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TESIS DOCTORAL

LA GESTIÓN DE LA FLEXIBILIDAD EN LA CADENA DE SUMINISTRO: UN ENFOQUE BASADO EN EL AMBIDIESTRISMO Y EN EL CONCEPTO DE AJUSTE

MENCIÓN DE DOCTORADO INTERNACIONAL

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"Sábete, Sancho que no es un hombre más que otro, si no hace más que otro. Todas estas borrascas que nos suceden son señales de que presto ha de serenar el tiempo y han de sucedernos bien las cosas porque no es posible que el mal ni el bien sean durables, y de aquí se sigue que, habiendo durado mucho el mal, el bien está ya cerca"

Don Quijote de la Mancha, Capítulo XVIII

Miguel de Cervantes Saavedra

A mis padres

A mi abuela Araceli

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INTRODUCCIÓN

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1.1. Marco general de la tesis doctoral

La flexibilidad es objeto de gran interés en la literatura actual por ser ampliamente reconocida como fuente de ventaja competitiva para la empresa (e.g. Krajewski et al., 2005; Eisenhardt et al., 2010). Existe una rica investigación previa que ha abordado su estudio, inicialmente desde el punto de vista de capacidad organizacional, posteriormente descendiendo al nivel operativo, analizando la flexibilidad de fabricación (Slack 1987; Upton, 1995; Gerwin, 1993), y más recientemente analizando esta capacidad en el más amplio contexto de la cadena de suministro de la empresa (Stevenson y Spring, 2007; Blome et al., 2013). Se entiende por cadena de suministro "la red de organizaciones que están involucradas, a través de relaciones tanto con proveedores como con distribuidores, en los diferentes procesos y actividades que producen valor para la empresa en forma de productos y servicios en las manos del consumidor final" (Christopher, 2005, p. 17).

La importancia del estudio de la flexibilidad de la cadena de suministro radica en el hecho de que ésta es un arma competitiva clave en el actual entorno empresarial, caracterizado por su dinamismo, incertidumbre e impredecibilidad, (Gunasekaran et al., 2001; Vanpoucke et al., 2014) dado que dicha flexibilidad es la habilidad de la función de la cadena de suministro para adaptarse y reaccionar a los cambios del entorno (e.g. Duclos et al., 2003; Lummus et al., 2005; Martínez-Sánchez y Pérez-Pérez, 2005). Además, se ha de notar que la competencia ya no tiene como sujetos rivales a las empresas sino a las cadenas de suministro (Spekman et al., 2002; Lo y Power, 2010). Sin embargo, pese a que la competencia actual tiene lugar entre cadenas de suministro, en la literatura de gestión de la cadena de suministro, el objeto de estudio sigue siendo predominantemente la empresa, aunque sean numerosas las llamadas de la comunidad científica para el estudio de la flexibilidad de la cadena de suministro, sus antecedentes y consecuencias (Stevenson y Spring, 2007; Blome et al., 2013; Blome et al., 2014), utilizando como unidad de análisis la cadena de suministro. Y es precisamente ahí donde se incardina la presente tesis doctoral, pretendiendo colmar el citado gap.

Por otra parte, uno de los tópicos que está recibiendo más atención actualmente en la literatura de Dirección de empresas es el ambidiestrismo, término utilizado como metáfora (Moreno-Luzón et al., 2014) para aludir a las organizaciones o unidades que son capaces de combinar las opciones estratégicas de exploración y explotación o, lo que es lo mismo, que son capaces de explotar las competencias existentes al mismo tiempo que exploran nuevas oportunidades y conocimientos (Cao et al., 2009). "La explosión de interés e investigación sobre este tema que se ha producido en los últimos años" (O´Reilly y Tushman, 2013: p.324) se debe a que se ha demostrado empíricamente que el ambidiestrismo se ha asociado a múltiples variables relacionadas con el desempeño empresarial (Junni et al., 2013), tales como el crecimiento de las ventas (Han y Celly, 2008), las medidas subjetivas de desempeño (Cao et al., 2009), la innovación (Rothaermel y Alexandre, 2009) y el valor de mercado de la empresa (Uotila et al., 2009). Además, resulta especialmente trascendente el hallazgo de que el ambidiestrismo se relaciona con la supervivencia a largo plazo de las unidades organizacionales que lo implantan (O´Reilly y Tushman, 2013) en tanto que mejora la habilidad de adaptarse al entorno (Gupta et al., 2006). Sin embargo, pese a los amplios beneficios que el ambidiestrismo ha demostrado en otras áreas, aun es escasa la evidencia empírica de la utilidad y consecuencias que reporta en el área de gestión de la cadena de suministro (Kristal et al., 2010) y dirección de operaciones (Adler et al., 2009).

En este sentido, la presente tesis doctoral se centra en el estudio de la relación entre ambidiestrismo y flexibilidad de la cadena de suministro, sus consecuencias, tanto a nivel de cadena de suministro como de empresa, así como en el análisis del papel de las distintas variables que pueden considerarse facilitadoras de esta relación.

Una vez acotado el marco general del presente trabajo, en el siguiente apartado de este Capítulo, delimitaremos los principales conceptos empleados en esta tesis, realizando una sucinta revisión de la literatura que nos permitirá formular los objetivos generales de este estudio.

1.2. Delimitación del objeto de estudio

El punto de partida que nos va a permitir establecer los objetivos de esta investigación, así como posteriormente delimitar el interés de nuestro objeto de estudio, es una somera revisión de la literatura de las variables utilizadas en esta tesis doctoral y de cómo éstas se interrelacionan.

La flexibilidad de la cadena de suministro es un tópico de gran preponderancia en la literatura de Dirección de Operaciones y Gestión de la Cadena de Suministro dada su importancia práctica para conseguir una ventaja competitiva en un entorno, como el actual, caracterizado por ciclos de vida del producto cada vez menores, una competencia global y un elevado grado de innovación. Sin embargo, pese a tratarse de un concepto ampliamente utilizado, aún existen importantes lagunas en la literatura que han de ser colmadas.

En primer lugar, no existe todavía consenso sobre su definición teórica. Para Stevenson y Spring (2007, p.686) "las cadenas de suministro que son flexibles son capaces de adaptarse efectivamente a interrupciones en el suministro y cambios en la demanda manteniendo constantes los niveles de servicio al cliente". Por otro lado, Gosain et al. (2005, p.10) sostiene que "la flexibilidad de la cadena de suministro se refiere a la medida en que las relaciones y *links* de la cadena de suministro son capaces de adaptarse a las cambiantes condiciones de negocio en lugar de ser forzadas a una obligada adaptación a un entorno dado". No obstante, aunque no existe consenso sobre la definición de flexibilidad de la cadena de suministro, existiendo tantas definiciones como autores abordan su delimitación, es cierto que todas las definiciones incluyen como elemento fundamental la referencia a la habilidad de adaptarse al entorno.

En segundo lugar, tampoco existe acuerdo en cuanto a su conceptualización teórica o a las dimensiones que permitan su análisis. No obstante, los autores que han intentado su delimitación coinciden en considerarlo un concepto complejo y multidimensional (Swafford et al., 2006). En la Tabla 1.1 se pueden observar los modelos conceptuales más importantes que se han desarrollado al intentar hacer operativa la flexibilidad de la cadena de suministro y las dimensiones que integran cada uno de ellos.

Tabla 1.1: Modelos de flexibilidad de la cadena de suministro

Autor	Dimensiones de la flexibilidad de la cadena de suministro	Naturaleza del trabajo
Vickery et al. (1999)	• Flexibilidad de producción (customización). • Flexibilidad de volumen. • Introducción de nuevos productos (flexibilidad de lanzamiento). • Flexibilidad de distribución. • Capacidad de respuesta al cliente.	Junto con el modelo conceptual, proporciona un instrumento de medida. Cada dimensión se mide con un solo item en el que se pregunta al directivo por la importancia de dicha dimensión. No se reporta la validación de la escala.
Duclos et al. (2003)	• Flexibilidad del sistema de operaciones. • Flexibilidad de mercado. • Flexibilidad de logística. • Flexibilidad de suministro. • Flexibilidad organizacional. • Flexibilidad de sistemas de información.	Modelo conceptual. No proporciona instrumento de medida.
Lummus et al. (2003)	• Flexibilidad de sistemas operativos. • Flexibilidad de procesos logísticos. • Flexibilidad de suministro. • Flexibilidad del diseño organizacional. • Flexibilidad de sistemas de información.	Modelo conceptual. No proporciona instrumento de medida.
Pujawan (2004)	• Flexibilidad de suministro. • Flexibilidad de desarrollo de nuevos productos. • Flexibilidad de customización de productos. • Flexibilidad de respuesta. • Flexibilidad de entrega.	Propone un instrumento de medida y lo valida con el estudio de un caso.
Gosain et al. (2005)	• Flexibilidad de oferta. • Flexibilidad de las relaciones con los otros miembros de la cadena de suministro.	Propone un instrumento de medida. La particularidad de este modelo es que considera a la flexibilidad como el producto (y no la adición) de las dimensiones. No reporta la validación de la escala.
Lummus et al. (2005)	• Flexibilidad del sistema operativo. • Flexibilidad de procesos logísticos. • Flexibilidad de suministro. • Flexibilidad organizacional. • Flexibilidad de sistemas de información.	Proporciona un instrumento de medida. Pero solo valida la validez de contenido.

Martínez-Sánchez y Pérez-Pérez (2005)	• Flexibilidad de producto. • Flexibilidad de volumen. • Flexibilidad de rutas. • Flexibilidad de entrega. • Flexibilidad de transbordo. • Flexibilidad de suministro. • Flexibilidad de aplazamiento. • Flexibilidad de respuesta al cliente. • Flexibilidad de distribución. • Flexibilidad de lanzamiento.	Proporciona un instrumento de medida. Cada dimensión es medida con un item en el que se pregunta al directivo por la importancia de esa dimensión. No se reporta la validación de la escala.
Kumar et al. (2006)	• Flexibilidad de producto. • Flexibilidad de desarrollo de nuevos productos. • Flexibilidad de customización de productos. • Flexibilidad de respuesta. • Flexibilidad de entrega.	Modelo conceptual. No proporciona instrumento de medida.
Swafford et al. (2006)	• Flexibilidad de suministro. • Flexibilidad de fabricación. • Flexibilidad de distribución.	Modelo conceptual. Proporciona instrumento de medida, del que se reporta su validación.
Stevenson y Spring (2007)	• Robustez. • Flexibilidad de reconfiguración. • Flexibilidad de las relaciones. • Flexibilidad de logistica. • Flexibilidad organizacional. • Flexibilidad interorganizacional de los sistemas de información.	Modelo conceptual. No proporciona instrumento de medida.
Moon et al. (2012)	• Flexibilidad de suministro. • Flexibilidad de sistema operativo. • Flexibilidad de distribución. • Flexibilidad de sistemas de información.	Modelo conceptual. Proporciona instrumento de medida del que reporta su validación.

De la revisión de los distintos modelos conceptuales propuestos por la literatura sobre la flexibilidad de la cadena de suministro se puede extraer una serie de conclusiones. La primera de ellas es que los modelos más antiguos tienden a incluir exclusivamente las relaciones e interacciones entre empresa y proveedores (*upstream linkages*), mientras que conforme evoluciona el concepto se introducen también las relaciones y vínculos con distribuidores (*downstream linkages*). Por consiguiente, la cadena de suministro incluye tanto la función de aprovisionamiento como la de distribución. Nuestra segunda conclusión es que, prácticamente, todas las taxonomías desarrolladas incluyen tanto aspectos intraorganizacionales, (relativos a los procesos operativos

muy cercanos a la flexibilidad de fabricación), como interorganizacionales de la cadena de suministro. De hecho, buena parte de los modelos de flexibilidad de la cadena de suministro se limitan a reproducir algunas de las dimensiones propias de la flexibilidad de fabricación (e.g. Pujawan, 2004; Martínez-Sánchez y Pérez-Pérez, 2005; Kumar et al., 2006) sin explicar por qué incluyen algunas de las dimensiones de los modelos de flexibilidad de fabricación (Sethi y Sethi, 1990; Gerwin, 1993; Upton, 1994; Koste y Malhotra, 1999; Vokurka y O´Leary-Kelly, 2000) y obvian otras. No obstante, los modelos más recientes, como el de Moon et al. (2012), aun cuando siguen utilizando como punto de partida los modelos teóricos de flexibilidad de fabricación, no reproducen las dimensiones de aquellos, sino que proponen dimensiones que permiten la distinción (y no solapamiento) entre flexibilidad de fabricación y flexibilidad de la cadena de suministro. Finalmente, de la revisión de los modelos expuestos se desprende que no en todos los casos la elaboración de un modelo teórico ha ido acompañada del desarrollo de un instrumento que sea capaz de medirlo; y que, además, en los supuestos en los que se propone un instrumento de medida, éste no siempre se valida. De hecho, han sido reiteradas las llamadas de la comunidad científica (vg. Stevenson y Spring, 2007) alertando sobre la ausencia de instrumentos de medida de la flexibilidad de la cadena de suministro, válidos y fiables, lo que impide el avance de la investigación empírica en este campo. Adicionalmente, al analizar los instrumentos de medida desarrollados hasta el momento, se observa que todos obvían la consideración de la adaptación al entorno, por lo que generan incongruencia entre las definiciones teóricas y las escalas propuestas.

Debido a los argumentos anteriormente expuestos, este trabajo propone, desarrolla y valida un nuevo instrumento de medida que salve el inconveniente citado, considerando los requerimientos del entorno, y tratando de conseguir así congruencia con las definiciones teóricas de flexibilidad.

En los estudios sobre flexibilidad se ha utilizado el término ajuste para referirse a la alineación entre variables externas e internas de la organización, esto es, entre las demandas y los requerimientos del entorno y las características internas de la empresa (Venkatraman y Camillus, 1984). Siguiendo esta línea de argumentación, las empresas, en lo relativo a su gestión de la cadena de suministro, han de perseguir un nivel ade-

cuado de la flexibilidad de ésta que equilibre el comportamiento y la estructura de la cadena de suministro con las exigencias procedentes del entorno.

De este modo, en esta tesis doctoral se propone el **concepto de ajuste de flexibilidad de la cadena de suministro**, que se define como el gap o diferencia entre la percepción del directivo de la flexibilidad requerida por el entorno y la flexibilidad real o potencial de la cadena de suministro.

Para medir la percepción directiva de la flexibilidad requerida por el entorno, hemos seguido la recomendación de Verdú Jover (2002). Este autor plantea que preguntar a los directivos por la flexibilidad requerida por el entorno, o flexibilidad ideal, puede conducir a muy distintas interpretaciones por parte de los informantes. Para evitar los sesgos que ello podría introducir, Verdú Jover (2002) recomienda seguir la propuesta de Parasuraman et al. (1991; 1993) para la valoración de la calidad de los servicios. Estos autores sostienen que preguntar a los directivos por la flexibilidad ideal o requerida que se "debería" tener conduce a unas expectativas muy poco realistas y, por tanto, a una puntuación, en ese aspecto, desmesuradamente alta. Para evitar esto, se debe preguntar siempre por una situación ideal, pero factible para el directivo, esto es, por la empresa excelente del sector. Por esta razón, se ha conceptualizado la flexibilidad requerida por el entorno mediante la referencia a la flexibilidad de la empresa excelente del sector.

Esta nueva forma de medición de la flexibilidad de la cadena de suministro es consistente con un importante cuerpo de literatura, que ha propuesto la medición de la flexibilidad estratégica, operativa, estructural y la metaflexibilidad por medio del concepto de ajuste (Llorens-Montes et al., 2004; Verdú-Jover et al., 2006; 2008). Además, la escala de medida aquí desarrollada no es sólo congruente con las definiciones teóricas previas, sino que además, dado que la inversión en flexibilidad tiene un coste para la empresa (He et al., 2012), permite hallar el nivel óptimo de flexibilidad exigido en cada momento para cada cadena de suministro.

Por otra parte, la literatura preconiza el estudio de qué estrategias pueden ayudar al desarrollo de la flexibilidad de la cadena de suministro (Blome et al., 2014). Conocer los antecedentes y prácticas que mejoran esta flexibilidad es de gran importancia porque es un arma clave para conseguir una ventaja competitiva, especialmente en los

mercados con mayor competencia e incertidumbre (Gosain et al., 2005; Gunasekaran et al., 2001). Además, se ha demostrado que la flexibilidad de la cadena de suministro no es sólo una capacidad reactiva, sino que también desempeña un papel estratégico dentro de la empresa (Gerwin, 1993; Lau, 1996).

Paralelamente, el ambidiestrismo en otras áreas está demostrando que facilita la supervivencia de la organización y de las unidades organizacionales que lo implantan (O´Reilly y Tushman, 2013). El ambidiestrismo es un término introducido por Duncan (1976) que hace referencia a la combinación o suma de exploración y explotación. Explotación y exploración son dos formas de aprendizaje completamente distintas. Mientras que la explotación se basa en el "refinamiento, producción, eficiencia, selección, elección, implementación y ejecución", la exploración se funda en la "búsqueda, variación, asunción de riesgos, experimentación, juego, descubrimiento e innovación" (March 1991, p. 71).

La investigación llevada a cabo hasta el momento no ha identificado por medio de qué procesos el ambidiestrismo mejora la supervivencia organizacional, pero estudios previos han reportado que mejora la habilidad de adaptación al entorno (Gupta et al., 2006) mediante el aprendizaje adquirido a través de la exploración y la explotación (Lumpkin y Lichtenstein, 2005; Santos-Vijande et al., 2012) y la adaptación al entorno exige de flexibilidad. Por este motivo, se decide indagar sobre el efecto que el ambidiestrismo tiene sobre la flexibilidad de la cadena de suministro. A los efectos de triangular esta relación y hacer más robustos los resultados, se analiza el efecto del ambidiestrismo sobre la flexibilidad de la cadena de suministro medida tanto en términos de ajuste, como en su valor absoluto y sobre cada una de las dimensiones que la componen.

Pese a existir una rica historia de investigación sobre el paradigma del ambidiestrismo (Im y Rai, 2008; Tushman et al., 2010; Jansen et al., 2009; Hill y Birkinshaw, 2014) encontramos una serie de gaps en la literatura que requieren de un mayor esfuerzo investigador. En primer lugar, se ha analizado prolijamente el ambidiestrismo en la empresa, unidades de negocio, proyectos, directivos y alianzas interorganizacionales (Mom et al., 2009; Birkinshaw y Gupta, 2013); sin embargo apenas se ha estudiado su efecto en redes organizacionales como la cadena de suministro (Kristal et al., 2010), pese a que la red organizacional que conforma la cadena de suministro es un impor-

tante facilitador del ambidiestrismo (Kauppila, 2007). De hecho, tanto Benkler (2006) como O´Reilly y Tuhsman (2013) realizan una llamada a la investigación del ambidiestrismo que trascienda los límites de la empresa e incorpore las redes organizacionales en las que la misma se integra. Por tanto, es imprescindible que el siguiente paso o avance en la investigación sobre ambidiestrismo sea su estudio en el contexto de la cadena de suministro. Por esta razón, la presente tesis doctoral utiliza el concepto de ambidiestrismo en la cadena de suministro o estrategia de ambidiestrismo en la cadena de suministro (ambos términos se han empleado de manera intercambiable) que fue introducido por Kristal et al. (2010, p. 415) y definido como "la decisión estratégica de una empresa manufacturera (énfasis de la dirección) consistente en perseguir simultáneamente prácticas de la cadena de suministro de exploración y explotación".

La segunda limitación de la gran mayoría de estudios empíricos que analizan el efecto del ambidiestrismo es que no reportan cómo miden y hacen operativo este concepto, lo que ha conducido a resultados inconsistentes en la literatura previa. Este constructo se ha hecho operativo indistintamente tanto como balance (He y Wong, 2004) como suma o combinación de las prácticas de exploración y explotación (Gibson y Birkinshaw, 2004). Dependiendo del punto de vista que se adopte, puede llevar a calificar a una misma organización con un alto grado de ambidiestrismo o justamente lo contrario, lo que resta rigurosidad a los estudios precedentes. Además, la forma de medición varía de un estudio a otro. Ante esta disparidad, tanto de puntos de vista como de formas de medir el ambidiestrismo, se ha optado por realizar una detallada revisión de la literatura en el Capítulo 2 sobre los efectos de medir el ambidiestrismo de un modo u otro, lo que nos permite profundizar y delimitar de una forma más precisa el concepto de ambidiestrismo en la cadena de suministro y esclarecer la controversia en cuanto a su conceptualización.

Al igual que tratamos de arrojar luz sobre los antecedentes de la flexibilidad de la cadena de suministro, prestamos atención a sus consecuencias, tanto a nivel de cadena de suministro como de empresa. El efecto de la flexibilidad de la cadena de suministro sobre su nivel de competencia es una cuestión controvertida en la literatura, pues la inversión en flexibilidad tiene un coste y supone la asunción de riesgos (Pujawan, 2004; He et al., 2012). Por esta razón, se analiza empíricamente el impacto del ajuste de la flexibilidad de la cadena de suministro sobre la competencia de la misma. La forma

en que ha sido definido el ajuste de flexibilidad de la cadena de suministro nos permite usar la teoría institucional para el estudio de esta relación. De acuerdo con la teoría institucional, la reproducción de las estrategias y prácticas de las empresas percibidas como excelentes conducen a mejores resultados (DiMaggio y Powell, 1983). De modo que, con el análisis del impacto del ajuste de flexibilidad de la cadena de suministro sobre la competencia se verifica si la estrategia de reproducción de las prácticas en flexibilidad de las empresas excelentes conduce a una mayor competencia. Dado que este es el primer estudio que propone la medida del ajuste de flexibilidad de la cadena de suministro, resulta imprescindible calibrar si el ajuste o *fit* con las prácticas en materia de flexibilidad percibidas como excelentes conducen a un mayor desempeño. Además, al testar esta relación se responde a las continuas llamadas de la literatura previa a evaluar los efectos de la estrategia de flexibilidad de la cadena de suministro sobre la propia cadena de suministro (Beamon, 1999; Stevenson y Spring, 2007; Blome et al., 2013).

Asimismo, se aborda en la presente investigación el impacto de la competencia de la cadena de suministro sobre el desempeño empresarial. La literatura de gestión de la cadena de suministro descansa sobre esta asunción o presupuesto, que se proclama siempre desde un punto de vista meramente teórico (Fisher, 1997; Stevenson y Spring, 2009), sin embargo apenas ha sido testado empíricamente (Qrunfleh y Tarafdar, 2014), por lo que es necesario arrojar luz sobre este presupuesto desde el punto de vista experimental.

