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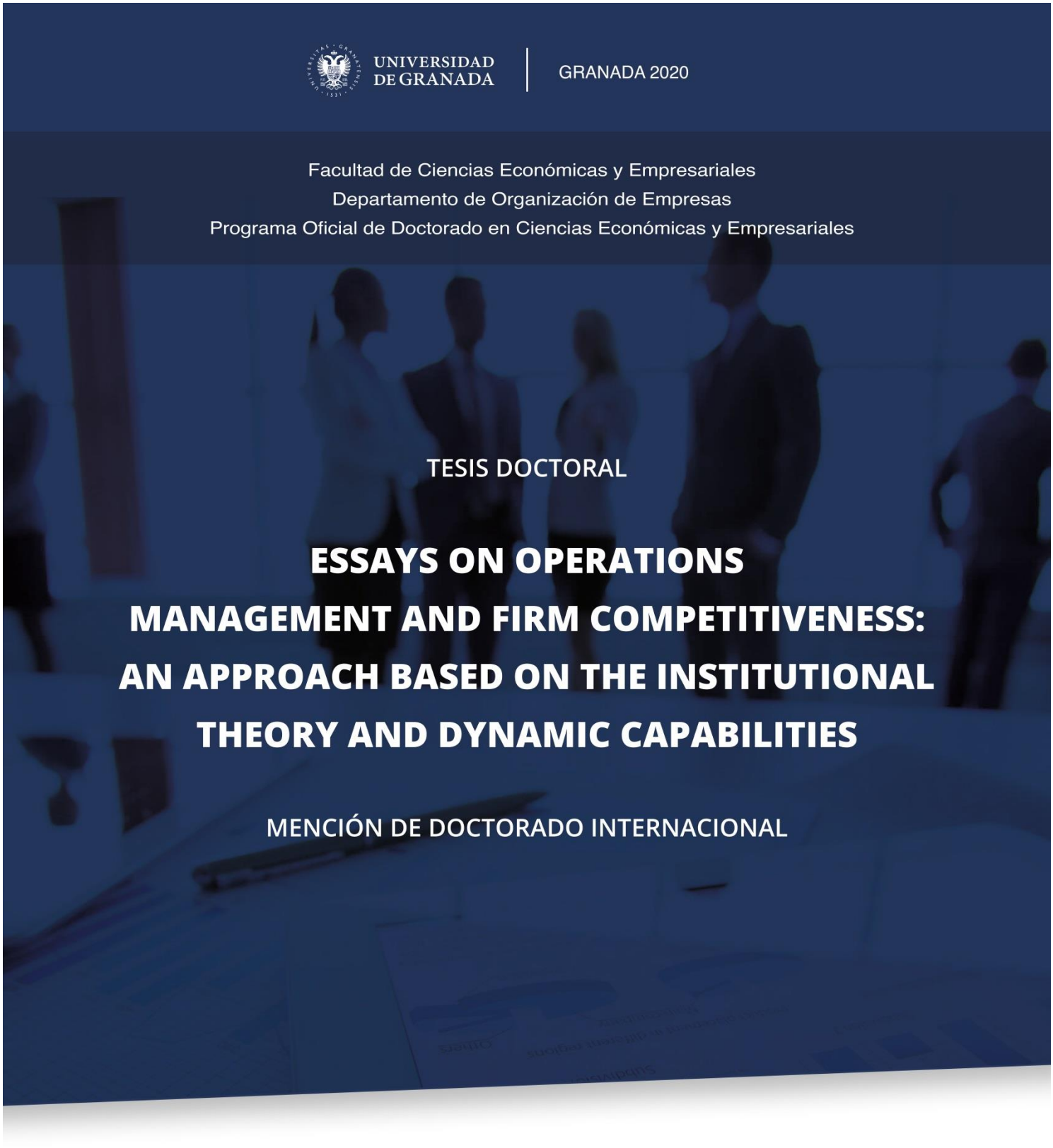
Programa Oficial de Doctorado en Ciencias Económicas y Empresariales



TESIS DOCTORAL

ESSAYS ON OPERATIONS MANAGEMENT AND FIRM COMPETITIVENESS: AN APPROACH BASED ON THE INSTITUTIONAL THEORY AND DYNAMIC CAPABILITIES

MENCIÓN DE DOCTORADO INTERNACIONAL

TESIS DOCTORAL PRESENTADA POR:

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"…Todo principio no es más que una continuación
y el libro de los acontecimientos
se encuentra siempre abierto a la mitad"

Wisława Szymborska

…….. A mi familia……
……..a la que me eligió y a la que yo elijo……..

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CAPÍTULO 1

Introducción

Introducción

El comienzo turbulento del nuevo siglo ha traído nuevos desafíos para países, industrias y empresas. El éxito y la supervivencia empresarial actual exigen nuevas perspectivas sobre la competitividad. Los avances en la tecnología de la información (TI), la globalización de los mercados, las operaciones descentralizadas, el aumento de la conciencia hacia las preocupaciones ambientales y sociales y la dependencia de los socios externos han obligado a las empresas a repensar sus estrategias y técnicas de productividad y calidad, incluido el enfoque de la dirección de operaciones (Gunasekaran y Ngai, 2012; Wamba et al., 2019). La dirección de operaciones ha experimentado cambios sustanciales desde sus orígenes en la industria manufacturera del siglo XIX (Sprague, 2007). Sus prácticas y estrategias tradicionales han quedado superadas por un nuevo paradigma que ha situado a la dirección de operaciones no sólo como un elemento dinámico y en continua expansión sino también como un elemento clave para la competitividad (Choi et al., 2016). En la actualidad, esta se ha convertido en mucho más que actividades relacionadas con la fabricación. La dirección de operaciones representa el corazón de cualquier negocio, ocupa la mayor parte de recursos de la empresa y es un elemento esencial en la posición competitiva futura y en la capacidad de respuesta al cliente (Zhao y Lee, 2009; Slack y Brandon-Jones, 2018). Las empresas, actores claves de un mercado global, deben proporcionar productos que satisfagan las preferencias cambiantes de los consumidores, mientras mantienen su capacidad para destacar simultáneamente en estándares de calidad, entrega, flexibilidad y bajo costo (Kristal et al., 2010; Gunasekaran y Ngai, 2012).

1.1. Marco general de la tesis doctoral

El marco general en el que se encuadra este trabajo de investigación es en el área de la Dirección de Operaciones. Específicamente, esta tesis evalúa cómo diferentes prácticas y estrategias utilizadas en el área de operaciones de la empresa en general, y en la gestión de la cadena de suministro en particular, pueden favorecer la competitividad empresarial ya sea, a través de la mejora del rendimiento operativo de la empresa o bien, del desarrollo de capacidades claves que permitan a la empresa competir en el mercado actual. Dos perspectivas teóricas emergentes en el desarrollo del campo son utilizadas para la investigación: la teoría institucional y el marco teórico de las capacidades dinámicas.

Tal y como se ha señalado anteriormente, los nuevos desafíos del entorno actual han obligado a las organizaciones a implementar nuevas técnicas, tecnologías y estrategias del área de operaciones con el fin de mantener su competitividad (Gunasekaran y Ngai, 2012). La competitividad en la dirección de operaciones requiere cambios significativos no sólo en las diferentes dimensiones de las capacidades operativas de la empresa (coste, calidad, entrega y flexibilidad) (Zhao y Lee, 2009; Kristal et al., 2010) sino también en el diseño e implantación de estrategias en el área (Gunasekaran y Ngai, 2012). En este sentido, diversos autores señalan la necesidad de explorar cómo la empresa puede mejorar su competitividad en las estrategias de operaciones utilizando los preceptos teóricos institucionales (Meredith, 2001; Zhao y Lee, 2009; Gunasekaran y Ngai, 2012) así como, utilizando las relaciones con los socios de la cadena de suministro en aras de contribuir al desarrollo de ciertas capacidades dinámicas (Cheng y Chen, 2014; Aslam, et al., 2018; Hong et al., 2018). Hasta la fecha, el estudio en detalle de estas cuestiones ha sido muy escaso o deficiente en la literatura. Por este motivo, esta tesis doctoral pretende suplir este vacío, profundizando en el desarrollo y análisis empírico del conocimiento sobre estas dos grandes cuestiones de la dirección de operaciones. En primer lugar, se evalúa cómo

impacta el entorno institucional en la adopción de ciertas estrategias en el área de operaciones y su efecto en la competitividad empresarial. En segundo lugar, se analiza cómo las relaciones en la gestión de la cadena de suministro (fundamentalmente relaciones con proveedores) favorecen el desarrollo de capacidades dinámicas (como por ejemplo la capacidad de innovación de la cadena de suministro) mejorando la competitividad empresarial.

1.2. Delimitación del tema objeto de estudio

Estrategias de operaciones y su impacto en la competitividad empresarial a partir de la Teoría Institucional.

Diversos autores reconocen la necesidad de examinar el impacto del entorno institucional en la elección de prácticas y estrategias de operaciones como un aspecto clave de la competitividad empresarial (Meredith, 2001; Ketokivi y Schroeder, 2004; Zhao y Lee, 2009, Gunasekaran y Ngai, 2012). Sin embargo, a pesar de considerarse al entorno institucional un factor crítico para el desarrollo de las operaciones y del enorme potencial de la teoría para explicar por qué las organizaciones adoptan ciertas prácticas en esta área, son prácticamente inexistentes los estudios que analizan esta relación (Rogers et. al, 2007; Cai et al., 2010; Liu et al., 2010; Kauppi, 2013; Sodero et al., 2013). En general, las investigaciones se han centrado principalmente en aspectos relativos a la gestión de la calidad, gestión de la cadena de suministro verde y aplicaciones electrónicas (Kauppi, 2013). No obstante, estudios que evalúen el impacto del entorno institucional sobre otras variables claves en la competitividad (por ejemplo, variables estructurales, culturales y tecnológicas) y su relación con el rendimiento de operaciones son todavía muy escasos y requieren una investigación más profunda y detallada. Empresas de todo el mundo influenciadas por un entorno

institucional globalizado, adoptaron muchas prácticas y estrategias de fabricación innovadoras provenientes de Japón. Sin embargo, dicha adopción no tuvo los resultados esperados para las empresas adoptantes (Ketoviky y Schroeder, 2004; Pereira et al., 2014). Aunque hace ya más de una década Ketokivi y Schroeder (2004) señalaron la necesidad de investigar este aspecto en el área de operaciones, investigaciones explícitas de los preceptos institucionales en el ámbito de la dirección de operaciones continúan siendo inexistentes o vagamente desarrollados.

Desde la perspectiva institucional, el entorno crea un conjunto de normas que afectan de modo sustancial a las organizaciones y las persuade a comportarse conforme a las mismas (Meyer y Rowan, 1977). Esta presión hacia la conformidad, lleva a las organizaciones a adoptar prácticas y estrategias similares a los competidores más legítimos o exitosos de su entorno (Wu et al., 2012; Sharma y Daniel, 2016), generando cierto grado de homogeneidad interogranizacional o isomorphism (Hawley, 1968; DiMaggio and Powell, 1983; Meyer y Rowan, 1977; Zucker, 1987). El isomorfismo es un *"proceso restrictivo que obliga a una unidad de una población a parecerse a otras unidades que enfrentan el mismo conjunto de condiciones medioambientales"* (DiMaggio y Powell, 1983; p.149).

Tres son los mecanismos principales que fuerzan a las organizaciones al isomorphism: coercive, normative and mimetic (DiMaggio y Powell,1983) y que han sido empleados en la mayoría investigaciones sobre operaciones (Wu et al., 2013). El isomorfismo coercitivo se refiere a las presiones formales e informales que otras organizaciones poderosas ejercen sobre la organización (DiMaggio and Powell, 1983). Por ejemplo, una empresa poderosa puede obligar a sus socios a adoptar ciertas prácticas operacionales que les sean favorables (Liu et al., 2010; Kauppi; 2013). El isomorfismo normativo se relaciona con los esfuerzos colectivos de los grupos para profesionalizar las prácticas organizativas, definiendo tanto las condiciones como los métodos de su trabajo (Barratt y Choi, 2007). Por ejemplo, organizaciones como la

Asociación Europea de Gestión de Operaciones (EUROMA) o la Sociedad de Gestión de Producción y Operaciones (POMS) favorecen el isomorfismo normativo en el área de operaciones (Kauppi, 2013). Por último, el isomorfismo mimético sugiere que, cuando las organizaciones no saben exactamente cómo deben actuar debido a la incertidumbre del entorno, éstas tienden a imitar voluntariamente las estrategias exitosas de otras organizaciones de su industria (Barreto y Fuller, 2006). Esto se produce porque las organizaciones atribuyen el éxito de sus competidores a las estrategias empleadas, convirtiéndose en un motor para la imitación. Por ejemplo, si algunas empresas del sector tienen éxito al adoptar sistemas de gestión de la cadena de suministro habilitados para Internet (eSCM), el resto de empresas podría intentar imitar estas estrategias con el fin de replicar dicho éxito (Liu et al., 2010). Por lo tanto, cuanto mayor sea la incertidumbre en el entorno, mayor será la probabilidad de que una empresa se modele a sí misma siguiendo a aquellas empresas percibidas como más legítimas o exitosas. Ahora bien, es reconocido por la literatura que estos mecanismos impactan en la adopción de ciertas prácticas de operaciones, pero se desconoce cuál es el resultado de dicha adopción. Este estudio pretende cubrir este vacío en la literatura.

***Estrategias en la gestión de la cadena de suministro y su impacto en la competitividad empresarial a partir del marco teórico de las capacidades dinámicas*.**

En la actualidad, la dirección de operaciones tiene un desafío importante. Las empresas no sólo deben integrar los procesos operacionales a nivel interno sino también a nivel externo, con los socios de su cadena de suministro (Gunasekaran y Ngai, 2012). Las organizaciones ya no pueden mejorar significativamente sus capacidades relacionadas con las operaciones mediante el uso exclusivo de sus propios recursos. Las organizaciones necesitan gestionar y aprovechar los recursos y

capacidades de sus proveedores y clientes claves. Por lo tanto, la gestión de la cadena de suministro se ha convertido en un tema esencial para la dirección de operaciones ofreciendo nuevas oportunidades para las investigaciones de las estrategias de operaciones. Ahora bien, debido a las condiciones actuales del entorno, la gestión de la cadena de suministro se ha convertido en un tema complejo y dinámico, lo cual requiere desarrollar y aplicar diferentes capacidades dinámicas en las cadenas de suministro (Hong et al., 2018).

La teoría de las capacidades dinámicas, una extensión de la teoría de recursos y capacidades, indica que en entornos con alta incertidumbre la ventaja competitiva depende del desarrollo de capacidades dinámicas (Teece et al., 1997). Estas capacidades permiten una mejor adaptación al entorno mediante la actualización, integración y modificación de capacidades ordinarias (o capacidades operativas que determinan cómo una empresa se gana la vida en el momento actual) (Kwak et al., 2018; Laaksonen y Peltoniemi, 2018).

La investigación existente sobre capacidades dinámicas ha demostrado el efecto positivo de estas en la creación de valor y en el rendimiento de la empresa (Teece et al., 2018). Sin embargo, en el contexto de las cadenas de suministro, sólo existen investigaciones limitadas debido a la novedad en la aplicación de dicho concepto (Hong et al., 2018). El concepto tradicional de capacidades dinámicas desarrolladas internamente por la empresa, se ha extrapolado a su desarrollo por la cadena de suministro (Aslam et al., 2018). Las cadenas de suministro permiten a las empresas desarrollar capacidades dinámicas fruto de la coordinación de los recursos de la propia empresa y de los recursos de los socios de la cadena de suministro para enfrentar mejor los cambios del mercado (Aslam et al., 2018; Teece, 2018). Por esta razón, esta investigación explora diferentes capacidades dinámicas como la agilidad o la capacidad de innovación en el contexto de la cadena de suministro y su relación con la mejora de la competitividad, cubriendo un vacío en la literatura existente.

1.3. Objetivos de investigación

La delimitación específica de nuestro objeto de estudio a través de la revisión de la literatura realizada en el apartado anterior nos permite formular los objetivos de esta investigación. El objetivo básico de la presente tesis doctoral es abordar las nuevas tendencias en la dirección de operaciones con el fin de ayudar a las organizaciones a incrementar su competitividad empresarial. Este objetivo se desagrega a su vez en otros dos objetivos expuestos a continuación.

En primer lugar, profundizar y analizar la relación entre diferentes estrategias en el área de operaciones y su relación con el desempeño desde la perspectiva teórica institucional. Específicamente se investiga de forma detallada y explícita cómo el ajuste institucional en diferentes estrategias desarrolladas por el área de operaciones de la empresa (estructura, cultura y tecnología) afecta el desempeño de operaciones.

En segundo lugar, explorar el papel de diferentes capacidades dinámicas en el contexto de la gestión de la cadena de suministro. Específicamente se analiza lo siguiente:

- Cómo puede desarrollarse la agilidad de la cadena de suministro. Para lo cual se investiga una variable interna de la empresa: el sistema de memoria transactiva y una variable externa, la flexibilidad de la red de proveedores de la empresa.
- Cuál es el papel de la agilidad de la cadena de suministro en el desempeño de operaciones.
- Cómo influye la ambidestreza en la cadena de suministro sobre la capacidad de innovación en la cadena de suministro.

- Cuál es el papel moderador del sistema de memoria transactiva del departamento de operaciones de la empresa en la relación ambidestreza e innovación en la cadena de suministro.

1.4. Estructura del trabajo de investigación

La presente tesis doctoral está compuesta por cinco capítulos que se agrupan en tres bloques: la introducción (Capítulo 1), el cuerpo central de la tesis o trabajos de investigación (Capítulos 2, 3, y 4), y las conclusiones finales (Capítulo 5).

En el Capítulo 1 se introduce el tema objeto de estudio: las nuevas tendencias en dirección de operaciones. Se hace una breve síntesis donde se exponen los cambios que han motivado el desarrollo de nuevas estrategias en la dirección de operaciones en general y en la gestión de la cadena de suministro en particular. Al mismo tiempo, se introducen las dos perspectivas teóricas utilizadas en la investigación. Se delimitan los aspectos claves que han motivado el desarrollo de la investigación, exponiendo el interés actual por el desarrollo de estudios empíricos que incrementen el conocimiento del área. Específicamente, estudios que ayuden a comprender cómo las empresas pueden incrementar su competitividad a partir del diseño e implantación de diferentes estrategias en el área de operaciones. También en este capítulo se plantean el propósito general y los objetivos específicos de la presente tesis doctoral. Finalmente se justifica el interés académico y empresarial de esta investigación.

El objetivo básico de la presente tesis doctoral se desagregaba en otros dos objetivos. En el Capítulo 2 se aborda el primero de ellos. Se investiga cómo el ajuste institucional en diferentes estrategias desarrolladas por el área de operaciones de la empresa (estructura, cultura y tecnología) afecta al desempeño. En este capítulo se hace una revisión exhaustiva del debate existente en la literatura institucional y la literatura de dirección de operaciones en la relación al desarrollo de estrategias de

operaciones y su impacto en el desempeño. Se explica qué estrategias de operaciones se recomiendan adoptar para la mejora del desempeño de operaciones, desde una perspectiva institucional. El modelo teórico propuesto es contrastado utilizando una muestra de 200 empresas españolas en el sector de la alta tecnología.

En el Capítulo 3 se aborda el segundo objetivo de la tesis. Se explora el papel de una capacidad dinámica como la agilidad en el contexto de la gestión de la cadena de suministro de la empresa y su impacto en el desempeño de operaciones. En este capítulo se evalúa, además, cómo la empresa puede desarrollar dicha agilidad, explorando el sistema de memoria transactiva y la flexibilidad de la red de suministro de la empresa. Se prueban cinco relaciones hipotéticas con datos de encuestas de 190 empresas en el sector de la alta tecnología.

En el Capítulo 4 se aborda también el segundo objetivo de la tesis. Se explora como la ambidestreza en la cadena de suministro puede contribuir al desarrollo una capacidad dinámica determinante para la competitividad empresarial: la capacidad de innovación en la cadena de suministro. Evaluamos, además, el papel mediador de la integración del proveedor (en la relación ambidestreza de la cadena de suministro y capacidad de innovación de la cadena de suministro) y el papel moderador del sistema de memoria transactiva en la relación ambidestreza de la cadena de suministro e integración del proveedor. Una muestra final compuesta por 205 empresas en el sector de la alta tecnología es usada para testar el modelo teórico propuesto.

Finalmente, en el Capítulo 5 se resumen las principales conclusiones derivadas de los resultados empíricos de esta investigación, destacando las contribuciones teóricas más relevantes. En este capítulo también se señalan una serie de aplicaciones prácticas, especialmente relevantes para los responsables del área de operaciones y/o de la gestión de la cadena de suministro de la empresa. Las limitaciones relativas al diseño de investigación y las futuras líneas de investigación son también detalladas en este apartado.

1.5. Justificación e interés de la investigación

El entorno hipercompetitivo actual, caracterizado por clientes exigentes, ciclos de vida de productos cortos, oferta y demanda volátiles, cadenas de suministro globales y rápidos avances tecnológicos, ha llevado a las empresas a buscar nuevas formas de competir. La estrategia de operaciones en un entorno global permite mejorar esta competitividad. Son innumerables los ejemplos de empresas en los que su estrategia de operaciones ha influido de forma clara en su éxito empresarial: Mercadona, Dell, Inditex, Ikea, Amazon o Toyota son algunos de los más conocidos. El éxito de Toyota, por ejemplo, se basa en la excelencia de sus operaciones, la cual incluye la gestión de proveedores, la gestión de sus fábricas y de sus canales de distribución (Aoki y Wilhelm, 2017). Las prácticas y estrategias de operaciones de la empresa la sitúan en una posición de ventaja competitividad sostenida en la industria. Toyota es capaz de ofrecer una mayor calidad de producto mientras obtiene una mayor eficiencia operativa que sus competidores.

Este ejemplo pone de relieve la importancia de adoptar prácticas en el área de operaciones que conduzcan a una mejora de la competitividad empresarial, basadas en el ámbito interno de las operaciones de la empresa y/o en su relación con los socios de la cadena de suministro.

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CAPÍTULO 2

Stratified View of Institutional Fit in the OM field

Abstract

The goal of the study is to analyse the impact of institutional fit (IF) on performance. Specifically, three variables of the IF in the operations field of the firm are evaluated: structure, culture and technology. Institutional theory suggests that external forces motivate firms to undertake similar strategic actions causing IF. Although the relevance of fit on performance has been considered an essential issue for institutional theory and operations management, its effects on performance remain a matter of debate in both areas. The results of the researches developed so far are as scarce as contradictory. The results suggest the possibility of stratification of the IF. The proposed theoretical model was tested using a sample of 200 Spanish firms in the high technology sector and the hypotheses validated using hierarchical regression analysis.

Keywords: Institutional fit, isomorphism, performance, strategies, operations management.

2.1. Introduction

Over the past three decades, institutional theory has developed into one of the leading perspectives in organizational analysis (Heugens and Lander, 2009). Its primary thesis is that the institutional environment influences organizational behavior (Oliver, 1991). Organizations are embedded in institutional environments or organizational fields (Kostova and Roth, 2008) that promote norms "*explaining what is and what is not, what can be acted upon and what cannot*" (Hoffman, 1999; p. 351).

In this regard, it is deemed good for organizations to conform to institutional norms (Heugens and Lander, 2009) to obtain legitimacy (i.e. acceptance from business partners) and resources (i.e. new contracts). By doing so, organizations fit better into

the institutional environment and increase their performance (Deephouse, 1999; Westphal, 1997; Heugens and Lander, 2009; Volberda et al., 2012). Simply put, to increase performance, they should increase their institutional fit.

Institutional fit has been formally defined as "*the degree of compliance of an organization*" to institutional norms (Kondra and Hinnings, 1998; p. 750). This fit is an outcome state derived from isomorphic processes (Hawley, 1968), wherein organizations take on the institutionally accepted traits and end up resembling each other (DiMaggio and Powell, 1983). From the organizational perspective, the goal is to attain fit with its institutional environment (Dacin, 1997).

Questions arise, "Is fit always good?" or "Is there more to fit when it comes to how it affects performance?" There are studies that promote fit is good (Heugens and Lander, 2009; Volberda et al., 2012; Wu et al., 2012; Zhu and Sarkis, 2007). The institutional fit allows obtaining better resource, efficient practices, and better learning (Deephouse, 1999; Volberda et al., 2012; Wu et al., 2012; Heugens and Lander, 2009). However, there are studies that suggest otherwise (Westphal et al., 1997; Barreto and Baden-Fuller, 2006; Choi and Eboch, 1998; Miemczyk, 2008). Institutional fit can be costly and awkward and can take away its competitiveness (Barreto and Baden-Fuller, 2006; Westphal et al., 1997). Institutional fit can have varied effects on performance involving customer satisfaction versus plant efficiency (Choi and Eboch, 1998). Therefore, the goal of the present study is to investigate more deeply into how institutional fit affects performance in the area of Operations Management (OM). Ketoviky and Schroeder (2004) point out that this research is a key issue in the OM literature due to the lack of empirical evidence in this field. For example, many innovative manufacturing practices in Japan evolved around an institutional fit. However, the institutional fit did not have the expected results for the organizations that adopted it (Ketoviky and Schroeder, 2004).

We hope to make two contributions to the literature. First, we intend to contribute to the debate surrounding the association between institutional fit and performance in the field of OM. Second, we espouse a stratified view of institutional fit as a construct. Building on the past literature (Volberda et al., 2012; add other REFs), we propose three dimensions of institutional fit: structure, culture and technology. We will investigate whether and how performance might vary across different dimensions considered for the fit. In general, studies have analyzed institutional fit as a unidimensional construct (Heugens and Lander, 2009; Deephouse, 1996; Miller and Eden, 2006; Wu and Salomon, 2016; Volberda et al., 2012). Even Volberda et al. (2012) that theorized three different dimensions of institutional fit treated it as a single construct when testing it. We intend to fill this gap in the literature.

2.2. Literature Review

2.2.1. Definitions and context: Isomorphism as a process and institutional fit as an outcome state

Organizations that share the same organizational field face similar conditions from their environment causing organizational homogeneity (Dacin, 1997). This phenomenon is known as isomorphism (Hawley, 1968; DiMaggio and Powell, 1983; Meyer and Rowan, 1977; Zucker, 1987). Traditionally, the studies on isomorphism have used this concept as both an outcome state (Deephouse, 1996; Liu et al., 2010; Wu and Salomon, 2016) and a process (William et al., 2009; DiMaggio and Powell, 1983; Barreto and Baden-Fuller, 2006). However, we conceptualize isomorphism here as a process. That is, isomorphism is a "*constraining process that forces one unit in a population to resemble other units that face the same set of environmental conditions*" (DiMaggio and Powell, 1983:149). Through this isomorphic process, organizations incorporate the norms of organizational field, in their structures and practices, coming

to resemble their environment and each other over time (Dacin, 1997; DiMaggio & Powell, 1983; Meyer & Rowan. 1977). In their seminal work, DiMaggio and Powell (1983) established three types of isomorphic pressures that encourage organizations to develop this isomorphic process: coercive, normative and mimetic pressures. Coercive pressures refer to the formal and informal pressures that other organizations put on the organization. (DiMaggio and Powell, 1983). Normative pressures are related to the collective efforts of groups to professionalize organizational practices to define both the conditions and the methods of their work (Barratt y Choi, 2007). Lastly, mimetic pressures arise when organizations do not know exactly how to behave due to uncertainty of environment; they voluntarily tend to mimic the successful strategies of other organizations in their industry (Kauppi, 2013; DiMaggio y Powell, 1983; Barreto y Baden-Fuller, 2006).

The final result of this isomorphic process is institutional fit (Deephouse, 1996). Institutional fit is defined as *"the degree of compliance of an organization*" to institutional norms (Kondra and Hinings, 1998; p.750). In this paper, therefore, we conceptualize institutional fit as an outcome state -at a given point in time- derived from isomorphic process.

From imperative institutional, the primary goal of organizations in their organizational fields is to achieve the fit with their environment (Dacin, 1997). Institutional fit allows organizations to achieve legitimacy –or social justification- in their organizational fields (DiMaggio y Powell, 1983; Meyer y Rowan, 1977; Heugens y Lander, 2009) which generates positive evaluations towards them and increases their probability of survival (Deephouse y Suchman, 2008).

2.2.2. The debate: institutional fit and performance

Despite the extensive body of work examining the antecedents and consequences of institutional fit (Wu and Salomon, 2016), their effects on performance remain a topic of debate not only in the institutional literature (Volberda et al., 2012; Heugens and Lander, 2009) but also in the operations management (OM) (Wu et al., 2012; Rogers et al., 2007; Wu et al., 2013). The theory suggests managers can exercise discretion as to why, when, and how to adopt isomorphism (Oliver, 1991, 1997; Wu and Salomon, 2016) obtaining a greater or lesser institutional fit. However, when organizations are subject to isomorphic pressures in the interest of achieving greater institutional fit, what happens to their performance?

