Δdf	$\Delta\chi 2$ / Δdf p value	CFI
Nonrestricted model (Model 1)	567.631	310	_	_	0.920
Metric invariance model (Model 2)	583.258	324	15.627/14	0.337	0.918

Table VI: Parameter Estimate Differences between ISO Certified and ISO Non-Certified Firms

		ISO 9001 certified firms		ISO 9001 non-certified firms	
Paths	Critical Ratios (C.R.) for differences between parameters	Standardized parameter (t value)	R^2	Standardized parameter (t value)	R^2
ASCS →SF	-4.003	0.124 (n.s)	-	0.438***	0.192
ASCS →OSF	-3.928	0.443***	0.197	0.183 (n.s)	-
ASCS →DF	-4.156	0.101 (n.s.)	-	0.509***	0.259
ASCS→ISF	0.070	0.363***	0.161	0.410***	0.168

Table VII: Multivariate Analysis of Variance (MANOVA)

Approach	Value	F	d.f.	Sig.	Partial Eta Squared
Pillai's Trace	0.030	2.283	4	0.060	0.030
Wilk's Lambda	0.970	2.283	4	0.060	0.030
Hotelling's Trace	0.031	2.283	4	0.060	0.030
Roy's Largest Root	0.031	2.283	4	0.060	0.030

Appendix A: Sample characteristics

	N	Percentage (%)
Manufacturing industry[1]		
Food products, beverages, and tobacco	3	1
Textile and wearing apparel	5	1.65
Chemistry and pharmaceuticals	26	8.61
Plastics	28	9.27
Computers, electronics, and optical equipment	23	7.61
Electrical equipment	30	9.93
Machinery and equipment	110	36.42
Furniture	47	15.57
Automobile	25	8.29
Other	5	1.65
Total	302	100
Size of firm (no. employees)		
10-49	69	22.85
50-250	142	47.02
251-1000	58	19.20
Over 1000	33	10.93
Total	302	100

[1] According to the International Standard Industrial Classification of all economic activities (ISIC)