Dado que el epicentro de esta investigación lo constituye la relación entre ambidiestrismo y flexibilidad de la cadena de suministro, nos interesa indagar qué variables pueden moderar esta relación, esto es, qué variables tienen la capacidad de amplificar o reducir el efecto del ambidiestrismo sobre la flexibilidad de la cadena de suministro. Específicamente, las dos variables que consideramos como potenciales moderadoras son la competencia en tecnología de la información (TI) y la implantación del estándar ISO 9000. Para la elección de las variables moderadoras hemos tomado como punto de partida el modelo de gestión de la cadena de suministro de Cooper et al. (1997). Este autor considera que la gestión de la cadena de suministro se divide en tres elementos muy relacionados: los procesos de negocio, los componentes de gestión y la estructura. Dado que la flexibilidad es un componente estructural de la gestión de la cadena de suministro, hemos seleccionado como moderadoras una variable relativa a los proce-

sos de negocio y otra relacionada con los componentes de gestión, para así estudiar la interrelación entre las tres clases de elementos involucrados en la gestión de la cadena de suministro. La variable relativa a los componentes de gestión de la cadena de suministro es la competencia en TI. Uno de los principales componentes en la gestión de la cadena de suministro son las tecnologías de la información y el uso que se hace de las mismas para la gestión de los flujos de información que tienen lugar entre los integrantes de la cadena de suministro. Debido a que las diferencias en el desempeño en la gestión de dichos flujos vienen explicadas no por la inversión en TI sino por el grado de competencia que la empresa alcance en su manejo (Tippins y Sohi, 2003), la variable analizada es la competencia en TI. De otro lado, la variable relativa a los procesos de negocio de la cadena de suministro es el estándar ISO 9000 y es seleccionada por la enorme influencia que ejerce sobre la gestión de los procesos a través de la formalización, estandarización y burocratización que introduce.

La competencia en TI ha sido definida como la medida en que una empresa conoce la tecnología de la información y la emplea eficazmente para la gestión de la información (Tippins y Sohi, 2003). En materia de competencia en TI en la cadena de suministro, la investigación académica se halla disociada de la práctica empresarial. Pese a ser muy habitual el empleo de tecnologías de la información para la gestión de la cadena de suministro (Fawcett et al., 2011), son muy escasos los estudios que han analizado el efecto de la competencia en TI en el ámbito de la cadena de suministro (Gosain et al., 2005; Swafford et al., 2008; Vickery et al., 2010), siendo por tanto necesario un mayor esfuerzo de investigación en este aspecto. Por otra parte, la literatura previa ha proclamado que la competencia en TI tiene un papel clave en la gestión del conocimiento. Así, Sher y Lee (2004: p. 934) afirman que "la competencia en TI es un elemento indispensable en las prácticas actuales de gestión del conocimiento". De igual modo, Pérez López et al. (2009) demostraron empíricamente que la competencia en TI tiene un rol facilitador sobre diferentes variables de gestión del conocimiento, al favorecer el desarrollo de estructuras organizacionales que posibilitan la expansión del conocimiento. Ahora bien, aunque es vasta la literatura que relaciona la gestión del conocimiento con la competencia en TI, ningún estudio hasta el momento ha evaluado conjuntamente el impacto del ambidiestrismo y la competencia en TI, pese a que el ambidiestrismo es el paradigma actual en materia de gestión del conocimiento. Por este motivo, se explora tanto desde un punto de vista teórico como empírico, si en presencia de la competen-

cia en TI, el efecto del ambidiestrismo sobre la flexibilidad de la cadena de suministro es mayor en tanto que la citada competencia puede facilitar una mayor coordinación del conocimiento obtenido vía exploración, así como incrementar la velocidad en la percepción del cambio y en la adaptación de los vínculos de la cadena de suministro (Gosain et al., 2005). Además, recientemente algunos autores han comenzado a reclamar el estudio de las relaciones entre estas tres variables. Así, Lee et al. (2015) señala que es necesario esclarecer cómo el ambidiestrismo y el uso de recursos de tecnologías de la información favorecen la agilidad organizacional. Estos autores proponen que las habilidades en la gestión de TI (o competencia en TI) favorecen la agilidad organizacional en tanto que contribuyen a la implantación y despliegue adecuados de los sistemas de información requeridos. Finalmente, desde la óptica empresarial es necesaria la inclusión de la competencia en TI porque en los últimos años las empresas han invertido millones de dólares en el desarrollo de esta capacidad tratando de obtener un beneficio superior (Liu et al., 2013). Y sin embargo, numerosas inversiones en TI no han tenido la tasa de retorno esperada. Por esta razón, la literatura científica se está centrando en la búsqueda de relaciones complementarias de esta competencia con otros activos organizacionales, que sirvan de guía a los directivos para rentabilizar sus inversiones en TI.

Al igual que la competencia en TI, este trabajo analiza la implantación del estándar ISO 9000 como variable moderadora de la relación entre ambidiestrismo y flexibilidad de la cadena de suministro. La inclusión de esta última variable en nuestro trabajo viene determinada por un doble motivo. De una parte, la literatura ha señalado la conexión entre prácticas de gestión de calidad y ambidiestrismo. Específicamente, los principios de mejora continua y orientación al cliente, que subyacen a todos los sistemas de gestión de calidad (Hackman y Wageman, 1995), están vinculados tanto a las prácticas de exploración como de explotación (Corso y Pellegrini, 2007) y por tanto al ambidiestrismo. Sin embargo, apenas encontramos estudios empíricos que relacionen ambidiestrismo con el estándar ISO 9000, el sistema de gestión de calidad más extendido actualmente (Tamayo-Torres et al., 2014; Moreno-Luzón et al., 2014). Y por otro lado, una de las premisas del estándar ISO 9000 es regular las actividades de la cadena de suministro, sin embargo, apenas se ha evaluado el efecto de este estándar en el contexto de la cadena de suministro (Prajogo et al., 2012). Además, es preciso esclarecer,

arrojando evidencia empírica, las relaciones entre ambidiestrismo, flexibilidad de la cadena de suministro y el estándar ISO 9000 porque en la literatura revisada encontramos opiniones encontradas. Parte de los autores sostienen que la orientación al mercado y mejora continua, como principios intrínsecos a la implantación del estándar ISO 9000 favorecen tanto exploración como explotación (Bell et al., 2002; Fernández-Pérez y Gutierrez-Gutierrez, 2012) y, por consiguiente, es plausible suponer que en las empresas que implantan dicho estándar, el efecto del ambidiestrismo sobre la flexibilidad de la cadena de suministro sea mayor. No obstante, al mismo tiempo, otro sector de autores argumenta que ISO 9000 afecta positivamente a las prácticas de explotación pero negativamente a las de exploración y, por consiguiente, también negativamente al ambidiestrismo. Dichos autores fundan su postura en el hecho de que la implantación del estándar se asocia a un incremento de la formalización, procedimentalización, estandarización y burocracia (Moreno-Luzón y Valls-Passola, 2011; Moreno-Luzón et al., 2014), lo que puede favorecer las prácticas de explotación e impedir las de exploración.

Igual de controvertida que la relación entre ambidiestrismo e ISO 9000 es la relación entre flexibilidad y el citado estándar. En la literatura de gestión de la calidad ha sido una constante el estudio de la relación entre flexibilidad y las distintas prácticas de calidad. La corriente mayoritaria de pensamiento es la que defiende que la implantación del estándar ISO 9000 tiene un efecto positivo sobre la flexibilidad organizacional, pues los principios de orientación al cliente y mejora continua hacen que la empresa sea más sensible a los cambios del entorno y por tanto desarrolle una mayor capacidad para ser flexible (Llorens-Montes et al., 2004). En oposición, una corriente minoritaria de autores manifiesta que el impacto de este estándar sobre la flexibilidad es negativo por el incremento de burocracia que conlleva (Casadesus y De Castro, 2005). Sin embargo, este debate aun no se ha trasladado al ámbito de la cadena de suministro, desconociéndose los efectos del estándar ISO 9000 en materia de flexibilidad de la cadena de suministro. Por lo que este trabajo no solo analiza el papel de ISO 9000 como variable moderadora de la relación entre ambidiestrismo y flexibilidad de la cadena de suministro, sino también si la implantación de dicho estándar tiene algún efecto sobre la flexibilidad de la cadena de suministro.

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 general de la presente tesis doctoral es profundizar y analizar la relación entre ambidiestrismo y flexibilidad de la cadena de suministro, constituyendo dicha relación el núcleo principal de estudio. Los objetivos específicos de la presente tesis doctoral son los que siguen:

- Delimitar y profundizar en el concepto de ambidiestrismo en la cadena de suministro.
- Desarrollar y validar un nuevo instrumento de medida de la flexibilidad de la cadena de suministro que sea congruente con las definiciones teóricas previas y tenga en cuenta los requerimientos del entorno: el ajuste de flexibilidad de la cadena de suministro.
- Estudiar si la estrategia de ambidiestrismo aplicada en la cadena de suministro es adecuada para mejorar su habilidad de adaptación al entorno. Para ello analizamos su efecto sobre la flexibilidad de cadena de suministro (en términos absolutos, en términos de ajuste y en cada una de las dimensiones que conforman el concepto de flexibilidad de la cadena de suministro).
- Determinar si un mejor ajuste de la flexibilidad de la cadena de suministro tiene un efecto positivo sobre la competencia de la cadena de suministro.
- Analizar si el grado de competencia de la cadena de suministro impacta positivamente sobre el desempeño empresarial.
- Estudiar el papel moderador de la competencia en TI en la relación entre ambidiestrismo y flexibilidad de la cadena de suministro. Indagar si este efecto moderador varía en función del nivel de la competencia en TI.
- Analizar si la implantación del estándar ISO 9000 facilita la relación entre ambidiestrismo y flexibilidad de la cadena de suministro.

— Estudiar la relación entre el estándar ISO 9000 y la flexibilidad de la cadena de suministro.

1.4. Estructura del trabajo de investigación

La presente tesis doctoral está formada por cinco Capítulos que se agrupan en tres grandes 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 presente Capítulo introductorio hemos delimitado nuestro objeto de estudio al mismo tiempo que hemos introducido los conceptos claves que utilizaremos en el resto del trabajo. La somera revisión de la literatura realizada nos ha permitido subrayar los gaps existentes en la investigación anterior y a partir de los mismos formular los objetivos de nuestra investigación.

En el Capítulo Segundo titulado "The influence of ambidexterity on supply chain flexibility fit and firm performance" se plantea el estudio de la relación entre ambidiestrismo y flexibilidad de la cadena de suministro. Antes de entrar a analizar la relación entre ambas variables, se exponen algunos de los problemas y limitaciones de la literatura anterior que ha abordado su estudio por separado. Específicamente, el estudio del ambidiestrismo ha sido muy profuso en la literatura más reciente, sin embargo, en ocasiones no ha ido acompañado de la suficiente rigurosidad en la forma de hacer operativo y medir este constructo. Por lo que en este Capítulo se realiza una revisión de los distintos puntos de vista para abordar el ambidiestrismo, así como sus diferentes medidas, lo que nos va a permitir delimitar mejor y profundizar en el concepto de ambidiestrismo en la cadena de suministro, que fue recientemente introducido por Kristal et al. (2010).

La principal limitación en el estudio de la flexibilidad de la cadena de suministro es la ausencia de instrumentos de medida válidos y fiables (Stevenson y Spring, 2007) y la falta de congruencia entre las escasas escalas desarrolladas y las definiciones teóricas del constructo (Das y Patel, 2002; Gosain et al., 2005; Gong, 2008). Por lo que en este Capítulo se desarrolla y valida empíricamente una nueva escala de medida de la flexibilidad de la cadena de suministro, el ajuste de flexibilidad de la cadena de sumi-

nistro, que tiene en consideración las exigencias y demandas del entorno, salvando así las limitaciones de las escalas desarrolladas hasta el momento. Además, el ajuste de flexibilidad de la cadena de suministro permite determinar el nivel óptimo de flexibilidad, lo que es harto valioso para la práctica empresarial dado que la inversión en flexibilidad es costosa y supone la asunción de riesgos por las empresas (He et al., 2012; Fantazy et al., 2009).

Una vez solventadas las limitaciones de la literatura previa en materia de ambidiestrismo y flexibilidad de la cadena de suministro, se analiza si la estrategia de ambidiestrismo en la cadena de suministro es una estrategia adecuada que facilita que ésta alcance el nivel óptimo de flexibilidad o un adecuado ajuste de flexibilidad. Para ello, se han utilizado argumentos propios de la teoría institucional. La utilización de este marco teórico, procedente de la Dirección estratégica, en el ámbito de la Dirección de Operaciones y Gestión de la cadena de suministro es muy reciente (Koulikkof- Souviron y Harrison, 2008; Martínez- Costa et al., 2008; Liu et al., 2010; Cai et al., 2010) y responde a las frecuentes llamadas de los autores de utilizar marcos teóricos propios de la Dirección Estratégica para explicar relaciones en el contexto de la gestión de la cadena de suministro (Ketchen y Guinipero, 2004).

Finalmente, este Capítulo aborda la relación entre competencia de la cadena de suministro y desempeño empresarial. Se testa y cuantifica si la competencia de la cadena de suministro influye positivamente sobre los beneficios empresariales. Obsérvese que en este estudio se ha optado por incluir dos medidas de desempeño, tanto a nivel de cadena de suministro como a nivel de empresa (la competencia de la cadena de suministro y el desempeño empresarial), pues una limitación común a prácticamente todos los estudios de gestión de la cadena de suministro (Beamon, 1999; Stevenson y Spring, 2007; Stevenson y Spring, 2009) es cuantificar los resultados de la cadena de suministro únicamente a nivel organizacional.

La metodología utilizada ha sido el análisis de ecuaciones estructurales aplicado a datos procedentes de una muestra de naturaleza transversal y multisectorial formada por 302 empresas fabricantes españolas. El informante clave utilizado fue mayoritariamente el responsable de la cadena de suministro de las mismas, y se le solicitó que evaluase las cuestiones desde la perspectiva de su cadena de suministro (Blome et al., 2013).

En el Capítulo Tercero, titulado "How can ambidexterity and IT competence improve supply chain flexibility? A resource-based view" se aborda la relación entre ambidiestrismo y flexibilidad de la cadena de suministro, así como el papel moderador que la competencia en TI puede tener sobre dicha relación.

Una vez que en el Capítulo Segundo se demuestra que el ambidiestrismo contribuye positiva y significativamente a un mejor ajuste de flexibilidad de la cadena de suministro, indagamos en este tercer Capítulo si igualmente dicha estrategia tiene un efecto positivo sobre la flexibilidad de cadena de suministro en términos absolutos, esto es, sin tener en cuenta las exigencias de flexibilidad del entorno. Realizamos esta doble corroboración porque la literatura previa (Llorens-Montes et al., 2004) ha demostrado que ciertas estrategias tienen un efecto diferenciado sobre la flexibilidad y la flexibilidad en términos de ajuste. Esto es, que ambas variables no responden en el mismo sentido ante idéntica estrategia. Por ejemplo, una determinada estrategia puede tener un efecto positivo sobre la flexibilidad en términos absolutos, y al mismo tiempo un impacto negativo sobre el ajuste de flexibilidad porque conduzca a una mayor flexibilidad que la requerida por el entorno. Por esta razón, es importante evaluar el efecto del ambidiestrismo sobre la flexibilidad, tanto en términos absolutos como de ajuste, en aras de la obtención de unas conclusiones más robustas y precisas.

Además de evaluar el impacto del ambidiestrismo en la flexibilidad de la cadena de suministro, se analiza el papel moderador de la competencia en TI en dicha relación. El enfoque conceptual empleado en este Capítulo es la Teoría de Recursos y Capacidades (*Resource-based view* o RBV, por sus siglas en inglés). Este marco teórico nos permite satisfacer un doble objetivo: en primer lugar, indagar en la naturaleza de la flexibilidad de la cadena de suministro desde un punto de vista estrictamente teórico, ofreciendo una explicación, consistente con la investigación previa, de por qué aquella es fuente de ventaja competitiva; y en segundo lugar, establecer una clasificación, siguiendo la jerarquía de capacidades (Sambamurthy et al., 2003; Rai et al., 2006), entre la flexibilidad de la cadena de suministro y la competencia en TI, que nos permitirá explicar el rol moderador de esta última.

La metodología utilizada ha sido la regresión lineal jerárquica aplicada a la misma muestra de datos a la que se hizo referencia en el Capítulo anterior.

En el Capítulo Cuarto titulado "The role of the ISO 9000 standard in the relationship between ambidextrous strategy and supply chain flexibility" se evalúa el impacto del ambidiestrismo sobre cada una de las dimensiones que conforman la flexibilidad de la cadena de suministro siguiendo la taxonomía propuesta por Moon et al. (2012). Se completan así los resultados obtenidos en los Capítulos anteriores, en los que consideramos a la flexibilidad como un constructo de segundo orden, pues en esta sede analizamos el efecto del ambidiestrismo sobre cada una de las dimensiones de la flexibilidad de la cadena de suministro. Este análisis nos permite obtener unos resultados más precisos y detallados, evitándose una posible pérdida de información. Además, este ha sido el criterio más utilizado en la literatura (Vickery et al., 1999; Tachizawa y Gimenez, 2009) al analizar los antecedentes y efectos de la flexibilidad de la cadena de suministro.

Este análisis no sólo tiene en cuenta el posible efecto diferenciado que el ambidiestrismo puede tener sobre cada una de las dimensiones de flexibilidad de la cadena de suministro, sino que también se atiende a la contingencia de la implantación de ISO 9000, esto es, se analiza si la implantación del estándar ISO 9000 facilita la relación entre ambidiestrismo y flexibilidad de la cadena de suministro. Con la inclusión de la variable ISO 9000 se responde a una doble llamada a la investigación de la comunidad científica. Por una parte, a la necesidad de indagar en la relación entre ambidiestrismo y prácticas de gestión de la calidad (Moreno-Luzón y Valls-Passola, 2011; El Mokadem, 2016) por la incidencia que los principios de orientación al cliente y mejora continua tienen sobre las prácticas de exploración y explotación (Corso y Pellegrini, 2007). Y en segundo lugar, a la necesidad de evaluar los efectos que las prácticas de gestión de la calidad tienen sobre la cadena de suministro, máxime el estándar ISO 9000 que establece una serie de pautas para las relaciones con los proveedores. Se trata de corroborar así el modelo conceptual propuesto por Mellat-Parast (2013) que teoriza que las prácticas de gestión de la calidad a nivel de empresa tienen implicaciones en las relaciones que se producen a nivel de cadena de suministro.

Este Capítulo finaliza con un análisis del efecto del estándar ISO 9000 sobre la flexibilidad de la cadena de suministro. De forma genérica, no existe consenso sobre la relación entre flexibilidad y estándar ISO 9000. Mientras que algunos autores aducen que conlleva un incremento de la burocracia y formalización que influye negativamen-

te sobre la flexibilidad (Kuo et al., 2009; Boiral y Roy, 2007), otros autores sostienen que los principios de mejora continua y orientación al cliente, que subyacen al estándar, permiten que la empresa sea más sensible a los cambios del entorno y, por tanto, más flexible (Tamayo-Torres et al., 2014). No obstante, aun no se ha evaluado su efecto sobre la flexibilidad de la cadena de suministro, aunque la literatura más reciente proclama que tiene un efecto positivo sobre la alineación de las actividades de la cadena de suministro con el entorno. Sin embargo, ello se ha proclamado desde un punto de vista teórico, sin validarse empíricamente (Theodorakioglou et al., 2006; Sila et al., 2006) o testándose en una muestra muy reducida (El Mokadem, 2016), por lo que es necesario arrojar más evidencia empírica al respecto.

La metodología utilizada ha sido el análisis de ecuaciones estructurales y análisis multivariante de la varianza (MANOVA) aplicados a la misma muestra de de datos de los Capítulos anteriores. Con la particularidad de que se dividió la muestra en función de si la empresa había implantado el estándar ISO 9000 o no, lo que nos permite extraer conclusiones en función de dicha variable.

El desarrollo teórico y empírico de los Capítulos 2, 3 y 4 nos permitirá dar respuesta a las siguientes preguntas de investigación

- ¿Puede el ambidiestrismo mejorar el grado de adaptación de la cadena de suministro al entorno? ¿Qué efecto tiene la adaptación al entorno de la cadena de suministro sobre su nivel de competencia? ¿La mejora de la competencia de la cadena de suministro tiene efecto sobre el desempeño a nivel empresarial?
- ¿El ambidiestrismo tiene efecto sobre la flexibilidad de la cadena de suministro? ¿Esta relación puede verse facilitada por la competencia en tecnología de la información? ¿El rol facilitador de la competencia en tecnología de la información depende de su nivel de desarrollo, esto es, de si es alta o baja?
- ¿El ambidiestrismo tiene un efecto significativo sobre cada una de las dimensiones que conforman el constructo flexibilidad de la cadena de suministro? ¿La implantación del estándar ISO 9000 modifica la relación entre ambidiestrismo y flexibilidad de la cadena de suministro? ¿El estándar ISO 9000 afecta al nivel de flexibilidad de la cadena de suministro?

Finalmente, en el Capítulo 5 se compilan los resultados y principales conclusiones que se derivan de los trabajos de investigación contenidos en los Capítulos 2, 3 y 4, prestándose especial atención a sus implicaciones, tanto para el desarrollo de la teoría como para la práctica empresarial. Asimismo, se han incluido las principales limitaciones de esta tesis doctoral y las futuras líneas de investigación que se derivan de la misma.

1.5. Justificación e interés de la investigación

Finalizamos este primer Capítulo introductorio justificando la relevancia y el carácter novedoso de la presente tesis doctoral.

La justificación de esta tesis doctoral reside en que en el entorno competitivo actual, caracterizado por la rapidez y profundidad de los cambios, es imprescindible conocer qué prácticas, estrategias y capacidades permiten la adaptación al entorno. Máxime si se tiene en cuenta que ya no son sólo los consumidores los que demandan cambios empresariales a través de sus preferencias cada vez más exigentes, sino que las propias empresas introducen una mayor necesidad de adaptación como consecuencia de los nuevos productos, procesos y procedimientos que continuamente introducen. Existe una vasta literatura sobre antecedentes y consecuencias de la habilidad de adaptación al entorno de la empresa. No obstante, la literatura científica más reciente ha advertido que para poder competir en el mercado actual no es suficiente con que la empresa sea capaz de adaptarse al entorno, sino que dicha habilidad ha de predicarse también de su cadena de suministro. Por esta razón es necesario y a dicha necesidad responde esta tesis doctoral, conocer qué estrategias, prácticas y capacidades se pueden desarrollar para mejorar dicha habilidad. Asimismo, para poder evaluar (tanto en la investigación académica como en la gestión empresarial) la habilidad de adaptación al entorno de la cadena de suministro se ha de contar con instrumentos que permitan cuantificar su grado de equilibrio/desequilibrio con el entorno, así como valorar el impacto que dicho equilibrio tiene sobre el desempeño de la cadena de suministro y sobre el desempeño empresarial.