Institutional theory considers the effects of isomorphic behaviour on performance an essential topic for the development of the field (Kondra and Hinnings, 1998). Various studies have thus attempted to evaluate whether or not institutional fit really improves performance (Heugens and Lander, 2009; Volberda et al., 2012; Wu and Salomon, 2016; Miller and Eden, 2006). Nevertheless, the results obtained have been as contradictory as they are few. At the same time, although the isomorphism-performance debate has not been as explicit in OM as in the institutional theory literature, some studies hint at contradictory findings among the isomorphic pressures (whose final result is the isomorphism and institutional fit) and efficiency (Rogers et al., 2007; Choi and Eboch, 1998; Miemczyk, 2008; Westphal et al., 1997; Wu et al., 2012; Zhu and Sarkis, 2007). In the OM literature, scholars in general agree with the importance of institutional issues in the area (Miemczyk, 2008; Huang et al., 2010; Kauppi, 2013; Liu et al., 2010). Frequently, operations managers have to address "*substantive operational activities"* (Rogers et al., 2007:570) and to comply with the norms governing in their organizational fields (Kauppi, 2013). For instance, they have to be concerned about the current quality requirements on the production floor and also the quality certification requirements by external agencies such as ISO.

Accordingly, the institutional environment plays a determining role in the adoption of certain operating practices (Cai et al., 2010; Choi and Eboch, 1998; Ketokivi and Schroeder, 2004; Kauppi, 2013). However, explicit, direct studies of isomorphism and institutional fit are nearly nonexistent in OM (Ketokivi and Schroeder, 2004; Miemczyk, 2008; Huang et al., 2010; Kauppi, 2013; Liu et al., 2010).

2.2.2.1. Positive relationship argument.

Some institutional theoreticians consider institutional fit and performance are closely related concepts with a positive correlation (Heugens and Lander, 2009; Volberda et al., 2012; Miller and Chen, 1995; Deephouse, 1999; Zaheer, 1995). That is, they affirm that institutional fit improves performance. In this regard, using a meta-analytic approach with a database composed of studies in the area of organizational institutionalism, Heugens and Lander (2009) found that conformity to institutional norms improved organizational performance. This positive relationship between isomorphism and performance was due primarily to three issues. First, institutional legitimacy enabled isomorphic organizations to attract higher-quality resources under better conditions. Second, institutionalized practices were more efficient practices. Third, isomorphism enabled some degree of differentiation. Despite the inherent homogeneity of an organizational field, organizations could customize some practices. Following this line of argumentation and examining a sample of 1,904 firms active in the Netherlands, Volberda et al. (2012) argued that institutional fit was positively associated with firm performance. Institutional fit increases performance through different reinforcing mechanisms such as collective learning and access to resources. Similarly, in a longitudinal study of commercial banks, Deephouse (1999) found that strategic conformity improved legitimacy of firms, which in turn enabled better performance due to social acceptance of these firms in their institutional environments.

Likewise, some studies in OM have also found a positive relationship between institutional fit and performance, arguing institutional conformity can increase efficiency (Rogers et al., 2007; Zhu and Sarkis, 2007; Wu et al., 2012). In a study on implementation and use of a supplier development program by a major North American automotive manufacturer, Rogers et al. (2007) evaluated how managers reconciled potential conflicts between externally imposed institutional demands and constraints on internal operational efficiency. Specifically, they analyzed how coercive isomorphism exercised by the buyer company affected suppliers' internal operational efficiency. They found *"the program had contributed to the implementation of solutions, to substantive improvements in costs and less to so much quality and service performance"* (Rogers et al., 2007:569). When an external agency inspects the operation routines of an organization, decoupling is generally unlikely to occur between what is demonstrated and what is really done on the operational level (Westphal et al., 1997). Suppliers thus not only accepted the program at the client's imperative, but also had to show customers actual improvements in performance (Rogers et al., 2007). Examining the moderator role of institutional pressures in relationships between green supply chain management (GSCM) practices, and environmental and economic performance in Chinese manufacturers, Zhu and Sarkis (2007) found that the presence of mimetic pressures encouraged increase in economic performance. That is, it reduced cost for purchasing materials, energy consumption, fee for waste treatment, and fee for waste discharge. Institutional pressures could thus lead firms to "win-win" situations, in which they obtain improvements in both environmental and economic performance. Along these lines, Wu et al. (2012) argue that mimetic isomorphism could lead firms to more efficient utilization of their resources, strengthening competitive advantage and improving their performance. In fact, textile manufacturers from Taiwan, oriented to exporting, used benchmarking strategies to develop more competitive products for international trade.

Therefore, from the institutional theory and OM, there are convincing arguments to consider a positive relationship between institutional fit and performance. Table 1 summarizes the proposed arguments for this positive relationship.

2.2.2.2. Nuanced relationship argument

Although the arguments of institutional theoreticians supporting the view that institutional fit improves performance are theoretically persuasive, these arguments' universality has not been proven (Heugens and Lander, 2009). Some researchers have indicated that legitimacy-driven forces may lead firms to inappropriate resource decisions (Oliver, 1997). In the words of Meyer and Rowan (1977): *"conformity to institutionalized rules often conflicts sharply with efficiency criteria."* (Meyer and Rowan, 1977, 340–341). In this sense, in a study of Portuguese banks, Barreto and Baden-Fuller (2006) found that mimetic isomorphism contributed negatively to the firm's profitability. When facing uncertain situations, firms tend to imitate other firms in their sector. But uncertainty is influenced by both the quality of the information received from the firms to be imitated and the quality of the information observed relative to the latter firms' strategic choices. In uncertain situations, it is likely that firms' strategic choices will *"result in erroneous or economically inefficient choices with adverse consequences and offer an explanation for mimetic adoption of technically inefficient innovations"* (Barreto and Baden-Fuller, 2006:1563).

Likewise, some studies in OM have also indicated a possible trade-off between institutional fit and performance, arguing institutional conformity could decrease efficiency (Westphal et al., 1997; Choi and Eboch, 1998; Miemczyk, 2008). Analyzing a sample of 2,700 hospitals in the U.S., Westphal et al. (1997) showed a negative relationship between isomorphism and efficiency. Studying the adoption of total quality management (TQM) programs and these programs' relationship to

organizational efficiency and legitimacy, the authors found that first adopters of TQM, who were free of institutional pressure, adopted the programs for reasons of technical efficiency. These adopters could customize specific quality practices to the unique capabilities of the organization. Over time, however, the TQMs were institutionalized. Late adopters, who were subject to institutional pressures, adopted these programs to make their practices conform to the environment, increasing their legitimacy but reducing their efficiency. Choi and Eboch (1998) also propose the possibility of a negative relationship between institutional pressures and efficiency. Their study of 339 manufacturing companies in the US showed that pressures to comply with institutional norms by adopting isomorphic behaviors could generate inefficiencies in companies. Manufacturing plants that adopted TQM practices due to coercive pressures from their customers did not achieve improvements in plant performance. When TQM programs are not "driven by the internal needs justified by the technical reasoning but by external needs justified by the institutional reasoning," performance can be jeopardized, since what companies show and what they actually do internally are decoupled. When firms prioritize external legitimacy instead of internalizing efficient behavior, variations may occur in the implementation of certain organizational practices (Ferrón-Vílchez, 2016; Delmas and Montes-Sancho, 2016). Using a sample of 1214 manufacturing firms in 7 OECD countries, Ferrón-Vílchez (2016) found empirical evidence that only firms that adopted ISO 14001 in a substantive manner were associated with positive business performance. However, firms that fit the symbolic profile were unable to benefit from the internal improvements associated with ISO 14001, and thus obtained lower performance. Using an exploratory case study approach, Miemczyk (2008) examined the implications of the institutional environment for manufacturing firms' end-of-life product recovery capabilities. The study included three case studies of product manufacturers who had developed relationships with product recovery specialists in order both to meet organizational goals and to respond to different institutional pressures. The results of their study

showed that coercive pressures on firms meant restrictions in existing processes and systems. These pressures homogenized firms' responses but made it difficult to develop capabilities of competitive value. Mimetic pressures could in turn lead to suboptimal results by duplicating the strategies for recovery of products from other countries without considering the specific context of the firm.

Therefore, from the institutional theory and OM, there are convincing arguments to consider a negative relationship between institutional fit and performance. Table 2 summarizes the proposed arguments for this negative relationship.

Table 2.1. Positive arguments for institutional fit

Studies	*Positive arguments*	*Explanation*
Deephouse (1999) *Heugens and Lander (2009)* *Volberda et al. (2012)* *DiMaggio and Powell (1983)*	**Better resource acquisition**	Institutionally confirming firms have greater capability to acquire resources from customers, suppliers, and regulators. These firms garner legitimacy and are viewed as non-threatening to other's reputation and as low risk.
Heugens and Lander (2009) *Deephouse (1999)*	**Efficient practices**	Institutionalized models persist because they offer efficiency. Over time, certain practices are approved and accepted and become institutionalized. These practices persist because they are proven to offer efficiency. Without efficiency being reinforced, these practices begin to lose legitimacy and may become deinstutionalized.
Volberda et al. (2012) *Zhu and Sarkis (2007)* *Wu et al. (2012)*	**Collectively accepted learning**	Companies may learn from conducting their own research, but to do that they have to expend their resources. They can also learn from benchmarking others and imitating what they do. This process of learning from what others have done and have accepted would offer more expediency.
Heugens and Lander (2009) *Deephouse (1999)* *Zbaracki (1998)*	**Sanctioned differentiation**	Once a firm becomes part of an institutional field, others may allow it to be a little different. This differentiation may help competitiveness. Deephouse (1999:152) makes reference to the "range of acceptability."

Source: Developed by the authors.
Note: It should be noted that not all previous studies explicitly express the concept of institutional fit. However, the interpretation is made through the operationalization of this concept used by the authors.

Table 2.2. Nuanced arguments for institutional fit

Studies	*Negative arguments*	*Explanation*
Barreto and Baden-Fuller (2006)	**Cost of conformance**	Firms need to spend corporate resources to conform to institutional norms. They have to search and discover what others do and then carry out activities to conform at the organizational level. It also takes resources to remain conformed. According to Barreto and Baden-Fuller (2006), these are the resources that may be better spent on other activities that are more closely associated with corporate bottomline.
Choi and Eboch (1998) *Ferrón-Vílchez (2016)* *Miemczyk (2008)*	**Decoupling of value-adding activities**	A firm's internal value-adding activities seeking efficiency and its effort to conform to institutional demands may conflict. To overcome this conflict, firms often decouple these two types of activities, akin to saying one thing to external constituents and doing something else internally.
Westphal et al. (1997)	**Lack of differentiation**	Isomorphism eliminates the possibilities for a firm to be different from its competitors, reducing its ability to obtain competitive advantages.

Source: Developed by the authors.
Note: It should be noted that not all previous studies explicitly express the concept of institutional fit. However, the interpretation is made through the operationalization of this concept used by the authors.

We believe the discrepancies between these two schools of thought regarding the institutional fit may come from the fact that the studies considered institutional fit as a unidimensional construct. For example, in the case of Volberda et al. (2012), they evaluated the institutional fit jointly despite recognizing three dimensions for fit. Also, when the institutional fit has been measured in the banking field (Deephouse et al., 1996), they recognized several facets but finally evaluated all of them as being isomorphic. It is in fact likely that institutional fit is a multidimensional construct - institutionalization is a complex process (Meyer and Rowan, 1977; Scott, 2008). Therefore, the relationship of each of the dimensions with the performance would likely be different.

As discussed earlier, institutional fit represents the level of conformance an organization exhibits to institutional norms. However, not all institutional norms would have significant impact on organizations (Dacin, 1997). Therefore, for some dimensions, the institutional fit would have positive effects while for other dimensions some other effects might occur. In fact, some studies about institutional fit have made vague reference to this observation. For example, Barreto and Baden-Fuller (2006) suggested the possibility that not all dimensions are equally important for institutional conformity and performance. Deephouse (1999) also pointed out that, in markets with strong institutional forces, both the conformity and non-conformity with institutional norms were important to performance. Therefore, we submit the following proposition.

Proposition: The association between institutional fit and organization performance varies along different dimensions of institutional fit.

2.2.2. Three dimensions of institutional fit: Structure, culture and technology

The institutional literature in general suggests three dimensions of institutional fit: structure, culture and technology (Scott, 1987; 2008; Meyer and Rowan, 1977; Volberda et al., 2012). In a seminal paper that empirically measured institutional fit, Volberda at al. (2012) explicitly identified these three dimensions of institutional fit. Given the focus of our research, we use the three dimensions suggested by Volberda et al. (2012) but adapted to the OM field.

According to DiMaggio and Powell (1983), structure has been the most widely studied construct by institutional analysts (Meyer and Rowan, 1977; Tolbert and Zucker, 1983; DiMaggio and Powell, 1983). Structure is defined as *"the way in which formal and informal social relations mediate or constitute the operation of markets for goods and services"* (Zukin and DiMaggio, 1990; p. 2-3). Such complex relationships within the structure of an organization arise from the processes of exchange and from the existence of institutional norms (Meyer and Rowan, 1977).

Culture refers to values, beliefs, assumptions, and symbols that define the way in which a firm conducts its business. According to Scott (2008; p. 428), culture is a complex set of *"shared conceptions that constitute the nature of social reality and the frames though which meaning is made."* Such shared conceptions provide order not only by being mapped into organizational forms and procedures but also by their direct influence on the beliefs and behaviors of individual participants (Scott, 1987). In fact, culture can lead to substantive differences in how organizations operate in different institutional field (Ahlstrom and Bruton, 2002), implicating how different organizations might attain different levels of institutional fit.

Finally, technology represents the hard assets and knowledge to orchestrate the assets to engage in value-adding activities (Volberta, 1996). It requires the resources related to the knowledge, materials, interests, and conditions at a given point in time

and organizational context (Orlikowski, 1992). In this sense, technology is not only a technical means to achieve a specific goal, but it is also an underlying driver for shaping how organizations formulate rule systems to attain their goals and interests (Scott, 1987).

2.3. Methodology

2.3.1. Unit of analysis

The study investigates the practices that the firm engages in around three dimensions of institutional fit (structure, culture and technology in OM) and how these practices affect its operational performance. The unit of analysis for the study is the firm. To measure how a firm would respond to the institutional field and make changes in the organization that would affect performance, we chose the upper level managers (Chen and Paulraj, 2004) that involved in operations and other functions that span organization boundaries and work closely with operations (i.e. procurement, materials management, or supply management). Many researches in the field have sampled similar respondents (Villena et al., 2011; Roldan-Bravo et al., 2016; Rojo et al., 2016).

2.3.2. Sample and data collection

The target population is composed of Spanish firms. The literature suggests selecting companies located in a relatively homogeneous geographical, cultural, legal and political space to minimize the impact of other variables that cannot be controlled in the empirical research (Rojo et al., 2016). The list of companies was compiled from the

Sistemas de Análisis de Balances Ibéricos (SABI) database[1]. For the population of study, only firms belonging to the high technology sector[2] and ones with complete data in their registries were chosen (active firms, with available mail and telephone number, complete secondary data and with at least 20 employees). To select firms in this sector, we used the procedure developed by Kile and Phillips (2009). It entails segmenting samples of companies in this sector based on the codes assigned by The North American Industry Classification System (NAICS): 3254, 3341, 3342, 3344, 3345, 3346, 3353, 3391, 5112, 5182, 5412, 5415, 5416, 5417, 5418, 563, 5614, 517. The compiled list had 2061 companies in total. Of these, 387 companies could not be contacted due to incorrect contact information. In the end, our list included 1674 companies. Primary and secondary data were used to increase the validity of our results.

Primary data. A detailed survey was designed to gather specific information on the three dimensions of institutional fit (structure, culture and technology in OM). A pilot survey was developed and validated through a pre-test with six practitioners and three academics. This pilot survey enabled the clarification of possible ambiguities and correction of errors. With this feedback, the final survey was obtained. The data collection was done through the computer-assisted telephone interview system (CATI), developed during the months of June to November 2016. Once the incomplete questionnaires were eliminated, a final sample of 200 companies was obtained.

Secondary data. Secondary data were obtained through SABI. This database includes firm size, industry sector, financial information, operational rates, and other pertinent data for each company. We used this database to compare and validate the survey-based measures, following the previous research (Villena et al., 2011). Most

[1] The SABI database is similar to the COMPUSTAT database in the United States, except that it includes firms that are not publicly traded.

[2] We chose the high technology sector because Volberda et al. (2012) suggest it. They point out this sector experiences a high level of uncertainty and would be sensitive to institutional processes.

importantly, SABI offers firm performance data (e.g. operating profit). SABI was also used to verify the non-response bias and to obtain the three control variables (firm size, firm age and firm past performance).

2.3.3. Measurement development and assessment

All constructs in our study were adapted from the existing literature and the questions in the survey were answered on a seven-point Likert scale (1 = strongly disagree to 7 = strongly agree).

2.3.3.1. Operationalization of the institutional fit

We operationalize institutional fit as a construct using the notion of fit as congruence (Pennings; 1987). Organizations achieve greater performance when organizational response variables match environmental variables (Volberda et al., 2012). We use the following definition to operationalize institutional fit: *"the alignment between three organizational design variables (structure, culture and technology in OM) and the institutional environment"* (Volberda et al., 2012; p.1041).

To measure institutional fit, we note that firms tend to follow the behavior of other firms that are perceived to be *"more legitimate or successful"* (DiMaggio and Powell, 1983; p.152). These firms are assumed to have reached fit with their environment (Kondra and Hinings, 1998; Volberda et al., 2012). These successful firms have high visibility and prestige in their organizational field and, therefore, influence the actions of other companies (Haveman, 1993). In the for-profit sector, highly profitable organizations are viewed as more successful than less profitable organizations. Thus, the most profitable organizations serve as the benchmark for the rest (Haveman,

1993). In this sense, following the methodology used by Volberda et al. (2012), we assume that top-performing firms respond effectively with the institutional requirements of the environment. As did Volberda et al. (2012), we also use the practices of these leading firms as a surrogate measure for institutional field. Therefore, the impact of a firm's operational practices on organizational performance depends on their similarity to the practices of top performing firms, this is captured in the following equation, with Y as firm performance:

$$Y = f\,[\underbrace{\text{abs}\,(X_1^{\,h} - X_1)}_{Y_1} + \underbrace{\text{abs}\,(X_2^{\,h} - X_2)}_{Y_2} + \underbrace{\text{abs}\,(X_3^{\,h} - X_3)}_{Y_3}]$$

Institutional fit ($X_i^{\,h}$ - X_i) for each of the independent variables is measured as the absolute differential score of a firm with respect to the top-performing firms. Volberda et al., (2012) use the Z-score for firm performance ≥ 1.05 to identify top-performing firms, and we stay consistent with their approach. X1, X2, and X3 are calculated as the average values of the structural, cultural and technological operational practices, respectively, of top-performing firms.

To recap, Y is firm performance, $X_1^{\,h}$ is structural operational variable representing the top performing firms, X_1 is structural operational variable of the rest of the firms, $X_2^{\,h}$ is cultural operational variable of the top performing firms, X_2 is cultural operational variable of the rest of the firms, $X_3^{\,h}$ is technological operational variable of the top performing firms, X_3 is technological operational variable of the rest of the firms. We want to note that institutional fit as measured in Equation 1 really represents the lack of institutional fit, which should therefore be considered as institutional misfit.

2.3.3.2. Independent variables

In our model, we include three independent variables related to the firm´s operations: structure, culture and technology. Items related to structure reflect the use of rules and procedures in the operations of the organization used in decision making, coordination and execution, i.e. the availability in the organization of explicit and detailed procedures. It is a first order construct. These items were adapted from the work of Volberda et al. (2012) and Kim (2014). Items related to culture reflect the values or beliefs shared by members of an organization in the operations area. It is a first order construct. These items were adapted on the work of Volberda et al. (2012) and Hult et al. (2007). Items related to technology reflect the resources related to the knowledge, information, communication and the use of technologies, i.e., the hardware and software used in transforming inputs into outputs. It is a first order construct. These items were adapted from Volberda et al (2012) and Chen and Paulraj (2004).

2.3.3.3. Dependent variable

Firm performance was measured using the operating profit for the 2015 year. We collected this data from the SABI databases. Operating profit is the profitability of the business, from the core operations of a business, excluding any financing or tax-related issues. To determine operating profit, operating expenses are subtracted from gross profit. We use this measure because it represents the income earned from the core operations of a business, its information is particularly valuable to see how a business is performing over a long period of time and it is a key number for managers to watch as it reflects the revenue and expenses that they can control.

2.3.3.4. Control variables

The literature indicates the importance of considering other organizational factors that could affect performance (Roldan-Bravo et al., 2016). In our model, we include three control variables: firm size, firm age and firm's past performance. Information on these variables is gathered from the SABI database. *Firm size* is measured as the number of employees in the firm. Researchers have identified firm size as a key variable in the relationship between strategy and performance (Volberda et al., 2012). *Firm age* is measured as the number of years since the firm was legally formed. It has been suggested that older firms could have higher levels of productivity (Coad et al., 2013), experience and resources to accomplish performance goals (Villena, 2016). Finally, *firm's past performance* is measured using the operating profit in 2014, two years prior to the year when the research took place. More profitable firms may be able to devote more resources to improving their performance (Villena et al., 2016).

2.3.3.5. Measurement assessment

We examine the reliability and validity of the measurement scales following the procedure developed by Kaynak and Hartley (2006). To assess the reliability of each scale, we calculate Cronbach's alpha (α) coefficient. All coefficients exceed the generally accepted cutoff values of 0.7. The confirmatory factor analysis (CFA) using the EQS 6.1 software package is performed to complete this analysis by calculating the composite reliability (CR), whose minimum recommended value is 0.7 and the average variance extracted (AVE), whose minimum recommended value is 0.5 (Hair et al, 2014). Table 2.3 shows the scales in all cases to be within the accepted limits. We also conduct a confirmatory factor analysis (CFA) to evaluate the convergent and discriminant validity. All standardized item loadings are above the cutoff of 0.60 and are significant (t-value superior a 1,96), indicating the constructs exhibited convergent

validity (Hair et al., 2014). Some items are removed from the scales to fulfill this requirement. All of the purified scales satisfy the requirements for convergent validity (see Table 2.3). To assess discriminant validity, we compare the correlation of each pair of factors to the square root of the average variance extracted (AVE) for each factor. To achieve discriminant validity, correlation of two factors must be less than the square root of the variance extracted for each factor (Fornell and Larcker, 1981). The results confirm discriminant validity (*see Table 2.4*).

Table 2.3. Reliability and Convergent Validity Results

Measurement Item	Factor loading[a]	R^2	α Cronbach	CR	AVE
Structure			0.87	0.87	0.58
S1	0.63	0.40			
S2	0.70	0.49			
S3	0.81	0.65			
S4	0.86	0.74			
S5	0.79	0.62			
Culture			0.92	0.96	0.54
C1	0.64	0.41			
C2	0.74	0.54			
C3	0.77	0.59			
C4	0.79	0.63			
C5	0.84	0.71			
C6	0.87	0.75			
C7	0.65	0.42			
C8	0.74	0.55			
C9	0.70	0.49			
Technology			0.90	0.91	0.77
T1	0.77	0.60			
T2	0.91	0.83			
T3	0.94	0.88			

Notes: CR = composite reliability; AVE = average variance explained.
[a] Confirmatory factor analysis: $\chi 2 = 213$ df = 116, root mean square error of approximation (RMSEA) = 0.06, comparative fit index (CFI) = 0.93, incremental fit index (IFI) = 0.93, Bentler-Bonnett non-normed fit index (BBNNFI) = 0.92. All factor loadings are significant.

Table 2.4. Mean Values, Standard Deviations (SDs), Average Variance Extracted (AVE), and Bivariate Correlations of Variables

	Mean	SD	1	2	3
Structure	5.25	1.30	0.76	0.62	0.45
Culture	5.10	1.17	-	0.73	0.48
Technology	4.47	1.53	-	-	0.88
Firm age	3.09	0.55	-	-	-
Firm size	4.25	1.09	-	-	-

Notes. The square root of the AVE appears on the main diagonal in italic.
The values of firm size and firm age are based on neperian logarithm

2.3.3.6. Tests for non-response bias and common method variance

Potential non-response bias in the sample was assessed following the recommendation of Fawcett et al. (2014). We compared the mean value of the size and age variables for all firms to the mean of the firms in the sample. Since we obtained similar values for both, non-respondent firms did not introduce significant bias into the study.

Since we have one respondent per firm, common method variance (CMV) could be of concern. The potential of a common method is evaluated by adopting a series of procedural and statistical measures suggested by Podsakoff et al. (2003). Regarding the procedural steps followed, the data used for the variables of the study come from primary and secondary sources. The questions used in the investigation are not grouped by constructs and various response formats are used (seven-point Likert scale). The respondents' anonymity has been also protected and a survey pre-test was performed to avoid ambiguity.

In addition, CMV is examined using methodological tests, starting with Harman's single-factor test, widely used in the literature (Podsakoff et al., 2003). We load all variables in the exploratory factor analysis, constraining the number of factors to 1. As

the first component accounts for less than 50 percent of all variables (It accounts for 44.98 percent of the variance), common method variance is not a problem in our study. Second, a common-method model following the guidelines of Podsakoff et al. (2003) is examined. This model includes a common-method factor along with the constructs estimated in the hypothesized model. This common method factor is created assuming that all scale items load in the same factor. The fit indices for the common-method model were: $\chi 2$ = 684 df = 152, root mean square error of approximation (RMSEA) = 0.13, comparative fit index (CFI) = 0.62, incremental fit index (IFI) = 0.63, Bentler-Bonnett non-normed fit index (BBNNFI) = 0.58. The results obtained reinforce the idea that the variance of the common method is not a problem. The indexes of the model worsened with respect to the validation of the scales composed of more than one factor ($\chi 2$ = 217 df = 142, root mean square error of approximation (RMSEA) = 0.05, comparative fit index (CFI) = 0.95, incremental fit index (IFI) = 0.95, Bentler-Bonnett non-normed fit index (BBNNFI) = 0.94).

2.4. Analysis and Results

As a preliminary step to the regression analysis, the assumptions of multivariate analysis for the variables were tested. The requirements of normality, linearity, homoscedasticity, and multicollinearity were satisfied by all the variables. The data were normalized using the LISREL 8.80 software. Collinearity statistics for each of the regression models yielded variable inflated factor (VIF) scores below 2 (ranging from 1.087 to 1.237) and condition indexes scores below 17, suggesting that multicollinearity was not a serious problem in the analysis (ranging from 1.000 to 5.779) (Belsley, 1991; Kleinbaum et al., 2013). The Durbin-Watson test that measures the independence of errors in the regression also showed adequate scores, given that their value was close to 2 (1.616). Once verified the fulfillment of all these

requirements, we proceeded to test the hierarchical regression analysis. Table 2.5 shows the main results obtained.

The study investigates the practices that the firm engages in around three variables (structure, culture and technology) and how these practices affect its performance. Model 1 tested the control variables: firm size, firm age and firm past performance.

Both the firm size and firm age variables were non-significant in this model. As expected, firm past performance had a positive and significant relationship with the firm performance (ß = 0.612; t = 10.586). Model 2 added the structural misfit. This variable showed a positive and non-significant relationship with firm performance (ß = 0.070; t = 1.244). Model 3 added the cultural misfit. In this model, the structural misfit kept its positive and non-significant relationship with firm performance (ß = 0.031; t = 0.510). However, the cultural misfit showed a positive and significant relationship with firm performance (ß = 0.102; t = 1.740). Finally, model 4 added the technological misfit. In this model, structural misfit kept its positive and non-significant relationship with firm performance (ß = 0.055; t = 0.908). Cultural misfit kept a positive and significant relationship with firm performance (ß = 0.128; t = 2.139). Technological misfit showed a negative and significant relationship with firm performance (ß = -0.147; t = -2.579). Since we are using the institutional misfit concept (*see section 3.3.1*), the institutional fit concept needs to be interpreted in the opposite way.

In sum, the results confirm the initial preposition: The association between institutional fit and organization performance varies along different dimensions of institutional fit.

Table 2.5. Effects of misfit on firm performance

	Model 1 Step 1	Model 2 Step 2	Model 3 Step 3	Model 4 Step 4
	βª (t)	βª (t)	βª (t)	βª (t)
Firm age	0.021 (0.363)	0.026 (0.448)	0.015 (0.254)	0.024 (0.421)
Firm size	0.041 (0.706)	0.049 (0.825)	0.045 (0.769)	0.048 (0.839)
Firm past performance	0.612 (10.586)***	0.619 (10.669)***	0.613 (10.600)***	0.611 (10.726)***
Structural misfit		0.070 (1.244)	0.031 (0.510)	0.055 (0.908)
Cultural misfit			0.102 (1.740)*	0.128 (2.139)**
Technological misfit				-0.147 (-2.579)***
F	42.553***	32.391***	26.747***	24.047***
R^2	0.394	0.399	0.408	0.428
Change in R^2	0.394	0.005	0.009	0.020
Adjusted R^2	0.385	0.387	0.393	0.410

Note. Standardized betas are reported *** p<0.01; ** p<0.05; * p<0.10

2.5. Discussion

Our literature review attests mixed theoretical dispositions surrounding the connection between institutional fit and organizational performance in OM. We then point out the inconsistency in the researchers' approach to conceptualizing the institutional fit and measuring it—many researchers (Deephouse, 1996; Barreto and Baden-Fuller, 2006; Volberda et al., 2012) theorize institutional fit as multi-dimensional construct but measure it as a unidimensional construct. Our research tries to address that inconsistency by conceptualizing it as a multidimensional construct and examining empirically the three dimensions of institutional fit as proposed by Volberda et al. (2012): structure, culture and technology.

Our findings support the stratified view of institutional fit. The association between institutional fit and organizational performance varies along different dimensions of fit. Institutional fit can improve performance (Heugens and Lander, 2009; Volberda et al., 2012; Rogers et al., 2007; Zhu and Sarkis, 2007), but it can also hurt performance (Barreto and Baden-Fuller, 2006; Westphal et al., 1997; Choi and Eboch, 1998; Miemczyk, 2008). These findings enable us to connect two different scholarly stances toward fit by proposing the stratifying effects of institutional fit. We define the stratification of institutional fit as the discrimination of dimensions of institutional fit (e.g. structure, culture and technology) whose impact on performance varies according to the dimension evaluated. Each of the dimensions is affected by different institutional norms.

According to the results obtained, there is a positive correlation between institutional fit and performance for the technological operational variable, no correlation between institutional fit and performance for the structural operational variable, and a negative correlation between institutional fit and performance for the cultural operational variable. One possible explanation for this disparity in results may

arise from the levels of organizational resistance relative to a specific standard. Organizational resistance could influence the organization's capability to reap the benefits of institutional fit. When the organizational resistance is greater, negative arguments about institutional fit acquire relevance, harming performance. However, when the organizational resistance is less, the opposite occurs. Positive arguments about institutional fit acquire relevance, favoring improvements over performance.

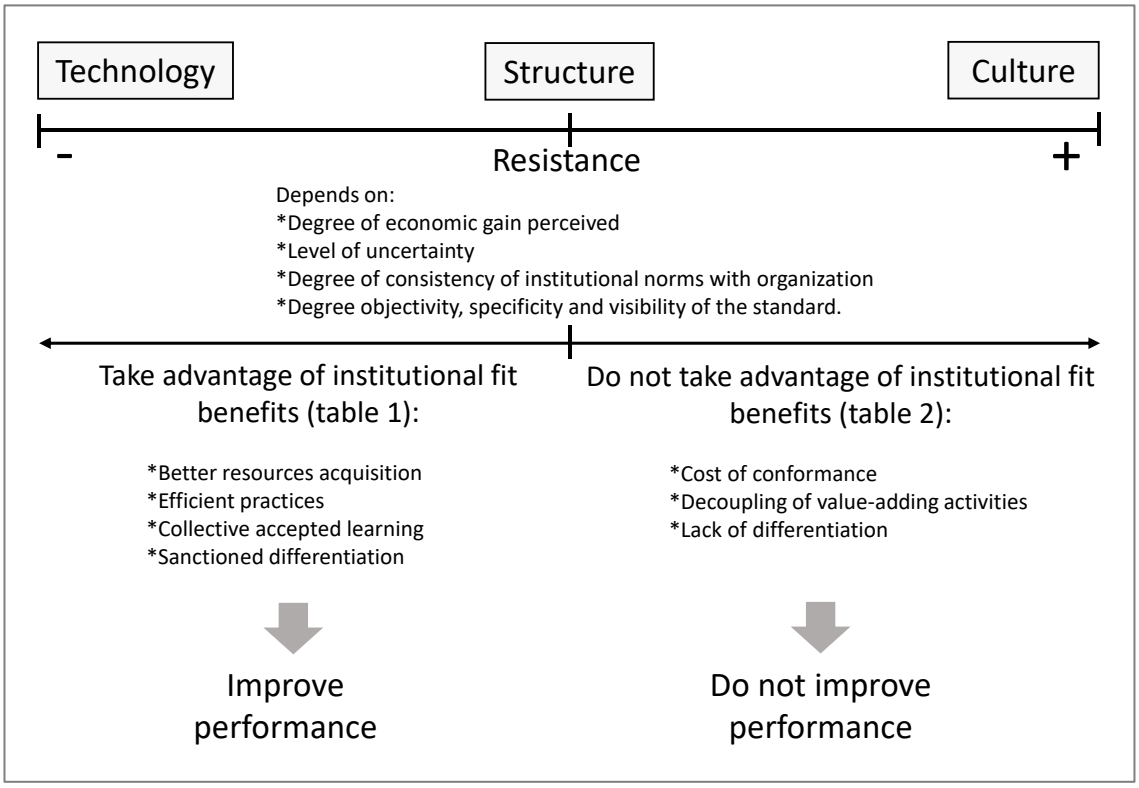
As we can see in Figure 2.1, the three dimensions proposed in the study - structure, culture and technology - represent a spectrum of the levels of organizational resistance. Technology is represented at the lowest end of organizational resistance, structure at the middle level and culture at the highest end of organizational resistance. The probability of resistance to institutionalization depends on different issues, such as the economic gain the organization considers to obtain when it adopts a standard, the levels of uncertainty associated with the environment, the levels of consistency between the standard and the organization (Oliver, 1991), or the levels of objectivity, specificity and visibility of the standard. Changing an organization's technology involves adjusting the assets, knowledge and techniques that the organization uses to convert inputs to outputs (Nagarajan and Mitchell, 1998). As with any change, the organization must adapt to the new situation. Consistent with the propositions developed by Oliver (1991), technological fit may present less organizational resistance. The characteristics and functionalities of technology usually develop and are perfected over time as the diffusion, adoption and utilization of the technology increase (Liu et al., 2010), that is, as the practice is institutionalized. Following the standard enables firms to reduce the high cost of researching the consequences of technology adoption and to adopt technologies that have been shown to be more efficient, thereby reducing costs and uncertainty (Liu et al., 2010). Thus, organizations that adopt the technological standard usually obtain some economic benefits from this adoption and reduce uncertainty by using a technology

that has already been validated. Moreover, institutional norms related to technology are more objective, specific and visible. For this reason, changes in the technological norms are likely to be adopted fairly quickly. Technology generates less organizational resistance and enables organizations to enjoy the benefits of institutional fit. For example, when they adopt the technological standard, they use more efficient practices and take advantage of collective learning.

Changing the organizational culture, in contrast, involves a substantial change in the ideas, values and meaning of the organization's members. These changes are more subjective, ambiguous and complex, and they occur more slowly. Consistent with the propositions developed by Oliver (1991), cultural fit may meet with greater organizational resistance. Since organizational culture constitutes a firm's personality or identity (McAfee et al., 2002; Ramarajan et al., 2017), cultural fit involves changing the way firms conduct their business and respond to specific problems (Cao et al., 2015; Hult et al., 2007; Mello and Stank, 2005). This situation can generate an identity conflict. *"Identity conflict is the experience where one is torn between, or must give up, the meanings, values, and behaviors associated with one identity in order to maintain or preserve another"* (Ramarajan et al., 2017; p. 2211). Cultural fit involves greater tension between what the organization is and what it should be. It jeopardizes the motivation of employees, who are paralyzed or trapped between two worlds, making it difficult for them to use their knowledge at work and thus jeopardizing performance (Ramarajan et al., 2017). Organizations that adopt the cultural standard thus do not usually obtain economic benefits from this adoption. Further, their uncertainty increases due to the complexity of the changes proposed. The organization accepts some ideas and values but remains sceptical in the face of the new, leaving the deepest aspects of its culture intact (Alvesson and Sveningsson, 2015). This greater organizational resistance prevents organizations from enjoying the benefits of institutional fit. For example, they adopt the cultural standard while decoupling their

activities. Various studies of quality or environmental certifications highlight this problem (Boiral, 2007; Darnall, 2006; Choi and Eboch, 1998; Ferrón-Vílchez, 2016). Many firms use the certification merely as a way to legitimate their practices to gain the support of the institutional environment around them, without making any real commitment to internal improvement (Aravind and Christmann, 2011). The deepest issues related to quality management systems (QMSs) or environmental management systems (EMSs) involve significant cultural changes that firms often fail to undertake.

Figure 2.1. Levels of organizational resistance and its relationship with institutional fit



Source: Developed by the authors.

The example of the automotive manufacturing plant NUMMI, joint property of General Motors (GM) and Toyota, could illustrates such organizational resistance

significantly in the face of specific variables. In theory, NUMMI allowed GM to learn Toyota's keys to success and translate them to the rest of its plants. GM was not able to replicate Toyota's model, however. Managers from GM visited NUMMI and saw how it worked. There was no mystery. The employees worked diligently and the production line ran as it would in any good plant. Managers from GM left wondering why they could not achieve the same success as NUMMI. A firm can learn about the mechanics of the Toyota Production System (TPS) quite easily, but implementing TPS is an entirely different story. The actual practices of TPS are socially complex and often context-specific (Liker, 2005; Adler et al., 1999). TPS techniques and tools - uch as just-in-time, kaizen, jidoka and heijunka -could be adopted relatively easily, but adopting Toyota's organizational philosophy and culture involved deep, substantial changes in the firms, which were not feasible.

2.5.1. Theoretical implications

This study makes three contributions to the literature of institutional theory and operations management. First, we contribute to the debate around the association between institutional fit and performance. The findings of the research show that this association varies according to the dimension studied which allows to reconcile two scholarly stances (positive and negative arguments) around the institutional fit (Heugens and Lander, 2009; Volberda et al., 2012; Rogers et al., 2007; Zhu and Sarkis, 2007; Barreto and Baden-Fuller, 2006; Westphal et al., 1997; Choi and Eboch, 1998; Miemczyk, 2008). These scholarly stances are not contradictory. Each of these perspectives provides a partial explanation of the effects of institutional fit on performance. Second and, as a result of the foregoing, we espouse the multidimensional perspective of institutional fit as a construct. Volberda et al. (2012) offered three dimensions of institutional fit: structure, culture and technology. We

build on their work and investigate whether and how performance vary across dimensions considered for the fit in the OM field. This is an important yet overlooked aspect of institutional fit. In general, studies have analyzed institutional fit as a unidimensional construct (Heugens and Lander, 2009; Deephouse, 1996; Miller and Eden, 2006; Wu and Salomon, 2016; Volberda et al., 2012). Even Volberda et al. (2012) that pointed out three different dimensions of institutional fit treated it as a single construct when testing it. We propose the stratification of institutional fit, where each dimension impacts in a different way on the performance. Figure 2.1, in turn, offers a possible explanation for these findings based on organizational resistance. Those dimensions that offer greater organizational resistance (e.g., culture) damage performance because the negative arguments of the institutional fit acquire relevance. However, the dimensions that offer less organizational resistance (e.g., technology) improve performance because the firm can benefit from the positive arguments of the institutional fit. Third, although the institutional fit-performance debate has not been as explicit in OM as in the institutional theory literature, some studies hint at contradictory findings among the isomorphic pressures (whose final result is the institutional fit) and efficiency (Rogers et al., 2007; Choi and Eboch, 1998; Miemczyk, 2008; Westphal et al., 1997; Wu et al., 2012; Zhu and Sarkis, 2007). Therefore, our study is one of the first to evaluate the institutional fit and performance in the OM, contributing to expand the knowledge of the field.

2.5.2. Managerial implications

Operations managers can exercise discretion as to why, when, and how to adopt institutional fit (Wu and Salomon, 2016). However, as some researchers have already pointed out (e.g. Ketokivi and Schroeder, 2004; Kauppi, 2013), mangers must know the effects of institutional fit on performance. In other words, they must know what

happens when the firm adopts an institutionalized standard to fit to its environment. The empirical evidence from this work indicates that the adoption of an institutionalized standard has different effects on performance depending on the characteristics of the dimension studied.

Adopting norms associated with the technological dimension is positive for performance. The technological changes in the organization are associated with a greater economic benefit, less uncertainty and are more objective, specific and visible changes. This makes the organizational resistance to them less. For example, firms decide to adopt Internet-enabled Supply Chain Management systems (eSCM) when they notice the benefits that other successful firms in the market have had when adopting them. Adopting technology previously tested by other successful firms eliminates uncertainties, research and / or experimentation costs (Liu et al., 2010). Therefore, managers should adopt the technological norms. However, adopting norms associated with the cultural dimension harms performance. Cultural changes in the organization are associated with a lower economic benefit, greater uncertainty and are more ambiguous, subjective and complex changes that undermine the identity of the firm. This makes the organizational resistance to them greater. For example, the lack of convergence between US and Japanese approaches to manufacturing practices due to the lens of organizational culture. An American Toyota competitor made the attempt to copy Toyota's product development practices. This competitor could only copy the most visible and observable artifacts of Toyota's culture without penetrating the deepest background such as the norms, attitudes and beliefs that support the culture (Pereira et al., 2014). Therefore, managers should not adopt cultural norms.

The study findings indicate that full conformity with the standard is not the best choice to improve performance. However, since firms must have legitimacy to survive in their environments, a possible strategic response to institutional processes could use "*balancing tactics*" (Oliver, 1991). This response involves partial conformance to

the institutional processes that enable firms to adapt to multiple institutional demands. Thus, our proposal consists of a balancing tactic characterized by technological fit that corresponds to the conformance required by institutional pressures and cultural misfit that corresponds to the organizational goals that require not changing organization. This study can guide managers in making strategic decisions, in order to improve their performance without altering their institutional legitimacy.

2.5.3. Limitations and future research directions

There are a few limitations of the current study as well as directions for future research. First, the cross-sectional research design limits the extent to which cause–effect relations can be inferred from the findings. When evaluating institutional fit with cross-sectional data, there is a risk of analyzing a temporary situation in the organization and not its capability for institutional fit over time. Hence, future research could, where possible, collect longitudinal data to have a more complete view of the fit. Second, our sample only contains firms that are active in Spain, which could represent a potential source of bias in our results and therefore needs validation in other contexts. Third, as a single respondent was used to obtain the data, there is a risk of common method bias. To attempt to solve this problem, the study tried to identify respondents who were experts on the questions studied and used a series of procedural measures to minimize the risk of this bias. In addition, we obtained data from different sources (primary and secondary data), which reduces the variance of the method (Podsakoff et al., 2003). However, adopting these remedies does not entirely eliminate the risk that common method bias may inflate or attenuate the relationships studied. Future studies could confirm the results obtained by using multiple informants on institutional fit.

We have proposed a possible explanation for the results obtained, based on organizational resistance. Therefore, future studies could assess whether the proposed arguments on resistance are confirmed for each of the dimensions. In addition, it would be interesting to evaluate different institutional norms belonging to each of the dimensions. For example, evaluate different norms related to technology. In this way, we would obtain a more detailed knowledge of what happens in each of the dimensions and we would avoid the possible bias associated with evaluating the dimension as a whole (i.e., technology). It has been shown that this has already happened with the institutional fit. It would also be important for future studies to explore the effects of the institutional fit using other performance measures to test that the results are maintained. Future studies should consider the causes and action mechanisms of fit.

Appendix 2.C. The Items Used in This Study

Regarding the processes developed in the firm's operations, indicate:

Technology

1. The layout and setup of our processes can be changed easily.
2. Our equipment and information systems of operations can be used for multiple purposes.
3. Our employees master several methods of production and operations.
4. We are updated regarding the know-how. *

Organic structure

1. We use extensive and structured systems for planning and control.
2. The division of work is defined in detailed descriptions of jobs and tasks.
3. Everything has been laid down in rules.
4. There are a lot of consultation bodies.
5. We have a clear metric to measure the performance of operations.*

Innovative culture

1. The following applies: “The rules can’t be broken, even if someone believes that it is best for operations."
2. Deviating opinions are not tolerated.
3. Creativity is highly appreciated.
4. The person that introduces a less successful idea in our department can forget about his or her career.
5. Technical innovation, based on research results, is readily accepted.
6. We actively seek innovative ideas.

7. Innovation is readily accepted in the operations.

8. People are not penalized for new ideas that do not work.

9. Innovation in operations is encouraged.

Note. * items were removed to meet the reliability and validity criteria.

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CAPÍTULO 3

Antecedents of a Firm´s Supply Chain Agility: The Roles of a Transactive Memory System and Supply Network Flexibility

Abstract

Given the importance of the firm supply chain agility (FSCA), this study expands the operations and supply management literature by exploring two new antecedents of FSCA and analyzing the impact of FSCA on different measures of OP. Specifically, the purpose of the paper is twofold. First, to evaluate the roles of a transactive memory system (TMS) and supply network flexibility (SNF) as antecedents of a FSCA, including the moderating role of TMS in the relationship between SNF and FSCA. Second, to evaluate the relationship between FSCA and operational performance (OP), including the mediating effect of FSCA on the SNF-OP relationship. Hypothesized relationships are tested with survey data from 190 Spanish high-tech firms using structural equation and linear regression models. The findings suggest that FSCA can be improved through TMS and SNF, although higher levels of intra-organizational TMS weaken the positive relationship between inter-organizational SNF and FSCA. A positive relationship is identified between FSCA and OP, while FSCA moderates the SNF-OP relationship. Therefore, managers should develop both TMS and SNF to increase FSCA and improve OP. However, given that firms have limited resources, investment in internal resources should be prioritized as this appears to be more effective at developing FSCA.

Keywords: Firm's supply chain agility, transactive memory system, supply network flexibility, operational performance.

Purpose: The purpose of this paper is twofold. First, to evaluate the roles of a transactive memory system (TMS) and supply network flexibility (SNF) as antecedents of a firm's supply chain agility (FSCA), incorporating the moderating role of TMS in the relationship between SNF and FSCA. Second, to evaluate the relationship between FSCA and operations performance (OP), including the mediating effect of FSCA on the SNF-OP relationship.

Design/methodology/approach: Five hypothesized relationships are tested with survey data from 190 high-tech firms using structural equation models.

Findings: FSCA can be enhanced through TMS and SNF, although a higher level of intra-organizational TMS weakens the positive relationship between inter-organizational SNF and FSCA. A positive relationship is identified between FSCA and OP, while FSCA moderates the SNF-OP relationship.

Practical implications: Managers should develop both TMS and SNF to increase FSCA and improve OP. Given that firms have limited resources, investment in internal capabilities should be prioritized as this appears to be more effective at developing FSCA.

Originality/value: The findings expand the literature by exploring two new antecedents of FSCA and analyzing the impact of FSCA on different measures of OP. Few prior studies have highlighted the importance of TMS to the operations function.

Keywords: Firm's supply chain agility; transactive memory system; supply network flexibility; operations performance.

Type: Research paper

3.1. Introduction

Today's hypercompetitive environment – characterized by demanding customers, short product life-cycles, volatile supply and demand, global supply chains, and rapid technological advancements – has pushed firms towards finding new ways to compete (Swafford et al., 2006; Chiang et al., 2012). Research suggests that developing a firm's

supply chain agility (FSCA) is an important means of improving competitiveness in the current environment (Gligor et al., 2015; Kim and Chai, 2017). Agile firms *"have a 70 percent chance of being in the top quartile of organizational health, the best indicator of long-term performance"* (McKinsey & Company, 2018). FSCA has been conceptualized variously as a comprehensive strategy, a paradigm, a management system or practice, and even as a capability (Shin et al., 2015). In this paper, we adopt Braunscheidel and Suresh's (2009, p. 126) definition of FSCA as *"the capability of the firm, internally, and in conjunction with its key suppliers and customers, to adapt or respond in a speedy manner to a changing marketplace, contributing to the agility of the extended supply chain"*.

The literature has identified various antecedents or enablers of FSCA by recognizing, for example, that it can be developed by: the flexibility of procurement/sourcing, manufacturing, and distribution/logistics (Swafford et al., 2006); internal and external integration (Braunscheidel and Suresh, 2009); coordinating, cooperative, and communicative mechanisms in the supply chain (Gligor and Holcomb, 2012); and the development of supply- and demand-side competences (Blome et al., 2013). Research has also identified some of the outcomes associated with FSCA. For example, it enables a firm to be more market-sensitive, have greater capacity to synchronize supply with demand, to better manage disruption risks, achieve shorter cycle times, ensure uninterrupted customer service, and accelerate new product introductions (Braunscheidel and Suresh, 2009; Blome et al., 2013; Gligor et al., 2015). Despite previous studies on some of the antecedents and outcomes of FSCA, there have been calls to explore other antecedents of FSCA and to further scrutinize its performance effect (Chiang et al., 2012; Blome et al., 2013; Gligor et al., 2015; Chan et al., 2017; Fayezi et al., 2017). Building on this, our study uses a survey to evaluate a new variable related to knowledge – a transactive memory system (TMS) – and a variable related to

flexibility – a firm's supply network flexibility (SNF) – as potential antecedents of FSCA. The study also evaluates the effect of FSCA on performance.

Our first variable, TMS, is intra-organizational and related to the creation, maintenance, transfer, and coordination of knowledge in work teams (Argote and Guo, 2016; Heavey and Simsek, 2017; Huang and Cheng, 2018). Although TMS has received limited attention in the operations management field, the TMS of the operations department could contribute greatly to the development of FSCA. For example, it has been recognized that uncertain environments require the rapid generation and coordination of new knowledge (Gligor et al., 2015; Argote and Guo, 2016). Further, firms like Honda, Apple, Zara, and Amazon have all succeeded in developing supply chain agility because they have teams that are motivated to develop creative solutions to unexpected problems (Choi et al., 2002; Lee, 2004; Gravier, 2016).

Our second variable, SNF, is inter-organizational and related to the ability to effectively and efficiently reconfigure the supply base (Liao et al., 2010), enabling the firm to maintain a sufficient set of alternatives and responses to possible environment changes (Liao and Marsillac, 2015). Regarding this variable, two things should be noted. First, the existing literature has recognized the importance of different types of flexibility and different dimensions of this (Chan et al., 2017; Manders et al., 2017) but we specify focus in SNF. It is a relatively new concept that remains underexplored in the FSCA literature (Liao et al., 2010; Purvis et al., 2014; Liao and Marsillac, 2015). As Lummus et al. (2003) argued, supply chains should be designed with change in mind. When the market changes, competitive priorities also change, making it necessary to find new supply chain partners with the required capabilities. Finding such partners is necessary for high levels of flexibility in supply networks (Purvis et al., 2014). Cisco, for example, uses three different supply networks to manufacture its products (depending on the type, volume, and customization required). When the need arises, it can switch manufacturing from one network to another, achieving a rapid response to change

(Lee, 2004). It is thus reasonable to expect that having different strategic options for product supply will facilitate higher levels of FSCA. Second, although a large body of literature suggests that flexibility can have a significant impact on FSCA (Swafford et al., 2006; Swafford et al., 2008; Braunscheidel and Suresh, 2009; Chiang et al., 2012; Chan et al., 2017), the circumstances under which flexibility is positively related to business success remain unexplored (e.g. moderating variables that could increase or decrease this relationship) (Manders et al., 2017). Thus, we explore how TMS moderates the SNF-FSCA relationship to have a more complete view of flexibility.

Given the need to further evaluate the effect of FSCA on performance (Gligor et al., 2015), we also examine the relationship between FSCA and a firm's operations performance (OP). Supply chain managers must know what results to expect from the implementation of FSCA-focused strategies, yet prior studies have evaluated only some measures of OP (e.g. Gligor and Holcomb, 2012; Blome et al., 2013; Eckstein et al., 2015; Gligor et al., 2015). Our study expands the literature by exploring the relationship between FSCA and four specific measures of OP – delivery, production cost, product quality, and production flexibility – that reflect the four key capabilities of a focal firm in responding to competition. Jointly considering these four measures provides a more complete and comprehensive understanding of the multiple criteria that affect operations performance (Wong et al., 2011).

Based on the above, our study has two main goals. First, to analyze the roles of TMS and SNF as potential antecedents of FSCA, incorporating the moderating role of TMS in the relationship between SNF and FSCA. Second, to evaluate the relationship between FSCA and OP; including the possible mediating effect of FSCA between SNF and OP. We ask:

RQ1. Are TMS and SNF antecedents of FSCA, and does TMS have a moderating effect on the relationship between SNF and FSCA?

RQ2. How does FSCA affect OP? More specifically, does it have a mediating effect in the relationship between SNF and OP?

This research focuses on the high-technology sector, which is considered to be a particularly relevant environment for testing FSCA. This is a sector that is characterized by the rapid renewal of knowledge and by its high degree of complexity, which requires constant investment in research and continuous adaptation to the environment in order to survive (Wang et al., 2013). The study contributes to the existing literature on agility in three key ways. First, it evaluates two new antecedents of FSCA – TMS and SNF – providing evidence of the positive influence of these intra- and inter-organizational variables. In doing so, it becomes one of the first studies to evaluate the role of TMS in developing agility. Second, it analyzes the relationship between FSCA and OP with an expanded set of measures compared to previous studies. And third, it explores how FSCA mediates between SNF and OP, confirming the need to develop FSCA to enhance OP.

The remainder of the paper is organized as follows. Section 2 provides the theoretical background and develops five hypotheses. Section 3 outlines the survey method adopted, the construction of the measurement instruments, and the validation of scales. Section 4 presents the results before they are discussed in Section 5, where concluding remarks, implications for research and practice, limitations, and future research directions are also provided.

3.2. Theoretical Background and Hypotheses

3.2.1 FSCA

FSCA is a relatively new construct in the operations and supply chain management literature (Braunscheidel and Suresh, 2009; Blome et al., 2013; Gligor et al., 2015). One of the first definitions related to FSCA was provided by Swafford et al. (2006), although the concept was redefined by Braunscheidel and Suresh (2009) to improve and clarify its content. FSCA is defined as "*the capability of the firm, internally, and in conjunction with its key suppliers and customers, to adapt or respond in a speedy manner to a changing marketplace, contributing to the agility of the extended supply chain*" (Braunscheidel and Suresh's, 2009; p. 126). This is a kind of dynamic capability that results from the firm's ability to reconfigure firm-level and supply chain-level resources (Gligor and Holcomb, 2012b; Blome et al., 2013). FSCA implies that firms quickly sense market changes (such as competitors' actions, changes in consumer preferences, economic shifts, regulatory changes, etc.) and are able to adapt or respond to them (Yang and Liu, 2012; Endres, 2018). Thus, FSCA enables firms to deal with external changes properly, making it an important determinant of firm survival in uncertain environments (Blome et al., 2013). For this reason, it is important for firms, once detected the changes in the environment, to know how they can face them, what actions to take to improve the FSCA.

3.2.2 FSCA Antecedents: TMS and SNF

Empirical researchers have identified various antecedents or enablers of FSCA (Fayezi et al., 2017). For example, Swafford et al. (2006) found that FSCA is directly and positively related to the flexibility of the manufacturing and procurement/sourcing processes of the supply chain; and indirectly related to the flexibility of the

distribution/logistics process. Braunscheidel and Suresh (2009) found that FSCA is related to internal integration, external integration with key suppliers and customers, and external flexibility. Further, Blome et al. (2013) showed that FSCA improves with a firm's ability to manage upstream (e.g. supplier and production management) and downstream (e.g. demand and distribution management) activities. More generally, it has been established that FSCA agility can be achieved through the development and use of both intra- and inter-organizational competencies (Braunscheidel and Suresh, 2009; Fayezi et al., 2017). Several authors have however noted the need to explore these antecedents in greater depth and to identify other, new antecedents (Swafford et al., 2006; Chiang et al., 2012; Blome et al., 2013; Chan et al., 2017).

Swafford et al. (2006) indicated that agility can be developed through thegenerating knowledge and using flexible processes; however, to date, there is limited empirical support to confirm this (Panda and Rath, 2018). In addition, although flexibility is a key antecedent of FSCA, specific dimensions of flexibility need to be studied in greater depth (Swafford et al., 2008; Chan et al., 2017). Furthermore, it has been pointed out that both internal (functional and multifunctional operations) and external integration (with suppliers and customers) influence the establishment of a firm's capacity to act in an agile way (Braunscheidel and Suresh 2009).

Our study thus aims to evaluate knowledge and flexibility antecedents of FSCA and to incorporate both intra- and inter-organizational competencies. It does so by examining the roles of an intra-organizational variable related to knowledge, i.e. the TMS of a firm's operations department, and an inter-organizational variable related to flexibility, i.e. a firm's SNF, in the value of FSCA. Taken together, the two variables provide a better understanding of how the internal abilities of the operations department and the supplier's external collaborative abilities influence the development of FSCA.