El carácter novedoso de la presente tesis doctoral reside en que propone estrategias, prácticas y capacidades que habían demostrado su capacidad de mejorar la ha-

bilidad de adaptación al entorno en contextos distintos al de la cadena de suministro; así como en ser el primer estudio que propone un instrumento de medida de la flexibilidad de cadena de suministro que permite evaluar cuantitativamente el grado de equilibrio (o la falta del mismo, en su caso) con el entorno.

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CAPÍTULO 2

THE INFLUENCE OF AMBIDEXTERITY ON SUPPLY CHAIN FLEXIBILITY FIT AND FIRM PERFORMANCE

THE INFLUENCE OF AMBIDEXTERITY ON SUPPLY CHAIN FLEXIBILITY FIT AND FIRM PERFORMANCE

Abstract

This paper examines the relationship between ambidexterity —exploitation of current capabilities alongside simultaneous exploration of new competences— and supply chain flexibility (SCF). It also explores the impact of this relationship on supply chain (SC) competence and firm performance. A significant body of research indicates that ambidexterity can improve a firm's or unit's survival rate in uncertain environments, but the mechanisms that produce this effect have not yet been sufficiently analysed. Previous literature indicates that the knowledge acquired through exploitation and exploration increases the level of adaptation and flexibility within the environment. The goal of this paper is thus to determine whether SC ambidexterity improves SCF. This paper draws on the literature to propose a new measurement of SCF that takes market demands into account, SCF fit. It also analyses the impact of SCF fit on SC competence and its subsequent effects on firm performance. The hypotheses are tested with data from 302 manufacturing firms using a structural equations model methodology. Theoretical and practical implications are discussed.

Keywords: Ambidexterity; Supply Chain Flexibility Fit; Supply Chain Competence; Firm performance.

2.1. Introduction

Organizational ambidexterity refers to the ability of firms to simultaneously develop exploitation of their current competences and exploration of new opportunities (Cao et al., 2009; Raisch et al., 2009). Although the recent literature shows that this capability impacts both the operating level (Production Department, Patel et al., 2012) and the supply chain (SC) level (Kristal et al., 2010; Huang et al., 2014), there is little empirical evidence of the impact of ambidexterity on the area of operations (Lin et al., 2007; Tamayo Torres et al., 2011).

Ambidexterity is important not only for its positive impact on performance but also for its role in the implementation of this strategy; it helps facilitate the survival of the organization or unit (March, 1991; O'Reilly and Tushman, 2013). The literature has not directly explored which processes enable ambidexterity to increase the survival rate of units that implement it, but evidence shows that firms can achieve better adaptation and fit with the environment through learning acquired via exploration and exploitation (McNiff, 2000; Lumpkin and Lichtenstein, 2005; Santos-Vijande et al., 2013). Adaptation to the environment requires flexibility, and ambidexterity fosters flexibility, as it permits implementation of operations based on efficacy (exploitation) and innovation (exploration). Thus this study investigates the impact of adopting SC ambidexterity on supply chain flexibility (SCF).Understanding the antecedents and practices that improve SCF is very important, as SCF is a key weapon for achieving competitive advantage, especially in more competitive and uncertain markets (Gunasekaran et al., 2001; Gosain et al., 2005). SCF is not only a capability that can be exploited, it also plays a strategic role in a firm (Gerwin, 1993).

One problem that analysis of SCF poses, as Stevenson and Spring (2007) indicate, is the near absence in the literature of valid, reliable measurement instruments. This study seeks to solve this problem by developing a new measurement instrument for SCF, defined as the gap or difference between the manager's view of the flexibility required by the environment and the SC's real or potential flexibility. This definition conceptualizes perception of what is required by reference to what is considered excellent in the sector's firms (Parasuraman et al., 1993). This study measures SCF through fit because all definitions in the literature reviewed include the notion of

coordination and congruence with the environment (Das and Patel, 2002; Gong, 2008), even though the measurement instruments do not consider this factor. The measure developed thus takes the requirements and demands of the environment into account. Prior studies use fit to measure operating flexibility, strategic flexibility, structural flexibility, and metaflexibility (Lloréns-Montes et al., 2004; Verdú-Jover et al., 2006; Verdú-Jover et al., 2008).

Second, the effect of SCF on SC competence is a controversial issue in the literature because investing in flexibility incurs costs (He et al., 2012) and risks (Fantazy et al., 2009). This study thus also analyses empirically the impact of SCF fit on SC competence. Although the prior literature indicates that reproduction of firm strategies and practices perceived as excellent leads to better results (DiMaggio and Powell, 1983), controversy exists because some authors indicate that this adaptation strategy yields worse results (Miemczyk, 2008).

Finally, this investigation analyses the impact of SC competence on firm performance. Although the literature assumes this impact, there is hardly any empirical evidence to support it (Qrunfleh and Tarafdar, 2014).Thus this study makes three contributions to the SCM literature. First, it develops the conceptual definition of SC ambidexterity and analyses its effect on the level of SCF; second, it develops a new instrument to measure SCF, called SCF fit; third, it studies the impact of SCF fit on SC competence as well as the importance of SC to firm performance.

This empirical study also has implications for managers, as it seeks to provide them a tool to diagnose the level of flexibility of the SC that they manage and measure its distance from the optimal level. It also offers specific recommendations for the decision-making process in SCM. First, if ambidexterity has the power to develop a flexible SC, refining routines to achieve better efficiency will not jeopardize SCF as long as it is accompanied by a high level of exploration. Second, the study identifies the key dimensions of SCF that must be changed to improve SC competence. Third, if a good criterion for making decisions about SCF is reproduction of the most widely used practices and strategies in the sector, there is a good possibility of improving supply chain competence.

To analyse 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.

2.2. Literature review and hypotheses

2.2.1. The supply chain ambidexterity

One of the most recent and widely accepted ideas in management is that a firm's long-term success depends on its ability to exploit its current capabilities while simultaneously exploring new competences (March, 1991; Levinthal and March, 1993). This ability, termed ambidexterity (Duncan, 1976), has become the basis for a new research paradigm in the field (Raisch and Birkinshaw, 2008; Raisch et al., 2009). The literature shows no consensus, however, on the compatibility of exploration and exploitation. Older studies generally affirm that these terms indicate opposed and mutually exclusive practices that compete for scarce resources and require completely different abilities, tasks, and routines (Levinthal and March, 1993). In contrast, more recent studies show not only that these abilities are compatible when performed simultaneously (Boer and Laugen, 2008) but they also lead to better business results (Katila and Ahuja, 2002).

Ambidextrous organizations can exploit their current competences while simultaneously exploring new opportunities (Cao et al., 2009). Developing this practice can help managers responsible for the SC to maintain their competitive advantage, facilitate achievement of an optimal degree of flexibility, and refine existing routines while absorbing new competences inherent in other departments in the firm and in its environment. Taylor and Helfat (2009, p.719) assert that "without the ambidexterity required to link the new with the old, the end result may be a technological advance that fails to meet market needs". The demonstrated benefits of organizational ambidexterity for a firm make it crucial to study their effects on the SC. Various researchers have analysed the effects of ambidexterity on a firm's business units, projects, managerial levels, and inter-organizational alliances (Birkinshaw and Gupta, 2013), but there is still only slight empirical evidence on its implementation in the area of SC.

The theoretical foundation of SC ambidexterity is found in Kauppila (2007): "Our primary conclusion is that a network is the main facilitator of ambidexterity" (p. 3). The nature of the SC network (Stevenson and Spring, 2009) will thus make it easier to implement ambidexterity. SC ambidexterity is a concept introduced by Kristal et al. (2010) and defined as "a manufacturing firm´s strategic choice (i.e. managerial emphasis) to simultaneously pursue both supply chain exploitation and exploration practices" (p. 415). O'Reilly and Tushman (2013) argue that future studies of ambidexterity should not be limited to the firm as unit of analysis but also should include the firm's larger ecosystem. Benkler (2006) argues that the locus of innovation will progress from the firm to the community with which it interacts. It is thus crucial to analyse ambidexterity in the SC.

According to studies by Cao et al. (2009) and Birkinshaw and Gupta (2013), the construct of ambidexterity has been operationalized indiscriminately in the literature as both balance (He and Wong, 2004) and the sum or combination of the practices of exploration and exploitation (Gibson and Birkinshaw, 2004). Depending on the point of view adopted, the same organization may thus be classified as having either a high or a low degree of ambidexterity, thereby decreasing the rigor of previous studies. Further, studies use different methods of measuring ambidexterity. Ambidexterity understood as the combination of exploration and exploitation has been measured as both the sum and the product of exploration and exploitation. If, in contrast, ambidexterity is understood as balance or equilibrium, studies measure the absolute value of the difference between exploration and exploitation. A third, mixed method considers ambidexterity simultaneously as the product of the two terms and takes the difference in their absolute values (Birkinshaw and Gupta, 2013). According to the meta-analysis developed by Junni et al. (2013), combined measures of ambidexterity capture its effects better than measures using balance, which suggests that the best effects of this strategy are obtained by combining high levels of exploration and exploitation, not when an optimal point or balance between the two practices is sought. This study thus conceives SC ambidexterity as the combination of both practices.

This study considers exploration and exploitation as independent dimensions of ambidexterity, an approach consistent with O'Reilly and Tushman (2013) and

Birkinshaw and Gupta (2013). Ambidexterity is thus measured as a multidimensional variable that combines the two practices (Birkinshaw and Gupta, 2013). In the literature, ambidexterity has been considered as the product of the individual's activity (Mom et al., 2009) and as a result of organizational mechanisms (Raisch and Birkinshaw, 2008). Raisch et al. (2009) show that these approaches are not mutually exclusive but complementary. Following their idea, SC ambidexterity has been conceptualized as the result of managers' behavior and organizational mechanisms.

2.2.2. Supply Chain Flexibility Fit

Flexibility is an object of great interest in the current literature on Operations Management (Gaimon and Singhal, 1992). The study of flexibility focused initially on the capability for flexibility in the organization, subsequently on the study of manufacturing flexibility, and most recently on SCF. This interest has arisen through researchers' and practitioners' realization that flexibility is a key weapon for achieving competitive advantage, especially in the most competitive markets and those with the greatest uncertainty (Gunasekaran et al., 2001; Gosain et al., 2005). The importance of SCF stems from the fact that firms do not compete in isolation but within the network that composes their SC (Lo and Power, 2010).

Having a flexible SC can be a reactive capability, but it can also play a strategic role in a firm. In environments with some uncertainty, firms with a flexible SC can derive a competitive advantage from that flexibility (Gerwin, 1993). For Gerwin (1993), this flexibility is not only a response that enables an organization to adapt to uncertainty in the environment, it also functions to create uncertainty that competitors find difficult to contend with.

Despite numerous studies, the literature reviewed presents several limitations that require further research. First, there is no commonly accepted definition of SCF (Gong, 2008), and when SCF is operationalized, it usually includes dimensions belonging to manufacturing flexibility, thus making differentiation between the two difficult. Second, SCF is studied predominantly from the perspective of the firm, without taking the whole SC into account (Candaci et al., 2011).

SCF is a complex, multidimensional concept. Most articles that study it, draw their definitions from concepts of firm flexibility and manufacturing flexibility. Further, there are multiple theoretical models of SCF (Duclos et al., 2003; Lummus et al., 2003; Gosain et al., 2005). Despite this diversity, the great majority of theoretical definitions analysed refer to adaptation to the environment. Das and Abdel-Malek (2003) define SCF as "the robustness of the buyer-supplier relationship under changing supply conditions" (p. 171). For Stevenson and Spring (2007), a flexible SC can adapt effectively to interruptions in supply and changes in demand while maintaining constant levels of delivery of services to the customer. For Gosain et al. (2005) "SCF refers to the extent to which supply chain linkages are able to adapt to changing business conditions rather than being forced into committed adaptation to a given environment" (p.10).

Most studies consider the best SC to be the most flexible (Stevenson and Spring, 2009), but there are some attempts to determine the best degree of flexibility (Graves and Tomlin, 2003; Gong, 2008), thereby creating a controversy. Given that investment in flexibility incurs both costs and risks for a firm, firms must be able to achieve the optimal level of flexibility required in each SC, though the disagreement makes it difficult for them to determine just what that optimal level is (He et al., 2012; Fantazy et al., 2009).

Attempts in the literature to measure SCF are at an early stage (Stevenson and Spring, 2007), so it is necessary to develop and establish measurements that are valid and reliable. To date, research has focused on identifying the theoretical dimensions that define this concept, and there are hardly any sufficiently validated instruments (Moon et al., 2012). However, the studies reviewed note that conceptualization of SCF always includes reference to adaptation to the environment. The few measurement scales developed do not consider this adaptation, thereby creating incongruence. This study thus develops a new instrument to measure SCF.

Das and Patel (2002) estimate that measurement of SCF must consider the flexibility needed, thus they link flexibility to the uncertainty experienced by the operations systems in manufacturing firms. Gong (2008) likewise highlights the fact that measuring SCF must take market demands into account. For Gosain et al. (2005), one of the processes that makes the SC flexible is its dynamic fit, the process by which firms can, through learning supported by Information Technology and adaptation

capability, effectively and rapidly reconfigure a set of inter-organizational processes appropriate to the changing environment. Based on these contributions, SCF should be determined by its fit. This approach has been used to measure strategic flexibility, operating flexibility, structural flexibility, and metaflexibility (Lloréns-Montes et al., 2004; Verdú-Jover et al., 2006; Verdú-Jover et al., 2008).

Fit is understood as the internal consistency between a set of fundamental variables related at a theoretical level (Venkatraman, 1989), that is, as the degree to which the needs, demands, objectives, and structure of one component are consistent with the needs, demands, goals, objectives, and structure of another component (Wright and Snell, 1998).The first studies that analyse the relationship between flexibility and fit consider the two concepts as extremes on a continuum and thus opposed to the extent that fit and flexibility cannot coexist in the same entity (Milliman et al., 1991). In contrast, Wright and Snell (1998) find that these concepts are independent and can be complementary. Fit can therefore be considered a temporary state, whereas flexibility is an internal variable of the organization (Lloréns-Montes et al., 2004). Volberda (1996) distinguishes between two kinds of flexibility: real flexibility, which indicates the current capability of flexibility in the firm, and required flexibility, which refers to the flexibility that managers perceive as demanded by their environment.

This study thus proposes that the concept of SCF fit be defined as the gap or difference between the managerial perception of flexibility required by the environment and the real or potential flexibility of the SC. SCF fit is conceptualized as a managerial ability that varies based on changes in the environment and in the manager's perception of it, since perceptions in matters of flexibility have been shown to condition the SC members' actions (Stevenson and Spring, 2009). A SC that achieves the level of dynamic fit required by the environment will produce a zero flexibility gap, either because its capability for flexibility changes as the environment requires or because it is in a situation of temporary equilibrium that does not require new adaptation of the SC. The flexibility gap will be a value other than zero if there is an excessive level of flexibility, with the attendant problems of inefficiency or insufficient level of flexibility, both of which involve the failure to adapt to the changes in the environment (Barrales-Molina, 2008). SCF fit produces a quantitative measurement of the degree to which the SC is as flexible, as it needs to be to succeed in its sector. Put another way, an evaluation is obtained that expresses the SC's degree of adaptation to the environment (Verdú-Jover et al., 2004; 2005).

2.2.3. The impact of Supply Chain Ambidexterity on Supply Chain Flexibility Fit

One of the first studies to analyse the connection between ambidexterity and flexibility is Adler et al. (2009), which proposes that the combination of exploration and exploitation in operating processes leads to long-term improvement in flexibility. Brunner et al. (2008) term this effect "intentional perturbation". O'Reilly and Tushman (2013) conclude that the importance of ambidexterity for an organization lies not only in its positive impact on a series of performance variables but also in its increase of a firm's survival rate in uncertain environments. Santos-Vijande et al. (2012) show that learning facilitates flexibility, which in turn enables implementation of operations based on efficiency (exploitation) and innovation (exploration) through a flow of accumulated experience and new knowledge that inspires creativity and, ultimately, achievement of competitive advantage. Organizations that learn can capture relevant information at any moment in a more precise way, a capability that enables them to anticipate market tendencies and discard routines that are no longer operational.

McNiff (2000) determines that organizations' learning enables them to neutralize threats in the environment, take advantage of market opportunities, and even influence future evolution of the market. Khazanchi et al. (2007) suggest that the capability to adapt to the environment is characteristic of units that promote simultaneous exploration and exploitation. Popadiuk (2012) affirms that the purpose of the learning process (derived from the combination of exploration and exploitation) leads to adaptation to a new context. Through the approach of dynamic fit, Gosain et al. (2005) show that organizations in the SC learn to adjust rapidly, suggesting that learning is the component that causes this fit. Environments characterized as dynamic require greater flexibility than more static ones. Previous research recognizes that learning can strengthen the firm's ability to recognize opportunities and achieve continuous fit with the environment (Lumpkin and Lichtenstein, 2005).

A competitive environment requires simultaneous achievement of efficiency, sensitivity, and speed, which means that organizations must learn from their competitive environment. This learning process is complicated, since firms with slow, inappropriate responses are penalized, which limits the possibility of experimenting and trying new tools in the environment (Hansser-Bauer and Snow, 1996). To achieve a

good response to the environment (which is simply a good SCF fit), firms must explore and exploit simultaneously.

Ambidextrous organizations can exploit existing competences while simultaneously exploring new opportunities (Cao et al., 2009). This form of management can help SC managers maintain their competitive advantage by achieving the optimal degree of flexibility through redesign of existing routines while simultaneously absorbing new competences from other departments of the firm and from the environment. Taking the foregoing into account, one can expect SC ambidexterity to facilitate the firm's survival, as it has a direct and positive impact on SCF, specifically on SCF fit. According to the literature reviewed, the following hypothesis is proposed:

H1: Supply Chain Ambidexterity has a positive impact on Supply Chain Flexibility Fit.

2.2.4. The Impact of Supply Chain Flexibility Fit on Supply Chain Competence

The behavior of firms cannot be explained by appealing only to rational motives or efficiency. It is also influenced by the context in which the behavior occurs (Rogers et al., 2007). In the process of decision-making, firms usually use their perception as a reference point when considering what actions are desirable, correct, or appropriate for a specific organization embedded in a specific system of rules, values, beliefs, and definitions (Suchman, 1995). Managers therefore tend to reproduce the structures, practices, strategies, processes, routines, etc. of organizations they perceive to be "more successful" (DiMaggio and Powell, 1983). The result of this practice is called isomorphism (Deephouse, 1996).

From this perspective, the decision to adopt a specific structure, strategy, or process is determined partly by the results expected but also partly because adopting it is considered a necessary condition for the ability to compete in a specific market. Few recent studies apply these arguments to the area of Operations Management and SCM (Martínez-Costa et al., 2008; Cai et al., 2010; Liu et al., 2010). In the area of SCM, these arguments have focused almost exclusively on explaining the motives that lead to adoption of practices characteristic of green SCM (González et al., 2008). Applying

this approach to research in Operations Management has shown that production managers' actions are not only motivated by reasons of economic efficiency (Miemczyk, 2008), they also experience pressure to satisfy demands from the context in which they act (Rogers et al., 2007).The definition of SCF fit is made operational through the comparison manager make of what they perceive as an excellent SC. This study measures the SC's degree of adaptation to the demands perceived by the managers.

According to the literature, isomorphism will have a positive effect on SC competence. First, adopting desired routines increases competence. It makes learning more efficient because firms learn not only from their own research and experience but also from other firms whose practices they imitate (Tolbert and Zucker, 1983).Furthermore, isomorphism increases public support (DiMaggio and Powell, 1983), access to resources (D'Aunno et al., 1991), and collective learning (Levitt and March, 1988). However, this is a controversial issue. Some evidence shows that isomorphism leads to worse results in terms of economic efficiency (Miemczyk, 2008), as it can cause less differentiation from the competition (Heugens and Lander, 2009) or require significant investment to adopt strategies and configurations similar to those of the most successful firms (Barreto and Baden-Fuller, 2006). Most of the studies reviewed suggest that the strategy of reproducing the most successful organizational practices has a positive impact on business competences, thus it is reasonable to expect that a SC whose flexibility more closely resembles the flexibility of a SC that is perceived to be excellent shows better competence. Based on this discussion, the following research hypothesis is proposed:

H2: Supply Chain Flexibility Fit has a positive impact on Supply Chain Competence.

2.2.5. The impact of Supply Chain Competence on firm performance

Chow et al. (2008) define SC competence as "a portfolio of organizational, managerial, technical and strategic capabilities and skills developed by enterprises over time. Adequate supply chain competence enables enterprises to respond reliably to market demands at any time" (p. 667). Bowersox et al. (2000) define this competence as a supply chain´s ability to respond to customer demands with low cost, high-quality products and services. Green et al. (2014) define "supply chain competence as a reflection of supply chain performance, as opposed to the performance of the individual

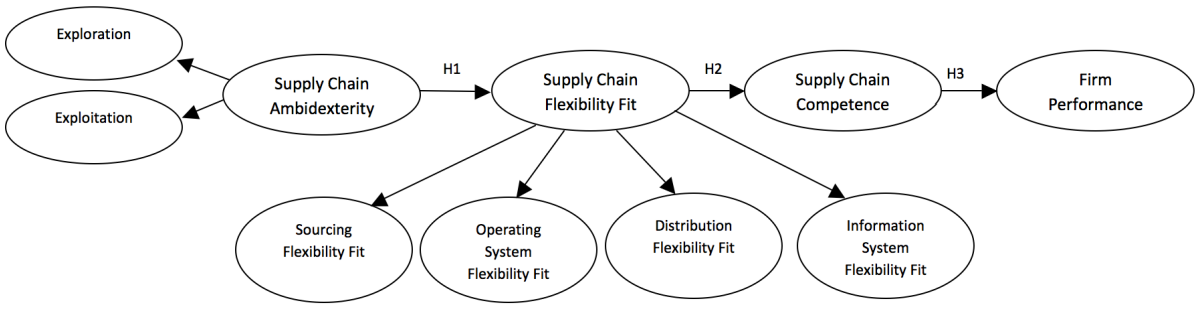
partnering firms" (p.127). Performance shows how a firm achieves its financial and market objectives. According to the previous literature (Li et al., 2006), and due to the difficulty of obtaining objective data on business performance, business performance is measured as managers' perception of their market share and rate of sales growth relative to their competition (Narasimhan and Das, 2001).

Fisher (1997) is one of the first studies to highlight the importance of SC competence and its impact on firm performance to show the negative impact the lack of flexibility has on organizational performance. In recent years, the scholarly literature has shown the importance of SCM as a means of improving firm performance (Martínez-Sánchez and Pérez-Pérez, 2005). A positive relationship between SC competence and firm performance is thus expected, since SC capabilities imply efficacy and efficiency, which assume improvement of the firm's processes. In spite of the qualitative evidence for this relationship, it has barely been tested in prior studies (Qrunfleh and Tarafdar, 2014).According to these arguments, the following research hypothesis is proposed:

H3: supply chain competence has a positive impact on firm performance.

Figure 2.1 illustrates the relationships proposed for empirical validation in the theoretical model developed.

Figure 2.1: Theoretical framework of the study



2.3. Methodology

2.3.1. Survey design and sample

A detailed survey was designed to gather specific information on the practices of exploration and exploitation, SCF, SC competence, and firm performance as well as demographic data from firms and their respondents. Most of the questions in the survey were answered on a seven-point Likert scale. The questionnaire items were drawn from the literature. The questionnaire was developed by implementing the three-stage procedure followed by Moore and Benbasat (1991) and detailed by Mackenzie et al. (2011). After the study constructs were defined, a pool of items was established for each construct. Four rounds of Q-sort procedures were performed to evaluate the scales' content validity. Following the procedure in Moore and Benbasat (1991), different judges—both academics and managers—participated in each round. During these rounds, the judges were asked to classify the items (presented in random order) based on the definitions of the constructs provided to them, with the option of not classifying an item or classifying it under the category "other/don't know/no answer". According to this procedure, if the judges classified an item consistently under a specific construct, that item was considered to show content validity. The procedure thus enabled confirmation that the process for developing the measurement instruments produced scales that demonstrated content validity. After each round, the items were revised to improve their clarity, although these changes did not result in items substantially different from the originals. The procedure was repeated after purification of the scales. These steps ensure the content validity of the measurement instruments employed.

The data were not collected in an English-speaking country, so the steps for back-translation proposed by Brislin (1976, p. 221) were used. An English version of the questionnaire was developed, translated into Spanish, and subsequently translated back into English. Each translation was performed by a different professional translator who specializes in management literature. The back-translated English questionnaire was then compared to the original English version, and several questions were reworded to enhance translation accuracy.

To provide empirical evidence on the different research hypotheses proposed, the set of Spanish manufacturing firms was established as the object of study. 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 in our empirical research (Adler, 1983). The study population was obtained from the SABI 2014 database (Iberian Balance Sheet Analysis System), which is composed of 45,166 firms. Only firms that belonged to the manufacturing sector and provided complete data in their record (correct phone number, non cessation of activity, and had more than ten workers) were considered, leaving a total of 2,517 firms. The survey was addressed to those responsible for the firm's SC, the purchasing manager or the top manager. The characteristics of the respondents and the firms composing the sample appear in Table 2.1.

Table 2.1: Sample characteristics

	N	Percentage (%)
Respondent job title		
SC Manager	81	26.82
Purchasing Manager	130	43.05
General Manager	91	30.13
Total	302	100
Manufacturing industry[1]		
Food products, beverages, and tobacco	3	1
Textile and wearing apparel	5	1.65
Chemistry and pharmaceuticals	26	8.61
Plastics	28	9.27
Computers, electronics, and optical equipment	23	7.61
Electrical equipment	30	9.93
Machinery and equipment	110	36.42
Furniture	47	15.57
Automobile	25	8.29
Other	5	1.65
Total	302	100

Size of firm (no. employees)		
10-49	69	22.85
50-250	142	47.02
251-1000	58	19.20
Over 1000	33	10.93
Total	**302**	**100**

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

The data were obtained through computer-assisted telephone interviews (CATI) performed in May 2014. A total of 302 valid questionnaires were obtained, a response rate of 12%. The sampling error is 5.23%, with a confidence level of 95% (Z=1.96) for p=q=0.5. Several recent studies in Operations Management have a similar or even smaller sample size than the sample used in this study (Gutierrez Gutierrez et al., 2009; Yang et al., 2009). The sample size in this study is thus appropriate and does not compromise the reliability of the results. Following Hair et al. (2010), missing data (< 1%) were imputed using the predictive mean matching algorithm (Little, 1988).

The possibility of non-response bias in the sample was analysed according to the recommendation of Fawcett et al. (2014). The mean value of the size variables for all firms was compared to the mean of the firms included in the sample, and the values were similar in both cases. These results show that the firms that did not respond to the questionnaire did not introduce significant bias into the study results. Furthermore, to analyse the presence of possible "late-response bias" in the sample, the study determined whether there were significant differences between the firms that responded first and the firms that responded at the end of the fieldwork. To do so, the sample was divided into responses obtained on the first phone call (n=170) and responses received after more than one call (n=132). As no significant differences were found for any of the model variables between firms that responded at the beginning of the fieldwork and those that responded at the end, the results support the absence of significant "late-response bias".

The firms in the sample came from ten different industries, so tests were also performed to confirm whether statistically significant differences based on firm sector existed, and none were found (for α =0.05).

2.3.2. Measurement scales

This study uses eight first-order constructs (exploration, exploitation, sourcing flexibility fit, operating system flexibility fit, distribution flexibility fit, information system flexibility fit, SC competence, and firm performance) and two second-order constructs (SC ambidexterity and SCF fit).The scales used to measure the variables in this study were adapted from prior studies to guarantee their validity and reliability. All questionnaire items were accompanied by a seven-point Likert scale, (1 indicates maximum disagreement and 7 maximum agreement with each item).

SC ambidexterity is measured multi-dimensionally through exploration and exploitation in the SC, according to the scales proposed by Kristal et al. (2010).

To adapt the scale for SCF fit, the measurement concept used was that developed in the studies by Volberda (1992, 1999), Llorens-Montes et al. (2004) and Verdú-Jover et al. (2006).. Flexibility fit was operationalized using the definition of a gap that includes the differences between what managers perceive their sector to require and what they perceive to happen in their firm. The managers were thus asked about the elements that compose their firm's SCF and that they evaluate the requirements of their sector relative to these elements. The flexibility gap was obtained by the difference in the evaluations of the sector relative to the evaluation of the firm.

The items used by Moon et al. (2012) were divided to measure the SCF by asking survey respondents about real and required flexibility. These authors distinguish four dimensions of SCF: sourcing flexibility, operating system flexibility, distribution flexibility, and information system flexibility. Thus one obtains:

— A gap equal to zero (required flexibility–real flexibility = 0), which indicates that the SC has the optimal flexibility that permits it to change to fulfill the demands of the environment.

— A gap greater than zero (required flexibility – real flexibility > 0), which indicates that the SC has some rigidity relative to the flexibility required by the environment. The greater the difference, the greater the lack of adaptation to new situations that arise in the environment.

— A gap less than zero (required flexibility – real flexibility < 0), which indicates that the SC has an excess of flexibility relative to that required by the environment, with the resulting problems of efficiency.

For the statistical analysis, once the gap was obtained for each SC, the point values obtained were transformed to adapt them to the scale of 1 to 7 that was used to measure the other model constructs. The transformation method used was that employed by Llorens-Montes et al. (2004). First, we converted the differences into negative absolute values so that 0 becomes the highest value on the scale, and the increase in distance with regard to 0 indicates a greater misfit in relation to the required flexibility. The more negative a value is, the worse its situation will be with regard to the environmental requisites. Secondly, so as to homogenize the figures to be used in the statistical analysis, we turned negative values on the scale into positive values between 1 and 7. Thus, the scale values on the flexibility gap in absolute values are similar to those of other constructs for which we have used a Likert-type 1 to 7 valuation. However, in this case, the categories do not correspond to the level of agreement or disagreement with the statement implied in each item, but, rather, refer to the degree of fit (value =7) or level of difference between the required and real values (from 6 down to 1), 1 reflecting the greatest discrepancy.

SC competence was measured using the scale proposed by Qrunfleh and Tarafdar (2014). Finally, firm performance was measured by adapting the scale proposed by Dess and Robinson (1984) and used to measure organizational performance. (See Appendix for a description of the items used in the study).

2.3.2.1. Exploratory Factor Analysis

To develop a parsimonious representation of the constructs used in the model, some of which were new, an exploratory factor analysis of principal components was performed using SPSS v.20 software for each set of questions determined *ex-ante* to represent each construct. The items with loadings over 0.4 on more than one construct or that loaded on a factor that made no sense were then eliminated (items SCC8, SCC9, and SCC10). After all measurement instruments were defined, another factor analysis was performed to verify the results of the initial exploratory analysis. The princi-

pal components method showed that eight constructs emerged using Cattell's (1966) screen test. These constructs represented 76.209 % of the total variance in the data. The factors obtained are consistent with previous expectations. VARIMAX rotation obtained the following factors:

Exlr: extent to which exploration practices are developed in the SC.

Expl: extent to which exploitation practices are developed in the SC.

SFF: sourcing flexibility fit.

OSFF: operating system flexibility fit.

DFF: distribution flexibility fit.

ISFF: information system flexibility fit.

SCC: SC competence.

FP: Firm performance.

The results of the exploratory factor analysis are shown in Table 2.2.

Table 2.2: Exploratory Factor Analysis

Items	Factor 1 Expl	Factor 2 Exlr	Factor 3 SCC	Factor 4 FP	Factor 5 SFF	Factor 6 OSFF	Factor 7 DFF	Factor 8 ISFF
Expl1	0.849							
Expl2	0.879							
Expl3	0.897							
Expl4	0.878							
Exlr1		0.757						
Exlr2		0.730						
Exlr3		0.772						
Exlr4		0.805						

Items	Factor 1 Expl	Factor 2 Exlr	Factor 3 SCC	Factor 4 FP	Factor 5 SFF	Factor 6 OSFF	Factor 7 DFF	Factor 8 ISFF
SCC1			0.501					
SCC2			0.655					
SCC3			0.773					
SCC4			0.727					
SCC5			0.768					
SCC6			0.695					
SCC7			0.568					
FP1				0.851				
FP2				0.885				
FP3				0.880				
SFF3					0.800			
SFF2					0.825			
SFF3					0.852			
OSFF1						0.917		
OSFF2						0.908		
OSFF3						0.927		
OSFF4						0.868		
DFF1							0.856	
DFF2							0.859	
DFF3							0.851	
ISFF1								0.861
ISFF2								0.871

The factor solution obtained shows the construct validity of the measurement instrument. Loadings greater than 0.5 for each factor with multiple questions show

convergent validity (Bagozzi and Yi, 1988). To further guarantee appropriateness of the measurements employed and to minimize the possibility of common method bias (Podsakoff et al., 2003), we adopted a serie of procedural measures before collecting the data. Although the respondents were aware that they were answering questions related to SCM, learning mechanisms, and performance measures, it is quite unlikely that they could have intuited the specific research model. If the research question is not known, respondents are less able to manipulate their responses in an attempt to satisfy the expectations about the relationships assumed. Various response formats were used (not at all –a lot – maximum disagreement–maximum agreement), and the questions were not grouped by construct. The respondents' anonymity was protected and a pre-test of the survey, using simple language that was easy to understand, was performed to avoid ambiguity. While we have attempted to adopt all *ex-ante* measures possible to mitigate common method bias, we are aware that a risk of this bias still exists.

2.3.2.2. Confirmatory Factor Analysis

The measurement model was evaluated using confirmatory factor analysis (CFA) (Gerbing and Anderson, 1988). Schumacker and Lomax (1996) recommend focusing on modeling in two steps, first evaluating the measurement model to ensure its fit and then examining the full model. The measurement model evaluates discriminant and convergent validity, whereas the full model evaluates predictive validity. Jöreskog and Sörbom (1993) emphasize that the measurement model should be tested independently to ensure that the indicators chosen to measure each construct are appropriate. EQS 6.2 software was used to evaluate the measurement model, as well as the structural model. The estimation method chosen was based on the normality/non-normality of the data (Bentler, 1995). Since the multivariate normality test showed non-normality of the data (Mardia's coefficient=229.975; t-value=56.562), the robust ML estimation method was applied using EQS software (Bentler, 1995).

CFA was used to evaluate the measurement model, and the reliability and validity of the scales were then tested. The scales' reliability was evaluated using the composite reliability statistics (CR), average variance extracted (AVE), and Alpha Cronbach (Hair et al., 2004). The Alpha Cronbach coefficients were used to measure the internal consistency of the constructs. Given the goal of this study and its use of scales widely employed in the

literature, values must be greater than 0.8 for the Alpha Cronbach (Nunnally, 1978; Lance et al., 2006). All statistics calculated for CR took values over 0.7, and the AVE statistics calculated took values over 0.5. These results show acceptable values for reliability and internal consistency of the scales (Hair et al., 2004), as can be confirmed in Table 2.3.

Table 2.3: CFA of measurement scales of first-order constructs

Item	Mean	S.D.	Factor loadings	t-value	R^2	Scale reliability
Exploration (Exlr)						
Exlr1	5.93	1.253	0.764	a[1]	0.584	CR: 0.895
Exlr2	5.96	1.232	0.810	14.620	0.655	AVE: 0.683
Exlr3	5.70	1.178	0.807	14.567	0.651	α: 0.863
Exlr4	5.75	1.156	0.918	16.491	0.843	
Exploitation (Expl)						
Expl1	6.13	1.136	0.915	a	0.837	
Expl2	5.77	1.280	0.915	26.890	0.837	CR: 0.958
Expl3	5.60	1.287	0.951	30.182	0.903	AVE: 0.852
Expl4	5.62	1.313	0.912	24.525	0.832	α: 0.945
Sourcing Flexibility Fit (SFF)						
SFF1	6.42	0.995	0.821	a	0.674	CR: 0.884
SFF2	6.40	1.231	0.834	15.993	0.696	AVE: 0.717
SFF3	6.45	1.079	0.884	16.584	0.782	α: 0.816
Operating System Flexibility Fit (OSFF)						
OSFF1	6.28	1.188	0.925	a	0.855	CR: 0.967
OSFF2	6.38	1.191	0.943	31.257	0.890	AVE : 0.878
OSFF3	6.33	1.199	0.970	34.678	0.940	α: 0.950
OSFf4	6.33	1.202	0.909	27.605	0.827	
Distribution Flexibility Fit (DFF)						
DFF1	6.51	0.977	0.825	a	0.680	CR: 0.931
DFF2	6.58	0.936	0.953	21.384	0.909	AVE: 0.818
DFF3	6.57	0.951	0.931	20.945	0.867	α: 0.863

Item	Mean	S.D.	Factor loadings	t-value	R^2	Scale reliability
Information System Flexibility Fit (ISFF)						CR: 0.714
ISFF1	6.55	0.979	0.911	a	0.830	AVE: 0.556
ISFF2	6.58	0.918	0.915	11.083	0.831	α: 0.871
SC Competence (SCC)						
SCC1	6.18	1.042	0.677	a	0.458	
SCC2	6.38	0.789	0.828	12.677	0.685	
SCC3	6.24	1.203	0.785	12.125	0.616	CR: 0.901
SCC4	6.01	1.206	0.784	12.119	0.615	AVE: 0.568
SCC5	5.60	1.331	0.766	11.870	0.586	α: 0.842
SCC6	5.40	1.463	0.720	11.248	0.519	
SCC7	6.08	1.105	0.703	11.005	0.494	
Firm Performance (FP)						
FP1	3.98	1.641	0.812	a	0.659	CR: 0.902
FP2	3.94	1.605	0.885	17.664	0.783	AVE: 0.756
FP3	4.22	1.500	0.908	17.957	0.824	α: 0.952

[1] a indicates that the parameter was set at 1.0. If a different parameter is set at 1.0, however, the indicator of the scale is also statistically significant.

A CFA was also developed to demonstrate multidimensionality and goodness of fit of the two second-order constructs used in the model, SC ambidexterity and SCF fit. As can be observed in Table 2.4, all results obtained guarantee correct fit of the scales used. A set of fit indicators was used to evaluate the measurement model of the second-order constructs: RMSEA (Root Mean Square Error of Approximation), NFI (Bentler-Bonett Normed Fit Index) (Bentler and Bonett, 1980), IFI (Incremental Fit Index), CFI (Comparative Fit Index), and AGFI (Adjusted Goodness of Fit Index). RMSEA is one of the most informative criteria for evaluating model fit (Byrne, 2001). A RMSEA value lower than 0.08 is reasonable, but a value lower than or equal to 0.05 indicates a better fit (Byrne, 2001). When the NFI, CFI, IFI, GFI, and AGFI produce values higher than 0.9, they are indicators of an acceptable fit (Bentler, 1992; Byrne, 2001). The measurement model for the second-order constructs shows acceptable fit indicators, as may be confirmed in Table 2.4.

Table 2.4: CFA of second-order constructs

Factors	Standardized Parameters	t-values	R^2	Scale reliability
Supply Chain Ambidexterity				CR:0.940
Exploitation	0.918	a[1]	0.844	AVE: 0.887
Exploration	0.965	21.001	0.931	α: 0.901
CFI 0.964; NFI 0.957; IFI 0.964; GFI 0.921; AGFI 0.842; RMSEA 0.05				
Supply Chain Flexibility Fit				
Sourcing Flexibility Fit	0.528	a	0.279	CR: 0.812
Operating System Flexibility Fit	0.688	7.147	0.473	AVE: 0.920
Distribution Flexibility Fit	0.865	7.336	0.748	α: 0.920
Information System Flexibility Fit	0.770	7.368	0.604	
CFI 0.992; NFI 0.973; IFI 0.992; GFI 0.902; AGFI 0.889; RMSEA 0.04				

[1] a indicates that the parameter was set at 1.0. If a different parameter is set at 1.0, however, the indicator of the scale is also statistically significant.

Discriminant validity evaluates the extent to which each construct used in the model is different from the others (Bagozzi et al., 1991). Discriminant validity at the construct level was evaluated using the procedures recommended by Voorhees et al. (2016). First, the criterion developed by Fornell and Larcker (1981), which consists of comparing the square root of the AVE to the correlations between the constructs, was used. The square root of the AVE appears on the main diagonal of Table 2.5 and is greater than the correlations between the constructs, which shows the presence of discriminant validity between the constructs used in the model. Table 2.5 shows that some of the correlations between the constructs are significant, as expected. Kenny (2012) suggests, however, that discriminant validity between latent factors in SEM is poor if the correlations are higher than 0.85, and no pair of correlations exceeds this limit.

Second, the HTMT ratio (Henseler et al., 2015) was calculated for each pair of constructs. As Table 2.6 shows, the HTMT ratio is lower than 0.85 for each pair of constructs, also indicating the presence of discriminant validity. Finally, following Howell (1987) and Szulanski (1996), discriminant validity was analysed at the item

level. The correlations observed in the CFA were compared to the correlation values calculated for the case of perfect correlation. The correlation values calculated must be greater than the values observed. As the results show that this condition is met for all cases; discriminant validity is ensured.

Table 2.5: Correlation matrix

	1	2	3	4	5	6	7	8	Mean	S.D.
1.Expl	**0.923**								5.835	1.205
2.Exlr	0.501**	**0.826**							5.781	1.256
3.SCC	0.305**	0.398**	**0.754**						5.984	1.180
4.FP	0.221**	0.227**	0.376**	**0.869**					4.146	1.583
5.SFF	0.455**	0.447**	0.314**	0.219**	**0.847**				6.420	1.094
6.OSFF	0.411**	0.420**	0.301**	0.201**	0.483**	**0.937**			6.331	1.196
7. DFF	0.408**	0.426**	0.390**	0.282**	0.431**	0.481**	**0.904**		6.551	0.988
8. ISFF	0.445**	0.459**	0.343**	0.278**	0.499**	0.402**	0.444**	**0.746**	6.563	0.988

** significant at a significance level of 0.05. The square root of the AVE appears on the main diagonal in bold

Table 2.6: HTMT results

HTMT	Expl	Exlr	SCC	FP	SFF	OSFF	DFF	ISFF
Expl								
Exlr	0.711							
SCC	0.520	0.784						
FP	0.263	0.311	0.620					
SFF	0.622	0.705	0.596	0.290				
OSFF	0.501	0.591	0.509	0.237	0.655			
DFF	0.530	0.639	0.703	0.354	0.623	0.620		
ISFF	0.561	0.668	0.600	0.339	0.700	0.503	0.592	

2.4. Analysis and discussion of the results

2.4.1. Fit of the structural model

The analytical methodology followed is based on confirmatory modeling. This method consists of specifying a model whose relationships have been established according to theory and that uses SEM to evaluate its statistical significance. Evaluating the study hypotheses requires analysing the proposed model's global fit. The SEM literature is still debating the best ways to evaluate model fit and has not reached consensus on this issue (Lance et al., 2006). To evaluate overall model fit, recommendations by Guide and Ketokivi (2015) and Bollen and Long (1993, p.6) were followed. These authors assert that in the absence of a consensus on how to evaluate global model fit, the following guidelines should be observed: 1) The model must fit a strong, substantial pre-existing theory. Only if the model agrees with and is consistent with a significant theoretical corpus can it evaluate fit positively. The model in this study is grounded in a significant body of theoretical literature, explained in Section 2.2; 2) Calculate the Chi-square (Chi square=5448.095; $p<0.001$). The value's statistical significance confirms that the model fits the data well, as the observed and predicted covariance matrices agree (Guide and Ketokivi, 2015); 3) Report multiple indices of global model fit (IFI=0.949; NNFI=0.942; CFI=0.948; RMSEA=0.05; see Table 2.7). Although all indices of global fit produce values above the widely accepted limits, the indices' value must be interpreted with caution, as values below 0.90 mean simply that the model can be improved substantially (Lance et al., 2006); 4) Examine the model components. The following section of this paper reports the R^2 for each of the equations as well as the magnitude and significance of the coefficients estimated, thereby demonstrating values consistent with the fit indices; 5) Estimate several plausible alternative models (performed to analyse whether there are problems of endogeneity in Section 2.4.3.). The set of criteria used to evaluate the global fit of the model confirms that the proposed model is a good representation of the data and fits them well. Further, following the recommendation of Riedl et al. (2014), the statistical power was calculated for the structural equations model using the approach of MacCallum et al. (1996). A value of 0.84 (for ε_0 =0.05; ε_a=0.08) was obtained, which, as it falls between 0.8 and 1, confirms the validity and reliability of the results.