3.2.2.1 The Relationship between TMS and FSCA

The adopted definition of TMS is based on that proposed by Lewis (2003) and Lewis and Herdnon (2011) who developed the first measurement scale for TMS in group contexts. TMS "*is the shared division of cognitive labor with respect to the encoding, storage, retrieval, and communication of information from different domains that often develops in close relationships*" (Lewis and Herdnon, 2011; p. 1254). It is concerned not only with developing a shared understanding of 'who knows what'; it also involves the dynamic integration and management of all members' existing expertise and the collective creation of new knowledge (Zheng and Mai, 2013; Huang and Chen, 2018). The concept was first used by Wegner (1987) when studying coordination between couples to resolve information processing problems (Huang and Cheng, 2018). Over time, it has been extended and applied to other contexts and units of analysis, including various other types of dyadic relationships (Hammedi et al., 2013; Argote and Guo, 2016), work groups (Liang et al., 1995; Argote and Guo, 2016), organizations (Huang and Cheng, 2018), and to contexts that transcend organizational boundaries, such as a TMS between supply chain partners (Obayi et al., 2017). In particular, this study evaluates the TMS in the operations department of the firm (hereafter referred to as operations TMS).

Traditionally, the literature has suggested a TMS has three basic characteristics: specialization, credibility, and coordination (Lewis and Herndon, 2011; Hammedi et al., 2013; Huang and Cheng, 2018). Specialization refers to the existence of differentiated and unique knowledge amongst group members. Credibility establishes that the group should trust the knowledge of each individual member. Finally, coordination involves sharing this individual knowledge to perform a specific task efficiently (Hammedi et al., 2013). These three characteristics allow working groups to obtain a series of benefits (Argote and Guo, 2016; Huang and Cheng, 2018). They enable the creation, maintenance, and transfer of knowledge (Huang and Cheng, 2018); and they improve

alignment between team members (Heavey and Simsek, 2017; Huang and Cheng, 2018). Thus, TMSs recognize and make use of the specific knowledge and experience of each team member and combine it through transactional processes or personal interactions that link team members and are necessary for processing and coordinating information cooperatively (Argote and Guo, 2016; Heavey and Simsek, 2017).

The above benefits are especially important to the development of agility (Argote and Guo, 2016; Fayezzi et al., 2017), which involves anticipating and rapidly responding to environmental uncertainty (Fayezi et al., 2017). Some authors have advocated the importance of TMSs when faced with high levels of uncertainty (Argote and Guo, 2016) for two main reasons. First, survival in dynamic and turbulent markets requires firms to foster learning and knowledge creation processes. Unstable environments require new knowledge to be generated rapidly to face unpredictable events (Gligor et al., 2015). Learning facilitates the creation and use of knowledge, and thus enables adaptation to new situations (Braunscheidel and Suresh, 2009). TMSs can therefore foster and accelerate group learning (Lin and Lin, 2001). Based on an analysis of 218 Taiwanese firms, Li and Huang (2013) found that specialization, credibility, and coordination influence exploitative and exploratory learning. Research has also demonstrated that learning impacts an organization's internal (or departmental) learning, which is itself an antecedent of FSCA (Braunscheidel and Suresh, 2009). Agile organizations trust their employees, who possess the technical experience and know-how to be alert to opportunities and challenges presented by the changing environment (Shin et al., 2015).

Second, the coordination of this learning and knowledge is key to managing uncertainty. High uncertainty requires non-programmed or relational coordination, which further requires high levels of communication and adjustment between team members (Argote and Guo, 2016). Such coordination is facilitated by the

characteristics of a TMS, e.g. specialization and credibility, which in uncertain situations facilitates consultation with subject experts. A TMS will allow knowledge to be properly coordinated in the operations department, and this improves an organization's reaction and/or adaptation capabilities. Moreover, organizations can improve collective improvisation (Zheng and Mai, 2013) and/or response capacity by making better use and application of their integrated knowledge (Heavey and Simsek, 2017). They can also develop capabilities for communication and problem solving between members of the department. Sharing individual mental models enables the base of shared meaning to expand, increasing a department's capability for effective coordinated action (Lin and Lin, 2001).

Teams that use their knowledge are versatile and excellent at solving problems (Shin et al., 2015) due to the creative friction that develops within the team. Further, non-redundant knowledge transactions facilitate the search for and discovery of new knowledge and ideas (Heavey and Simsek, 2017). For example, Ren et al. (2006) indicated that TMSs reduce response times by facilitating knowledge recovery and improving the quality of decision making through the coordination and evaluation of tasks. TMSs can also reduce the time needed to complete tasks properly (Argote and Guo, 2016) and increase innovation potential (Peltokorpi, 2014; Argote and Guo, 2016).

Based on the above, it is argued that an operations TMS could increase FSCA due to the benefits derived from the creation, use, and coordination of knowledge. The TMS implies the strategic use of resources and the tactical management of manufacturing operations (Chan et al., 2017). We thus propose verifying the following hypothesis:

Hypothesis 1 (H1): The level of the operations TMS positively influences FSCA.

3.2.2.2 The Relationship between SNF and FSCA

SNF is a relatively new concept in the operations management field (Purvis et al., 2014). Only a few recent studies have used this concept to evaluate, for example, sources of SNF (Purvis et al., 2014), the mediating role of SNF in acquiring external knowledge and production innovation flexibility (Liao and Marsillac, 2015), and the relationship between SNF and supply chain performance (Liao et al., 2010). Although there are various definitions of SNF (e.g. Lummus et al., 2003; Stevenson and Spring, 2007; Purvis et al., 2014; Liao and Marsillac, 2015), as summarized in Table 3.1, they all agree that SNF implies the ability to manage, reconfigure, re-align or reinvent relationships with suppliers. This study follows the definition suggested by Liao et al. (2010), which encapsulates the main aspects of key definitions (see Table 3.1). SNF is defined as *"the extent of responsive ability through the use of collaborative capabilities to reconfigure the supply base effectively and efficiently"* (Liao et al., 2010, p. 8). A firm's supply base is the visible part of its supply network, specifically the *"portion of the supply network that is actively managed by the focal company through contracts and purchasing of parts, materials, and services"* (Choi and Krause, 2006, p. 638). Accordingly, SNF does not depend on a supplier's capabilities (Purvis et al., 2014) but rather on the focal firm's ability in a future situation to redesign and reconfigure its supply base (Swafford et al., 2006). The firm must be able to reorganize rapidly and find alternative suppliers (Purvis et al., 2014) to maintain a sufficient set of options and responses to potential changes in the environment (Liao and Marsillac, 2015).

Flexibility has traditionally been measured (e.g. in a manufacturing flexibility context) in terms of range, mobility, and uniformity (Swafford et al., 2006; Stevenson and Spring, 2007; Liao and Marsillac, 2015), and these terms can be applied to SNF. Firms must have multiple alternative sources of supply (range), the ability to change from one supplier to another without penalties in time or cost (mobility), and the

ability to change suppliers whilst maintaining similar levels of performance (uniformity) (Liao and Marsillac, 2015).

The availability of different strategic options for product supply enables the focal firm to quickly and easily structure, coordinate, and manage its supply network based on environment uncertainties (Lummus et al., 2003; Liao et al., 2010; Liao and Marsillac, 2015). Firms with multiple suppliers have contingency plans that provide them with greater reaction capabilities (Masson et al., 2007). In other words, SNF enables the focal firm to develop the ability for *"surprise management"* (Chan et al., 2017, p. 488).

Table 3.1. Definitions of Supply Network Flexibility (SNF) from the Literature

Journal /Authors	Concept
International Journal of Production Research Liao and Marsillac (2005)	**SUPPLY CHAIN NETWORK-ORIENTED FLEXIBILITY** **Supply chain network flexibility (SNF)** The extent of responsive ability through the use of collaborative capabilities to reconfigure the supply base effectively and efficiently. **Information-spanning flexibility (ISF)** The ability of a firm to efficiently and effectively disseminate change-provoking information along the supply chain.
International Journal of Production Economics *Purvis et al. (2014)*	**SUPPLY NETWORK FLEXIBILITY (SNF)** **Vendor flexibility** Refers to the flexibility related to individual vendors within the supply system. The flexibility of individual nodes. **Sourcing flexibility** Refers to the ability of the system's coordinator to reconfigure a supply chain network through the selection and deselection of vendors. The ability of the focal firm to re-design (re-configure) and manage (coordinate) the supply chain (sourcing flexibility).
Journal of Supply Chain Management *Liao et al. (2010)*	**SUPPLY FLEXIBILITY** The extent of responsive ability through the use of supplier-specific capabilities and of inter-organizational collaborative capabilities. **Supplier flexibility (SF)** The extent of responsive abilities through the use of supplier-specific capabilities. **Supply network flexibility (SNF)** The extent of responsive abilities through the use of collaborative capabilities to reconfigure the supply base effectively and efficiently.
International Journal of Operations & Production Management *Stevenson and Spring (2007)*	Four-tiered hierarchy of flexibilities: floor level, plant level, firm level, network level **SUPPLY CHAIN FLEXIBILITIES (NETWORK LEVEL)** **Robustness** Range of market change with which the existing supply chain configuration is able to cope. **Re-configuration** Potential to re-align or reinvent the supply chain in response to (or in anticipation of) market change. **Relationship** Ability to build collaborative relationships both up- and downstream, including for new product development. **Logistics** Potential to rapidly send and receive products cost effectively as customers and sources of supply change. **Organizational ability** Ability to align (or re-distribute) skills to meet the current needs of the whole supply chain. **Inter-organizational IS** Ability to align information systems with existing supply chain entities to meet changing information needs.
Global Journal of Flexible Systems Management *Lummus et al. (2003)*	**SUPPLY NETWORK FLEXIBILITY (SNF)** Ability to add and remove suppliers and select suppliers, to select suppliers that can add new products quickly, to vary supplier relationships, and to have suppliers make volume changes.

Source: developed by authors.

Agile supply chains have the ability to rapidly reconfigure a temporary network of organizations (Purvis et al., 2014). Choi and Krause (2006) indicated that many firms, in their eagerness to optimize the supply base, reduce their number of suppliers; but this increases dependence on a more limited set of remaining suppliers, which ultimately constrains flexibility. SNF eliminates supplier dependence and enables the focal firm to rapidly adjust to supply and demand (Liao and Marsillac, 2015). The capability to add and eliminate suppliers, to choose suppliers that can cope with volume changes or rapidly introduce new products, and the ability to vary relationships with providers (Lummus et al., 2003), are key to fulfilling new demands with sufficient speed and precision (Choi and Krause, 2006). As Lummus et al. (2003) argued, the supply chain must be designed whilst taking change into account. But when the market changes, competitive priorities can also change, which can then make it necessary to find new supply chain partners with the capabilities required. For example, firms can use suppliers with new and better knowledge, technologies, or other capabilities needed to fulfill changing supply requirements (Liao et al., 2010). Such capabilities facilitate responsiveness to customers (Chiang et al., 2012), more reliable product supply, positive changes to product volumes and mix (Liao et al., 2010), and the development of more effective and profitable innovations (Liao and Marsillac, 2015). In their study of a sample of 201 manufacturing firm leaders, Liao and Marsillac (2015) found that SNF enables firms to acquire external knowledge and improve their product innovation capabilities.

It therefore follows that the availability of different strategic options for product supply (without penalties of cost, time, or quality) enables the focal firm to make better use of the resources in its supply base (Lummus et al., 2003; Liao et al., 2010), enhancing adaptation to changing market requirements (Purvis et al., 2014). This could

facilitate the development of FSCA and the contribution to key supply chain outcome measures. We thus propose verifying the following hypothesis:

Hypothesis 2 (H2): The level of SNF positively influences FSCA.

3.2.2.3 The Moderating Effect of TMS on the Relationship between SNF and FSCA

The SNF-FSCA relationship requires a firm to find appropriate suppliers that can face up to the changing environment as quickly as possible. It is therefore necessary to be able to know and detect changes in the environment so that the best strategic combination for supplying products and managing network complexity can be identified. The presence of an operations TMS could contribute greatly to this relationship given that one of the most striking benefits of a TMS concerns the creation, maintenance, transfer, and coordination of knowledge (Heavey and Simsek, 2017; Huang and Cheng, 2018). Thus, the TMS could make it easier for the firm to detect and respond to environmental change.

A firm must be able to determine the heterogeneous resources and capabilities of its current and potential supply base and to understand the potential for reengineering its systems and processes throughout the supply chain (Liao and Marsillac, 2015). That is, operations managers must evaluate each supplier's capabilities and any risks to order fulfillment (Kull et al., 2014). The internal knowledge base is needed to recognize the value of external knowledge, to assimilate and apply it (Liao and Marsillac, 2015). An operations TMS is thus expected to contribute the knowledge needed to establish the best combination for the supply network promptly, thereby strengthening the relationship between SNF and FSCA.

A TMS could also facilitate management of the complexities associated with the chosen strategic combination. Complexity of the supply base depends on three factors: (1) the number of suppliers; (2) the degree of differentiation between suppliers; and, (3) the level of interrelationships between suppliers (Choi and Krause, 2006). We can thus expect a flexible supply network to have greater complexity, since a firm's SNF is known to involve at least two of these characteristics. The focal firm should have multiple and different suppliers available to supply products (Liao and Marsillac, 2015), but having a large number of suppliers increases the coordination required (Handfield and Nichols, 1999). The characteristics of a TMS could be key to management in such contexts as they facilitate both the generation of knowledge on different suppliers and coordination abilities.

It is thus concluded that the knowledge generation and coordination capabilities of an operations TMS can make it easier for the focal firm to find the best strategic combination for supplying its products quickly and for managing the complexities associated with the network effectively. Such activities are key in a changing market as they strengthen the relationship between SNF and FSCA. We thus propose verifying the following hypothesis:

Hypothesis 3 (H3): Operations TMS positively moderates the relationship between SNF and FSCA.

3.2.3 FSCA, SNF, and OP

Although the literature suggests FSCA can influence an organization's success and prosperity (Fayezi et al., 2017), little empirical research has been undertaken to assess its true performance impact (Gligor et al., 2015). Some recent studies have begun to examine this relationship, but the focus has been on measures related to financial

performance or on a narrow range of operations measures (Swafford et al., 2008; Gligor and Holcomb, 2012; Blome et al., 2013; Eckstein et al., 2015; Gligor et al., 2015; Al-Shboul, 2017; Chan et al., 2017; Um, 2017). This study therefore provides a more in-depth analysis of the relationship between FSCA and OP, expanding on prior studies as summarized in Table 3.2. We examine four key areas of OP – delivery, production cost, product quality, and production flexibility – that reflect the four key capabilities required of a focal firm when responding to competition (Wong et al., 2011).

Table 3.2. Prior Literature on the Relationship between FSCA and Performance

JOURNAL, SUMMARY AND AUTHOR	PERFORMANCE DIMENSIONS
Supply Chain Management: An International Journal Al-Shboul, M.A. (2017) The study examines the role of delivery dependability and time-to-market on the relationship between the infrastructure framework and supply chain agility. In addition, it evaluates the impact of supply chain agility on firm performance.	**Manufacturing firm performance** Market share Return on investment The growth of market share The growth of sales Growth in return on investment Profit margin on sales Overall competitive position
European Journal of Operational Research *Chan et al. (2017)* *The authors study two organizational flexibility factors – strategic flexibility and manufacturing flexibility – that are critical antecedents to supply chain agility. They also evaluate the relationship between strategic flexibility, manufacturing flexibility and supply chain agility and the effect on firm performance.*	**FIRM PERFORMANCE** **Firm performance – operational excellence** Product delivery cycle time Timeliness of after-sales service Productivity improvements **Firm performance – customer relationship** Bond with customers Knowledge of customer buying patterns **Firm performance – revenue growth** Increased sales of existing products Finding new revenue streams **Firm performance – financial achievement** Return on investment after tax Growth in return on investment Sales growth Return on sales Growth in return on sales
Operations Management Research *Um (2017)* *The paper examines the effect of supply chain agility on customer service, differentiation, and business performance.*	**Business performance** Return on sales (ROS) Return on Assets (ROA) Market share growth Sales growth

International Journal of Production Research *Eckstein et al. (2017)* *The authors investigate the effects of supply chain agility and supply chain adaptability on cost performance and operational performance.*	**Cost performance** Manufacturing cost Inventory carrying costs Cost of transportation and handling Cost of purchased goods and services **Operational performance** Product quality Service level On-time delivery
Journal of Operations Management *Gligor et al. (2015)* *The authors examine the association between firm's supply chain agility (FSCA), cost efficiency and customer effectiveness and financial performance.*	**Customer effectiveness** Ability to handle customer emergencies Ability to handle non-standard orders to meet special needs Ability to provide customers with real-time information about their order Stock availability Order fulfillment Order-to-delivery cycle time Order-to-delivery cycle time consistency **Cost efficiency** Distribution costs Manufacturing costs Inventory costs **Financial performance** Return on Assets (ROA)
International Journal of Production Research *Blome et al. (2013)* *The paper investigates the fundamental building blocks of supply chain agility, which are conceptualized as supply- and demand-side competence. The model further assesses the influence of supply chain agility on operational performance.*	**Operational performance** Customer service Cost performance Service level performance Flexibility
Journal of Business Logistics *Gligor and Holcomb (2012)* *The authors study different antecedents of supply chain agility and their relationship with operational performance and relational performance.*	**Operational performance** A firm's ability to: Deliver undamaged orders each time Provide accurate orders at all times Meet deadlines as promised to supply chain partners
International Journal Production Economics *Swafford et al. (2008)* *The paper evaluates the relationship between supply chain flexibility, information technology integration and supply chain agility. Further, it examines the effect of information technology integration and supply chain agility on performance.*	**Competitive business performance** Return on global assets Global market share Profit margins Sales/number of employees

Source: developed by authors.

3.2.3.1 The Relationship between FSCA and OP

FSCA can maintain or develop a sustainable competitive advantage (Blome et al., 2013; Gligor et al., 2015; Chan et al., 2017; Um, 2017) by improving the internal functioning of the organization and by enabling more effective responses to external parties (Blome et al., 2013). Three characteristics enable FSCA to generate a sustainable competitive advantage (Blome et al., 2013): (1) it is a unique capability generated from specific internal and external competences; (2) it requires a temporary evolution over a prolonged time period; and, (3) it relies on the development of complex relationships internally and externally with customers and suppliers based on history. From a resource based view (RBV) perspective, these characteristics enable the firm to sustain a competitive advantage, which may in turn lead to higher levels of operating performance (Barney, 1991; Blome et al., 2013).

Some studies have indicated that FSCA contributes to the success of particular operations objectives (Gligor et al., 2015; Chan et al., 2017). First, the ability of agile supply chains to recover rapidly from external disturbances encourages adherence to delivery deadlines and guarantees a reliable and precise service (Gligor and Holcomb, 2012; Eckstein et al., 2015). Second, supply chain interruptions have been shown to represent an important cost factor for firms (Blome et al., 2013). FSCA enables firms to manage interruptions, preventing stoppages in production and optimizing supply chain costs (Blome et al., 2013; Eckstein et al., 2015; Chan et al., 2017). Further, FSCA reduces the time required to replace materials and services, to reconfigure machinery, and to adjust production processes, generating more profitable personalization of products and greater efficiency (Eckstein et al., 2015). Based on a sample of 283 firms, Gligor et al. (2015) examined two performance dimensions: customer effectiveness and cost efficiency. The authors argued that FSCA is a dynamic capability that results from a firm's ability to reconfigure firm-level and supply chain-level resources. The development of FSCA then allows firms to meet ever-changing customer expectations

in a cost-efficient manner. Third, FSCA enables the rapid and flexible fit of production processes and relocation of inventories (Blome et al., 2013). Finally, a firm's capability to perform incremental changes in design and modify engineering specifications rapidly enables waste reduction and more effective responses to incidents, improving product quality (Eckstein et al., 2015). Thus, it can be argued that FSCA permits a firm to rapidly change key supply chain outcome measures.

Based on the above, it follows that FSCA enables the development of a sustainable competitive advantage by strengthening a series of key abilities underpinning the success of firms in environments characterized by strong competition and high uncertainty (Chan et al., 2017). Such abilities in turn lead to better operations performance. We thus propose verifying the following hypothesis:

Hypothesis 4 (H4): FSCA positively influences OP.

3.2.3.2 The Mediating Effect of FSCA on the Relationship between SNF and OP

We also consider the potential mediating role of FSCA on the relationship between SNF and OP, which can be explained through the theoretical lens of the RBV. Although FSCA and flexibility are both associated with the ability to change, there is a conceptual difference between the two terms (Swafford et al., 2006). Following the argument developed by Swafford et al. (2006) and subsequently used in other studies (e.g. Swafford et al., 2008; Braunscheidel and Suresh, 2009; Chiang et al., 2012; Blome et al., 2013), we analyze *"the flexibility–agility association as a competency–capability relationship"* (Swafford et al., 2006, p. 172). In other words, SNF is a competence while FSCA is a capability (Swafford et al., 2006). Competences, such as SNF, are seen as assets or resources needed to build capabilities, such as FSCA (Blome et al., 2013). According to the RBV, the firm is a unique combination of heterogeneous resources

and capabilities that can be exploited to achieve sustainable competitive advantage over time, and thus better performance (Barney, 1991).

Resources are indispensable for the organization, but each resource in itself neither generates competitive advantage nor explains better business performance (Gligor et al., 2015). A firm must combine and manage its resources to develop capabilities (Amit and Schoemaker, 1993), which generate a lasting differential advantage because they are truly rare, valuable, and inimitable (Grant, 1996). Thus, FSCA is a higher-order capability *"derived from integrating lower-order capabilities and resources"* (Vickery et al., 2010, p. 7027). That is, the development of FSCA requires multiple competences, including flexibility (Swafford et al., 2006; Braunscheidel and Suresh, 2009; Blome et al., 2013) to improve performance. Following this logic, SNF is unlikely to impact performance directly.

Some studies have argued that FSCA can play an important mediating role; for example, Blome et al. (2013) found that FSCA mediates between supply-side and demand-side competence and operations performance. The ability to manage these upstream (supply-related) and downstream (demand- and distribution-related) activities thus requires FSCA. FSCA is a capability that enables supply chain competencies (supply- and demand-side) to adapt to the changing environment and ultimately leads to elevated performance (Blome et al., 2013). Meanwhile, Chan et al. (2017) showed that FSCA has a partial-mediation effect on the relationship between strategic flexibility and firm performance, implying strategic flexibility has a direct effect on firm performance. The authors also found that FSCA has a full-mediation effect on the relationship between manufacturing flexibility and firm performance. FSCA is a capability that allows a firm to detect and respond effectively to uncertain markets. This allows it to improve its strategic flexibility (the possession and deployment of resources) and production flexibility (the capacity of a firm to adopt different configurations within its existing production capability) to undertake strategic

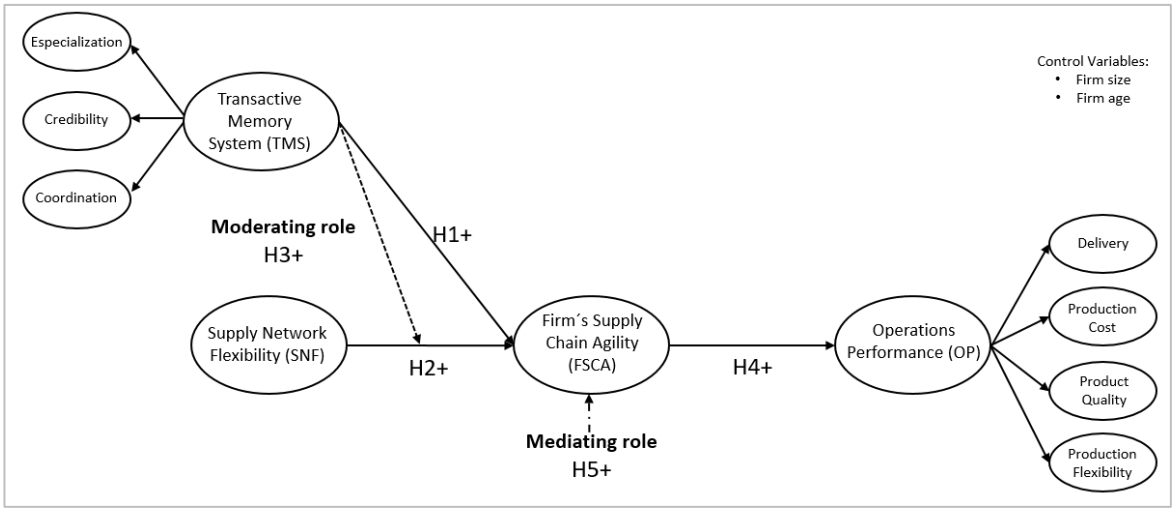
and operative actions that allow the firm to achieve better performance. Finally, Swafford et al. (2008) found that FSCA mediates the relationship between supply chain flexibility and firm performance. This mediating relationship is explained because flexibility is a competency. Competencies alone do not allow performance to be improved, but they enable higher order capabilities, such as FSCA, to be reached.

Based on the above, it is posited that a firm's SNF is necessary but not sufficient to generate superior operations performance. Further, if SNF influences a firm's operations performance directly then exploring the mediating effect of FSCA could provide a more complete understanding of the relationship between SNF and OP. We thus propose verifying the following hypothesis:

Hypothesis 5 (H5): FSCA mediates between SNF and OP.

The five relationships to be empirically investigated are illustrated in the theoretical model depicted in Figure 3.1.

Figure 3.1. Theoretical Framework of the Study



3.3. Research Method

3.3.1 Target Population and Survey Procedure

Spanish companies in the high-tech sector were selected from the Iberian Balance Sheet Analysis System (SABI) database to investigate the hypotheses. The database includes information on company size, age, industry sector, financial ratios, operations measures, and other miscellaneous data. Relevant firms were identified according to the codes attributed by The North American Industry Classification System (NAICS), as used in Kile and Phillips (2009). This sector was chosen because of its highly competitive and dynamic market environment (Wang et al., 2013) meaning the development of knowledge, flexibility and agility are crucial to survival.

We followed Dillman's (2000) prescriptions to collect survey data. After a comprehensive literature review, we developed a pilot survey, which was validated using four academics and six supply chain managers. The experts recommended some modifications and minor changes in wording to facilitate comprehension of the questions, and these were incorporated. Following Braunscheidel and Suresh (2009), the unit of analysis was the firm, and the preferred respondents were senior managers with knowledge of the processes and activities of the firm´s operations department and who had the capacity to make decisions in that department. Data were collected via the computer-assisted telephone interview (CATI) system. Interviewers were trained to know the measures in detail meaning they could answer any questions posed by the respondents.

From a total population of 1,525 firms, 495 were contacted by telephone and we received 226 responses. Responses with a high number of missing values were deleted. Hair et al. (2010) suggested that *"the researcher should consider the simple remedy of deleting offending case(s) and/or variable(s) with excessive levels of missing*

data… variables or cases with 50 percent or more missing data should be deleted" (Hair et al., 2010; p.46). We decided to remove all non-complete responses, obtaining a final sample composed of 190 responses. We also evaluated non-response bias according to Fawcett et al. (2014) by comparing the mean values between respondent (190 firms) and non-respondents (305 firms, i.e. 495 minus 190) according to the number of employees (firm size), sales, and operating profit variables. The values were similar suggesting non-respondent firms did not introduce significant bias into the study (number of employees df=2; F=0.16; Sig.=0.84; sales df=2; F=1.85; Sig.=0.16, and, operating profit df=2; F=1.36; Sig.=0.26). In addition, non-respondents were asked why they were unable to take part. The main reasons were the lack of a qualified person to answer the survey and a firm policy that did not permit the sharing of confidential information.

3.3.2 Instruments and Measures

The main constructs used were: TMS, SNF, FSCA, and OP. All four are reflective constructs. The measurement scales for these variables, as shown in Appendix 3.A, were adapted from prior studies: TMS (Lewis, 2003), SNF (Liao et al., 2010), FSCA (Swafford et al., 2006), and OP (Wong et al., 2011). A seven-point Likert scale was adopted to capture managers' perceived levels of these variables (from 1=maximum disagreement to 7=maximum agreement).

Two firm-level control variables that might influence operations performance were also investigated: firm age and firm size. Firm age, i.e. the number of years since a firm was founded, can affect the implementation of supply chain management practices and therefore OP (Gligor et al., 2015). Firm size, based on the number of employees, can also influence OP as large firms may derive greater synergistic effects from supply chain agility than smaller firms (Chan et al., 2017). Moreover, large firms have more

resources to implement supply chain management practices (Gligor et al., 2015; Chan et al., 2017). Consistent with research conventions, both control variables were measured by logarithmic transformations (Gligor et al., 2015). More specifically, the Neperian logarithm was used.