Table 2.7: Measures of global fit of the structural model

Measures	Acceptance levels	Result of the model
Measures of Absolute Fit		
Chi-Square	High, low	448.095 (p<0.001)
Goodness of Fit Index (GFI)	> 0.9	0.902
Root Mean Square Residual (RMSR)	Close to 0	0.017
Root Mean Square Error of Approximation (RMSEA)	< 0.09	0.05
Measures of Incremental Fit		
Adjusted Goodness of Fit Index (AGFI)	>0.9	0.901
Normed Fit Index (NFI)	>0.9	0.906
Non-Normed Fit Index (NNFI)	>0.9	0.942
Comparative Fit Index (CFI)	>0.9	0.948
Incremental Fit Index (IFI)	>0.9	0.949

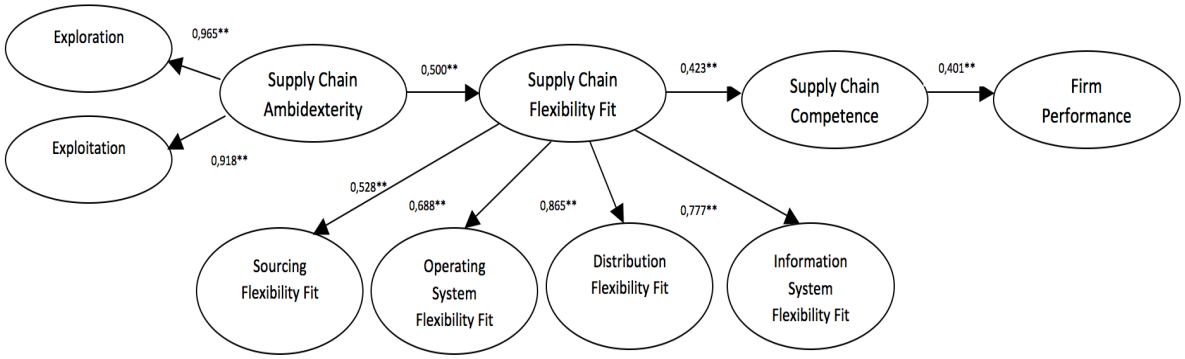
2.4.2. Hypotheses testing results

Table 2.8 and Figure 2.2 show the estimation values of the standardized coefficients for the representative parameters for each research hypothesis as well as their respective significance levels.

Table 2.8: Structural equations model

Parameters and Relationships	Standardized coefficients (t-value)	R^2
Supply Chain Ambidexterity → Supply Chain Flexibility Fit	0.500** (12.227)	0.250
Supply Chain Flexibility Fit→ Supply Chain Competence	0.423** (6.860)	0.179
Supply Chain Competence →Firm Performance	0.401*** (6.503)	0.160

Figure 2.2: Structural equations modeling results with standardized parameter estimated



**significant at a significance level of 0.05

The results show a significant and positive impact of SC ambidexterity on SCF fit (β=0.500; t=12.227; p <0.05), thus empirically confirming Hypothesis 1, as proposed in the theoretical framework. This result shows the extent to which ambidexterity is found to be positively related to SCF fit. To date, this relationship has received only slight attention in the literature. This result is consistent with the results obtained by Kristal et al. (2010), Tamayo Torres et al. (2011), and Patel et al. (2012), all of whom show the efficacy of the practice of ambidexterity in the area of Operations Management. The evidence provided underscores the importance of SC ambidexterity as an antecedent of SCF. The knowledge acquired via exploration and exploitation allows rapid adaptation to market evolution and facilitates capturing the relevant information in a more precise way and anticipating market tendencies, thus enabling the SC to have the flexibility required by the environment. This result shows that adopting the practices of exploration and exploitation simultaneously is a good strategy for achieving the level of SCF that the environment requires. Ambidexterity avoids incurring both excess rigidity and excess flexibility in the SC. This result also provides empirical evidence for the exclusively theoretical proposition by Kauppila (2007) that adopting a strategy of ambidexterity is plausible in the organizational areas that compose a network.

The results also show a positive and significant impact of SCF fit on SC competence (β=0.423; t=6.860; p<0.05), and provides empirical evidence to confirm Hypothesis 2 of

the proposed model. It can be affirmed that fitting SC strategy to the demands of the environment in matters of flexibility positively influences SC competence. The smaller the SCF gap, the better the results obtained in the SC's efficacy and efficiency. This result is consistent with propositions that argue that successful systems move toward an ideal state through a dynamic process (Webb and Pettigrew, 1999; Zajac et al., 2000). Furthermore, this result responds to the controversies found in the literature reviewed on whether satisfying the needs managers perceive as related to the environment has a positive impact on competence. The evidence found in this study shows that the better SCs adjust their flexibility to their context, the higher the level of their competence. They thus show that a strategy to improve SC competence consists of establishing the level of flexibility best adapted to the demands perceived. This result is also consistent with previous studies of Martínez-Costa et al. (2008) and Liu et al. (2010).

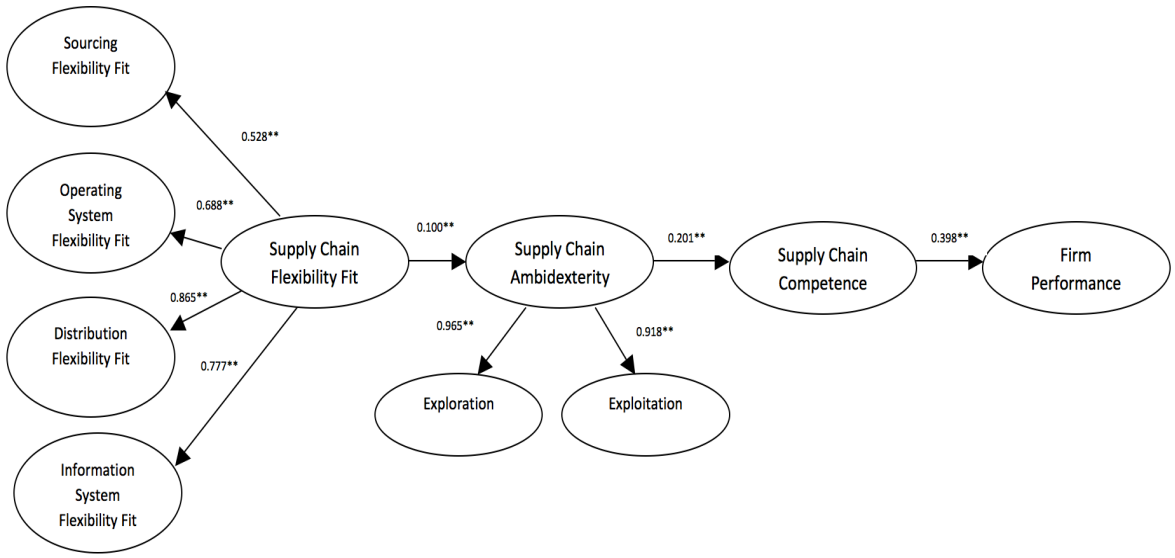
Finally, there is a significant and positive relationship between SC competence and firm performance (Hypothesis 3, β= 0.401; t=6.503; p <0.05), which is consistent with the studies by Li et al. (2006) and Qrunfleh and Tarafdar (2014). Improving efficacy and efficiency in the SC thus has positive and significant implications for organizational results. If a SC has high competence, the firm will see its results improve, since better competence means lower cost, better quality, and a decrease in delivery time. The result indicates that those firms that improve their SC competence show better business results relative to the competition. In the literature reviewed, this relationship is usually assumed (Martínez-Sánchez and Pérez-Pérez, 2005), although it is not tested empirically. The evidence shows the importance of differentiating between SC level and organizational level as well as the influence of SCM on firm performance. This study thus confirms that SCM can become a key competitive weapon for firms.

2.4.3. Test of Robustness

To ensure that the proposed model does not suffer from problems of endogeneity, a test of robustness was performed. Two alternative models were estimated and their global fits compared (Jöreskog, 1993; Tanriverdi, 2005). While keeping the other relationships constant, the first model assumed that SCF fit influences SC ambidexterity, which in turn influences SC competence. The second model, while also keeping the

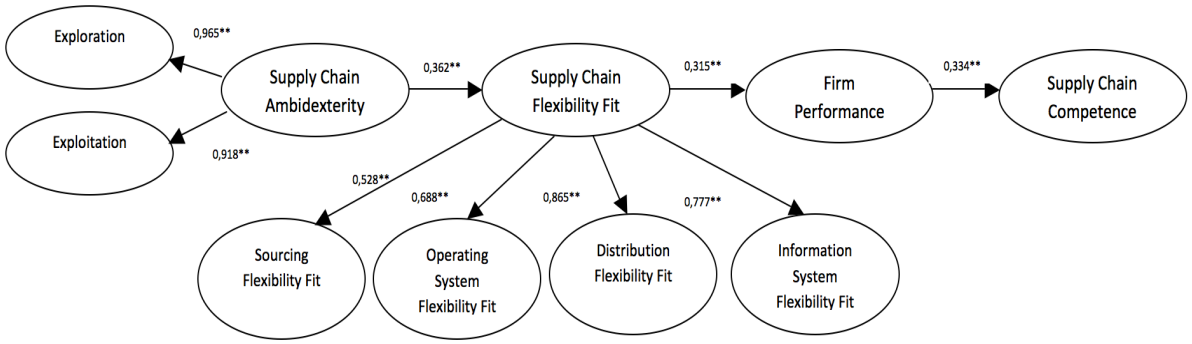
other relationships constant, assumed that SCF fit influences firm performance, which in turn influences SC competence. The estimation results for the two alternative models and their respective fit indices are included in Figure 2.3 and Figure 2.4. As they show, the alternative models present a worse fit than the proposed model, thus affirming that the proposed model gives a better explanation of the data (e.g. Braojos-Gomez et al., 2015; Benitez-Amado et al., 2015).

Figure 2.3: Alternative model 1



Chi-Square=508.950 ($p<0.001$); GFI=0.890; RMSR= 0.027; RMSEA=0.067; AGFI=0.880; NFI=0.900; NNFI=0.918; CFI=0.920; IFI= 0.920

Figure 2.4: Alternative Model 2



Chi-Square=729.897 (p<0.001); GFI=0.885; RMSR= 0.188; RMSEA=0.10; AGFI=0.859; NFI=0.869; NNFI=0.880; CFI=0.889; IFI= 0.889

2.5. Conclusions, limitations, and directions for future research

The results demonstrate empirically that developing knowledge exploration and exploitation practices in the SC improves the SC's general efficacy in achieving the flexibility needed and improving competence, which has a positive impact on the firm performance.

2.5.1. Theoretical contributions

This study makes important contributions to the literature on SCM. First, it deepens and demarcates the concept of SC ambidexterity, which has barely been developed in the prior literature (Kristal et al., 2010). This advance overcomes the limitations that have hindered its study to date (Birkinshaw and Gupta, 2013). Further, this is one of the first studies to analyse the effects of exploration and exploitation practices on an organizational network and to demonstrate that the SC is a context in which high levels of both practices are plausible simultaneously.

The prior literature indicates that simultaneous practice of exploration and exploitation increases the organizational unit's survival level (O'Reilly and Tushman, 2013). These studies do not, however, analyse the mechanism by which this effect is produced. This study fills this gap by determining that the effect occurs in SC through these practices' positive impact on SCF. This finding is especially important, and it is new because prior studies link exploration practices to increase in flexibility and exploitation practices to the opposite effect (Miller et al., 2006).This study demonstrates empirically that high levels of exploration together with high levels of exploitation not only have positive effects on SCF but also facilitate achievement of the level of SCF required by the environment. This means that a firm must find "new information about alternatives and thus improving future returns" (March, 1991, p. 72) while also purifying and refining current routines if it wishes to achieve the right level of SCF.

Further, this study develops and validates a scale for measuring SCF, which is called SCF fit in this study. There are multiple theoretical models of SCF but hardly any valid measurement instruments, and the prior literature indicates the need to develop these (Stevenson and Spring, 2007). This study thus proposes a new scale for SCF, whose main advantage is that it takes into account the demands and requirements of the environment. These demands and requirements are a key element in all definitions of SCF, although they have not been included in the scales developed to date.

This study demonstrates empirically that reproducing the SCF structures and strategies most widely used in the sector has a positive effect on SC competence and business results. This means that isomorphism, which has shown controversial results in other areas (Barreto and Baden-Fuller, 2006; Heugens and Lander, 2009; Miemczyk, 2008), leads to better results in the area of SCF.

Finally, this study is one of the first to analyse the impact of SCF on the SC itself, as Stevenson and Spring (2007) recommend. Until now, study of the SC has been dominated by a view based on the firm and has ignored the need to use the SC as unit of analysis, since rivalry between manufacturing firms has been displaced by competition between SCs (Spekman et al., 2002).This is also one of the first studies to analyse the impact of SC competence on firm performance (Chow et al., 2008; Green et al., 2014). Research on SCM is dominated by the idea that the SC's competence and capability

have a positive impact on the organization's results, but few empirical studies test this relationship (Qrunfleh and Tarafdar, 2014). The article therefore fills this research gap.

2.5.2. Implications for Supply Chain Managers

This study also makes important contributions to managerial practice. First, understanding how to foster SCF is crucial. As firms develop their activity in markets that require increased flexibility, it is essential that managers understand what strategies can improve flexibility. Verification of Hypothesis 1 in the model translates into business practice insofar as high use of the SC's existing competences to lower costs and increase its reliability (exploitation) does not penalize its flexibility as long as new knowledge and ideas are sought for exploration in the SC. That is, high levels of exploration and exploitation are compatible in the SC and lead to the right level of SCF. This study thus stresses the need for SC managers to perform both practices of refinement and reuse of routines and practices of experimentation and innovation to achieve good SCF fit. Managers do not have to choose between a high level of exploration or exploitation but can opt for high development of both practices. This finding implies a change in the strategies that the literature has traditionally recommended for achieving flexibility (Miller et al., 2006).

Second, verifying Hypothesis 1 also suggests that managers must attend not only to learning practices in the firm but also to those in the network of organizations that form its SC. That is, they must manage their partners' learning, which means that they must create an environment that encourages such learning through collaboration and cooperation (Spekman et al., 2002).

Third, this study provides a measurement instrument that enables managers to diagnose the flexibility level of the SC they manage and identify its lack of correspondence (if this is the case) with the optimal level. It also enables them to establish comparisons between different SCs. Further development of the concept of SCF fit and its positive impact on SC competence implies that the idea the best SC is the most flexible is incorrect (Stevenson and Spring, 2007) since what is important is that the SC has the degree of flexibility required by its environment.

Fourth, this study shows that reproducing the most widely used practices in the sector in matters relating to SCF has a positive effect on level of SC competence. Thus, when making decisions about SCF, managers should satisfy the pressures and demands of the sector in which they act and not make decisions based solely on criteria of profitability and efficiency.

Fifth, this study is useful for decision-making in which managers seek to improve the competence of the SC they manage. It provides them with key dimensions to modify (sourcing flexibility, operating system flexibility, distribution flexibility, and information system flexibility), as well as a reference point for establishing their goals (the SC considered as excellent in the sector).

Finally, this study shows that SCF fit is a source of competitive advantage in a firm through its impact on SC competence. This finding stresses that the competence and capability of the organizational network in which the firm operates influence its benefits. Specifically, this study has shown the importance of efficiency in SC operations for firm results. This finding implies a paradigm change in management: one must erase the distinction between what constitutes a firm and what makes up its network, as managers must manage the assets and competences of both the firm and the SC.

2.5.3. Research limitations and future research

In spite of the important contributions of this study for both the academic and managerial fields, it has several limitations. First, since 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 followed the recommendation of Vachon and Klassen (2006), 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. However, adopting these remedies does not entirely eliminate the risk that common method bias may inflate or attenuate the relationships studied (Richardson et al., 2009). Future studies could confirm the results obtained by using various key informants, and, following the recommendation by Junni et al. (2013), by utilizing multiple informants on ambidexterity.

Second, this research was unable to analyse the impact of ambidexterity on SCF over time. Very few studies analyse ambidexterity with longitudinal data (Raisch et al., 2009), and future studies might incorporate this dynamic component. When evaluating SCF fit with cross-sectional data, there is a risk of analyzing a temporary situation in the organization but not its capability for flexibility over time.

Third, SC ambidexterity, SCF fit, and SC competence were evaluated from the perceptions of one manager from one of the firms composing the SC. Following Stevenson and Spring (2007), it is crucial that future studies incorporate the perceptions of other members of the same SC.

Fourth, the scale of Dess and Robinson (1984) used to measure firm performance, although widely used, does not take into account either the multidimensional nature of this construct or its time-dependent character (Richard et al., 2009). The scale used to measure information system flexibility fit was adopted from the original study by Moon et al. (2012) and has fewer than three items, which could create problems of reliability. Further, as reported, the data collected are not normal at either univariate or multivariate levels, a result that could influence the global fit indices of the model. However, we used an estimation method (ML robust) to deal with this problem (Byrne, 2006).

Given ambidexterity's nature as a multilevel phenomenon (Raisch and Birkinshaw, 2008; Birkinshaw and Gupta, 2013), it would be interesting to have future studies analyse SC ambidexterity on different levels simultaneously and incorporate analysis of knowledge flows in the SC as analysed by Mom et al. (2007). This study would also be a useful starting point for development of new measures of SCF fit that adopt the same methodological approach.

Finally, it would be interesting for future studies to focus exclusively on one or two industries to test this model and determine whether there are significant changes in the results.

Appendix: Items used in this study

Supply Chain Ambidexterity (Kristal et al., 2010)

Exploitation

Expl1.- In order to stay competitive, our supply chain managers focus on reducing operational redundancies in our existing processees.

Expl2.- Leveraging of our current supply chain technologies is important to our firm's strategy.

Expl3.- In order to stay competitive, our supply chain managers focus on improving our existing technologies.

Expl4.- Our managers focus on developing stronger competencies in our existing supply chain processes.

Exploration

Exlr1.- We proactively pursue new supply chain solutions.

Exlr2.- We continually experiment to find new solutions that will improve our supply chain.

Exlr3.- To improve our supply chain, we continually explore for new opportunities.

Exlr4.- We are constantly seeking novel approaches in order to solve supply chain problems.

Supply Chain Flexibility Fit

The following questions were posed to determine the SCF required ("excellent firms in our sector…") and real flexibility ("in our firm…"). The respondents were asked to select the level of agreement (1= strongly disagree, 7=strongly agree) based on what they perceived in their own firm and in the business environment.

Sourcing Flexibility Fit

SFF1.- Number of available suppliers.

SFF2.- Range of products and services provided by major suppliers.

SFF3.- Range of suppliers that provide major materials/components/products.

Operating System Flexibility Fit

OSF1.- Range of new products or services the firm can develop every year.

OSF2.- Ability to change output volume.

OSF3.- Ability to change products and services mix.

OSF4.- Ability to adjust manufacturing facilities and processes.

Distribution Flexibility Fit

DFF1.- Ability to change storage space, loading capability, and other distribution installations.

DFF2.- Ability to change delivery modes.

DFF3.- Ability to transfer delivery schedules.

Information System Flexibility Fit

ISFF1.- Support of information systems in transportation and distribution management.

ISFF2.- Support of information systems in firm inventory management.

Supply Chain Competence (Qrunfleh and Tarafdar, 2014)

Our supply chain

SCC1.- Is able to handle nonstandard orders.

SCC2.- Is able to meet special customer specification requirements.

SCC3.- Is able to produce products characterized by numerous features options, sizes and colors.

SCC4.- Is able to rapidly adjust capacity so as to accelerate or decelerate production in response to changes in customer demands.

SCC5.- Is able to rapidly introduce large numbers of product improvements/ variation.

SCC6.- Is able to handle rapid introduction of new products.

SCC7.- Has fast customer response time.

SCC8.- Is characterized by a great amount of cross-over of the activities of our firm and our trading partners.

SCC9.- Is characterized by a high level of integration of information systems in our firm.

SCC10.- Has a short-order-to-delivery cycle time.

Firm Performance (Dess and Robinson, 1984)

Compare your firm to firms of similar sales volume in your industry and region relative to (1 = relatively weak, 7 = market leader)

FP1.- Your firm's total sales growth.

FP2.- Your firm's after tax return on total assets.

FP3.- Comparing your firm to your competitors, what percent of ideal or optimal performance do you personally feel that your firm is achieving in your industry? (1= the minimum, 7= the maximum).

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CAPÍTULO 3

HOW CAN AMBIDEXTERITY AND IT COMPETENCE IMPROVE SUPPLY CHAIN FLEXIBILITY? A RESOURCE-BASED VIEW

HOW CAN AMBIDEXTERITY AND IT COMPETENCE IMPROVE SUPPLY CHAIN FLEXIBILITY? A RESOURCE-BASED VIEW

Abstract

Supply chain flexibility (SCF) has become an important competitive weapon for companies in the current environment characterized by dynamism. In this context, this paper uses the resource-based view (RBV) and the theory of dynamic capabilities to explore the influence of supply chain (SC) ambidexterity on SCF. It also theorizes the moderating effect of information technology (IT) competence on the relationship between SC ambidexterity and SCF. Whereas prior research focuses on the positive results of SCF for business performance, little empirical research studies its facilitators, leaving a gap this study seeks to fill. Following the literature on hierarchy of capabilities, this study proposes that SCF is a higher-order capability, and that the presence of lower-order capabilities such as IT competence facilitates the relationship between SC ambidexterity and SCF. These hypotheses are tested with data from a survey of 302 manufacturing firms using hierarchical regression methodology. As expected, the study confirms that SC ambidexterity is an antecedent of SCF and has a positive moderating effect on IT competence. Finally, theoretical and practical implications are discussed.

Keywords: Ambidexterity; Supply chain flexibility; IT competence; Resource-based view; Dynamic capabilities.

3.1. Introduction

Supply chain flexibility (SCF) has been identified as one of the most relevant topics in research on supply chain management (SCM). Having a flexible supply chain (SC) is a key weapon for achieving competitive advantage in the current environment, characterized by dynamism, uncertainty, and unpredictability (Braunscheidel and Suresh, 2009; Gunasekaran et al., 2001).

For this reason, a significant body of literature has emerged to study SCF. While abundant, this literature focuses specifically on studying the benefits and effects reported, and SCF's positive effect on firm performance is widely recognized (Ngai et al., 2011). A significant gap exists in the literature, however; hardly any studies develop deeper understanding of the strategies and practices that facilitate SCF, a gap indicated by Swafford et al. (2006). Although an abundant prior literature shows that SCF leads to greater performance, no agreement exists on the different ways of achieving this improvement.

The study thus first asserts that implementation of SC ambidexterity can have a positive effect on SCF, conceptualizing SC ambidexterity as the simultaneous implementation of practices of exploitation of current knowledge and exploration and creation of new knowledge (Kristal et al. 2010; March, 1991). Although the benefits of ambidexterity at organizational level have been widely researched (O'Reilly and Tushman, 2013), they have received very little study in the area of SC operations (Im and Rai, 2008; Patel et al., 2012). Evidence exists that better adaptation to the environment is achieved by means of the learning acquired via exploration and exploitation (Lumpkin and Lichtenstein, 2005; McNiff, 2000; Santos-Vijande et al., 2012),and adaptation to the environment requires flexibility (Krajewski et al., 2005). The strategy of ambidexterity thus has a positive effect on SCF. Further, basing its arguments on the resource-based view (RBV) and the theory of dynamic capabilities, this study proposes that SCF is a dynamic, or higher-order, capability facilitated by simultaneous implementation of knowledge exploration and exploitation practices in the SC.