3.3.3 Validity and Reliability of Scales

We first established the content validity of the scales by performing an extensive literature review. Second, we assessed the reliability of each scale, calculating Cronbach's alpha (α) coefficient, with all coefficients exceeding the generally accepted cut-off value of 0.07 (Kaynak and Hartley, 2006). Third, we examined construct validity (convergent and discriminant validity) using confirmatory factor analysis (CFA). Convergent validity requires standardized item loadings and >0.6 and significant, i.e. a t-value >1.96 (Hair et al., 2010). Some items that did not meet these criteria were removed (see Appendix 3.A). Moreover, a good fit of the measurement model can ensure convergent validity (Schumacker and Lomax, 1996). A model is considered satisfactory if the incremental fit index (IFI) is > 0.90, the comparative fit index (CFI) is > 0.90, and the root mean square error of approximation (RMSEA) is < 0.08 (Byrne, 2013). The results of the CFA indicate good fit for the measurement model with a Chi-square (X2) of 797 and 546 degrees of freedom (df) (X2/df=1.46; IFI=0.90; CFI=0.90; and RMSEA=0.05). In summary, all standardized item loadings indicated that the constructs exhibit convergent validity. Table 3.3 shows that the purified scales, which in all cases are within the accepted limits.

Table 3.3. Reliability and Convergent Validity Results

Measurement Item	Factor loading	R^2	α Cronbach	CR	AVE
Specialization (SP)			0.83	0.83	0.55
SP1	0.68	0.46			
SP2	0.80	0.64			
SP3	0.69	0.47			
SP4	0.78	0.61			
Credibility (CRE)			0.92	0.92	0.73
CRE1	0.81	0.66			
CRE2	0.87	0.76			
CRE3	0.91	0.83			
CRE4	0.83	0.69			
Coordination (CO)			0.91	0.91	0.71
CO1	0.88	0.77			
CO2	0.85	0.72			
CO3	0.84	0.70			
CO4	0.81	0.66			
Supply networks flexibility (SNF)			0.89	0.90	0.76
SNF1	0.75	0.56			
SNF2	0.93	0.86			
SNF3	0.92	0.85			
Firm´s supply chain agility (FSCA)			0.91	0.94	0.62
FSCA1	0.71	0.50			
FSCA2	0.75	0.57			
FSCA3	0.77	0.60			
FSCA4	0.74	0.54			
FSCA5	0.76	0.57			
FSCA6	0.81	0.66			
FSCA7	0.84	0.70			
FSCA8	0.83	0.70			
FSCA9	0.88	0.78			
Delivery (DE)			0.84	0.86	0.67
DE1	0.76	0.58			
DE2	0.94	0.88			
DE3	0.75	0.57			
Production cost (PC)			0.87	0.87	0.68
PC1	0.85	0.72			
PC2	0.81	0.66			
PC3	0.82	0.68			
Product quality (PQ)			0.92	0.93	0.82
PQ1	0.80	0.65			
PQ2	0.98	0.97			
PQ3	0.92	0.85			
Production flexibility (PF)			0.75	0.75	0.60
PF1	0.79	0.62			
PF2	0.76	0.58			

Note. CR = composite reliability; AVE = average variance explained. All factor loadings are significant at least 0.05 level. Goodness of Fit Statistics: $x^2/df = 797/546 = 1.46$; IFI = 0.90; CFI = 0.90; RMSEA = 0.05.

Following Fornell and Larcker (1981), we used AVE to evaluate discriminant validity. The square root of the AVE for each pair of constructs was greater than their correlation (see Table 3.4). The square root of the AVE appears on the main diagonal of Table 3.4 and is greater than the correlations between constructs. This demonstrates the presence of discriminant validity between the constructs used in the model. In addition, following Henseler et al. (2015), the heterotrait-monotrait ratio of correlations (HTMT) was calculated for each pair of constructs. As Table 3.5 shows, the HTMT ratio is <0.85 for each pair of constructs, also indicating the presence of discriminant validity.

Table 3.4. Mean Values, Standard Deviations (SDs), Average Variance Extracted (AVE), and Bivariate Correlations of Variables

	Mean	SD	1	2	3	4	5	6	7	8	9
1. Specialization	4.66	1,64	***0.74***								
2. Credibility	5.88	1.12	0.39***	***0.86***							
3. Coordination	5.79	1.06	0.30***	0.75***	***0.84***						
4. Supply network flexibility	3.90	1.29	0.01	0.07	0.12	***0.87***					
5. Firm´s supply chain agility	4.60	1.31	0.34***	0.26**	0.34***	0.28**	***0.79***				
6. Delivery	6.09	0.92	0.11	0.18*	0.42***	0.13	0.30***	***0.82***			
7. Production cost	4.26	1.65	0.03	0.06	0.09	-0.01	0.23**	0.34***	***0.83***		
8. Product quality	6.17	0.88	0.30***	0.46***	0.45***	0.12	0.21**	0.51***	0.17*	***0.91***	
9. Production flexibility	4.68	1.66	0.34***	0.10	0.16	0.13	0.61***	0.28**	0.54***	0.35***	***0.77***
10. Firm size	4.31	1.14									
11. Firm age	3.09	0.56									

Note. The AVE appears on the main diagonal in italics. Significant at *p<0.05; **p<0.01; ***p<0.001

Table 3.5. HTMT Ratio

	FSCA	CO	PC	CRE	DE	PF	PQ	SNF	SP
FSCA	1								
CO	0.35	1							
PC	0.22	0.10	1						
CRE	0.28	0.75	0.08	1					
DE	0.33	0.50	0.35	0.19	1				
PF	0.60	0.16	0.53	0.11	0.30	1			
PQ	0.26	0.48	0.21	0.47	0.56	0.37	1		
SNF	0.30	0.12	0.05	0.09	0.17	0.13	0.14	1	
SP	0.35	0.30	0.08	0.38	0.16	0.37	0.35	0.09	1

3.3.4 Common Method Variance

This study is based on a single respondent per firm. In order to avoid the problems associated with the use of a single respondent, we follow the requirements suggested by Malhotra and Grover (1998) and Krause et al. (2018). Specifically, Krause et al. (2018) explain when single-respondent research with a key informant may be considered valid in the operations and supply chain management surveys, e.g. based on the cognitive perspective, key informant's role, and target concept. In addition, it should be noted that much recent research has employed a single respondent approach without affecting methodological rigor (e.g. Gligor et al., 2015; Rojo et al., 2018; Roldan Bravo et al., 2018).

Nonetheless, it remains important to consider whether common method bias is a concern. Therefore, we followed the steps proposed by Podsakoff et al. (2003). Respondents were assured that there were no correct or incorrect answers and that they were free to answer the questions in the most honest way possible. In this sense, although the respondents were answering questions related to TMS, SNF, FSCA, and OP, it was unlikely that they could have intuited the specific research model. If the research question is unknown, respondents are less able to manipulate their answers to meet expectations about the assumed relationships. In addition, the response range was broad (seven point scales) and the questions were not grouped by construct. The pretest of the questionnaire also eliminated potential ambiguities, improving the scale items.

Harman's single-factor test was also used, whereby if common method bias is a serious threat to the results then a single factor will account for most of the variance. We employed an exploratory factor analysis of all survey items. The first factor accounting for only 26.54 % of the explained variance. Since no general factor emerged that accounted for the majority of the covariance, we can conclude that

common method bias is not a serious issue among our data. Alternatively, Chang et al. (2010) suggested using confirmatory factor analysis (CFA). Following the authors' suggestions, all survey items were charged to a single factor in the CFA and the fit statistics did not show good fit (X^2/df 4.52; IFI 0.23; CFI 0.22; RMSEA 0.14). Further, to add robustness to the single-respondent data, we correlated the OP results with secondary data from the SABI database, reaching a high and significant correlation (OP correlation based on operating profit=0.77**; OP correlation based on sales =0.56**). This verifies that the respondents were knowledgeable about the content of the survey.

3.4. Results

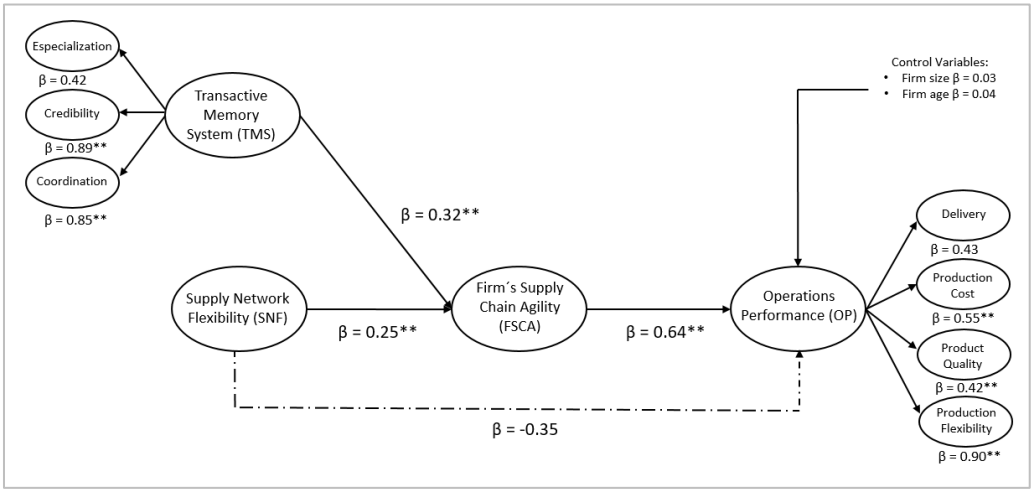
After validating the measurement model, structural equation modeling (SEM) was used to estimate all hypotheses. To conduct this analysis, we utilized SEM with bootstrapping (Nevitt and Hancock, 2001). As a nonparametric resampling procedure, bootstrapping uses the available data to generate an empirical approximation of the sampling distribution of a statistic. Each parameter is associated with a confidence interval (CI). The effects are significant if zero is not contained in the 95 percent confidence interval (Zhao et al., 2010). If the confidence interval includes zero, then the hypothesis is rejected. Bootstrapping was preferred to test the hypotheses because it requires far fewer assumptions and has greater statistical power (Preacher and Hayes, 2008). It allows effect sizes to be calculated and hypothesis tests to be conducted for an estimate even when the underlying distribution is unknown; it can test significance in small samples (Preacher and Hayes, 2008; Hayes, et al., 2013); and, it is widely accepted across a variety of literatures (Huertas-Valdivia et al., 2018).

To test the proposed research model, we first calculated the direct effects (*H*1, *H*2 and *H*4) and the mediating effect (*H*5) before following the methodology used by Gligor et al. (2015) to calculate the moderating effect (*H*3).

3.4.1 Direct and Mediating Effect Results

Figure 3.2 depicts the results of the direct effects (H1, H2 and H4) and the results of the mediating effect (H5). Results indicate a good fit for the model with a Chi-square of 1,209 and 616 degrees of freedom, IFI=0.90, CFI=0.90 and RMSEA=0.07 (Byrne, 2013).

Figure 3.2. Direct and Mediating Effect Results



Note. Significant at *p<0.05; **p<0.01; ***p<0.001

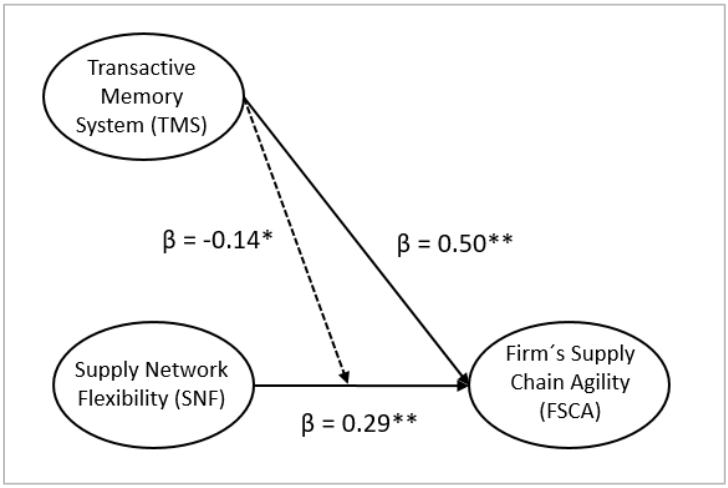
H1 was supported by the data (CR = 0.69; β_1=0.32; p < 0.01; IC 0.22, 1.6), indicating a direct and positive relationship between TMS and FSCA. Results also support *H2* (CR=3.21; β_2=0.25; p < 0.01; IC 0.08, 0.43), suggesting a direct and positive relationship between SNF and FSCA. This demonstrates that both TMS and SNF impact positively

and significantly on FSCA. *H4* was also supported (CR=3.97; β_4=0.64; $p < 0.01$; IC 0.03, 0.40); hence, results provide support for the hypothesized direct and positive relationship between FSCA and OP. In addition, we did not find a direct and positive relationship between SNF and OP (CR=-0.43; β=-0.01; $p > 0.05$; IC -0.11, 0.08). The direct effect of SNF on OP was not significant (p=0.66) indicating complete mediation. This can be classified as indirect-only mediation since a mediated effect (a x b), but no direct effect, exists (Zhao et al., 2010). This provides empirical evidence to support *H*5.

3.4.2 Moderating Effect Results

To test the moderating effect (H3), we examined the interaction between SNF and TMS. The two variables were first centered to reduce the risk of multi-collinearity (Aiken and West, 1991). Next, FSCA was regressed on SNF, TMS, and SNF×TMS. The results are depicted in Figure 3.3. The interaction term was significant (CR=-2.034; β3= -0.14; $p<0.05$; IC -0.28, -0.01) and multi-collinearity was not a problem (VIF=1.00). Results show that TMS moderates the relationship between SNF and FSCA. The interaction term was however negative meaning H3 is not supported. This suggests TMS has a negative moderating effect on the relationship between SNF and FSCA. We will return to this result in the forthcoming discussion.

Figure 3.3. Moderation Results



Note. Significant at *p<0.05; **p<0.01; ***p<0.001

3.4.3 Robustness Tests

A test of robustness was performed to ensure that the proposed model does not suffer from endogeneity problems. Two alternative models were estimated and their global fit compared (Rojo et al., 2016). The first model assumed that FSCA influences TMS, TMS influences SNF, which in turn influences OP. The results indicate a Chi-square of 1,258 and 617 degrees of freedom, IFI=0.87, CFI=0.87 and RMSEA=0.07. The second model assumed that TMS influences SNF, SNF influences FSCA and finally, FSCA influences OP. The results indicate a Chi-square of 1,566 and degrees of freedom 618, IFI=0.81, CFI=0.80 and RMSEA=0.09. The estimations result for the two alternative models are included in Appendix 3.B. As the fit indices and appendix shows, the alternative models present a worse fit than the proposal model. Therefore, the proposed model gives a better explanation of the data (Rojo et al., 2016¸ Rojo et al., 2018).

3.5. Discussion and Conclusions

This study has pursued two main goals: (i) to analyze the role of TMS and SNF as potential antecedents of FSCA, evaluating the moderating role of TMS in the SNF-FSCA relationship; and, (ii) to evaluate the relationship between FSCA and OP, examining the potential mediating effect of FSCA on the SNF-OP relationship. This final section discusses the study's main implications for research and practice, along with its limitations and future research potential.

3.5.1 Research Implications

The paper makes three important contributions. First, it responds to Swafford et al. (2006) by evaluating the role of TMS and SNF as potential antecedents of FSCA. These antecedents have not previously been considered in the literature on agility. The identified positive relationship between TMS and FSCA (H1) supports the argument that high levels of TMS in the operations department encourage FSCA. Although the benefits of TMS and the use of knowledge have been recognized in other fields and organizational areas (Zheng and Mai, 2013; Peltokorpi, 2014; Argote and Guo, 2016; Heavey and Simsek, 2017), there has been almost no exploration of these benefits in operations management. Therefore, our work adds to the pioneering study by Obayi et al. (2017), which considered the TMS generated between supply chain partners. Our study extends knowledge by considering the operations TMS and exploring the benefits that this can have for FSCA.

In addition, the positive relationship between SNF and FSCA (*H2*) reinforces the need to reconfigure the supply base when confronted by environmental change. This is consistent with operations management literature that recognizes the importance of different types of flexibility for achieving FSCA (Swafford et al., 2006; Swafford et al.,

2008; Braunscheidel and Suresh, 2009; Chan et al. al., 2017) whilst expanding knowledge on the flexibility-agility relationship by exploring a type of flexibility rarely considered, i.e. SNF. Taken together, these antecedents – TMS and SNF – highlight the need to develop intra- and inter-organizational competencies to achieve FSCA. The importance of intra- and inter-organizational competences was suggested in prior studies (e.g. Braunscheidel and Suresh, 2009; Gligor et al., 2015; Fayezi et al., 2017) and is now empirically confirmed by our paper.

The negative moderation effect of TMS on the SNF-FSCA relationship (*H3*) is also important. The relationship between SNF and FSCA has been shown to be weakened when a firm has high levels of operations TMS. This may be because TMS provides the firm with greater internal management capabilities, which facilitate its own adaptation to market changes. Similarly, Zheng and Mai (2013) demonstrated that a well-developed TMS dampens the search for external resources to attend unexpected events in the environment. The environments with significant commercial opportunities and high uncertainty generate unexpected events that require a business response. One way to respond to these events is to improvise. The teams with a well-developed TMS have the cognitive resources necessary to generate that knowledge internally. Real-time integration and the application of new and pre-existing knowledge favors rapid and improvised responses to changes in the environment without looking for solutions using external sources (Zheng and Mai, 2013).

As the operations department develops its TMS, it relies less on the supply base to improve FSCA as solutions can be forged internally. Indeed, the ability to create, maintain, transfer and coordinate knowledge enables the firm to draw on its own abilities instead of consulting external parties to solve problems (Carney et al., 2008). Further, improving FSCA through a firm's internal processes encourages quick response and eliminates the costs associated with seeking out new suppliers and

generating commercial transactions (Williamson, 1975). SNF involves finding the best strategic combination for product supply. This requires not only the presence of available suppliers but also the time, cost and knowledge necessary to perform a search and select suppliers effectively and efficiently. Firms with a high level of operations TMS will thus be incentivized to invest in themselves to respond to uncertainty instead of delegating this to external agents.

Second, the study contributes to the agility literature by examining the relationship between FSCA and OP. The identified positive relationship between FSCA and OP (*H4*) confirms the importance of developing FSCA to improve a firm's operating measures. Prior studies have explored the relationship between FSCA and OP but considered only some dimensions of performance (Blome et al., 2013; Eckstein et al., 2015; Gligor et al., 2015; Chan et al., 2017). By considering four specific dimensions – delivery, production cost, product quality and production flexibility – our study provides a more complete understanding of the operating measures improved by FSCA.

Finally, the study enhances literature on the competency-capability relationship between flexibility and agility (Swafford et al., 2006 and 2008; Braunscheidel and Suresh, 2009; Chiang et al., 2012; Blome et al., 2013). Further, much of the existing literature has focused on evaluating flexibility relative to the internal processes of the firm. Few studies have extended flexibility beyond the boundaries of the focal firm. Our findings suggest that FSCA mediates the relationship between *supply network* flexibility and OP (*H5*). That is, while SNF is a competency, FSCA is a capability. According to the RBV, competencies in themselves do not lead to sustainable competitive advantage. Rather, they must be combined and managed to develop capabilities. Thus, SNF in itself does not generate greater OP *per se* – it requires FSCA to obtain operations benefits.

3.5.2 Managerial Implications

The empirical evidence highlights the practical value of investing in FSCA in order to build a sustainable competitive advantage. FSCA enables the firm to compete in an increasingly dynamic and changing environment by improving operations dimensions such as product quality, production costs, product delivery, and production flexibility. This study enables managers to understand how FSCA can be strengthened. It depends not only on internal aspects of the firm but also on other agents in the supply chain. Managers should thus develop both intra- and inter-organizational resources to encourage FSCA.

In a recent McKinsey Quarterly survey report of 2,500 business leaders, was found that "*few companies have achieved organization-wide agility but many have already started pursuing it in performance units*" (McKinsey & Company, 2018). In this regard, this study provides evidence of how companies can improve FSCA by managing aspects related to the operations department. Managers can develop a solid TMS in the operations department by building collaborative work teams, fostering trust amongst group members, and recruiting personnel that specialize in a specific area and are willing to share and coordinate their individual knowledge. Such teams exhibit a greater responsive capability and can develop creative solutions to unexpected problems (Akgün et al., 2006), increasing FSCA. Meanwhile, managers can develop SNF by building a network of suppliers flexible enough to adapt to changes in the environment and thus able to quickly respond to new demands. Maintaining flexible networks in uncertain environments reduces a firm's dependence on its suppliers and increases its capability to adjust supply to meet demand.

Given that firms have limited resources; it may be necessary to prioritize one antecedent over another. In such a context, investment in internal resources appears to be more effective at developing FSCA. Indeed, developing TMS in the operations

department could be especially valuable when uncertainty is high, such as in the high-tech industry. It provides a knowledge base that can be coordinated to better address uncertain conditions in the environment (Argote and Guo, 2016). The operations department can use its internal knowledge, improvising when there are changes and ambiguities in the environment, without facing the costs associated with the search for new suppliers and the generation of new commercial transactions. The consultant McKinsey & Company in its study on successful agile teams, already pointed out as one of the most important factors for the development of agility, the ability of teams to manage ambiguity in the environment (McKinsey & Company, 2018).

Finally, although SNF can be developed to strengthen FSCA, it does not directly improve OP measures. Rather, it creates different strategic options for product supply, which enables a greater capability to adapt to changing market requirements. This increases FSCA, which leads to improvements in operations measures.

3.5.3 Research Limitations and Future Research Directions

Despite the theoretical contributions and managerial implications, the present study has certain limitations. Like most previous studies it is based on self-reported and single-respondent data. Thus, although we have tried to resolve this issue with appropriate analysis, the data may be less objective than in studies that use multiple respondents or that analyze objective databases. The cross-sectional research design also limits the extent to which we can infer cause-effect relationships. This can be overcome in future research through multiple respondent and longitudinal data collection. Further, this study was conducted exclusively in the high-tech sector in Spain. High-tech firms often operate globally, i.e. their clients are markets, countries, firms and organizations around the world. Therefore, we would expect similar results in other countries of a comparable level of development and industrialization,

although this needs to be verified. Beyond the high-tech sector, questions might be raised about the generality of the results; hence, caution should be exercised when extrapolating the findings to other industries. Thus, future research could evaluate whether these relationships are transferrable to other industries, e.g. with lower volatility or uncertainty. In addition, we have focused on the operations TMS whereas future research could evaluate the development of a joint TMS between buyers and suppliers and its impact on other operations performance measures. Moreover, an important aspect of agility is related to the ability to sense changes in the environment and then be able to respond to them. However, given that our study only assesses how firms can respond to these changes, future lines of research could focus on how these changes are felt. Finally, agility is a capability that improves through repetition. Therefore, research could be conducted that considers as a control variable the number of times that a firm has deployed agility as this may represent a form of learning curve and influence future performance.

Appendix 3.A. The Items Used in This Study

Transactive Memory System (TMS): Lewis (2003). With respect to the operations department of the firm:

Specialization

1. Each member has specialized knowledge of some aspect of operations.
2. I have knowledge about one aspect of the operations that no other member has.*
3. Different members are responsible for expertise in different areas of operations.
4. The specialized knowledge of several different members was needed to complete the operations projects.
5. I know which members have expertise in specific operational areas.*

Credibility

1. I was comfortable accepting procedural suggestions from other members.
2. I trusted that other members' knowledge about the project of operations was credible.
3. I was confident relying on the information that other members brought to the discussion.
4. When other members gave information, I wanted to double-check it for myself.*
5. I did not have much faith in other members' expertise.

Coordination

1. Our department worked together in a well-coordinated fashion.
2. Our department had very few misunderstandings about what to do.

3. Our department needed to backtrack and start over a lot.
4. We accomplished the task smoothly and efficiently.
5. There was much confusion about how we would accomplish the operations task.*

Supply Network Flexibility (SNF): Liao et al. (2010).

1. We have multiple supply sources for most purchased items.*
2. We are able to replace one supply source for another with low cost.
3. We are able to replace one supply source for another in a short time.
4. We can switch supply source with little negative effect on component quality and design.

Firm´s Supply Chain Agility (FSCA): Swafford et al. (2006).

1. Reduce manufacturing lead times.
2. Reduce product development cycle time.
3. Increase frequency of new product introductions.
4. Increase level of customization.*
5. Adjust worldwide delivery capacity/capability.*
6. Improve level of customer service.*
7. Improve delivery reliability.
8. Improve responsiveness to changing market needs.
9. Reduce setup/changeover time.
10. Increase production capacity.
11. Decrease ramp-up time for new products.
12. Reduce delivery lead time.

Operations Performance (OP): Wong et al. (2011).

Delivery

1. Correct quantity with the right kind of products.*
2. Delivery products quickly or short lead-time.
3. Provide on-time delivery to our customers.
4. Provide reliable delivery to our customers.
5. Reduce customer order taking time. *

Production cost

1. Produce products with low costs.
2. Produce products with low inventory costs.
3. Produce products with low overhead costs.
4. Offer price as low or lower than our competitors. *

Product quality

1. High performance products that meet customer.*
2. Produce consistent quality products with low defects.
3. Offer high reliable products that meet customer needs.
4. High quality products that meet our customer needs.

Production flexibility

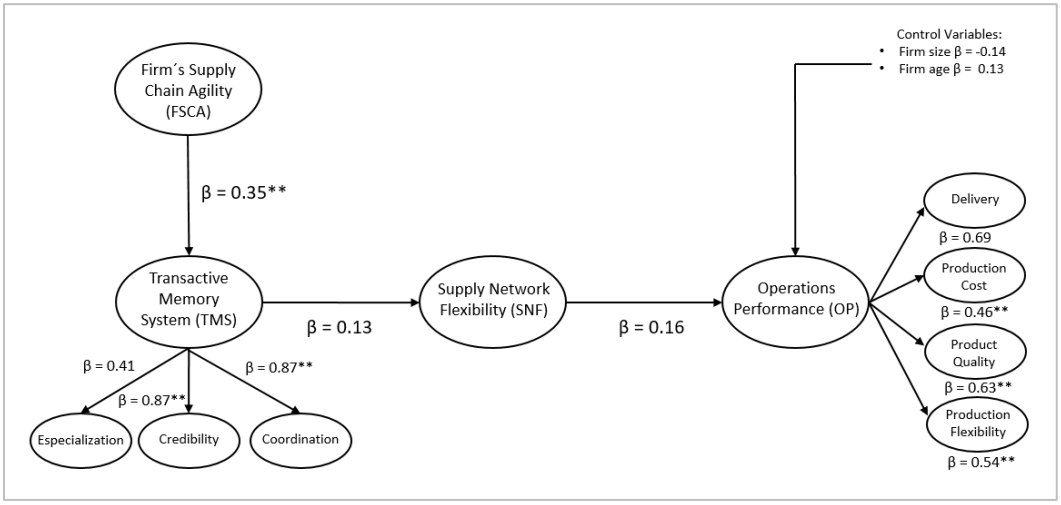
1. Able to rapidly change production volume.
2. Produce customized product features.*
3. Produce broad product specifications within same facility.*

4. The capability to make rapid product mix changes.

Note. * items were removed to meet the reliability and validity criteria.

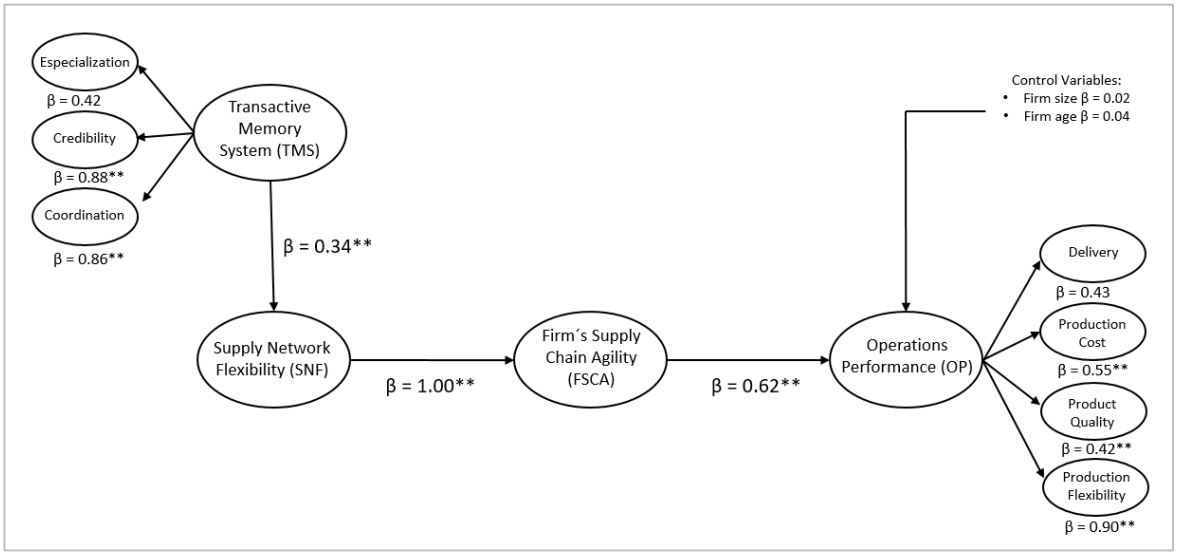
Appendix 3.B. Tests of robustness

Figure 3.B.1. Alternative model 1



Note. Significant at *p<0.05; **p<0.01; ***p<0.001

Figure 3.B.2. Alternative model 2



Note. Significant at *p<0.05; **p<0.01; ***p<0.001

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CAPÍTULO 4

The impact of Ambidexterity on Supply Chain Innovation Capability: The Roles of a Transactive Memory System and Supplier Integration

Abstract

The study pursues three main objectives. First, analyze how SC ambidexterity mechanisms support the supply chain innovation (SCI) capability. Second, explore whether the supplier integration (SI) is a key aspect for SC ambidexterity to lead to the SCI capability. Third, evaluate the moderating role of the transactive memory system (TMS) in the SC ambidexterity - SI relationship. A survey of 205 Spanish firms in the high technology sector was developed to test the hypotheses. The results demonstrate empirically that developing SC ambidexterity improves the SC's general efficacy by achieving greater integration with suppliers and fostering an essential aspect of business competitiveness such as SCI capability. In turn, we found that TMS positively moderates the relationship between SC ambidexterity and SI. The study contributes to the existing literature on SCM delving into the concept and measurement of SC ambidexterity and analyzing through which mechanisms the ambidexterity SC improves business survival.

Keywords: supply chain ambidexterity, supplier integration, supply chain innovation capability, transactive memory system, dynamic capabilities

4.1. Introduction

Today's firms compete in an increasingly volatile and unpredictable marketplace. To remain competitive, it has been argued that firms should develop organizational ambidexterity i.e., simultaneously develop exploitation of their current competences and exploration of new opportunities (Cao et al., 2009). Although the recent literature shows that this capability impacts both on the operating level (Production Department, Patel et al., 2012) and the supply chain (SC) level (Kristal et al., 2010; Lhe and Rha, 2016; Rojo et al., 2016; Partanen et al., 2019), there is little empirical

evidence of the impact of ambidexterity on these fields (Partanen et al., 2019). However, O'Reilly and Tushman (2013) suggest evaluating ambidexterity outside business limits. SC provides a more appropriate context to explore ambidexterity because it allows access to inter-organizational resources available in the SC (Kristal et al., 2010). This helps to overcome the limitations of internal resources necessary to simultaneously develop both practices. Therefore, this study addresses recent calls for a deeper study of ambidexterity in the SC context (SC ambidexterity) and its impact on business competitiveness (Rojo et al., 2016).

In general, ambidextrous organizations have demonstrated benefits associated with sales growth, subjective ratings of performance, innovation, market valuation, and firm survival (O'Reilly and Tushman, 2013). However, there is a gap in the literature on which processes enable ambidexterity to increase the survival rate of units that implement it, but evidence shows that firms can achieve better adaptation with the environment through learning and knowledge acquired via exploration and exploitation (Rojo et al., 2016). Adaptation to the environment requires innovation, and ambidexterity fosters innovation, as it permits the development of two types of knowledge. One based on the use of existing knowledge, which allows the implementation of efficient operations (exploitation) and the other, based on the search for new knowledge that allows more flexible operations (exploration) (Kristal et al., 2010; Patel et al., 2012). Field literature suggests that both types of knowledge may be necessary for innovation (Katila and Ahuja, 2002; Kristal et al., 2010). However, this statement has not been explored in the context of the SCs. Thus, this study investigates the impact of adopting SC ambidexterity on supply chain innovation (SCI) capability, two variables that have shown keys to business competitiveness (Partanen et al., 2019; Zimmerman et al., 2016) but are unexplored jointly in this context. Most studies have focused on the internal scope of the firm and have evaluated some limited aspects of innovation (Andriopoulos and Lewis, 2009). The current

environment recognizes that innovation is most effective when seen as a collaborative process with other firms, where the SC plays a fundamental role (Zimmermann et al., 2016). Therefore, assessing the influence of the SC ambidexterity on the supply chain innovation (SCI) capability could be important to advance knowledge in this area.

In addition, we evaluate the role of the SI in the relationship SC ambidexterity and SCI capability. The SC ambidexterity fosters collaborative relationships that can lead to greater acquisition, share and consolidation of knowledge and information necessary for the SI (Peng et al., 2013). In turn, this greater SI could lead to the SCI capability. A large body of literature suggested that SI had a significant impact on innovation capabilities (Peng et al., 2013). However, the most recent literature has begun to recognize certain limitations of the SI for innovation. These limitations arise from the allocation of considerable technical and managerial resources and the great interdependence that creates substantial risks for both parties (Villena et al., 2013; Kim et al., 2015). This research helps clarify the existing debate on supplier integration and innovation in SC.

Finally, this study also evaluates the role of the transactive memory system (TMS) in the relationship between SC ambidexterity and SI. To build successful interorganizational relationships, firms must build internal resources and management capabilities (Wagner, 2003). Firms are lacking in the development of strategies that enable the effective management of supply chain collaborations. One way to address this challenge is to invest in internal competencies that facilitate the development of external collaborative relationships skills (Whipple et al., 2015). TMS is an internal variable related to the creation, maintenance, transfer and coordination of knowledge in work teams (Huang and Cheng, 2018) that could lead to the effective management of collaborative relationships.

Specifically, we analyze how the mechanisms of the SC ambidexterity support the SI and the SCI capability. At the same time, it is evaluated what role the TMS has in the SC ambidexterity-SI relationship. All these relationships are analyzed using a final sample composed of 205 firms in the high-technology sector from the perspective of the buying firm. We ask:

RQ1. How does SC ambidexterity affect SCI capability?

RQ2. Does SI have a mediating effect in the relationship between SC ambidexterity and SCI capability?

RQ3. Does TMS have a moderating effect in the relationship between SC ambidexterity and SI?

The study contributes to the existing literature on SCM, in four key ways. First, the study adds to an increasingly growing number of few previous studies that evaluate ambidexterity in the context of SC demonstrating that SC ambidexterity leads to organizational survival via SCI capability. Second, sheds light on the importance of SI in the SC ambidexterity-SI relationship. Third, the study deepens and demarcates the concept of SCI capability. Finally, the study assesses how the development of an internal competence (TMS) can improve the SC ambidexterity-SI relationship.

To analyze the objectives proposed, the rest of the article is structured as follows: First, it explains the theoretical foundations of the conceptual model proposed and the hypotheses that compose it. It then presents the research methodology, the analysis performed, the results obtained and a discussion of them. Finally, it presents the conclusions drawn from this study as well as its limitations and proposes future lines of research.

4.2. Literature review and hypotheses

This study develops from the theory of dynamic capabilities, an extension of the resourced-based view (Teece et al., 1997). This theory indicates that in environments with high uncertainty (e.g. high-tech sector[3]) the competitive advantage depends on the development of dynamic capabilities. The term "*dynamic*" reflects the firm's ability to renew, integrate, change or modify internal and external ordinary capabilities (also called operational capabilities, competencies, resources, capabilities) to ensure congruence with the changing environment (Teece et al., 1997; Pavlou and Sawy, 2011; Laaksonen and Peltoniemi, 2018). That is, enable the firm to change. On the other hand, ordinary capabilities, determine how a firm makes its living at the moment (Laaksonen and Peltoniemi, 2018). They constitute routines and organizational processes inside and outside the firm (e.g. routines within a functional area and routines with supply chain partners) (Teece et al., 1997).

In this context, supply chain innovation (SCI) capability can be considered a dynamic capability (Helfat et al., 2007). The literature on innovation reflects the importance of this ability to sustain a competitive advantage, favoring the updating and reconstruction of other competences to achieve and maintain competitiveness (Breznik and Hisrich, 2014), facilitating organizational environmental adaptation. We evaluate two potential antecedents of the SCI capability: Supply chain (SC) ambidexterity and supplier integration (SI) which determine how the firm performs its work today. In turn, we explore the role of transactive memory system (TMS) in these antecedents.

[3] High-tech sector is characterized by the rapid renewal of knowledge and by its high degree of complexity which requires constant investment in research and continuous adaptation to the environment in order to survive (Wang et al., 2013).

The following sections develop the theoretical building blocks of the study with specific focus on the relationship between SC ambidexterity, TMS and SI and the development of a dynamic capacity as the SCI capability.

4.2.1 Supply chain ambidexterity

In the last decades, the concept of ambidexterity (Duncan, 1976) has obtained special relevance in the operations and supply chain management field (Kristal et al., 2010, Blome et al., 2013, Lee and Rha, 2016, Rojo et al., 2016, Aslam et al., 2018, Turner et al., 2018; Im et al., 2019). Traditionally, the study of ambidexterity has focused on the internal scope of the firm (Cao, et al., 2009, Raisch et al., 2009, Simsek et al., 2009). That is, on the evaluation of the characteristics, processes or structures that a firm should develop internally to achieve ambidexterity (O'Reilly and Tushman, 2013). However, the lack of resources within a firm and the increase in the environment's competitiveness, have limited the firm's ability to develop ambidexterity based alone on internal resources (Kristal et al., 2010; Eltantawy, 2016). In this sense, the supply chains allow a more adequate context to explore ambidexterity. Through them, firms can access inter-organizational resources from their partners to develop ambidexterity (Kauppila, 2010; Rojo et al., 2016). Moreover, the benefits associated with this strategy (e.g. improvements in organizational performance and long-term organizational survival) (O'Reilly and Tushman, 2013) have generated the interest of the researchers to analyze their effects in supply chain management field (Rojo et al, 2016).

Supply chain (SC) ambidexterity is defined as the "*firm's strategic choice to simultaneously pursue both supply chain exploitation and exploration practices*" (Kristal et al., 2010, p. 415). Supply chain exploitation practices seek to refine and use the current resources of the supply chain (Kristal et al., 2010). Exploitation has a short-term temporary orientation that involves "*refinement, choice, production, efficiency,*

selection, implementation, and execution" (March, 1991, p. 71). Supply chain exploration practices have a long-term temporary orientation that seeks to develop and discover new supply chain resources (Kristal et al., 2010). Exploration involves "*search, variation, risk-taking, experimentation, play, flexibility, discovery, and innovation*" (March, 1991, p. 71). Recent studies have demonstrated that it is possible to simultaneously develop both practices and this generates positive results for the firms (Kristal et al., 2010; Rojo et al., 2016). Firms can exploit their resources to be more efficient, assuring their current viability and, at the same time, firms can explore new resources to be more flexible towards changes in the environment, assuring their future viability (March 1991, O'Reilly and Tushman, 2013). Exploitation allows the alignment of current certainties (i.e., internal and external alignment along the supply chain of processes such as purchasing, manufacturing, marketing, and logistics) and exploration allows the adaptation to new possibilities (i.e., reshape supply chain when necessary) (Lee and Rha, 2016; Dubey et al., 2018). The simultaneous development of both practices allows avoiding the trade-off between efficiency and flexibility, alignment and adaptability (O'Reilly and Tushman, 2013, Lee and Rha, 2016, Aslam et al., 2018). Studies on SC ambidexterity have shown, among others, that SC ambidexterity helps to achieve the optimal level of SCF (Rojo et al., 2016), mitigate the negative impact of SC disruptions (Lee and Rha, 2016), influences on combinative competitive capabilities (the ability to excel simultaneously on competitive capabilities of quality, delivery, flexibility, and cost) (Kristal et al., 2010) and is positive for business performance (Kristal et al., 2010; Lee and Rha, 2016; Wamba et al., 2019). In addition, some antecedents of the SC ambidexterity have been identified as supply chain agility, supply chain adaptability (Aslam et al., 2018), big data analytics (i.e. data generated from Internet-based platforms such as social media tools (Wamba et al., 2019) and SC seizing (i.e react quickly after SC turbulence and give shape to potential opportunities at the right time) and reconfiguring (i.e. recombine resources to routinize competitive advantages from sensing and seizing and pursue long-term success) were positively

associated with SC ambidexterity (Lee and Rha, 2016). However, numerous aspects of SC ambidexterity remain unassessed and need to be explored to better understand the effects of it (Partanen et al., 2019).

4.2.2 Supplier integration

Recognized the importance of the integration between the partners of the supply chain for the achievement and maintenance of a sustainable competitive advantage, supplier integration (SI) has positioned itself as an area of great interest in the literature of the supply chain management (Flynn et al., 2010; Danese and Romero, 2011; Zhu et al., 2018). SI is a subset of supply chain integration (SCI), known as external integration (Flynn et al., 2010) and specifically focusing on the upstream part of the supply chain (Lockström et al., 2010).

Usually, literature differentiates between two types of integration: operational integration and strategic integration (Narashiman and Kim, 2002; Flynn et al., 2010). Operational integration mainly concerns day-to-day activities such as scheduling, order processing, material handling and shipment schedules. In contrast, strategic integration refers to longer term collaborative activities dealing with relationship building, joint technology development, resources and cost sharing, and strategic alignment (Peng et al., 2013). This study focuses on strategic integration with suppliers to remain consistent with the strategic-level SC ambidexterity and innovation capabilities that are also examined.

Although SI has been the object of numerous definitions (Wong et al., 2011; Yang et al., 2016; Yuanqiong et al., 2017; Shou et al., 2018), a common idea of the term integration implies a relational characteristic either within or between firms (Barki and Pinsonneault, 2005). Most researchers postulate that SI is based on collaborative

relationships between a focal buyer and its suppliers (Flynn et al., 2010; Wong et al., 2011; Vanpoucke et al., 2014; Yang et al., 2016; Shou et al., 2018). SI is defined as "*the combination of internal resources of the buying firm with the resources and capabilities of selected key suppliers through the meshing of intercompany business processes to achieve competitive advantage*" (Wagner, 2003, p. 4). Integration implies the joint collaboration between a firm and its suppliers in managing cross-firm business processes (Wong et al., 2011). This collaboration involves sharing information, joint product development, strategic partnership, collaboration in planning, product and process integration between the firm and its suppliers (Wong et al., 2011, Yuanqiong et al., 2017). SI aims to improve the efficiency and effectiveness of the information and physical flows between a manufacturer and suppliers (Zhang et al., 2018), obtaining as result of SI a perfect fit between the tasks and processes developed internally by the organization and the tasks and processes developed externally by the suppliers (Lockström et al., 2010).

4.2.3 Transactive memory system

The number of publications on transactive memory systems (TMS) has grown considerably in recent years (Zheng an Mai, 2013; Huang and Cheng, 2018). Originating in research by Wegner in the late 1980s, the concept of the TMS has been applied in a wide variety of situations, including dyadic relationships, work groups, organizations and to contexts that transcend organizational boundaries, such as a TMS between supply chain partners (Hammedi et al., 2013; Argote and Guo, 2016; Obayi et al., 2017; Huang and Cheng, 2018).

A TMS is defined as a shared cognition that people in relationships develop for encoding, storing and retrieving essential knowledge and meta-knowledge (Obayi et al., 2017; Huang and Cheng, 2018). It is concerned not only with developing a shared

understanding of 'who knows what'; it also involves the dynamic integration and management of all members' existing expertise and the collective creation of new knowledge (Zheng and Mai, 2013; Huang and Chen, 2018). This meta knowledge provides individuals with access to more knowledge than they individually possess (Argote and Ren, 2012).

A TMS implies the specialized knowledge that resides in the minds of individuals and the transactive processes that link individuals and enable them to coordinate their specialized knowledge and skills (Argote and Guo, 2016). Specifically, researchers have identified three indicators of the existence of TMS: specialized knowledge; trust in others' knowledge; and the ability to coordinate knowledge according to the task structure and members' distributed knowledge (Lewis, 2003; Huang and Cheng, 2018). Following to Argote and Ren (2012) the specialized knowledge is related to the tendency for team members to remember different aspects of a task or to develop specialized and complementary expertise; trust in others' knowledge is related to how much team members trust each other's knowledge; and the ability to coordinate knowledge is related to the ability of team members to work together smoothly and efficiently while performing a task. All these elements as a whole allow the members of a team, department, organization or organizations to develop skills to assimilate, coordinate and create knowledge more effectively and efficiently (Zheng and Mai, 2013; Obayi et al., 2017).

4.2.4 Supply chain innovation capability

Innovation, commonly associated with the successful exploitation of new ideas, is an essential component for business strategy (Carnovale et al., 2015). This provides the basis for survival and future success because it allows solving problems and business challenges (Hult et al., 2004). Innovation can be generated within organizations.

However, competitive reality is pushing organizations to innovate outside them, using relationships between firms (Liao and Kuo, 2014). For this reason, innovation has begun to be understood as a process that requires constant contact with the environment and greater collaboration with members of the supply chain (Roldan-Bravo et al., 2016).

The definitions around innovation include a wide variety of possibilities that range from the capability to innovate to the innovation outcome (Kahn, 2018). In this particular study, we will focus on the innovation of the SC as a capability. Specifically, dynamic capability. However, despite the importance of innovation, there is little empirical research on the measurement of innovation in SC and, more importantly, on the measurement of innovation capability in supply chain (Arlbjørn et al., 2011; Iddris, 2016; Zimmermann et al., 2016). Therefore, after a review of the literature, we propose a definition of supply chain innovation (SCI) capability. Following the recommendations of Liao and Kuo (2014) on SC capabilities and the suggestions of Arlbjørn et al. (2011) and Kwak et al. (2018) on SC innovation, we define *SCI capability as the ability of a firm to develop changes (incremental or radical) within the SC in order to optimize chain configuration and improve customer satisfaction*. The ability to innovate is a multidimensional construct, which can materialize in different aspects. The literature recognizes three essential areas of innovation in operations and SCs: innovation in technology, products and processes (Arlbjørn et al., 2011; Peng et al., 2013; Kwak et al., 2018).

A technological innovation is related with the application of technological advances in the SC (e.g. radio frequency identification (RFID), electronic data interchange (EDI), enterprise resource planning (ERP), business intelligence, etc.) (Arlbjørn et al., 2011; Kwak et al., 2018). The main objective is to improve the integrated information system, real-time tracking technology and innovative logistics equipment across global SCs (Kwak et al., 2018). The application of advanced planning systems in supply chains

is an example that enables innovations in cross-firm collaboration, speed in information flow, and demand visibility (Arlbjørn et al., 2011). A product innovation is related to the development of new products or services that are offered in the market. The product innovation varies from incremental to radical offers, which make possible different types of innovations (e.g. cost reductions, product improvements, new uses of products, new markets, etc.) (Kahn, 2018). In the SCs field, product innovation implies the application of integrated product development in which suppliers and customers become part of the product development process (Arlbjørn et al., 2011). Finally, "*A process innovation is the implementation of new improved techniques, methods and procedures with the goal to continually improve the quality of a service or reduce the cost of providing a service.*" (Wagner, 2008; p. 222). Process innovation is concerned with the effective re-design and re-engineering of the SC which allows to solve the problems and operational processes that improve distribution, acquisition, management practices, networking, etc. (Kwak et al., 2018).

4.2.5 Effects of the supply chain ambidexterity on supplier integration

SC ambidexterity implies, by definition, the strategic choice of the firm to simultaneously develop exploration and exploitation practices in the SC (Kristal et al, 2010). This strategic choice shape "*the dynamics of the firm's relation with its environment for which the necessary actions are taken to achieve its goals*" (Ronda-Pupo and Guerras-Martin, 2012; p.182). On the one hand, when the focal firm develops exploitation practices in its SC, it promotes the use of existing competencies in the SC (Kristal et al., 2010). Exploitation leads firms to use skills, knowledge and resources within SC relationships (March, 1991; Kristal et al., 2010, Lee and Rha, 2016). For example, the use of existing processes and technologies in the SC such as IT-enabled automation in billing and inventory management, is encouraged to reduce

supply costs and achieve efficiency, reliability and alignment between partners (Lee and Rha, 2016; Partanen et al., 2019). On the other hand, when the focal firm decides to undertake exploration practices in its SC, it promotes the development of new competencies in the SC (Kristal et al., 2010; Partanen et al., 2019). Exploration leads firms to develop new skills, knowledge and resources within SC relationships (March, 1991; Kristal et al., 2010, Lee and Rha, 2016). For example, the complex search, experimentation and acquisition of new SC processes, resources and technologies such as experimentation with new technologies with suppliers, is encouraged to achieve flexibility and adaptability (Kristal et al., 2010; Lee and Rha, 2016; Rojo et al., 2016; Partanen et al., 2019). Therefore, the use of these practices requires close relationships with supply chain partners.

The exploitation and exploration practices in SC promote the inter-organizational collaborative relationships (Turner et al., 2018). The collaboration occurs when ‘‘two or more independent companies work jointly to plan and execute supply chain operations with greater success than when acting in isolation’’ (Simatupang and Sridharan, 2002, p. 19). These collaborative relationships among supply chain partners are necessary to align the different existing processes throughout SC related to exploitation practices (e.g., purchasing, manufacturing, marketing and logistics), and reshape and develop new resources in the SC related to exploration practices (Lee and Rha, 2016; Dubey et al., 2018). The collaborative relationships encourage a mutual understanding, facilitating task coordination in managing SC activities across partner firms (Wong et al., 2011), facilitate future adaptation and improving the current alignment with supply chain partners in general, (Lee and Rha, 2016) and suppliers in particular. Specifically, collaboration with suppliers translates into joint problem solving, information exchange, development of formal evaluation and feedback systems and joint problem solving between buyers and suppliers (Das et al., 2006). The result of these close collaborations could lead a greater SI. In fact, it has been shown

that firms with positive attitudes towards collaborative relationships enhance the SI (Yang et al., 2016). SI at a strategic level requires that the focal firm, previously acquire, share and consolidate knowledge and information with its suppliers (Peng et al., 2013). This occurs once the focal firm has decided to develop SC ambidexterity.

An example of firm that develops SC ambidexterity is the Toyota Motor Corporation. Specifically, Toyota has organizational systems to support exploitative activities with their suppliers that can lead to improving productivity, quality, and inventory turnover, and others to support suppliers in exploratory activities such as developing new system components (Aoki and Wilhelm, 2017). Both practices (i.e., exploitation and exploration) requires a high level collaboration with the suppliers. Thus, Toyota invests a large amount of resources in collaborative relationships with them, creating, for example, consulting teams and inter-firm employee transfer programs (Villena et al., 2011). As a result, Toyota, has fully integrated suppliers, by creating and fostering collaborative relationships, in which employees from the firm and from suppliers continuously interact and experiment jointly. (Villena et al., 2011; Aoki and Wilhelm, 2017).

In sum, it is reasonable to think that firms that follow SC ambidexterity will promote the development of collaborative relationships with their suppliers sharing information, collaboration in planning, product and processes integration, which will result in a higher SI.

Based on the foregoing, we propose the following hypothesis for empirical confirmation:

Hypothesis 1 (H1): SC ambidexterity is positively related to SI.

4.2.6 Transactive memory system (moderating effect)

The strategic choice of developing SC ambidexterity leads to collaborative relationships with suppliers whose result is a greater SI. The first step in the management and improvement of external collaborative relationships (e.g., relationships with suppliers) is the development of internal management skills (Whipple et al., 2015). Zacharia et al. (2011) points out that internal competencies are necessary to manage external collaboration because they allow "*select appropriate partners, establish processes to monitor and manage the initiative, and resolve conflicts and difference of opinion as they arise*" (Zacharia et al., 2011, p. 594). In this sense, the development of an internal competence such as TMS (in the firm's operations department), could be key to the management of internal knowledge (Huang and Chen, 2018) necessary to manage successful external collaborative relationships. The TMSs allow to easily detect the specialized and diverse knowledge of each member of the department and create a map of that knowledge. This facilitates access to resources that lead to learning (Lin and Lin, 2001). Learning, in turn, allows organizational adaptation through which firms can respond to dynamic challenges (Li and Huang; 2013) such as any suggestion, concern or problem with suppliers.

In general, the literature has demonstrated a series of benefits associated with the existence of a TMS (Lewis and Herdnon, 2011) that could improve collaborative relationships. First, TMSs favor communication and problem solving (Shin et al., 2015) by providing a basis for coordination in uncertain conditions (Ren et al., 2006). Firms can improve collective improvisation (Zheng and Mai, 2013) and / or response capacity by making better use and application of the integrated knowledge of each team member (Heavey and Simsek, 2017). Sharing individual mental models enables the base of shared meaning to expand, increasing a department's capability for effective coordinated action (Lin and Lin, 2001). They reduce the incidence of non-constructive conflicts by reducing the time and effort dedicated to the search and retrieval of

information (Hammedi et al., 2013). Further, TMS allows us to better anticipate, instead of simply reacting to the behavior of others, facilitating communication and coordination of tasks (Huang and Cheng, 2018). Second, TMSs improve quality in decision making (Ren et al., 2006). Each team member has knowledge about the experience and skills of their colleagues which encourages rapid and effective decision making on different issues (Akgün et al., 2006) that can affect collaborative relationships with suppliers. Finally, the TMSs can provide with the necessary knowledge to establish the best way to integrate the routines with the suppliers and manage effectively the collaborative relationships. When deciding who to collaborate with, it is important to find key suppliers that offer new knowledge and complementary competencies (Whipple et al., 2015). The characteristics of a TMS could be key to management in such contexts as they facilita both the generation of knowledge on different suppliers and coordination abilities. A firm must be able to determine the heterogeneous resources and capabilities of its current and potential supply base and to understand the potential for reengineering its systems and processes throughout the supply chain (Liao and Marsillac, 2015). That is, operations managers must evaluate each supplier's capabilities and any risks to order fulfillment (Kull et al., 2014). The internal knowledge base is needed to recognize the value of external knowledge, to assimilate and apply it (Liao and Marsillac, 2015).

The case of the Toyota Motor Corporation illustrates the importance of developing and managing internal knowledge to develop collaborative relationships with suppliers. According to Aoki and Wilhelm (2017), Toyota uses a series of internal competencies that allow it to develop suppliers support programs in order to improve collaboration relationships between both parties. Many of the programs are developed primarily by the operational area of the firms (i.e., purchases, production and quality) and are related to the knowledge generated in this area. Such programs help suppliers improve, refine and develop their routines and achieve the expected

results at the operational level. For example, "*Toyota issues kanban to suppliers several times per shift to keep them updated on quantities needed and delivery timing. The suppliers use the information to produce parts and deliver them in a JIT manner* "(Aoki and Wilhelm, 2017; p .--).

In sum, the TMS (of the firms's operations department) can improve the internal knowledge of the firms by favoring communication and problem solving, improving quality in decision making, provide the necessary knowledge to establish the best way to integrate the routines with the suppliers, facilitate the learning and organizational adaptation necessary to manage successful external collaboration relationships.

Based on the foregoing, we propose the following hypothesis for empirical confirmation:

Hypothesis 2 (H2): TMS positively moderates the relationship between SC ambidexterity and SI.

4.2.7 Effects of supplier integration on supply chain innovation capability

The literature has recognized that firms do not always have benefits from SI. There is a debate in the field literature about the relationship between both variables (Kim et al., 2015). Some studies indicate that close collaborative relationships imply a great interdependence between the parties, invest considerable technical and managerial resources, make communication difficult and create substantial risks between the parties involved hindering innovation (Villena et al., 2013). Other research, on the other hand, suggests that close collaborative relationships with suppliers lead to innovation due to the existence of greater mutual commitment, emotional support,

access to experience, knowledge and resources (Hoegl and Wagner, 2005; Revilla and Villena, 2012; Kim et al., 2015).

Most of the literature is positioned in favor of this last plot line (Peng et al., 2013). It is known that the relationships amongst actors in the SC are potentially the facilitators of the innovation process (Zimmermann et al., 2016). A large body of literature suggests that integration with suppliers have a significant impact on innovation capabilities (Peng et al., 2013; Haartman and Bengtsson, 2015). Interaction, communication, information sharing, coordination and collaboration across firms, have a positive effect on the performance of innovation (Wong et al., 2013). Roy et al. (2004) pointed out that interactions with suppliers (e.g., electronic data interchange, and Web-enabled business-to-business systems) allowed the adaptive learning process, which was the basis of knowledge transfer necessary for innovation. SI allows to overcome certain barriers to innovation in SC. For example, it has been recognized that technological differences between supplier and customer, difficulty to establish trust-based relationships or problems of the focal firm to integrate specialized knowledge dispersed between firms, could hinder the innovative process (Zimmermann et al., 2016). In contrast, integration at the strategic level implies acquiring, sharing and consolidating knowledge and information from its supply chain partners (Peng et al., 2013). SI allows the strategic alignment of business processes, information sharing and joint collaboration with suppliers, all this helps firms to establish mutual understanding and gain information through network relationships (Wong et al., 2013). Strategic alignment between partners of the SC leads the innovation (Modi and Mabert, 2010; Zimmermann et al., 2016). Interacting with supply chain partners exposes a firm to different perspectives and approaches, facilitating flexible thinking (Peng et al., 2013) and knowledge transfer (Wong et al., 2013). For example, Ragatz et al. (1997) suggest that the effective integration of suppliers into product innovation processes can yield benefits through reduced product

development time and improved access to the application of technology. In addition, SI for the development of new products, allows access to the experience, knowledge, financial resources and the assumption of shared risk (Villena et al., 2013). Using a sample of 157 manufacturing firms located in the U.S., Koufteros et al. (2007) found that when there is a formalized integration between buyer and supplier, and decisions and product development are conducted jointly (i.e., gray-box integration), there was a positive effect towards product innovation.