Second, the positive moderating effect of information technology (IT) competence on the relationship between SC ambidexterity and SCF is analyzed. IT competence must be studied because knowledge management is an IT-driven capability, and changes in IT

may influence the outcomes of knowledge management (Setia and Patel, 2013). Empirical study is needed to understand the mechanisms underlying IT capabilities in this context (Ray et al., 2005; Wu et al., 2006), both because it is common business practice to use numerous ITs in SC and operational knowledge management (Fawcett et al., 2011), and because little is known about how IT competence enables superior performance of knowledge management in the SC. From the RBV, Wade and Hulland (2004, pp.109) hold that "information systems exert their influence on the firm through complementary relationships with other firm assets and capabilities". It is thus argued that the effect of IT competence on organization occurs through other organizational capabilities and assets, since IT competence is a lower-order capability whose presence facilitates other higher-order capabilities (Liu et al., 2013). Since SCF is a dynamic capability, it is proposed that the influence of ambidexterity on SCF will be strengthened in the presence of high IT competence, as the latter facilitates greater coordination in management of the knowledge obtained through exploration and exploitation, due to increased speed in perceiving change and adapting SC connections (Gosain et al., 2005). This relationship is thus grounded in prior studies, such as that by Perez Lopez et al. (2009), which demonstrates empirically the facilitating effect of IT competence on knowledge management practices, encouraging development of organizational structures that facilitate the development and expansion of knowledge, a result also supported in the study of Chuang et al. (2013). Further, some authors have recently begun to call for study of the relationships between these three variables. Lee et al. (2015) state that it is necessary to clarify how ambidexterity and use of IT resources encourage organizational agility. These authors propose that IT management abilities (or IT competence) encourage organizational agility insofar as they contribute to proper implementation and deployment of the information systems required. Finally, from the perspective of business practice, it is necessary to understand the role IT competence plays in SC performance (such as SC flexibility), due to results are mixed on this issue. Some firms report that investment in IT capability improves SC performance, but others do not obtain this effect, or argue that it can even have negative effect on performance (Zhang et al., 2016).

Taking this background into account, the current study provides a theoretical framework of strategies and capabilities that improve SCF. Specifically, it focuses on practices related to knowledge management, analyzing the impact of SC ambidexterity, as well as the positive moderating effect of IT competence on this relationship.

This article thus seeks to make three contributions to the literature of IT and SCM. The first is to deepen understanding of the conceptual definition of SC ambidexterity and to study its effects on the level of SCF. The second is to study the moderating effect of IT competence on this relationship. The third is to use the RBV and its extension in dynamic capabilities to explain the relationships between SC ambidexterity, SCF and IT competence.

To analyze these goals, the rest of the article is structured as follows: Section 3.2. presents the theoretical foundations of the conceptual model proposed and the hypotheses that compose it. Sections 3.3. and 3.4.1. present the research methodology and analyses performed, as well as the results and discussion of them. Finally, Section 3.4.2., 3.4.3. and 3.4.4. confirms the study's conclusions and its limitations and future lines of research.

3.2. Theoretical framework and hypotheses development

3.2.1. Supply chain ambidexterity

The concept of ambidexterity has seen growing interest in organizational theory, becoming one of the paradigms for current research (Raisch et al., 2009). Ambidexterity is understood as the ability to exploit current knowledge while simultaneously exploring and creating new knowledge (Levinthal and March, 1993; March, 1991).

The first studies of ambidexterity focused on determining whether exploration and exploitation practices could be compatible. Whereas older studies hold that the tasks or routines required for exploiting existing knowledge differ completely from those used for exploring new, and even warn of the risks of falling into "failure traps" and "success traps" (Levinthal and March, 1993), subsequent studies show the compatibility of the two (Cao et al., 2009), considering exploration and exploitation as two parts of the same learning process. Since this compatibility has been demonstrated, current research focuses on analyzing its benefits. The benefits of implementing ambidexterity have been demonstrated on the level of the organization, business unit, project, and alliance between companies (Birkinshaw and Gupta, 2013; O'Reilly and Tushman, 2013), but

there has been very little study in the area of operations and the SC (Im and Rai, 2008; Tamayo-Torres et al., 2011). In this context, our study develops deeper understanding of SC ambidexterity.

The current study adopts the conceptualization by (Kristal et al., 2010, pp. 415) of SC ambidexterity as "a manufacturing firm's strategic choice (managerial emphasis) to simultaneously pursue both supply chain exploration and exploitation practices". This strategy is justified by the fact that it is easier to implement ambidexterity in organizational networks (Kristal et al., 2010), since this involves combining the organization's own knowledge with external knowledge and since the SC is "the network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer"(Christopher, 2005 pp. 17). Along these lines, O'Reilly and Tushman (2013) argue that research on ambidexterity should not limit its scope to the area of the firm but should extend to the firm's strategy with the agents with which it interacts.

The literature reviews on ambidexterity by Cao et al. (2009) and Birkinshaw and Gupta (2013) indicate incongruences in the prior research. To advance study of this topic and obtain consistent results, research must resolve the problems detected, which are described as follows. The main problem in the research to date is operationalization of the construct of ambidexterity indiscriminately as both balance (He and Wong, 2004) and the sum or combination of the practices of exploration and exploitation (Gibson and Birkinshaw, 2004). Depending on the point of view adopted, the same organization may thus be classified as having either a high or a low degree of ambidexterity. Further, the way of measuring ambidexterity differs from study to study. Ambidexterity understood as the combination of exploration and exploitation has been measured as both the sum and the product of the constructs of exploration and exploitation. In contrast, studies that understand ambidexterity as an equilibrium between the two practices measure the absolute value of the difference between exploration and exploitation. A third, intermediate method considers ambidexterity as having two dimensions: the balance between exploration and exploitation and their combination (Birkinshaw and Gupta, 2013). According to Junni et al. (2013), considering ambidexterity as a combination of these two practices captures its effects better than

measures that consider it as a balance between exploration and exploitation. The best effects of this strategy are thus obtained when high levels of exploration and exploitation are achieved simultaneously, not when an optimal point or balance between the two practices is sought. This study thus conceives SC ambidexterity as the combination of both practices.

3.2.2. The resource-based view (RBV) and dynamic capabilities

In the research on Strategic Management, the theoretical framework currently most used to explain the success of firms is the resource-based view (RBV). The RBV explains the foundation of strategies that enable achievement of competitive advantage (Ray et al., 2005). This approach argues that only from assets, resources, and capabilities that unique, valuable, rare, imperfectly imitable, and non-substitutable (VRIN) characteristics can firms develop strategies to achieve competitive advantage and greater benefit than their competition (Barney, 1991).

The theory of dynamic capabilities develops from the static perspective of the RBV, beginning with the study by Teece et al. (1997). According to this theory, in unpredictable environments with high uncertainty, a firm may at a given moment possess the resources indicated by Barney (1991), but this does not guarantee a competitive advantage sustained over time (Helfat and Peteraf, 2003). Dynamic capabilities enable the firm to achieve a long-term competitive advantage. Teece et al. (1997, p.516) define them as "the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments". According to Zollo and Winter (2002), dynamic capabilities are a complex set of abilities through which organizations systematically modify their operating routines and reconfigure their resources and abilities to achieve good adaptation to the changing demands of the market.

Some authors have attempted to establish how these capabilities are related amongst themselves, establishing a hierarchy among them (Rai et al., 2006; Sambamurthy et al., 2003). They thus usually differentiate between fundamental, or lower-level, and higher-level capabilities. Higher-order capabilities, developed through lower-order ones, lead the firm to obtain better benefits and to achieve competitive

advantage. Lower-order capabilities in themselves have no impact on entrepreneurial benefits but influence them through their role of facilitating higher-order capabilities (Grewal and Slotegraaf, 2007; Kraaijenbrink et al, 2010).

3.2.3. Supply Chain Flexibility

The current business environment, characterized by uncertain demand and a high degree of volatility, presents a challenge for SCM, as it requires firms to possess flexible supply chains. Flexible SCs are able to adapt effectively to interruptions in supply and changes in demand, while maintaining constant levels of delivery of service to the customer (Stevenson and Spring, 2007). Tachizawa and Gimenez (2009) define SCF as the ability of the firm's purchasing function to respond effectively, rapidly, and at the lowest cost possible in order to change the requirements for components that it buys in terms of volume, mix, and delivery date. This definition synthesizes the advantaged linked to SCF: efficacy, lower cost, and rapid response. Despite the variety of conceptualizations of SCF, all theoretical definitions describe it as an ability of SC function to react to changes in the environment.

Although multiple theoretical models outline the dimensions of SCF (Duclos et al., 2003; Lummus et al., 2005; Martínez Sánchez and Pérez Pérez, 2005), most share two problems: they confuse two dimensions inherent in manufacturing flexibility with those of SCF, making it harder to establish a clean distinction between the two concepts. They also lack a measurement scale that operationalizes their conceptualization (Stevenson and Spring, 2007). This study thus follows the model proposed by Moon et al. (2012) who solve these two problems. These authors propose that SCF is a construct composed of the following dimensions: sourcing flexibility, defined as the availability of materials and services and the ability to purchase them according to changing needs; operating system flexibility, defined as the capability to provide products with a wide variety of characteristics, combinations, and volumes to satisfy multiple specifications for customers; distribution flexibility, defined as the firm's ability to manage its distributors, warehouses, loading capability, and other distribution installations effectively and efficiently; and information system flexibility, understood as the ability of the firm's information systems to adapt to changing market circumstances, especially in situations of unexpected misfit.

Having a flexible SC can be a reactive capability, but it can also perform a strategic role in the firm. In environments with uncertainty, firms that have a flexible SC can develop a competitive advantage from it (Gerwin, 1993). Following this argument, Gerwin (1993) underscores that SCF not only permits adaptation to change in the environment but also enables the creation of uncertainties that competitors cannot fight. The literature is in nearly unanimous agreement on the positive effect of SCF on organizational performance (Aprile et al, 2005; Blome et al., 2013; Martínez Sánchez and Pérez Pérez, 2005; Swink et al., 2005). The mechanisms underlying this capability have hardly been researched, however. Since it has been shown that SCF precedes firm benefits and is a source of competitive advantage, research must focus on providing a theoretical explanation, consistent with the prior literature on why SCF has this beneficial effect on business results. Research must also study what strategies and mechanisms encourage achieving these results. This article seeks to fill this gap.

Starting from the demonstrated positive effect of SCF on performance, and following Barney (1997), this study argues that SCF is VRIN, which explains why the prior literature shows it to be a precursor of competitive advantage. SCF is not a question of rules and procedures, a quality that makes it difficult to imitate. Rather, it is a capability generated by coordination and integration among different members and functions of the SC. It is also complex and rare, as it requires management of the SC as a single entity (Croom et al., 2000), and many organizations lack these abilities. Finally, SCF is valuable since, for example, it has the capability to prevent the firm from being affected by interruptions in supply (Blome et al., 2014). This article argues that SCF is not only a VRIN capability, but that it can be considered as a dynamic capability in so far as it can serve the firm to take advantage of opportunities and neutralize threats, and require the firm to modify its operating routines and reconfigure its resources and abilities to adapt to market changes. This argument follows the lines of studies like Blome et al. (2013) and Liu et al. (2013). Its approach of understanding SCF as a dynamic capability is consistent with Makadok (2001), which argues that dynamic capabilities are constructed by the firm and cannot be bought on the market, since SCF requires a way of understanding network connections and the relationships that compose it are thus impossible to acquire.

3.2.4. Effect of Supply Chain ambidexterity on Supply Chain Flexibility

While ambidexterity has recently begun to be studied in the area of operations and SCM (Kristal et al., 2010; Patel et al., 2012), the relationship of SC ambidexterity to the SC and SCF has not been tackled directly. The first study to propose this relationship tangentially is Adler et al. (2009), which suggests that combining exploration and exploitation in the firm's operating processes improves long-term flexibility.

SCF permits the organization to respond immediately to unexpected market changes. It is important for an organization to be able to learn continually in order to be prepared for any challenge from its environment (Ngai et al., 2011). Organizations that learn from their current competences and current activities (exploitation), while simultaneously integrating this knowledge with knowledge from outside the organization and putting new abilities into practice (exploration), can learn from their customers, competitors, and market situation. Such learning makes it easier for the firm to recognize unforeseen changes and market trends and to react to them (Tippins and Sohi, 2003). Hernández-Espallardo et al. (2010) also show the importance of learning and sharing knowledge in SCs.

Organizational units that learn can capture relevant information precisely and at the right moment to anticipate market tendencies and discard routines that are no longer operational. Khazanchi et al. (2007) stress that capability to adapt to the environment is characteristic of units that promote exploration and exploitation together. Popadiuk (2012) indicates that the learning process (derived from combining exploration and exploitation) leads to adaptation to a new context.

Gosain et al. (2005) show empirically that the organizations that compose the SC learn to adjust rapidly, such that learning facilitates adaptation to the environment and the other SC members. Likewise, Beer et al., (2005) and Lumpkin and Lichtenstein (2005) recognize the role that learning plays in strengthening the firm's ability to recognize opportunities and to adapt continually to the environment. Sharing this study's approach on understanding SCF as a dynamic capability, Ancona et al. (2001) suggest that dynamic capabilities develop from innovations based on exploration and exploitation.

According to the literature review, this study proposes that implementing learning practices based both on refinement and perfection of existing routines and competences (exploitation practices) and on the testing and elimination of new routines and competences (exploration practices) produces recombination of internal and external knowledge that leads to improvement in SCF. We thus formulate the first study hypothesis:

H1: Supply Chain ambidexterity is positively associated with Supply Chain Flexibility.

3.2.5. Moderating effect of IT competence on the relationship between Supply Chain ambidexterity and Supply Chain Flexibility

The prior literature shows that IT resources are ineffective in improving performance, as they are widely available in factors markets. The literature also provides evidence, however, for the existence of IT resources that can be combined to form an IT competence or capability that is valuable, rare, difficult to imitate and difficult to replace (Perez et al., 2015; Wade and Hulland, 2004). Bharadwaj et al. (2002) define IT capacity as the firm's ability to acquire, develop and manage its IT resources to determine and support its business strategies and value chain activities. For Tippins and Sohi (2003, p. 748), an IT competence represents the degree to which a firm possess IT knowledge and uses it effectively to manage the information generated in the firm. As conceptualized by these authors, IT competence is composed of three dimensions: IT knowledge, the extent to which a firm possesses a body of technical knowledge of IT objects, it is a technical knowledge that can be identified with the firm's IT know-how; IT operations, the extent to which a firm uses IT to manage the market and consumer information, this dimension refer to the operations, techniques, activities and abilities that show the firm technical knowledge of the firm in IT; and IT objects, which include software, hardware and support personnel in the firm and are thus the IT tools that enable the acquisition, processing, storing, dissemination and use of the information. Taken together, these three dimensions represent the firm's specialized resources and are indicative of its ability to understand and employ IT tools and processes to manage information from the market and its customers. This way of conceptualizing IT competence has the advantage of avoiding the main difficulties

involved in the study of ITs, which derive from the following facts: i) new IT tools are being developed constantly. As new technologies are generalized and made available for firms, the results of the prior studies of older technologies become useless; and ii) many of the advantages obtained by firms through adoption of a specific IT have a very short duration, since these advantages disappear, when the technologies are generalized or become obsolete (Tippins and Sohi, 2003).

Although many articles have examined the role that IT competence or capability should have, extensive debate exists about the definition of an IT competence and about what mechanisms produce improvements in performance (Mikalef and Pateli, 2017). Based on their meta-analysis to determine the impact of IT on organizational performance, Sabherwal and Jeyaraj (2015) conclude that IT adoption or use, IT alignment and interorganizational IT have a positive impact on firm performance, unlike variables such as IT investments, IT infrastructure, IT assets and IT sophistication.

According to Kohli and Grover (2008), IT competence should be measured and examined in terms of the organizational processes it enable. IT capabilities improve new product development (Pavlou and El Sawy, 2010), supply chain practices (Devaraj et al., 2007), quality practices (Perez et al., 2015), agility (Roberts and Grover, 2012) and operational absorptive capacity (Setia and Patel, 2013).

According to the capability-hierarchy principle, certain lower-order capabilities precede higher-order capabilities (Grant, 1996). The most recent studies, which follow the RBV and hierarchy of firm capabilities, hold that IT competence is a fundamental, lower-order capability that deploys its effects in the firm only through higher-order capabilities, such as SCF (Liu et al., 2013; Rai et al., 2006; Sambamurthy et al., 2003).

Furthermore, the facilitating or moderating role of IT in the relationship between other variables has been demonstrated empirically, for example, in the relationship between endogenous knowledge management and improvement of dynamic capabilities, and the relationship between exogenous knowledge management and improvement of dynamic capabilities (Sher and Lee, 2004).

Taking this background into account, this study proposes that the positive effect of SC ambidexterity on SCF is strengthened when the firm possesses IT competence. Thus, IT competence can strengthen the ability of the knowledge acquired via exploration and exploitation to enable identification of market change more rapidly and to communicate this change to other members of the SC to enable coordination of a joint response. According to the empirical study by DeGroote and Marx (2013) IT competence improves the quality of the information transmitted throughout the SC and coordination of the actions that SC members adopt in response to market changes.

The quality of information communicated through the SC is based on coordinated decision making and actions (Simatupang and Sridharan, 2008). IT competence can thus play an important role in coordinated decision making, as it permits management of large quantities of data on market changes that should be distributed, assimilated, and used in the SC to achieve flexibility (DeGroote and Marx, 2013).

IT competence has been shown to improve the opportunity, accessibility, precision, appropriateness, and processing of information by means of the SC (Vickery et al., 2010). This capability can also improve the ability of firms in the SC to develop and implement coordinated responses to market changes at the right moment with precision and cost-effectiveness (Yusuf et al., 2004).

From the perspective of knowledge management, prior research shows the facilitating role of IT competence in knowledge management processes (Wang et al., 2007). Along these lines, McDermott (1999) affirms that IT is a crucial dimension to study in knowledge management. Further, Chuang et al. (2013) conclude that IT support is essential in initiating and performing knowledge management activities, as it permits reuse of current knowledge and rapid tackling of new knowledge needs. Likewise, Perez Lopez et al. (2009) demonstrate empirically the relationship between IT competence and all knowledge management processes (generation, transfer, coding, and storage). Alavi and Leidner (2001) hold that IT-based systems are developed to support and improve organizational processes for the creation, storage, recovery, transfer, and application of knowledge.

We thus propose that IT competence increases the effects of both exploration and exploitation (and thus of ambidexterity) on SCF.

IT competence enhances SC exploration by helping a firm to acquire and assimilate knowledge from SC partners and others firm departments. This effect stems from the fact that IT competence enhances technical coordination in the firm and informative coordination. IT competence improves technical coordination because it helps with synchronization of different data standards and with connecting communication networks across organizations (Setia and Patel, 2013). Greater technical coordination produces closer relationships among SC members and makes acquisition of knowledge from SC partners more reliable and efficient. Informative coordination is uniformity in information exchanges among different agents inside and outside the organization (Setia and Patel, 2013). IT competence improves informative coordination by enabling boundary-spanning processes across a firm's network (Dewet and Jones, 2001), processes that integrate knowledge acquisition and improve shared meaning in knowledge transfer. When access is uniform and meaning shared in the process of knowledge acquisition, interpretation, analysis and application of this knowledge converge, making the knowledge more effective (Szulanski, 1996; Zahra and George, 2002). This result is especially important in exploration practices in the SC, a network in which each member firm has its own organizational culture and know-how, making it harder to have a shared vision of quality, speed, etc. (Skarholt et al., 2016) and ultimately hindering knowledge exploration processes.

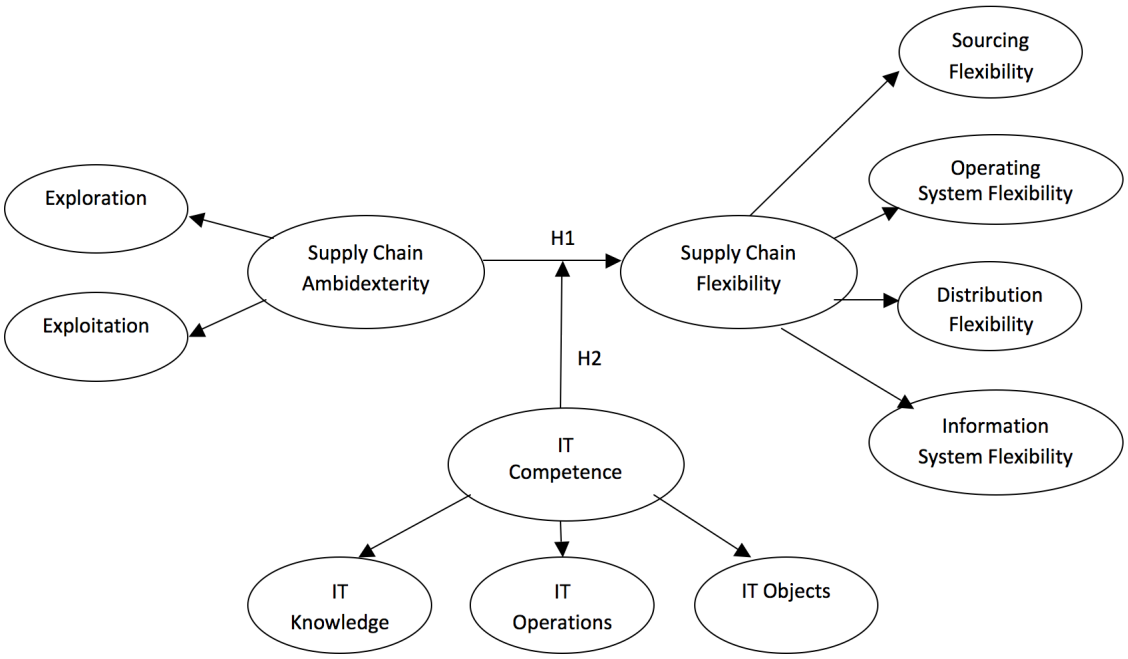
IT competence enhances SC exploitation by improving strategic coordination. Strategic coordination is needed for knowledge exploitation in organizational networks and is developed through discussions with SC partners (Setia and Patel, 2013). The exploitation and refinement of the SC's competences requires coordination of multiple interested parties (suppliers and distributors) who have their own business interests. Firms that possess IT competence are in the best condition to facilitate these discussions to improve strategic coordination, such as e-brainstorming, collaborative learning, e-meetings, etc. (Gallupe et al., 1992; Alavi, 1994; Dennis et al., 1988; Setia and Patel, 2013).

Specifically, we propose the following hypothesis:

H2: IT competence positively moderates the relationship between Supply Chain Ambidexterity and Supply Chain Flexibility.