In sum, since suppliers are valuable sources of technical knowledge and specific engineering, design and manufacturing capabilities (Perols et al., 2012), it is reasonable to think that greater SI allows the development of SCI capability. Based on the foregoing, we propose the following hypothesis for empirical confirmation:

Hypothesis 3 (H3): SI is positively related to SCI capability.

4.2.8 Effects of the supply chain ambidexterity on supply chain innovation capability

The literature on ambidexterity recognizes the importance of this variable on innovation (Katila and Ahuja, 2002; Andriopoulos and Lewis, 2009; Wong et al 2013). In fact, O'Reilly and Tushman (1996) understood ambidexterity as "*The ability to simultaneously pursue both incremental and discontinuous innovation…from hosting multiple contradictory structures, processes, and cultures within the same firm*" (O'Reilly and Tushman (1996; p. 24). However, the vast majority of research that affirms this direct and positive relationship is based on theoretical approaches not empirically tested. (O'Reilly and Tushman, 2008). In addition, among the studies that explored some aspect of ambidexterity and innovation (Adler et al., 1999; Burgers et al., 2009; Katila and Ahuja, 2002; McGrath, 2001; Tushman et al., 2010) we have not

found any that specifically explored the relationship between ambidexterity and innovation in the context of the SC.

SC ambidexterity allows firms to take advantage of the knowledge sources of the external SC, encouraging interaction of different learning processes and knowledge creation, which enables building other competences and capabilities (Kristal et al., 2010). Following O'Reilly and Tushman, 2008, ambidexterity is associated with two basic types of innovation. Exploitation practices are related to incremental innovations (i.e., in which an existing product or service is made better, faster or cheaper) since they arise from an existing set of competencies and proceed along a known path. (Nelson and Winter, 1982; O'Reilly and Tushman, 2008). Exploration practices are related to radical innovations (i.e., in which a product or service arises from significant changes that make significant improvements) that usually come from technological advances that destroy existing competition. In turn, different authors (Katila and Ahuja, 2002; Andriopoulos and Lewis, 2009; Kristal et al., 2010) point out, although they do not explicitly explore, that both practices are necessary and complementary to innovation. An approach exclusively on exploitation, focused on the continuous but incremental improvement of the quality, efficiency, products, services and operations existing in the SC, would lead the company to renounce the innovations necessary to maintain its competitiveness in an environment every time more dynamic and changing, falling into the so-called ''competence traps'' (Kristal et al., 2010, p.418). Temporary orientation based exclusively on the present would damage the company's ability to face future competition. On the other hand, an approach based exclusively on exploration focused on the continuous search for radical improvements of new technologies, products, services and systems in the SC could lead to "*failure traps*" (Levinthal and March, 1993). That is, firms focused only on the future, would increase their vulnerability to current competition. Therefore, we propose to assess whether

effectively SC ambidexterity, which implies developing exploitation and exploration practices in the SC, could foster innovation in the field of SC.

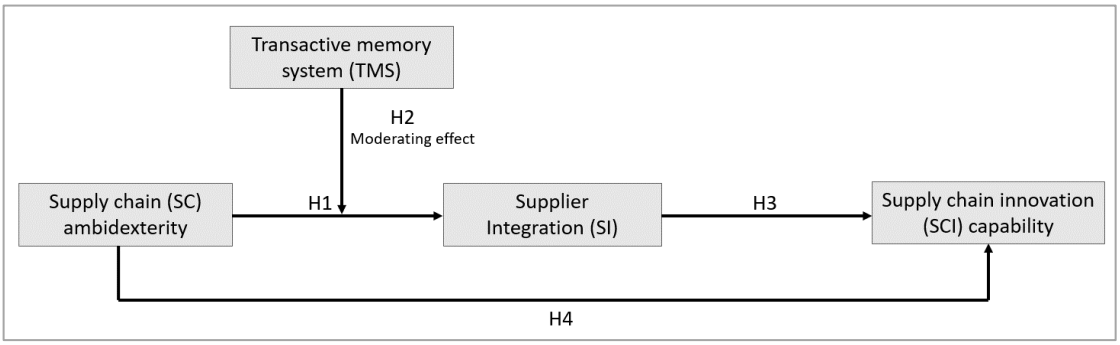
In sum, SC ambidexterity implies exploitation and exploration practices that use different competencies or skills of the company with its SC that are necessary and complementary to develop the SCI capability.

Based on the foregoing, we propose the following hypothesis for empirical confirmation:

Hypothesis 4 (H4): SC ambidexterity is positively related to SCI capability.

The four relationships to be empirically investigated are illustrated in the theoretical model depicted in Figure 4.1.

Figure 4.1. Theoretical Framework of the Study



4.3. Methodology

4.3.1 Survey design and sample

A survey was developed to obtain specific information for this research. To identify the different items and scales included in the survey, we performed an in-depth literature review. Once the questionnaire had been designed, four academics and six supply

chain managers, with knowledge on the topic, reviewed each item to analyze content, wording, structure and comprehension. Subsequently, the questionnaire was refined.

We performed a pilot study of the refined questionnaire with a random sample of fourteen firms. Finally, we incorporated changes based on the previous responses and proceeded to administer the final questionnaire to firms in the high-technology sector. The country selected for the data collection was Spain. The literature recommends selecting a sample of firms located in a relatively homogeneous geographical, cultural, legal and political space to minimize the impact of other variables that cannot be controlled (Rojo et al., 2016).

The study population was obtained from the SABI (Iberian Balance Sheet Analysis System) database. This database includes information on company size, age, industry sector, financial ratios, operations measures, and other miscellaneous data. Relevant firms were identified according to the codes attributed by The North American Industry Classification System (NAICS), as used in Kile and Phillips (2009). A study population of 1,525 Spanish high-technology firms was obtained. The survey was addressed to those managers with knowledge of the processes and activities of the firm´s operations department and who had the capacity to make decisions in that department (e.g. responsible for the firm's supply chain, the purchasing manager, or the top manager). The key respondents of the firms were selected considering Malhotra and Grover (1998) and Krause et al. (2018). The data were obtained through computer-assisted telephone interviews (CATI). Due to cost and time constrains, from the study population, 495 firms were randomly selected and contacted, obtaining 226 responses (45,65 % response rate). Following the suggestions by Hair et al. (2010), the responses with a high level of missing data were deleted (>0.50). We obtained a final sample composed of 205 firms (41,41 % response rate). The technical details are shown in Table 4.1.

Table 4.1. Technical Details of the Research

Sector	High technology sector
Methodology	Semi-structured questionnaire
Study population	1,525 firms
Firms contacted	495 firms
Firms that responded (response rate)	205 firms (41.40%)
Sample error	6,40%
Confidence interval	95%; p-q = 0.50; z = 1.96

The possibility of non-response bias in the sample was analyzed according to the recommendations of Fawcett et al. (2014). These results show that the firms that did not respond to the questionnaire did not introduce significant bias into the study results. In addition, a sample of non-respondents were asked why they were unable to take part. The main reasons were the lack of a qualified person to answer the survey and a firm policy that did not permit the sharing of confidential information.

4.3.2 Measures

As depicted in Appendix 1, all measures of our key constructs are adapted from the literature to make them more suitable to our study. A seven point Likert scale was used for all the following constructs (1= maximum disagreement; 7 = maximum agreement).

4.3.2.1 Supply chain (SC) ambidexterity

This construct was operationalized using the scale developed by Kristal et al. (2010). SC ambidexterity is a second order construct with two dimensions: SC exploitation practices and SC exploration practices. Each dimension has four items. SC exploitation

practices contains items related to the manufacturer's efforts to refine and extend their existing resources (e.g. "*our managers focus on developing stronger competencies in our existing supply chain processes*"). SC exploration practices contains items related to the manufacturer's efforts to develop new supply chain competencies through experimentation and the acquisition of new knowledge and resources (e.g. "*We proactively pursue new supply chain solutions*").

4.3.2.2 Transactive Memory System (TMS)

This construct was operationalized as a second order construct using the scale developed by Lewis (2003). This scale has been widely adopted by many prior studies utilizing the transactive memory system construct (Zheng and Mai, 2013). Since the construct is imported from the field of psychology, the items were adapted to the field of operations such that we can evaluate how the TMS works in the operations department of the firm. This construct has three key dimensions: Specialization, credibility, and coordination; and each dimension has five items. Specialization contains items related to the existence of differentiated and unique knowledge among team members (e.g. "*different members are responsible for expertise in different areas of operations*"). Credibility contains items related to the trust that each team member has about the knowledge of other team members (e.g. "*I trusted that other members' knowledge about the operation was credible*"). Finally, coordination contains items that measure whether the individual knowledge of each team member is shared with the team in order to perform tasks more efficiently (e.g. "*our department worked together in a well-coordinated fashion*").

4.3.2.3 Supplier integration (SI)

This construct was operationalized using the scale developed by Wong et al. (2011). This construct has five items related to joint collaboration between a focal firm and its suppliers (e.g. "*our suppliers are involved in our product development processes*" or "*Have a high degree of strategic partnership with suppliers*").

4.3.2.4 Supply chain innovation (SCI) capability

The measurement items for SCI capability were adapted from instruments developed by Peng et al. (2013) and Kwak et al. (2018). This construct was operationalized as a second order construct with three dimensions: Technological innovation, product innovation, and processes innovation in the SC. While many practices may be relevant to innovation, this paper focuses on a selected set of practices that represent areas of innovation in the SC and are believed to contribute to its innovation capacity (Arlbjørn et al., 2011; Kwak et al., 2018). Technological innovation contains items related to the application of technological advances in the SC (e.g. "*we make an effort to anticipate the potential of new technologies that can integrate information in the SC*"). Product innovation contains items related to the development of new products or services that are offered in the market (e.g. "*we work in teams with members from different parts of the SC) to present new products*"). Finally, processes innovation contains items related to the implementation of new improved techniques, methods and procedures (e.g. "*we pursue the development of agile and receptive processes for the SC against possible changes in the environment*").

4.3.2.5 Control variables: firm size and firm age

To ensure the robustness of results, two control variables that might influence SCI capability were included. The first control variable concerns firm age, i.e. the number of years since a firm was founded, which can affect the implementation of supply chain management practices (Gligor et al., 2015) and therefore SCI capability. The second control variable concerns firm size, based on the number of employees, which can also influence SCI capability as large firms may derive greater synergistic effects from supply chain agility than smaller firms (Chan et al., 2017). Moreover, large firms have more resources to implement supply chain management practices (Gligor et al., 2015; Chan et al., 2017). Consistent with research conventions, both control variables were measured by logarithmic transformations (Gligor et al., 2015). More specifically, the Neperian logarithm was used.

4.3.3 Common method variance

To reduce the possibility of common method bias due to self-reported measures, several procedures suggested by Podsakoff et al. (2003 and 2012) were implemented. First, this study assured the survey respondent's anonymity, communicated the study goals and used items in a random order. Although the respondents were aware that they were answering questions related to supply chain management (SCM) and operations it is quite unlikely that they could have intuited the specific research model. In addition, only previously tested scales were used to avoid this bias. Second, Harman's single-factor test was used, whereby if common method bias is a serious threat to the results then a single factor will account for most of the variance. We employed an exploratory factor analysis of all survey items. The first factor accounted for only 32.47% of the explained variance. Since no general factor emerged that accounted for the majority of the covariance, we can conclude that common method

bias is not a serious issue among our data. Finally, following the recommendations of Chang et al. (2010), a confirmatory factor analysis (CFA) was used to test this result. All survey items were charged to a single factor in the CFA and the fit statistics did not show good fit (X2/df 4.23; BBNNFI = 0.41; IFI 0.45; CFI 0.45; RMSEA 0.12). The single factor model was compared with the measurement model and the fit was worse for the one-dimensional model than for the measurement model.

4.3.4 Assessment of psychometric properties of the measures.

To evaluate the validity of the scales, the procedure developed by Kaynak and Hartley (2006) was followed. The content validity of the measurement scales was tentatively established by extensive literature reviews and the pre-test of the survey performed with selected practitioners and academics. We also performed a pilot study, as explained in Section 3.1 above.

First, confirmatory factor analysis (CFA) was used to assess construct validity (convergent and discriminant validity). Since the multivariate normality test showed non-normality of the data, the robust ML estimation method was applied (Byrne, 2006). To verify convergent validity, we examined factor loadings and their significance. Some items were deleted (Appendix 1) due to factor loadings < 0.5 (Hair et al., 2010). After this process, all factor loadings were significant ($t > 1.96$; $p < 0.05$) and their value was higher than the recommended threshold ($\beta > 0.50$). The findings confirmed the convergent validity (Bollen, 1989). In addition, the average variance extracted (AVE) for the different constructs was higher than the recommended minimum value of 0.50 (ranging from 0.522 to 0.786) (Forner & Larcker, 1981). Each item was significantly related to their construct, supporting the existence of convergent validity.

Second, the reliability of the constructs was examined. Cronbach's alpha (α) exceeded the recommended value of 0.7 (ranging from 0.764 to 0.923) and Composite Reliability (CR) of the constructs were higher than the recommended value of 0.70 (ranging from 0.766 to 0.923). Therefore, AVE, α and CR supported the reliability and internal consistency of the scales (Forner & Larcker, 1981; Hair et al., 2010). In addition, statistical values indicated that the measurement model had a good fit χ^2/df = 695/453 = 1.53; Bentler-Bonett normed fit index (BBNNFI) = 0.90; incremental fit index (IFI) = 0.91, comparative fit index (CFI) = 0.91; and the root mean square error of approximation (RMSEA) = 0.05. According to Byrne (2013), a model is considered satisfactory if IFI >0.90, CFI >0.90, and RMSEA <0.08. Therefore, the proposed measurement model indicated good model fit. Table 4.2 shows the reliability and convergent validity results.

Table 4.2. Reliability and Convergent Validity Results

Measurement Item	Factor loading	R^2	α Cronbach	CR	AVE
Exploitation practices			0.838	0.841	0.640
Ex1	0.741	0.549			
Ex2	0.742	0.550			
Ex4	0.905	0.819			
Exploration Practices			0.848	0.857	0.750
Er1	0.819	0.671			
Er2	0.911	0.829			
Specialization			0.839	0.840	0.568
Sp1	0.698	0.488			
Sp3	0.815	0.663			
Sp4	0.717	0.515			
Sp5	0.778	0.605			
Credibility			0.918	0.920	0.742
Cr1	0.820	0.673			
Cr2	0.881	0.776			
Cr3	0.912	0.832			
Cr5	0.829	0.687			
Coordination			0.923	0.923	0.707
Co1	0.888	0.789			
Co2	0.854	0.729			
Co3	0.824	0.679			
Co4	0.836	0.699			
Co5	0.800	0.640			
Supplier integration			0.823	0.871	0.576
SI1	0.685	0.470			
SI2	0.844	0.712			
SI3	0.788	0.620			
SI4	0.766	0.587			
SI5	0.702	0.492			
Technological innovation			0.895	0.896	0.685
Tec1	0.787	0.620			
Tec2	0.857	0.735			
Tec3	0.918	0.844			
Tec4	0.736	0.542			
Product innovation			0.880	0.880	0.786
Pd3	0.865	0.749			
Pd4	0.908	0.824			
Processes innovation			0.764	0.766	0.522
Proc1	0.751	0.564			
Proc2	0.702	0.492			
Proc3	0.714	0.510			

Note. CR = composite reliability; AVE = average variance explained. All factor loadings are significant at least 0.05 level.
Goodness of Fit Statistics: x^2/df = 695/453 = 1.53; IFI = 0.91; CFI = 0.91; RMSEA = 0.05.

Third, we checked for discriminant validity (see tables 4.3 and 4.4). Discriminant validity was evaluated in accordance with Voorhees et al. (2016). First, the approach developed by Fornell and Larcker (1981) suggests that discriminant validity is assumed to exist if the squared average variance extracted for each construct exceeds its shared variance (correlation). This was found in all combinations of paired constructs, thus providing evidence of discriminant validity for all scales. Table 4.3 shows the descriptive statistics, correlations among constructs and squared average variance extracted for each construct. Second, the HTMT ratio (Henseler et al., 2015) was calculated for each pair of constructs. As Table 4.4 shows, the HTMT ratio <0.85 for each pair of constructs, also indicating the presence of discriminant validity.

Table 4.3. Mean Values, Standard Deviations (SDs), Average Variance Extracted (AVE), and Bivariate Correlations of Variables

	Mean	SD	1	2	3	4	5	6	7	8	9
Firm age	3.086	0.549									
Firm size	4.241	1.126									
1.Exploitation practices	5.793	1.147	0.800								
2.Exploration Practices	5.514	1.178	0.599**	0.870							
3.Specialization	4.651	1.684	0.323**	0.289**	0.750						
4.Credibility	5.907	1.104	0.475**	0.455**	0.310**	0.860					
5.Coordination	5.199	1.378	0.269**	0.290**	0.185**	0.332**	0.840				
6.Supplier integration	4.672	1.410	0.449**	0.467**	0.381**	0.269**	0.301**	0.760			
7.Technological innovation	4.985	1.315	0.483**	0.638**	0.383**	0.300**	0.178*	0.479**	0.830		
8.Product innovation	5.202	1.488	0.473**	0.505**	0.330**	0.393**	0.246**	0.424**	0.448**	0.890	
9.Processes innovation	4.021	1.658	0.323**	0.372**	0.346**	0.263**	0.197**	0.453**	0.518**	0.413**	0.720

Note. The square root of the AVE appears on the main diagonal.

Table 4.4. HTMT Ratio

	1	2	3	4	5	6	7	8
1.Exploitation practices								
2.Exploration Practices	0.678							
3.Specialization	0.381	0.333						
4.Credibility	0.510	0.494	0.389					
5.Coordination	0.257	0.258	0.220	0.238				
6.Supplier integration	0.487	0.518	0.458	0.275	0.342			
7.Technological innovation	0.590	0.741	0.464	0.362	0.147	0.514		
8.Product Innovation	0.550	0.576	0.408	0.490	0.234	0.468	0.518	
9.Processes Innovation	0.424	0.494	0.453	0.377	0.217	0.533	0.624	0.553

4.4. Results

All hypotheses were tested using regression analysis using the PROCESS plug-in for SPSS developed by Hayes (2013).

As a preliminary step to the regression analysis, the assumptions of multivariate analysis for the variables were tested. The requirements of linearity, homoscedasticity, and multicollinearity were satisfied by all of the variables[4]. The evaluation of the bivariate correlations showed low and moderate values, which suggests the non-presence of collinearity between the variables. In addition, collinearity statistics for each of the regression models yielded variable inflated factor (VIF) scores below 2 and condition index scores below 17, suggesting that multicollinearity was not a serious problem in the analysis (Belsley, 1991; Kleinbaum et al., 2013) The Durbin-Watson test, which measures the independence of errors in the regression, also showed adequate scores as their values were close to 2. Once the fulfillment of all these requirements had been verified, we proceeded to the regression analysis. Table 4.5 shows the main results obtained.

[4] This method has great statistical power even when the samples are small and it does not require the normality of the data (Preacher and Hayes, 2008; Hayes, et al., 2013).

Model 1 allows hypotheses 1 and 2 to be contrasted. It represents the relationship between the independent variable SI and the dependent variables firm size, firm age, SC ambidexterity, TMS and the term of the interaction (SC ambidexterity * TMS). In order to avoid problems of multicollinearity, we centered the interaction terms relative to the mean before calculating their product (Aiken and West, 1991). H1 was supported by the data (β=0.563; t=5.608; p=0.000), indicating a direct and positive relationship between SC ambidexterity and SI. Results also support H2 (β=0.153; t=2.506; p=0.013), suggesting a positive moderating effect of the TMS in the relationship between SC ambidexterity and SI. In order to validate this result, the moderating effect (H2) was tested individually for these three variables (SC ambidexterity, TMS and SI) (see Table 4.6). We examined the interaction between SC ambdiexterity and TMS. The two variables were first centered to reduce the risk of multi-collinearity (Aiken and West, 1991). Next, SI was regressed on SC ambidexterity, TMS, and SC ambidexterity×TMS. The interaction term was significant (β2= 0.153; t = 2.539; p<0.011) and multi-collinearity was not a problem (VIF=1.00). Figure 4.2 presents the moderating effect of TMS in this relationship for low, moderate, and high TMS values. The data suggests that higher levels of TMS strengthen the relationship between SC ambidexterity and SI.

Model 2 allows hypotheses 3 and 4 to be tested. It represents the relationship between the independent variable supply chain innovation competence (SCI capability) and the dependent variables firm size, firm age, supply chain ambidexterity (SC ambidexterity) and supplier integration (SI). H3 was supported (β=0.238; t=4.862; p=0.000); hence, results provide support for the hypothesized direct and positive relationship between SI and SCI capability. Finally, the results provide support for the direct and positive relationship between SC ambidexterity and SCI capability (β=0.610; t=9.051; p=0.000). Therefore, H4 was also supported. Considering that H4 was

supported, but H1 and H3 were also supported, it is possible that SI has a positive mediating effect on the relationship between SC ambidexterity and SCI capability.

Table 4.5. Effects of Supply Chain (SC) Ambidexterity and its Moderator on Supply Chain Innovation (SCI) Capability

	Model 1. Supplier integration				Model 2. Supply chain innovation (SCI) capability			
	β[a]	SE	*t*	*p*	β[a]	SE	*t*	*p*
Constant	-0.112	0.539	-0.209	0.834				
Firm size	0.046	0.078	0.591	0.554	-0.028	0.055	-0.515	0.607
Firm age	-0.071	0.155	-0.460	0.645	-0.071	0.112	-0.629	0.529
Supply chain (SC) ambidexterity	0.563***	0.100	5.608	0.000	0.610***	0.067	9.051	0.000
Transactive memory system (TMS)	0.398***	0.099	3.985	0.000				
Interaction (SC ambidexterity * TMS)	0.153**	0.061	2.506	0.013				
Supplier integration (SI)					0.238***	0.049	4.862	0.000
F	18.398***				49.297***			
R	0.562				0.704			
R^2	0.316				0.496			

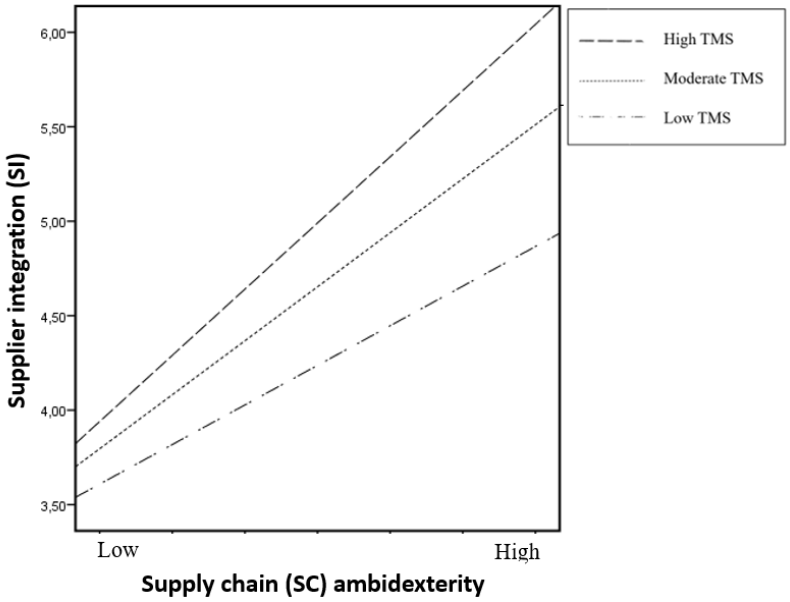
Note. Significance *** p < 0.01; ** p < 0.05; * p < 0.10.

Table 4.6. Moderating Effect

	Supplier integration			
	β[a]	SE	*t*	*p*
Constant	-0.138	0.087	-1.578	0.116
Suply chain (SC) ambidexterity	0.551***	0.097	5.647	0.000
Transactive memory system (TMS)	0.409***	0.096	4.249	0.000
Interaction (SC ambidexterity * TMS)	0.153**	0.060	2.539	0.011
F	30.738***			
R	0.560			
R^2	0.314			

Note. Significance *** p < 0.01; ** p < 0.05; * p < 0.10.

Figure 4.2. Moderating Role of Transactive Memory System (TMS)



In order to improve interpretation of a mediating effect, Zhang and Bartol (2010) advise conducting a decomposition of effects. This procedure can provide a more complete understanding of both the direct and indirect effects. We followed Zhao et al. (2010), estimating the direct, indirect, and total effects of SC ambidexterity upon SCI capability. According to Zhao et al. (2010), a mediating effect is significant if the confidence interval for the indirect effect does not include zero. Table 4.7 presents the results of this analysis, where the direct effect of SC ambidexterity on SCI capability is significant (β=0.611; t=9.193; p=0.000) as well as both indirect effects, i.e. through SI (β=0.156; t=0.156; p=0.000; CI=0.077; -0,247). Thus, SI partially mediates the relationship between SC ambidexterity and SCI capability. This can be classified as complementary mediation (Zhao et al., 2010) since the direct and indirect effects have significant and have the same sign.

Table 4.7. Mediating Effect

Independent variable (IV)	Mediating variable (MV)	Dependent variable (DV)	Effect of IV on MV (a)	Effect of MV on DV (b)	Direct effect (c´)	Indirect effect (a x b)	Total effect (c)	95 Percent CI for mean indirect effect
SC ambidexterity	SI	SCI capability	0.660***	0.236***	0.611*** (t = 9.193)	0.156	0.768*** (t = 12.504)	0.077; 0.247

*Notes. Significance *** p<0.01; ** p<0.05; * p<0.10. Confidence interval (CI).*

4.5. Discussion, implications, limitations, and future research directions

The study has pursued three main goals: (i) to analyze how the mechanisms of the SC ambidexterity support the SCI capability; (ii) to explore whether SI is a key aspect for SC ambidexterity to lead to the SCI capability; and, (iii) to evaluate the moderating role of TMS in the SC ambidexterity-SI relationship. The results demonstrate empirically that developing SC ambidexterity improves the SC's general efficacy by achieving greater integration with suppliers and fostering an essential aspect of business competitiveness such as SCI capability (Zimmermann et al., 2016). In turn, we found that TMS positively moderates the relationship between SC ambidexterity and SI.

This final section discusses the study's main implications for research and practice, along with its limitations and future research potential.

4.5.1 Theoretical implications

The study contributes to the existing literature on SCM, in four key ways. First, the study adds an increasingly growing minority of previous studies (Kristal et al., 2010; Lee and Rha, 2016; Rojo et al., 2016; Turner et al., 2018) that evaluate ambidexterity in context of SC. We delve into the concept and measurement of SC ambidexterity, developed by Kristal et al., (2010), widely mentioned in the literature of the area but scarcely tested empirically. It provides empirical evidence of the complementary vision

of exploration and exploitation practices in the context of the SC, demonstrating that the SC allows the development of high levels of both practices simultaneously. This progress overcomes the limitations that have hindered its study to date (Birkinshaw and Gupta, 2013; Rojo et al., 2016).

The literature on ambidexterity points out that the simultaneous practice of exploration and exploitation increases the level of organizational survival (O'Reilly and Tushman, 2008; 2013). However, in general, the studies do not analyze which mechanisms produce this effect (Rojo et al., 2016). This study fills this gap by determining that one of the effects on SCs occurs through the positive impact of these practices on the SCI capability. This finding is consistent with the study developed by Katila and Ahuja (2002), who affirm that the dynamic interactions of different types of organizational knowledge are necessary for the creation of new types of knowledge. Exploitation of existing capabilities is often necessary to explore new capabilities, while exploring new capabilities also improves a company's existing knowledge base (Katila and Ahuja, 2002). In addition, studies such as those developed by O'Reilly and Tushman (2008) and Andriopoulos and Lewis (2009) also consider that exploitation and exploration practices can lead to different types of innovation. Incremental innovation (i.e., improvements in an existing product) for example, arises from an existing set of skills and comes from a long history already known. Radical innovation (i.e., significant improvements of a product that destroy existing competencies) instead, requires skills different from those already known (O'Reilly and Tushman, 2008). All this supports that both exploitation and exploration practices are necessary and complementary aspects when developing the SCI capability. This means that a firms must take care of its temporary orientation to the present and the future simultaneously to improve its possibilities of innovation, avoiding both the "*competence traps*" and the "*failure trap*" (Kristal et al., 2010; p. 418). This finding is especially important because despite the existence of literature supporting this

possibility in the field of SCs, this is one of the first studies to empirically analyze the relationship between these variables in the context of SCM. It is known that ambidextrous firms are relatively more innovative (Wong et al., 2013) but this argument has not been explored in the context of the SCs.

Second, the findings show that, although the SC ambidexterity by itself leads to the SCI capability, the SI explains an important part of this relationship. To date, we have no knowledge of studies that have evaluated the relationship between ambidexterity and the SI. Although recent studies have suggested that interorganizational (IO) relationships (e.g., buyer-supplier partnerships) play an important role in achieving ambidexterity (Kauppila et al., 2010; Kristal et al, 2010; Partanen et al., 2019), consequences of these relationships have not been explored. This study contributes to advancing the knowledge of the field, confirming that the SC ambidexterity strengthens the collaborative relationships that lead to a greater SI. At the same time, firms that improve the SI increase their skills to develop the SCI capability. This finding is consistent with previous studies such as those developed by Hoegl and Wagner (2005); Peng et al. (2013); Revilla and Villena, (2012) and is especially important because it helps shed light on an existing debate about the relationship between these variables (Kim et al., 2015). We demonstrate that the benefits associated with the SI are greater than the damages caused by the integration. Developing the SCI capability becomes a much more complex task to execute without integration. Access to suppliers' experience, knowledge and resources are decisive aspects for innovation.

Third, based on a review of the previous literature, this study deepens and demarcates the concept of SCI capability. There are diverse features of innovation evaluated in the context of the SCs. Nevertheless, there is no clear and concise definition that allows SCI capability to move towards a clear theoretical development. Previous literature indicates the need to develop it (Arlbjørn et al., 2011). This is a basic aspect for the development of empirical studies that allow a more unified and

homogeneous interpretation of results and make the studies comparable. We developed a set of expanded SCI capability measures based on the study developed by Peng et al. (2013), which aim to incorporate a more holistic view of the study phenomenon. The dimensions included in the scale are key elements in the definitions of innovation in operations and SCs. However, these have been partially included in the scales developed to date (Arlbjørn et al., 2011; Kwak et al., 2018).

Finally, the study allows us to understand how the development of an internal competence called TMS via the generation of knowledge allows managing collaborative relationships between the firm and its suppliers more effectively. Although the benefits of TMS and the use of knowledge have been recognized in other fields and organizational areas (Zheng and Mai, 2013; Peltokorpi, 2014; Argote and Guo, 2016; Heavey and Simsek, 2017), there has been almost no exploration of these benefits in operations management (Argote and Guo, 2016). However, the findings are consistent with the research that supports a whole series of benefits associated with the existence of a TMS that can improve communication and coordination, problem solving, effective and efficient critical decision making and improvisation for unexpected problems (Lin and Lin, 2001; Ren et al., 2006; Lewis and Herdnon, 2011; Shin et al., 2015; Heavey and Simsek, 2017). Thus this study allows to explore the TMS in an area of the firm necessary but little explored to date.

4.5.2 Practical implications

Our study offers practical implications for operations and supply chain managers on how to build a sustainable competitive advantage (SCI capability) based on the SC ambidexterity. The study shows that adopting ambidexterity within their SCs is an important strategy choice to improve the capability for innovation in the SC.

The current environment characterized by demanding customers, short product life-cycles, volatile supply and demand, global supply chains, and rapid technological advancements, leads managers to adopt strategies that allow them to be competitive in their short and long term time orientations. One possibility for this is the development of the SC ambidexterity. The network of organizations that form the SC are an essential component for the incremental improvement of the quality, efficiency, products, services and operations existing in the SC (exploitation practices) and for the search and development of radical improvements of new technologies, products, services and systems in the SC (exploration practices). Both practices are not only compatible in the context of the SCs but also necessary because they help a firm achieve an elevated innovation capability in SC. Developing and managing innovation effectively is a challenge for most firms but it is a key component for organizational survival and competitiveness. This capacity improves performance, increases demand and reduces operating costs (Zimmermann et al., 2016). In fact, many firms recognized worldwide as Intel Corporation, Dell or Walmart, have based their success on developing innovations in their SCs. The findings show that the exploitation of existing resources is necessary to explore new resources and the exploration of new resources also improves the base of knowledge to manage existing resources. Therefore, managers do not have to decide whether to explode or explore resources in their SCs, both practices (i.e., exploitation and exploration) are fundamental to innovate in the SC.

In addition, the empirical evidence suggests that although SC ambidexterity by itself leads to the SCI capability, the SI is a key component in this relationship. Accelerated changes in industry and globalization have pushed firms to focus on improving their relationship with suppliers and take advantage of this relationship a driving force for growth and competitiveness. In this sense, SC ambidexterity is a viable option to improve and strengthen integration with suppliers by strategically cooperating with

them and collaboratively managing inter-organization processes. Managers should encourage inter-organizational relationships and the learning of their partners, creating an environment that fosters such learning through collaboration and cooperation in order to improve supplier integration. At the same time, this SI puts the firms in a better position to develop the SCI capability. SI aims to improve the efficiency and effectiveness of the information, physical flows, knowledge and expertise between a focal firm and suppliers, which can lead to develop changes (incremental or radical) within the SC in order to optimize chain configuration and improve customer satisfaction.

Finally, when the firm makes the strategic decision to undertake ambidexterity in the SC, the necessary measures are taken with its environment (e.g. relationships with suppliers) to achieve that goal. Therefore, it is important that managers understand how they can facilitate these collaborative relationships between firm and suppliers. Mangers should consider developing a TMS in the operations department by building collaborative work teams, fostering trust among group members, and recruiting personnel that specialize in a specific area and are willing to share and coordinate their individual knowledge. TMS allows generating the internal knowledge necessary to manage external collaboration relationships successfully. They favoring communication and problem solving, improving quality in decision making, provide the necessary knowledge to establish the best way to integrate the routines with the suppliers, facilitate the learning and organizational adaptation necessary to manage successful external collaboration relationships.

4.5.3 Research limitations and future research directions

This study has some limitations, which must be taken into account when interpreting the results. The first limitation is the use of self-reported and single-respondent data. A

single informant per firm participated in the survey and answered all the questions. Our "*Methodology*" section (robustness analysis) suggests that this measure does not invalidate our results. However, the study would be enriched by using more than one informant per organization surveyed, among other reasons, to minimize common method variance. Second, this research is conducted from the viewpoint of a single firm. Although we asked respondents to answer questions from the perspective of their most important SC, dyadic or triadic data would better represent the essence of the SC (Gligor et al., 2015). Third, this study uses cross-sectional data, and SC ambidexterity, SI and TMS, can evolve over time. We recommend longitudinal study to follow the evolution of these variables over time to demonstrate the path-dependent role of capabilities. Fourth, we conducted this research in a single industry, the high-tech sector. Although using a single industry in a relatively homogeneous geographical, cultural, legal and political space to minimize the impact of other variables that cannot be controlled in the empirical research (Rojo et al., 2016), it also harms the generalization of the study induced by industry differences. Thus, future research could evaluate whether the relationships found in this study are transferrable to other industries, e.g. with lower volatility or uncertainty. Finally, a two-item scale was employed for exploration, as we had to delete two items due to low factor loadings. Despite having demonstrated the validity and reliability of this scale, future studies could use richer measures of exploration. However, studies such as Roldan-Bravo et al. (2018) have used scales with two items to measure ambidexterity without affecting the validity of their results.

In general, the literature on ambidexterity has indicated that exploitation and exploration practices could generate different benefits for firms. Usually, exploitation is associated with production and efficiency, and exploration is associated with flexibility and innovation. While this study has explored the importance of both practices in the development of the SCI capability, Rojo et al., (2016) has done so in the

field of SC flexibility. That is, the SC ambidexterity has been evaluated in its longer term. It might be interesting to study the importance of SC ambidexterity in its most associated short-term (i.e., productivity and efficiency), even evaluating both aspects in a single study, would give a more complete view of the effects of SC ambidexterity on business competitiveness. Studies evaluating SC ambidexterity using the survey-based method are also necessary.

Appendix 4.A. Scales used in this study

Supply chain (SC) ambidexterity. Kristal et al. (2010)

Listed below are supply chain management practices that may affect a firm's ability to compete in an industry. Please indicate your level of agreement with these statements about your business unit's supply chain practices over the past 12 months (1 = strongly disagree, 7 = strongly agree).

SC Exploitation Practices

Ex1. In order to stay competitive, our supply chain managers focus on reducing operational redundancies in our existing processes.

Ex2. Leveraging of our current supply chain technologies is important to our firm's strategy.

Ex3. In order to stay competitive, our supply chain managers focus on improving our existing technologies.*

Ex4. Our managers focus on developing stronger competencies in our existing supply chain processes.

SC Exploration Practices

Er1. We proactively pursue new supply chain solutions.

Er2. We continually experiment to find new solutions that will improve our supply chain.

Er3. To improve our supply chain, we continually explore for new opportunities.*

Er4. We are constantly seeking novel approaches in order to solve supply chain problems.*

Transactive Memory System (TMS). Lewis (2003)

With respect to the operations department of the firm:

Specialization

Sp1. Each member has specialized knowledge of some aspect of operations.

Sp2. I have knowledge about one aspect of the operations that no other member has.*

Sp3. Different members are responsible for expertise in different areas of operations.

Sp4. The specialized knowledge of several different members was needed to complete the operations projects.

Sp5. I know which members have expertise in specific operational areas.

Credibility

Cr1. I was comfortable accepting procedural suggestions from other members.

Cr2. I trusted that other members' knowledge about operations was credible.

Cr3. I was confident relying on the information that other members brought to the discussion.

Cr4. When other members gave information, I wanted to double-check it for myself.*

Cr5. I did not have much faith in other members' expertise.

Coordination

Co1. Our department worked together in a well-coordinated fashion.

Co2. Our department had very few misunderstandings about what to do.

Co3. Our department needed to backtrack and start over a lot.

Co4. We accomplished the task smoothly and efficiently.

Co5. There was much confusion about how we would accomplish the operations task.

Supplier integration (SI). Wong et al. (2011)

SI1. Share information to our major suppliers through information technologies.

SI2. Have a high degree of strategic partnership with suppliers.

SI3. Have a high degree of joint planning to obtain a rapid response ordering process (inbound) with suppliers.

SI4. Our suppliers provide information to us in the production and procurement processes.

SI5. Our suppliers are involved in our product development processes.

Supply chain innovation (SCI) capability. Peng et al. (2013); Kwak et al. (2018)

Technological Innovation

Tec1. We are constantly thinking of the next generation of technology for the SC.

Tec2. We pursue long-range programs to acquire SC capabilities in advance of our needs.

Tec3. We make an effort to anticipate the potential of new technologies that can integrate information in the SC.

Tec4. We remain on the leading edge of new technologies for the SC in our industry.

Product Innovation

Pd1. Different suppliers are significantly involved before introducing new products or making product changes.*

Pd2. Different customers are involved to a great extent before the introduction of new products or making product changes.*

Pd3. There is a high involvement of different members of the SC in the early design of products before they reach at the firm.

Pd4. We work in teams with members from different parts of the SC (suppliers, customers, etc.) to present new products.

Processes Innovation

Ed1. We seek continuous innovation in the core processes of the SC.

Ed2. We pursue the development of agile and receptive processes for the SC against possible changes in the environment.

Ed3. We pursue the development of creative methods and / or techniques in the SC to improve operational processes.

Note. * Items were removed to meet the reliability and validity criteria.

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CAPÍTULO 5

Conclusiones e implicaciones

Introducción

El objetivo básico de la presente tesis doctoral es abordar las nuevas tendencias en la dirección de operaciones con el fin de ayudar a las organizaciones a incrementar su competitividad empresarial. Este objetivo se desagrega a su vez en otros dos objetivos expuestos a continuación. Primero, profundizar y analizar la relación entre diferentes estrategias en el área de operaciones y su relación con el desempeño desde la perspectiva teórica institucional. Segundo, explorar el papel de diferentes capacidades dinámicas en el contexto de la gestión de la cadena de suministro.

5.1. Conclusiones

Este trabajo de investigación muestra la importancia de abordar ciertas estrategias en el área de operaciones de la empresa con el fin de incrementar la competitividad empresarial. Por un lado, a nivel interno de las operaciones de la empresa y, por otro lado, a nivel externo con los socios de la cadena de suministro.

A continuación, se recogen las conclusiones específicas que se derivan de cada uno de los trabajos de investigación desarrollados en esta tesis doctoral.

En el Capítulo 2, se exploraron los efectos de adoptar prácticas institucionales en tres grandes aspectos de la competitividad empresarial y su relación con el desempeño de operaciones. La cultura, estructura y tecnología del área de operaciones de la empresa. Los resultados obtenidos sugieren que la asociación entre ajuste institucional y desempeño en el área de operaciones, varía a lo largo de las diferentes dimensiones estudiadas del ajuste. El ajuste institucional puede mejorar el desempeño, pero también puede perjudicarlo. Estos hallazgos nos permiten conectar dos posturas académicas diferentes hacia el ajuste al proponer el efecto de la estratificación del

ajuste institucional. Es decir, el impacto en el desempeño de cada variable (estructura, cultura y tecnología en operaciones) varía de acuerdo con la dimensión evaluada. Cada una de las dimensiones se ve afectada por diferentes normas institucionales lo que sugiere que, adoptar prácticas y/o estrategias del área de operaciones por imperativos institucionales no siempre mejora el desempeño. Adoptar estrategias de operaciones basadas en aspectos más visibles como la tecnología puede mejorar el desempeño, pero adoptar estrategias de operaciones menos visibles como la cultura puede perjudicarlo. La resistencia organizativa de la empresa en esa área puede explicar los diferentes resultados en el desempeño.

En el Capítulo 3, permitió evaluar cómo se puede desarrollar una capacidad dinámica como la agilidad de la cadena de suministro de la empresa y cuál es su impacto sobre el desempeño de operaciones. Asimismo, se evaluó el papel moderador de una capacidad interna de operaciones: el sistema de memoria transactiva. Los resultados obtenidos demuestran en primer lugar que, la flexibilidad de la cadena de suministro puede mejorarse a través del desarrollo de una variable interna de operaciones relacionada con el sistema de memoria transactiva y de una variable externa relacionada con la flexibilidad de la red de proveedores de la empresa. Sin embargo, el desarrollo de un sistema de memoria transactivo en operaciones (variable interna) perjudica la relación positiva entre la flexibilidad de la red de proveedores (la variable externa) y la agilidad de la cadena de suministro. En segundo lugar, existe una relación positiva entre agilidad de la cadena de suministro y el desempeño de operaciones.

En el Capítulo 4, se evaluó como la ambidestreza de la cadena de suministro se relaciona con el desarrollo de una capacidad dinámica concreta: la capacidad de innovación de la cadena de suministro. Asimismo, se estudió el papel mediador de la integración de proveedores en esta relación y el papel moderador del sistema de memoria transactiva en la relación ambidestreza de la cadena de suministro e

integración de proveedores. Los resultados empíricos de este trabajo de investigación demuestran que el desarrollo de la ambidestreza de la cadena de suministro mejora la eficacia general de la cadena al lograr una mayor integración con los proveedores y al fomentar un aspecto esencial de la competitividad empresarial, como lo es la capacidad de innovación en la misma (Zimmermann et al., 2016). A su vez, encontramos que el sistema de memoria transactiva modera positivamente la relación entre la ambidestreza de la cadena de suministro y la integración de los proveedores.

5.2. Implicaciones del trabajo de investigación para el ámbito académico

5.2.1. Contribuciones teóricas

Esta tesis doctoral tiene novedosas aportaciones fundamentalmente para el área de la dirección de operaciones y la gestión de la cadena de suministro. No obstante, las aportaciones son extensivas también a otros campos como el de la teoría institucional y/o la teoría de las capacidades dinámicas.

Primero, contribuimos a evaluar el impacto del entorno institucional sobre ciertas prácticas y estrategias de operaciones. Específicamente, contribuimos al debate existente en la literatura de la teoría institucional y la gestión de operaciones, sobre la relación entre ajuste institucional y desempeño. Los resultados de la investigación demuestran que esta relación varía según el tipo de dimensión estudiada. Esto permite conciliar dos posturas académicas (argumentos positivos y matizados) en torno al ajuste institucional (Heugens y Lander, 2009; Volberda et al., 2012; Rogers et al., 2007; Zhu y Sarkis, 2007; Barreto y Baden-Fuller, 2006; Westphal et al., 1997; Choi y Eboch, 1998; Miemczyk, 2008). A su vez, y como resultado de lo anteriormente expuesto, adoptamos la perspectiva multidimensional del ajuste institucional. Volberda

et al. (2012) ofrecieron tres dimensiones del ajuste institucional: estructura, cultura y tecnología. Nos basamos en su trabajo e investigamos si y cómo el desempeño varía según las dimensiones consideradas para el ajuste en un área específica de la empresa: la dirección de operaciones. Este es un aspecto importante pero ignorado del ajuste institucional. Proponemos la estratificación del ajuste institucional, donde cada dimensión impacta de manera diferente en el desempeño. Tercero, aunque el debate sobre el ajuste institucional no ha sido tan explícito en la dirección de operaciones como en la literatura institucional, algunos estudios sugieren hallazgos contradictorios entre las presiones isomórficas (cuyo resultado final es el ajuste institucional) y la eficiencia (Rogers et al., 2007; Choi y Eboch, 1998; Miemczyk, 2008; Westphal et al., 1997; Wu et al., 2012; Zhu y Sarkis, 2007). Por lo tanto, nuestro estudio es uno de los primeros en evaluar el ajuste institucional y el desempeño en esta área, contribuyendo a expandir el conocimiento del campo.

Segundo, contribuimos al estudio de las capacidades dinámicas en la gestión de la cadena de suministro. Específicamente en este apartado, las contribuciones han sido las siguientes:

- Aportaciones sobre la *capacidad dinámica de la agilidad de la cadena de suministro.* Se evaluaron dos antecedentes no considerados previamente en la literatura sobre la capacidad dinámica de la agilidad de la cadena de suministro: el sistema de memoria transactiva y flexibilidad de la red de proveedores de la empresa. Por un lado, aunque los beneficios del sistema de memoria transactiva y el uso del conocimiento han sido reconocidos en otras áreas organizativas (Zheng y Mai, 2013; Peltokorpi, 2014; Argote y Guo, 2016; Heavey y Simsek, 2017), los

estudios en el campo de las operaciones son prácticamente inexistentes. Nuestro trabajo se suma al estudio pionero de Obayi et al. (2017) en este campo, ampliando el conocimiento sobre sistemas de memoria transactiva y sus posibles beneficios sobre la agilidad. Por otro lado, la relación positiva entre la flexibilidad de la red de proveedores y la agilidad de la cadena de suministro refuerza la necesidad de reconfigurar la base de suministro como medio para enfrentar cambio en el entorno. Esto es consistente con la literatura de gestión de operaciones que reconoce la importancia de diferentes tipos de flexibilidad para lograr FSCA (Swafford et al., 2006; Swafford et al., 2008; Braunscheidel y Suresh, 2009; Chan et al., 2017). Se analizó el papel moderador del sistema de memoria transactiva en la relación entre la flexibilidad de la red de proveedores de la empresa y la agilidad de la cadena de suministro, demostrando que esta relación se debilita cuando una empresa tiene altos niveles de sistema de memoria transactiva. Esta es una aportación totalmente novedosa en el área. Una posible explicación para este hallazgo, es que la existencia de un sistema de memoria transactiva proporcione a la empresa mayores capacidades de gestión interna, lo que facilita su propia adaptación a los cambios del mercado (Zheng y Mai, 2013) sin necesidad de recurrir a agentes externos (como los proveedores) para ello. Po último, se demostró que la agilidad de la cadena de suministro contribuye al desempeño de operaciones. Si bien estudios anteriores exploraban esta relación, lo hacían sólo de forma parcial (Blome et al., 2013; Eckstein et al., 2015; Gligor et al., 2015; Chan et al., 2017). Al considerar cuatro dimensiones específicas: capacidad de entrega, costes de producción, calidad del producto y flexibilidad de la

producción, nuestro estudio proporciona una comprensión más completa de las medidas operativas mejoradas por FSCA.

- Aportaciones sobre la *capacidad dinámica de la capacidad de innovación en la cadena suministro.* El estudio profundiza y delimita el concepto de capacidad de innovación en la cadena de suministro. Existen diversas características de la innovación evaluadas en el contexto de las cadenas de suministro. Sin embargo, no existe una definición clara y concisa que permita que dicha capacidad avance hacia un desarrollo teórico claro. La literatura previa indica la necesidad de desarrollarlo (Arlbjørn et al., 2011). El estudio se agrega una minoría cada vez mayor de estudios previos (Kristal et al., 2010; Lee y Rha, 2016; Rojo et al., 2016; Turner et al., 2018) que evalúan la ambidestreza en el contexto de las cadenas de suministro. Nos adentramos en el concepto y la medición de la ambidestreza en la cadena de suministro, desarrollada por Kristal et al., (2010), ampliamente mencionada en la literatura del área, pero escasamente probada empíricamente. Esto proporciona evidencia empírica de la visión complementaria de las prácticas de exploración y explotación en el contexto de las cadenas de suministro, lo que demuestra que las cadenas de suministro permiten el desarrollo de altos niveles de explotación y exploración. Además, los hallazgos respaldan que tanto las prácticas de explotación como de exploración son aspectos necesarios y complementarios al desarrollar la capacidad de innovación en la cadena de suministro. Este hallazgo es especialmente importante porque a pesar de la existencia de literatura que respalda esta posibilidad en el campo de las cadenas de suministro, este es uno de los primeros estudios en analizar empíricamente la relación

entre estas variables en el contexto de la gestión de la cadena de suministro. Se sabe que las empresas ambidiestras son relativamente más innovadoras (Wong et al., 2013), pero hasta donde conocemos, este argumento no se ha explorado en este contexto. A su vez, los resultados demuestran que, aunque la ambidestreza de la cadena de suministro por sí sola conduce a la capacidad de innovación, la integración de proveedores explica una parte importante de esta relación. Hasta la fecha, no tenemos conocimiento de estudios que hayan evaluado dicha relación. Este estudio contribuye a avanzar en el conocimiento del campo, confirmando que la ambidestreza de la cadena de suministro fortalece las relaciones de colaboración que conducen a una mayor integración de proveedores. Al mismo tiempo, las empresas que mejoran dicha integración aumentan sus habilidades para desarrollar la capacidad de innovación de la cadena de suministro. Este hallazgo es consistente con estudios previos como los desarrollados por Hoegl y Wagner (2005); Peng y col. (2013); Revilla y Villena, (2012) y es especialmente importante porque ayuda a arrojar luz sobre el debate existente sobre la relación entre estas variables (Kim et al., 2015). Finalmente, el estudio nos permite comprender cómo el desarrollo de una competencia interna como el sistema de memoria transactiva a través de la generación de conocimiento permite gestionar las relaciones de colaboración entre la empresa y sus proveedores de manera más efectiva.

5.2.2. Contribuciones empíricas

De este trabajo de investigación se derivan una serie de aportaciones de interés para el ámbito empresarial al mejorar el conocimiento de los gerentes

de operaciones y de la cadena de suministro sobre cómo mejorar la competitividad de sus áreas. El entorno actual caracterizado por clientes exigentes, ciclos de vida de productos cortos, oferta y demanda volátiles, cadenas de suministro globales y rápidos avances tecnológicos, lleva a los gerentes a adoptar estrategias que les permitan ser competitivos en sus orientaciones a corto y largo plazo.

5.3. Implicaciones para la práctica empresarial

Este trabajo de investigación permite a los gerentes de operaciones conocer los efectos del ajuste institucional en el rendimiento. Estos gerentes pueden ejercer discreción sobre por qué, cuándo y cómo adoptar el ajuste institucional (Wu y Salomon, 2016). Sin embargo, como algunos investigadores ya han señalado (por ejemplo, Ketokivi y Schroeder, 2004; Kauppi, 2013), los gerentes deben saber qué sucede cuando la empresa adopta un estándar institucionalizado para adaptarse a su entorno. La evidencia empírica de este trabajo indica que la adopción de un estándar institucionalizado tiene diferentes efectos sobre el desempeño, dependiendo de las características de la dimensión estudiada. Los resultados del estudio indican que la plena conformidad con el estándar no es la mejor opción para mejorar el rendimiento. Sin embargo, dado que las empresas deben tener legitimidad para sobrevivir en sus entornos, una posible respuesta estratégica a los procesos institucionales podría utilizar "tácticas de equilibrio" (Oliver, 1991). Esta respuesta implica una conformidad parcial con los procesos institucionales que permiten a las empresas adaptarse a múltiples demandas institucionales. Nuestra propuesta consiste en una táctica de equilibrio caracterizada por un ajuste tecnológico que corresponde a la conformidad requerida por las presiones institucionales y el desajuste cultural que corresponde a los objetivos organizacionales que requieren no cambiar la organización. Este

estudio puede guiar a los gerentes en la toma de decisiones estratégicas, a fin de mejorar su desempeño sin alterar su legitimidad institucional.

Segundo, la evidencia empírica de este trabajo destaca el valor práctico de invertir en la agilidad de la cadena de suministro para construir una ventaja competitiva sostenible. Este estudio permite a los gerentes comprender cómo se puede fortalecer la agilidad de la cadena de suministro. Esta depende no solo de los aspectos internos de la empresa, sino también de otros agentes de la cadena de suministro, razón por la cual los gerentes deben desarrollar recursos internos e interorganizacionales para alentar dicha agilidad. Los gerentes pueden desarrollar un sistema de memoria transativa sólido en el departamento de operaciones creando equipos de trabajo colaborativo, fomentando la confianza entre los miembros del grupo y reclutando personal que se especialice en un área específica y estén dispuestos a compartir y coordinar su conocimiento individual. A su vez, los gerentes también pueden desarrollar la flexibilidad de la red de proveedores construyendo una red lo suficientemente flexible como para adaptarse a los cambios en el entorno y así poder responder rápidamente a las nuevas demandas. Por último, los gerentes pueden confirmar la necesidad de incrementar la flexibilidad para mejorar la agilidad de la cadena de suministro.

Finalmente, los gerentes de operaciones y de la cadena de suministro pueden tener una comprensión mayor sobre cómo desarrollar una ventaja competitiva sostenible basada en la innovación de la cadena de suministro. La ambidestreza dentro de su cadena de suministro es una opción de estrategia importante para mejorar la capacidad de innovación en la misma. Los gerentes no tienen que decidir si explotar o explorar recursos en sus cadenas de suministro, ambas prácticas (es decir, explotación y exploración) son fundamentales para innovar en dicho contexto. Desarrollar y gestionar la

innovación de manera efectiva es un desafío para la mayoría de las empresas, pero es un componente clave para la supervivencia y competitividad de la organización. Esta capacidad mejora el rendimiento, aumenta la demanda y reduce los costos operativos (Zimmermann et al., 2016). Un aspecto importante en esta relación es que la ambidestreza facilita la integración con proveedores, lo cual a su vez mejora la capacidad de innovar.

Además, cuando la empresa toma la decisión estratégica de llevar a cabo la ambidestreza en la cadena de suministro, esta toma las medidas necesarias con su entorno (por ejemplo, relaciones con los proveedores) para lograr ese objetivo. Por lo tanto, es importante que los gerentes entiendan cómo pueden facilitar estas relaciones de colaboración entre la empresa y los proveedores. Los gerentes deberían considerar desarrollar un sistema de memoria transactiva en el departamento de operaciones ya que este permite generar el conocimiento interno necesario para gestionar con éxito las relaciones de colaboración externas.

5.4. Limitaciones y futuras líneas de investigación

Los resultados de esta investigación, a pesar de aportar importantes contribuciones teóricas y prácticas, deben ser interpretadas con su debida cautela al no estar exentos de limitaciones. Dichas limitaciones pueden ser consideradas como áreas a tener en cuenta en futuras líneas de investigación. Las principales limitaciones de este estudio son las siguientes.

La primera limitación es el uso de datos autoinformados y de respuesta única. En las encuestas hubo un solo informante por empresa. Si bien se efectuaron los análisis pertinentes para asegurar la robustez de los datos, el estudio se enriquecería utilizando más de un informante, entre otras razones, para minimizar la varianza del método común.

La segunda limitación se relaciona con la perspectiva utilizada para valorar la cadena de suministro. Además, aunque se solicitó a los encuestados que respondieran a preguntas desde la perspectiva de su SC más importante, los datos diádicos o triádicos representarían mejor la esencia de la SC (Gligor et al., 2015).

La tercera limitación es el uso de datos transversales. Las capacidades dinámicas se verían mejor reflejadas mediante el uso de datos longitudinales (Teece, 2018), por lo que se sugiere un estudio longitudinal para seguir la evolución de estas variables a lo largo del tiempo.

La cuarta y última limitación significativa se refiere a la utilización de una única industria para explorar todos los análisis. Si bien el uso de una sola industria en un espacio geográfico, cultural, legal y político relativamente homogéneo permite minimizar el impacto de otras variables que no pueden controlarse en la investigación empírica (Rojo et al., 2016), también perjudica la generalización del estudio inducido por diferencias de la industria. Por lo tanto, la investigación futura podría evaluar si las relaciones encontradas en este estudio son transferibles a otras industrias con menor volatilidad o incertidumbre.

5.5. Referencias

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