Figure 3.1 represents visually the relationships proposed for empirical validation in the theoretical model developed.

Figure 3.1: Theoretical model



3.3. Methodology

3.3.1. Data collection and sampling

A detailed survey was designed to gather specific information about exploration and exploitation practices, SCF, and IT competence, as well as demographic data on the firms and their informants. Most of the survey questions were answered using a seven-point Likert scale. The questionnaire was developed by implementing the three-stage procedure followed by Moore and Benbasat (1991) to ensure the content validity of the measurement instruments employed.

To provide empirical evidence on the different research hypotheses proposed, we established the object of study as the set of Spanish manufacturing firms. The study population was obtained from the 2014 SABI database (Iberian Balance Sheet Analysis System), composed of 45,166 firms. We included only firms in the manufacturing sector that provided complete registry data (correct phone number, had not ceased activity, and had over 10 employees) and obtained a total of 2517 firms. The surveys were addressed to the individuals in charge of the firm's SC or, if this position did not exist, to those in charge of purchasing or to the general manager. Table 3.1 shows the characteristics of the informants and firms composing the sample.

To analyze the possibility of non response bias in the sample, we confirmed whether there were significant differences between the firms that responded first and those that responded at the end of the fieldwork. To do so, we divided the sample into responses obtained first (n= 170) and those obtained after more than one phone call (n= 132). We did not find significant differences between firms that responded first vs. last for any of the model variables. The results obtained thus support the absence of significant non response bias.

Table 3.1: Characteristics of the sample

	N	Percentage (%)
Informant		
SC Manager	81	26.82
Production Dept. Manager	130	43.05
General Manager	91	30.13
Total	302	100
Manufacturing industry[1]		
Food, beverage, and tobacco products	3	1
Textiles and apparel	5	1.65
Chemical and pharmaceutical	26	8.61
Plastics	28	9.27
Computers, electronics, and optics	23	7.61
Electrical equipment	30	9.93
Machinery and equipment	110	36.42
Furniture	47	15.57
Automotive	25	8.29
Other	5	1.65
Total	302	100
Firm size (no. employees)		
10-49	69	22.85
50-250	142	47.02
251-1000	58	19.20
Over 1000	33	10.93
Total	302	100

1 According to the International Standard Industrial Classification of All Economic Activities (ISIC).

3.3.2. Measurement scales

The variables of SC ambidexterity and IT competence were operationalized using scales from prior studies to guarantee their validity and reliability. All questionnaire items were answered through the informant's perceptual evaluation using a 7-point Likert scale on which 1 indicated maximum disagreement and 7 maximum agreement.

SC ambidexterity was measured using exploration and exploitation of the SC following the 8-item scale proposed by Kristal et al. (2010).

SCF was measured using the 13-item scale developed by Moon et al. (2012). These authors distinguish four dimensions of SCF: sourcing flexibility, operating system flexibility, distribution flexibility, and information system flexibility.

Finally, IT competence was measured by adapting the 15-item scale proposed by Tippins and Sohi (2003). The three dimensions these authors propose refer to resources that cumulatively indicate the organization's ability to use and understand IT tools and processes necessary to managing information on the market and demand: IT knowledge, IT operations, and IT objects.

3.3.2.1. Exploratory Factor Analysis

The first approach used to purify the measurement scales was exploratory factor analysis of principal components, using SPSS v.20 software for each set of questions predicted *ex ante* to represent each construct. After all measurement instruments were defined, another factor analysis was performed to verify the results of the initial exploratory analysis. The principal components method produced eight constructs with a value greater than 1.0 that represented 74,171 % of the total variance of the data. The factors obtained agree with prior expectations. Using VARIMAX rotation, the following factors were obtained:

Exlr: extent to which exploration practices are developed in the SC.

Exlp: extent to which exploitation practices are developed in the SC.

SF: sourcing flexibility.

OSF: operating system flexibility.

DF: distribution flexibility.

ISF: information system flexibility.

ITK: IT knowledge.

ITOp: IT operations.

ITOb: IT objects.

The results of the exploratory factor analysis are shown in Table 3.2.

Table 3.2: Exploratory Factor Analysis

Items	Factor 1 Exlp	Factor 2 Exlr	Factor 3 SF	Factor 4 OSF	Factor 5 DF	Factor 6 ITK	Factor 7 ISF	Factor 8 ITOp	Factor 9 ITOb
Exlp1	0.949								
Exlp2	0.961								
Exlp3	0.980								
Exlp4	0.925								
Exlr1		0.791							
Exlr2		0.976							
Exlr3		0.947							
Exlr4		0.911							
SF1			0.844						
SF2			0.857						
SF3			0.858						

Items	Factor 1 Exlp	Factor 2 Exlr	Factor 3 SF	Factor 4 OSF	Factor 5 DF	Factor 6 ITK	Factor 7 ISF	Factor 8 ITOp	Factor 9 ITOb
OSF1				0.933					
OSF2				0.947					
OSF3				0.988					
OSF4				0.970					
DF1					0.849				
DF2					0.857				
DF3					0.857				
ITK1						0.865			
ITK2						0.851			
ITK3						0.758			
ITK4						0.909			
ISF1							0.831		
ISF2							0.861		
ITOp1								0.780	
ITOp2								0.817	
ITOp3								0.819	
ITOp4								0.772	
ITOp5								0.846	
ITOp6								0.762	
ITOb1									0.751
ITOb2									0.755
ITOb3									0.711
ITOb4									0.718
ITOb5									0.780

3.3.2.2. Confirmatory Factor Analysis

The scales were evaluated using confirmatory factor analysis (CFA) with EQS 6.0 software. The scales' reliability was evaluated using the statistics for composite reliability, average variance extracted (AVE), and the Alpha Cronbach (Fornell and Larcker, 1981; Hair et al., 2004). Alpha Cronbach coefficients are used to measure the internal consistency of the constructs (Nunnally, 1978). All statistics calculated for composite reliability and the Alphas Cronbach take values above 0.7; the AVE values are over 0.5. These values are acceptable, demonstrating the scales' reliability and internal consistency (Hair et al., 2004), as can be seen in Table 3.3.

Table 3.3: CFA of the measurement scales

Item	Factor loadings	t-value	R^2	Scale reliability
Exploration (Exlr)				
Exlr1	0.764	a[1]	0.584	
Exlr2	0.810	14.620	0.655	CR: 0.895
Exlr3	0.807	14.567	0.651	AVE: 0.683
Exlr4	0.918	16.491	0.843	α: 0.863
Exploitation (Exlp)				
Exlp1	0.915	a	0.837	
Exlp2	0.915	26.890	0.837	CR: 0.958
Exlp3	0.951	30.182	0.903	AVE: 0.852
Exlp4	0.912	24.525	0.832	α: 0.945
Sourcing Flexibility (SF)				
SF1	0.821	a	0.674	CR: 0.884
SF2	0.834	15.993	0.696	AVE: 0.717
SF3	0.884	16.584	0.782	α: 0.816
Operating System Flexibility (OSF)				
OSF1	0.925	a	0.855	
OSF2	0.943	31.257	0.890	CR: 0.967
OSF3	0.970	34.678	0.940	AVE : 0.878
OSF4	0.909	27.605	0.827	α: 0.950

Item	Factor loadings	t-value	R^2	Scale reliability
Distribution Flexibility (DF)				
DF1	0.825	a	0.680	CR: 0.931
DF2	0.953	21.384	0.909	AVE: 0.818
DF3	0.931	20.945	0.867	α: 0.863
Information System Flexibility (ISF)				
ISF1	0.911	a	0.830	CR: 0.714 , AVE: 0.556
ISF2	0.915	11.083	0.831	α: 0.871
IT Knowledge (ITK)				
ITK1	0.677	a	0.458	
ITK2	0.828	12.677	0.685	CR: 0.901
ITK3	0.785	12.125	0.616	AVE: 0.568
ITK4	0.784	12.119	0.615	α: 0.842
IT Operations (ITOp)				
ITOp1	0.720	11.248	0.519	
ITOp2	0.703	11.005	0.494	
ITOp3	0.766	11.870	0.586	
ITOp4	0.785	12.125	0.616	CR:0.852
ITOp5	0.784	12.119	0.615	AVE:0.569
ITOp6	0.828	12.677	0.685	α:0.891
IT Objects (ITOb)				
ITOb1	0.812	a	0.659	
ITOb2	0.885	17.664	0.783	
ITOb3	0.908	17.957	0.824	
ITOb4	0.784	12.119	0.615	
ITOb5	0.828	12.677	0.685	

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

Discriminant validity at the construct level was evaluated using the procedures recommended by Voorhees et al. (2016). First, the criterion developed by Fornell and Larcker (1981), which consists of comparing the square root of the AVE to the correla-

tions between the constructs, was used. The square root of the AVE appears on the main diagonal of Table 3.4 and is greater than the correlations between the constructs, which shows the presence of discriminant validity between the constructs used in the model. Table 3.4 shows that some of the correlations between the constructs are significant, as expected. Kenny (2012) suggests, however, that discriminant validity between latent factors in SEM is poor if the correlations are higher than 0.85, and no pair of correlations exceeds this limit. Second, the HTMT ratio (Henseler et al., 2015) was calculated for each pair of constructs. As Table 3.5 shows, the HTMT ratio is lower than 0.85 for each pair of constructs, also indicating the presence of discriminant validity. Finally, following Howell (1987) and Szulanski (1996), discriminant validity was analyzed at the item level. The correlations observed in the CFA were compared to the correlation values calculated for the case of perfect correlation. The correlation values calculated must be greater than the values observed. As the results show that this condition is met for all cases; discriminant validity is ensured.

Table 3.4: Correlation Matrix

	1	2	3	4	5	6	7	8	9.	Mean	D.T.
1.Exlr	**0.826**									5.780	1.254
2.Exlp	0.590**	**0.923**								5.835	1.205
3.SF	0.405**	0.365**	**0.847**							6.423	1.102
4.OSF	0.421**	0.427**	0.373**	**0.937**						6.330	1.195
5.DF	0.455**	0.347**	0.402**	0.448**	**0.904**					6.553	0.955
6.ISF	0.511**	0.410**	0.430**	0.408**	0.350**	**0.746**				6.545	0.988
7.ITK	0.173**	0.296**	0.300	0.338**	0.371**	0.306	**0.754**			4.617	1.676
8.ITOp	0.210**	0.231**	0.487**	0.451**	0.411**	0.385**	0.436**	**0.754**		4.617	1.948
9.ITOb	0.196**	0.204**	0.425**	0.414**	0.403**	0.322*	0.340**	0.430**	**0.869**	3.626	2.303

** Significance level of 0.01. The square root of the AVE appears on the main diagonal in bold.

Table 3.5: HTMT ratio

HTMT	Exlr	Exlp	SF	OSF	DF	ISF	ITK	ITOp	ITOb
Exlr									
Exlp	0.837								
SF	0.639	0.499							
OSF	0.593	0.521	0.506						
DF	0.682	0.451	0.581	0.577					
ISF	0.655	0.455	0.531	0.449	0.411				
ITK	0.298	0.441	0.497	0.500	0.584	0.412			
ITOp	0.338	0.322	0.754	0.623	0.605	0.484	0.736		
ITOb	0.380	0.342	0.793	0.689	0.715	0.488	0.691	0.817	

3.3.3. Common Method Variance

Further guarantee of appropriateness of the measures used was examined through rigorous testing for common method bias, using both procedural and statistical methods (Podsakoff et al., 2003). Although the informants knew they were answering questions related to SCM, learning mechanisms, and IT, it is quite unlikely that they could have intuited the specific research model. If the informants do not know the research question, they are less able to manipulate their responses to attempt to satisfy expectations concerning relationships they presume. We used several response formats (not at all – a lot, maximum disagreement – maximum agreement) and did not group the questions by construct. We also protected the informants' anonymity and pre-tested the survey to eliminate ambiguity, using simple language that was easy to understand. To evaluate the extent of the effect of common method bias (in addition to all of the procedural measures employed to avoid it), we used Harman's one-factor test (Podsakoff and Organ, 1986), performing an exploratory factor analysis of all construct items to eliminate the possibility of obtaining a single factor that explains the majority of the variance. If most of the variance were explained by the first factor, there would be significant bias. In this analysis, only 20.776 % of the variance was explained by the first factor, and the rest of the variance explained was distributed evenly across the other factors (15.276%, 11.037%, 5.659%, 4.951%, 4.283%, 3.297%, 2.891%, 2.691%). We can thus conclude that the potential of common method bias is low.

3.3.4. Hypotheses testing

To verify the different model hypotheses, we performed hierarchical regression analysis with SPSS v.20 software, a methodology used to test moderating effect (Gu et al., 2014; Tamayo-Torres et al., 2010). In the first step, a regression analysis was calculated with SCF as dependent variable and SC ambidexterity as independent variable. The moderating variable, IT competence, was then introduced in the model. Finally, the term representing the interaction effect between SC ambidexterity and IT competence was added. This multiplicative term included in the equation creates problems of multicollinearity, since it correlates with the independent variables that compose it. According to the recommendation by Jaccard et al. (1990), the variables that compose the multiplicative term are taken into account relative to their mean to avoid the problem of multicollinearity. Further, to ensure that the results are not affected by multicollinearity, the variance inflation factors (VIF) were calculated for all regressions. In all cases, they obtained levels well below the recommended maximum, indicating that the results are not affected by multicollinearity. The results of the hierarchical regression analysis are presented in Table 3.6

Table 3.6: Effect of strategy of SC ambidexterity on SCF

	SCF		
	Model 1	Model 2	Model 3
SC Ambidexterity	0.315*** (5.752)	0.214*** (3.656)	0.229*** (4.015)
IT Competence		0.243*** (4.145)	0.125 (1.986)
IT Competence * SC Ambidexterity			0.252*** (4.353)
R^2	0.100	0.148	0.200
Adjusted R^2	0.096	0.143	0.191
F	33.089***	26.029***	24.712***
Change in R^2		0.048	0.052
VIF SC Ambidexterity IT Competence IT Competence*SC Ambidexterity	 1.000	 1.207 1.207	 1.212 1.480 1.249

To complete verification of the moderation hypotheses, once a significant moderating effect was found, the strength and nature of the interaction term had to be confirmed, as indicated by Jaccard et al. (1990). An additional regression analysis was thus performed to evaluate the effect of the independent variable on the dependent variable, distinguishing different levels of the moderating variable. Following the recommendation by Jaccard et al. (1990), the observations have a high point-value in the moderating variable when they take values higher than its mean, while the low level of this variable includes the cases that take values below the mean. The results of this analysis are shown in Table 3.7.

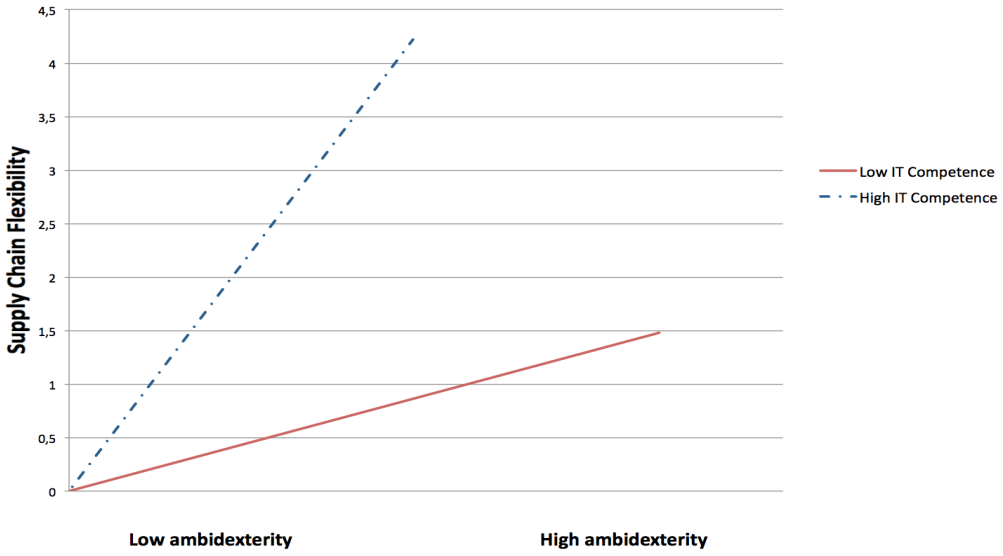
Table 3.7: Effect of strategy of SC ambidexterity on SCF for different levels of IT competence

	Model 1 (n=162)	**Model 2 (n= 140)**
	High IT Competence	Low IT Competence
SC Ambidexterity	0.354*** (4.795)	0.076 (0.892)
R^2	0.126	0.006
Adjusted R^2	0.120	0.001
F	22.995	0.796

The results obtained confirm Hypothesis 1 of the model (β= 0.315; t=5.752; p <0.01), providing empirical support for the thesis that SC ambidexterity improves SC capability to recognize market changes and enable the firm to react to them.

Second, the results obtained support H2 of the model proposed, as IT competence moderates the relationship between SC ambidexterity and SCF. The results indicate that the positive relationship between these two variables is moderated by IT competence when it is high (β= 0.354; t=4.795; p <0.01). Figure 3.2 represents the moderating effect of IT competence.

Figure 3.2: Moderating Effect of IT Competence



3.4. Discussion and implications

3.4.1. Discussion of the results

This study seeks to understand the factors that facilitate SCF. Specifically, it focuses on strategies and capabilities related to knowledge management, the practice of SC ambidexterity, and IT competence. Several relevant implications that help to fill the gaps found in the prior literature can be derived from this study.

First, the results show that SC ambidexterity has a direct and positive effect on SCF. This result answers the firs research hypothesis of the theoretical model proposed. The positive relationship between ambidexterity and SCF indicates that implementing practices for exploitation of existing knowledge and capabilities simultaneously with practices of exploration and creation of new competences and capabilities improves the SC's ability to detect changes in the environment and speed in reacting to them. This conclusion is especially important because the prior literature usually relates only exploration practices to achievement of flexibility (Miller et al. 2006), while this study provides important empirical demonstration that combining these practices with

others that tend to refinement and efficiency of current competences increases SCF. This is one of the few studies to relate both exploration and exploitation to improvement of flexibility, indicating that the SC's capability for adaptation and reaction to changes in the environment requires not only innovative practices and experimentation with new ideas and knowledge (exploration practices), but also their combination with practices based on existing strategies and knowledge (exploitation practices). That is, it is not enough to develop new knowledge and innovative capabilities. The firm must also improve existing strategies and competences. This result is consistent with the latest findings in the literature on operations, which show that ambidexterity has beneficial effects in this area (Kristal et al., 2010; Patel et al., 2012; Tamayo-Torres et al., 2011). It is also consistent with the literature that relates different learning mechanisms to adaptation to the environment (Lumpkin and Lichtenstein, 2005; Santos-Vijande et al., 2012).

Second, the moderating effect of IT competence on the relationship between SC ambidexterity and SCF indicates that firms with high IT competence strengthen the positive effect of ambidexterity on SCF. This finding confirms our second research hypothesis, which presents the relationship between IT competence and SCF, as well as the moderating role of IT competence. Given the current market's greater competition for the efficient use of resources, finding complementary relationships and interaction effects between different capabilities is of vital importance. Investment in and improvement of IT competence has been a business constant in recent years, and this result improves understanding of how this capability is connected to others in the SC. We thus show that possessing a high level of knowledge of current technology combined with effective use of this technology improves the effectiveness of SC ambidexterity, as it increases collection, distribution, and use of the information obtained via exploration and exploitation throughout the SC. Ultimately, the added value that IT competence contributes to the relationship between ambidexterity and SCF is that this capability makes the process of transforming the knowledge obtained via exploration and exploitation to adapt SC configuration to market changes faster and more effective. Without the support of IT competence, information will flow more slowly than is necessary to make the best response to market change (Ngai et al., 2011). Likewise, when supported by IT competence, learning obtained via exploration and exploitation can lead more easily to lower inventory levels, faster design of products,

shorter purchase-order cycles, and higher quality in the decision-making process (Cachon and Fisher, 2000; Fawcett et al., 2011; Fiala, 2005), thereby improving SCF.

The RBV and its extension in dynamic capabilities enable us to explain that IT competence is a lower-order capability that impacts the firm by means of other, higher-order capabilities such as SCF. This result is consistent with the prior literature on hierarchy of capabilities (Kraaijenbrink et al., 2010; Rai et al., 2006).

Finally, this study follows the recommendation by Ray et al. (2005) and Wu et al. (2006) that research must analyze IT competence in the SC.

3.4.2. Theoretical implications

This research makes important contributions to the existing literature. First, it extends the field of study of SC ambidexterity to the SC. Whereas the positive effects of ambidexterity have been reported at the level of the firm, project, or manager (O'Reilly and Tushman, 2013), study of these effects in the SC has been very limited (Kristal et al., 2010). This article continues the line of research in Adler et al. (2009), Im and Rai (2008) and Patel et al.(2012), by incorporating this question into operations research. In doing so, it follows the recommendations by Birkinshaw and Gupta (2013) to make the results obtained more precise and rigorous in conceptualizing flexibility.

Second, the RBV and the theory of dynamic capabilities and hierarchy of capabilities have been applied to explain the relationship between the model variables. This study follows the recommendation of Ketchen and Guinipero (2004) to test models belonging to Operations Management using approaches drawn from strategic management. The theoretical framework developed follows the line of recent studies, such as Allred et al. (2011) and Hollos et al. (2012), which have begun to incorporate the RBV and dynamic capabilities approaches from Strategic Management research in Operations Management. Further, researchers have recently begun to apply the RBV and the theory of dynamic capabilities to interorganizational networks (Smart et al., 2007). This article contributes to this line of research in applying these theories to the SC. From the theoretical point of view, this approach represents a change of paradigm, since it blurs the distinction between what constitutes the firm and what composes its network.

Third, the research shows that SC ambidexterity and IT competence are antecedents and facilitators, respectively, of SCF. The study thus responds to the call by Swafford et al. (2006) for research that develops a deeper understanding of the antecedents of SCF.

3.4.3. Practical implications

This study also makes important contributions to business practice. First, understanding how to foster SCF is crucial, as firms develop their activity in markets that require them to have increasing flexibility, making it crucial for managers to know what strategies and competence development enable improved flexibility. This study shows that exploration and exploitation are compatible in the SC and that managers must implement both practices of refinement and reuse of current competences (that lead to improvement in efficiency, efficacy and reliability of processes) and exploration in order to achieve a flexible SC. This finding means that efficiency and flexibility are not opposing goals in SC management.

Second, firms have in recent years invested millions of dollars in the attempt to obtain greater profit (Liu et al., 2013). Numerous investments in IT have not, however, translated into increased profit level because managers fail to take into account that IT alone does not have a direct effect on the firm results, but rather affects them through other, higher-order capabilities. This study thus provides a guide to enable managers to make their investment in IT profitable, since it shows what part of IT's business value consists of its positive impact on SCF. On the other hand, examining the relationships among flexibility, ambidexterity and IT competence helps firms to discern whether and how much they must invest in developing IT competence to build a flexible SC. Our finding that the relationship between ambidexterity and SCF is amplified when IT competence is high implies that transmission of IT effort in a higher-order capability, as is SCF, occurs when the firm has invested to a high degree in IT, since the effect does not occur for lower and initial levels of this competence. Managers must thus perform a cost-benefit analysis before investing in IT competence to achieve a flexible SC.

Finally, studying strategies applied to the SC, as well as the use of the RBV in this area, helps managers to recognize that the firm they manage is only a node in a net-

work and that they can create competitive advantage not only based on firm assets but increasingly from the assets and capabilities of the network in which they operate (Cheng, 2011; Smart et al., 2007). Firms must thus concern themselves with managing not only their capabilities but also those of the SC to which they belong.

3.4.4. Limitations and future lines of research

This study has certain limitations. First, it focuses on manufacturing firms that develop their activity in Spain, which can limit generalization from the results to different contexts.

Second, it uses a single informant to obtain the data, with the attendant risk of common method bias. Although a series of procedural and statistical measures were performed to prevent the risk of incurring this bias, future research could confirm the results obtained with various key informants, a procedure recommended by Junni et al. (2013) to improve studies of ambidexterity. Stevenson and Spring (2007) also recommend that future studies incorporate the perceptions of other members of the SC to enable more precise evaluation of its flexibility.

Third, the data used are transversal in nature, so that, in analyzing SCF, there is a risk of analyzing a momentary situation in the organization but not its long-term capability for flexibility.

Finally, future studies could incorporate control variables used in the prior research to measure SCF, since these may impact SCF. Examples could include environmental uncertainty (Kristal et al., 2010), technological level of the firm (Martínez Sánchez and Pérez Pérez, 2005), and production method (Patel et al., 2012).

3.5. References

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CAPÍTULO 4

THE ROLE OF THE ISO 9000 STANDARD IN THE RELATIONSHIP BETWEEN AMBIDEXTROUS STRATEGY AND SUPPLY CHAIN FLEXIBILITY

THE ROLE OF THE ISO 9000 STANDARD IN THE RELATIONSHIP BETWEEN AMBIDEXTROUS STRATEGY AND SUPPLY CHAIN FLEXIBILITY

Abstract

Although the prior literature shows that ambidexterity —the combination of exploration and exploitation practices— encourages adaptation of the firm and organizational units to the environment, study of ambidexterity in the supply chain (SC) is very limited. This article analyzes the effect of ambidexterity on each dimension of supply chain flexibility (SCF), including implementation of the ISO 9000 standard. It also examines whether this certification affects level of SCF. We introduce the ISO 9000 variable because, although the literature indicates that it may encourage ambidexterity, hardly any empirical studies have been performed to confirm this indication. Further, very little evidence exists determine how the practice of ISO 9000 affects the SC. Based on data from 302 manufacturing firms, our results demonstrate that ambidexterity does not affect all dimensions of SCF in the same way. Rather, its effect is contingent on the presence of the ISO 9000 certification, and this certification does not affect level of SCF. This study develops a theoretical framework that is useful for business practice, as it enables determination of which strategy is the best for developing SCF. It also confirms the need to integrate quality management with SC management.

Keywords: Ambidextrous strategy; Supply Chain Flexibility; ISO 9000 Standard.

4.1. Introduction

In today's globalized world, competition has gone beyond the limits of the firm, extending to a wider spectrum, the supply chain (SC), and making supply chain flexibility (SCF) a key weapon through which firms maintain their competitive advantage (Moon et al., 2012). Although the benefits of SCF are widely known, a gap exists in literature on antecedents of the different dimensions that compose SCF (Blome et al., 2013; Swafford et al., 2006).

Ambidexterity —the combination of exploration and exploitation practices— has dominated the literature on adaptation to the environment since the seminal study by March (1991). Thus, "exploration and exploitation have emerged as the twin concepts underpinning organizational adaptation research" (Gupta et al., 2006, p. 693), with studies even affirming that ambidexterity is a critical ability for organizations' survival (Li et al., 2008). Although abundant literature supports the importance of ambidexterity to the adaptation of all kinds of organizational units -firm, interorganizational alliance, business units, etc.- (O'Reilly and Tushman, 2013), study of ambidexterity in the field of operations and in the SC is very recent and limited (Kristal et al., 2010; Patel et al., 2012; Tamayo-Torres et al., 2014). No research to date has analyzed whether ambidexterity can improve the different dimensions of SCF. This gap enables us to formulate our first research question: Does ambidexterity have a significant effect on the dimensions of SCF?

Prior literature also indicates the connection between quality management (QM) practices and ambidexterity, but hardly any theoretical or empirical studies relate ambidexterity to implementation of an ISO 9000 system (Tamayo-Torres et al., 2014; Moreno-Luzón et al., 2014; Moreno-Luzón and Valls-Pasola, 2011). Similarly, a central premise of the ISO 9000 standard is regulation of SC activities, but previous literature lacks empirical evidence on the impact of this quality management practice on the SC (Prajogo et al., 2012). Although some authors have begun to evaluate empirically the effect of different QM practices on the SC (Bayo-Moriones et al., 2011; Casadesus and De Castro, 2005; Theodorakioglou et al., 2006), knowledge of QM practices at SC level is still very limited (Mellat-Parast, 2013), and study of the impact of ISO 9000 on the SC is a good starting point from which to analyze the role of the different QM practices on

improvement of SC performance (El Mokadem, 2016). We thus formulate our second and third research questions: Does implementation of ISO 9000 change the relationship between ambidexterity and SCF? And does ISO 9000 affect the level of SCF?

We answer these research questions using data from a sample of 302 Spanish manufacturing firms, employing structural equations modelling and multivariate analysis of variance.

This article is organized as follows: Section 4.2 reviews the theoretical foundations of our study, from which we develop the hypotheses. Section 4.3 presents the research methodology and Section 4.4 the results of the data analysis. Finally, Section 4.5 concludes with a discussion of the results, their implications for theory and practice, and the limitations and future lines of research.

4.2. Literature review and hypotheses

4.2.1. Ambidextrous Supply Chain strategy (ASCS)

Exploitation and exploration are two completely different types of learning. Whereas exploitation is based on "refinement, production, efficiency, selection, choice, implementation, and execution", exploration is grounded in "search, variation, risk assumption, experimentation, play, discovery, and innovation" (March 1991, p. 71). One can also differentiate between exploration and exploitation based on the origin of the knowledge acquired by the firm. Exploitation consists of developing the firm's knowledge from the firm's own abilities, whereas exploration is the vehicle through which knowledge is acquired from interaction with the environment (Jansen et al., 2006). The goal of exploration is to satisfy customers' needs and emerging markets, provide new designs, create new markets, and develop new distribution channels, while the goal of exploitation is to satisfy customers' needs and current markets, extend current knowledge and abilities to improve current designs, and increase the efficiency of current distribution channels (Jansen et al., 2006).

Exploration and exploitation are not just two kinds of organizational learning; they have also been considered as strategic behaviors or basic concepts in the definition of

strategy (Tamayo-Torres et al., 2011), since exploitation seeks immediate, short-term results while exploration has a long-term orientation (March, 1991).

We use the concept ambidexterity as metaphor (Moreno-Luzón et al., 2014) to refer to organizations or units capable of combining the strategic options of exploration and exploitation, in other words, capable of exploiting existing competences at the same time as they explore new opportunities and knowledge (Cao et al., 2009). Despite the proliferation of studies on ambidexterity in recent years, there is still only slight empirical evidence of the benefits and consequences generated by ambidexterity in SC management (Kristal et al., 2010) and operations (Adler et al., 2009).

Ambidextrous SC strategy (ASCS), a concept introduced by Kristal et al. (2010, p. 415), is defined as "a manufacturing firm´s strategic choice (i.e. managerial emphasis) to simultaneously pursue both supply chain exploitation and exploration practices". While the literature on ambidexterity initially debated the compatibility-incompatibility of exploration and exploitation (Levinthal and March, 1993), more recent research demonstrates the compatibility between these two practices (Boer and Laugen, 2008), with current research concentrating on their benefits (Rojo et al., 2016). Study of SC ambidexterity is especially interesting because the network of firms that compose the SC acts as a facilitator of this strategy (Kauppila, 2007).

4.2.2. Supply chain flexibility (SCF)

For some time, flexibility has been considered as a source of competitive advantage, but study of flexibility from the SC perspective is still recent and quite limited (Moon et al., 2012). The importance of SCF as a source of competitive advantage stems from the contemporary circumstance that competition currently occurs not between firms but between the networks that compose a SC (Lo and Power, 2010).

Lummus et al. (2003) define SCF as the speed with which the SC responds to changes in demand and the degree to which it can adjust its speed, destination, and volume in response to market changes. Stevenson and Spring (2007) argue that a flexible SC can adapt effectively to interruptions in supply and changes in demand while maintaining constant levels of delivery and customer service. Gosain et al. (2005)

conceive of SCF as the extent to which links in the SC can adapt to changing business conditions. Although the prior literature suggests multiple conceptualizations of SCF (Moon et al., 2012; Lummus et al., 2003; Duclos et al., 2003), all have two features in common: first, they characterize SCF as the SC's ability or function to adapt and react to changes and uncertainties in the environment (Vickery et al., 1999); second, they unanimously consider SCF as a complex, multidimensional concept (Garavelli, 2003), although they disagree on the dimensions that measure this construct (Swafford et al., 2006).

SCF has been a recurrent topic in the operations management in recent years, but the prior literature still has limitations that require further research. First, although the benefits of a flexible SC are widely known, more research is required to determine which antecedents or strategies permit its development (Blome et al., 2013). Second, SCF has been studied predominantly from the firm's perspective, without considering the SC as a whole (Candaci et al., 2011). Our study overcomes these two limitations —first, in researching the influence of ambidextrous strategy on SCF and, second, in concentrating on the SC as unit of analysis— . To achieve these goals, we follow the approach of Blome et al. (2014), which asks informants to respond to the questionnaire from the perspective of their SC.

4.2.3. Relationship between Ambidextrous Supply Chain Strategy and Supply Chain Flexibility

Ambidextrous strategy has shown that it not only has a positive impact on performance but increases survival of the unit or organization that implements it (O'Reilly and Tushman, 2013; Benner and Tushman, 2003). However, the literature has not yet analyzed the mechanisms by which ambidexterity increases the survival rate (Rojo et al., 2016). Adler et al. (2009) proposes for the first time, from a conceptual perspective, what combination of exploration and exploitation in operating processes leads to improvement in flexibility in the long term. Researchers explain this effect by reasoning that both exploration and exploitation pursue new ways of adapting to the environment (Cao et al., 2009). In fact, Zollo and Winter (2002) affirm that the goal of organizational learning mechanisms is to achieve the firm's adaptation to the environment. Recently,

Tamayo-Torres et al. (2014b) have shown empirically that ambidexterity enables firms to respond flexibly to changes in the environment.

Firms adapt to future changes through exploration practices and to present changes through exploitation (Lavie and Rosenkopf, 2006). Exploration is thus oriented to the long term, through development of new knowledge completely different from the knowledge that the firm currently possesses, whereas exploitation has a short-term vocation oriented to perfecting current processes (March, 1996). SCF likewise has a double temporal orientation. In the short term, it attempts to fulfill the current requirements of demand; in the long term, it is a weapon that can provide the firm with a competitive advantage. Exploration and exploitation are thus two kinds of learning which, performed simultaneously, are crucial factors for the organizational unit's success and survival (Moreno-Luzón and Valls-Pasola, 2011), and which in the area of the SC can lead to improvement of its ability to adapt to the environment and to changes, that is, to the improvement of SCF.

Finally, SCF enables the firm to respond quickly and efficiently to dynamic market changes (Vickery et al., 1999). Speed requires exploitation practices, which refine routines, processes, etc. to the point where they are as efficient as possible (March, 1991). At the same time, a response to dynamism in the environment requires innovation or exploration to enable the firm to anticipate change (March, 1991). According to the foregoing, we propose:

H1: Ambidextrous Supply Chain Strategy is positively related to Supply Chain Flexibility.

We decided to analyze the effect of ambidextrous strategy on each dimension of SCF instead of treating SC as a second-order construct, both to obtain more detailed results that avoid information loss and because this is the criterion most used in the literature (Vickery et al., 1999; Tachizawa and Gimenez, 2009) to analyze the antecedents and effects of SCF. We thus study the effect of ASCS on each of the dimensions composing SCF, following the taxonomy proposed by Moon et al. (2012), and divide H1 into the following subhypotheses.

Sourcing flexibility is defined as achieving availability of materials and services of the necessary quality, and ability to acquire them effectively in response to changes

in the requirements (Moon et al., 2012). This dimension clearly has two aspects or components. First, the manufacturing firm must be able to find new suppliers easily to minimize the risk of production delay caused by an interruption in supply (Moon et al., 2012). Second, the components and materials supplied must be of the requisite quality to satisfy the changing needs of the environment. We argue that ASCS can improve this dimension by helping the firm to manage its supply flow. On the one hand, exploration practices in the SC can help the firm to have a sufficient number of suppliers to ensure uninterrupted flow of components. This is due to exploration enables the search for alternative paths and new modes of performing processes (March, 1991), such that practicing exploration in the SC facilitates the search for new suppliers, different kinds of cooperation with the same suppliers, and adoption of different logistical strategies to obtain a component from a supplier. At the same time, since exploitation practices improve efficiency (Baum et al., 2000) and reliability (Kristal et al., 2010) due to the experience accumulated, exploitation practices in the SC can enable the flow of components to maintain the standard of quality required, reducing uncertainty on this issue (Lummus et al., 2003; Swafford et al., 2006). We thus propose that:

H1a: Ambidextrous Supply Chain Strategy is positively related to sourcing flexibility.

Operating system flexibility is defined as the ability to exploit effectively resources obtained to produce a range of products and services that enable the firm to satisfy market demand. This dimension thus refers to the SC's operating processes —that is, to its abilities to vary output volume, develop new products, and modify product and service mix— and its capability to adjust manufacturing installations (Moon et al., 2012). ASCS can help the firm to develop operating system flexibility. Patel et al. (2012) shows empirically that ambidexterity improves the firm's ability to change its product mix and develop new products. We propose, however, that ambidexterity's effect on the SC in development of this dimension can be greater. Exploration practices seek development of new technologies, products, services, and systems, which are usually identified as radical innovations. Exploitation practices, in contrast, seek incremental improvement of products, services, operations, quality, and efficiency (Levinthal and March, 1993). If the firm focuses on exploitation practices only, it will be able to change product mix but unable recognize the need to develop new products for its customers or to incorporate new technologies into SC processes (Koberg et al., 2003). If, in

contrast, the firm opts exclusively for implementing exploration practices, it will tend to seek new opportunities (in products, processes, services, etc.) but will not be able to eliminate redundancies or improve current processes (Tamayo-Torres et al., 2014b). ASCS permits improvement of current SC operating processes while simultaneously incorporating new ones (Raish and Birkinshaw, 2008); it will facilitate maintaining continuity of prior routines while incorporating new processes (Patel et al., 2012). ASCS can thus improve operating system flexibility through reduction in installation time, efforts to improve quality and efficiency of processes, improved ability to develop new products and services and greater ability to change product mix (Patel et al., 2012; Koste and Malhotra, 1999). We thus propose:

H1b: Ambidextrous Supply Chain Strategy is positively related to operating system flexibility.

Distribution flexibility refers to the firm's ability to control movement and storage of materials, components, finished products, and/or services under continually changing market conditions. The main determinant of distribution flexibility is the firm's ability to manage its distributors, warehouses, loading capability, and other distribution installations effectively and efficiently (Moon et al., 2012). Developing distribution flexibility requires implementing practices of both exploration and exploitation in the SC. Implementing exploitation practices permits the firm to avoid situations of lack of inventory for products most in demand and of unexpected increase in market demand (Vickery et al., 1999). At the same time, the SC requires exploration practices to increase the range of options available to satisfy customers' changing needs, such as those described by Zhang et al. (2002), who argues that the firm should have varied operating characteristics (transit time, capability, cost, delivery frequency, etc.) in the different means of transportation used. Distribution flexibility is to SCF what routing flexibility is to manufacturing flexibility (Garavelli, 2003), since distribution flexibility refers to the various alternate pathways for distributing products and routing flexibility to the different pathways for manufacturing a component. Tamayo-Torres et al. (2014b) demonstrate empirically that ambidexterity is positively related to routing flexibility insofar as it facilitates the search for alternate pathways/sequences for manufacturing a component, while at the same time permitting improvement in current paths and sequences through better cost allocation, elimination of redundancies, and

specialization. We therefore propose that SC ambidexterity can help the firm to develop distribution flexibility, facilitating development of different logistical strategies for launching and distributing products on the market, whether through improvement and change of current strategies and modes of distribution, or through development of other, completely different forms of distribution. Likewise, ASCS can facilitate the search for new distributors with which to contract new modes of delivery, while simultaneously time improving and specializing current modes of delivery with current distributors (Moon et al., 2012; Swafford et al., 2006). We thus propose that:

H1c: Ambidextrous Supply Chain Strategy is positively related to distribution flexibility.

Information system flexibility refers to the ability of the firm's information systems to adapt to changing circumstances, especially in situations of substantial, unexpected changes, and to operatization of these systems through use of IT to share information among functions and departments and with members of the SC (Moon et al., 2012). Improving this dimension of SCF requires ambidexterity —the simultaneous practice of exploration and exploitation—. Exploitation practices enable reduction of work time in the system and connection time among the different organizations that compose the SC, as well as improvement in the rhythm of work due to the greater efficiency these provide (Lucas and Olson, 1994). Exploration practices in the SC are also necessary to achieve synchronization among SC members when one member updates a new technology or adopts a new technical functionality. Further, these practices enable synchronization of hardware and software architectures among firms in the SC (Lummus et al., 2003). We thus propose that:

H1d: Ambidextrous Supply Chain Strategy is positively related to information system flexibility.

4.2.4. Relationship between Ambidextrous Supply Chain Strategy, Supply Chain Flexibility, and the ISO 9000 standard

Two basic principles on which all QM systems are grounded, including the ISO 9000 standard, are continuous improvement and market orientation (Hackman and Wageman, 1995; Anderson et al., 1994). These principles are linked to both exploration

and exploitation (Corso and Pellegrini, 2007) and thus to ambidexterity. Li et al. (2008) show that market-oriented firms —a characteristic of firms with ISO 9000— are capable of exploring and exploiting simultaneously, that is, have greater likelihood of being ambidextrous. Further, the concept of market orientation has been associated with conceptual mastery of organizational learning (Bell et al., 2002). Fernández-Pérez and Gutierrez-Gutierrez (2012) contrast empirically whether the QM practices involved in the ISO 9000 standard foster development of the organizational networks to which the firm belongs, especially access to information in them. We can thus expect implementation of ASCS to have a greater effect on SCF if the firm follows the ISO 9000 standard.

It is important to mention that some theoretical arguments suggest that implementation of ISO 9000 affects exploitation only and thus blocks exploration and ambidexterity. Implementing ISO 9000 has been linked, on occasions, to formalization and excessive proceduralization. Since the standard is based on rules and procedures, one could conclude that it blocks experimentation and innovation. Likewise, inspection and control of processes —a characteristic of ISO 9000— and standardization, can hinder creativity and experimentation (Moreno-Luzón et al., 2014; Moreno-Luzón and Valls-Pasola, 2011). The greatest demand of the ISO 9000 standard is that organizations develop and implement a set of routines and procedures for product design, manufacturing, delivery, service, and support. Such standardization and formalization ensure that customers consistently acquire the same product. ISO 9000 requires specifying a list of detailed requirements that must be satisfied and without which the work is rejected. Specifying these requirements can promote attention to detail (exploitation) and adherence to rules and procedures (Naveh and Erez, 2004). Majority opinion in the literature asserts, however, that continuous improvement underlies ISO 9000, which stimulates creativity and generation of ideas (Prajogo and Sohal, 2001). Norms and regulations do not necessarily impede exploration and can even foster it. Exploration activities must be fostered, and norms and regulation can to some extent create an environment favorable to innovation. Likewise, procedures and norms can improve exploration in its implementation phase; without procedures and norms, new ideas can have disastrous results when implemented (Craig, 1995). The process management introduced by the ISO 9000 standard can also expand the effect of ASCS on SCF. Theodorakioglou et al. (2006) show empirically that ISO 9000 process management provides a system useful for managing suppliers and distributors, since it improves communi-

cation processes between the firm and its SC members due to clear specification and documentation of questions related to product supply, transportation, delivery, and handling. Following all arguments presented above, we propose that firms with the ISO 9000 standard experience greater influence of ASCS than firms that do not follow this standard. We thus formulate the following hypothesis:

H2: The ISO 9000 standard facilitates the relationship between Ambidextrous Supply Chain Strategy and Supply Chain Flexibility.

4.2.5. Relationship between the ISO 9000 standard and Supply Chain Flexibility

The effect of ISO 9000 is subject to a lot of controversy. Some authors view its implementation as beneficial, claiming that the certification increases employees' awareness in questions of quality and fosters continuous improvement through quality audits. Others disagree, arguing that firms focus mainly on obtaining the certification rapidly and easily, without real commitment to quality. Such practice can result in increased bureaucracy and reduced flexibility and innovation (Kuo et al., 2009; Boiral and Roy, 2007). More empirical research is required to resolve this controversy.

Central elements underlying the ISO 9000 standard are continuous improvement and customer orientation (Anderson et al., 1994). These elements can increase firms' sensitivity to changes in the environment and thus development of greater capability to be flexible (Llorens-Montes et al., 2004). For Tamayo-Torres et al. (2014b), firms that develop QM systems should be more flexible than those that do not have such systems, since the former are oriented to the market and will respond better to changes in the environment. Llorens-Montes et al. (2004) find that firms with some kind of quality initiative have greater flexibility than firms not committed to these initiatives.

QM processes reduce process variance, directly impacting different variables of SC performance, including inventory and measures related to time, such as cycle time and reliability delivery (Flynn et al., 1995). As process variance decreases, the firm requires less safety stock and cycle stock inventory (Flynn and Flynn, 2005). Based on a sample of manufacturing firms in Germany, Italy, Japan, England, and the US, these authors

show empirically that implementation of QM practices has a beneficial impact on SC performance, specifically on reduction of cycle time, increase in on-time delivery rate, and inventory turnover ratio. Possessing a QM system ensures the firm that raw materials or components have a zero-defect orientation, enabling the manufacturing firm to reduce safety stock maintained for contingencies involving defects in raw materials and thus to have a more flexible SC (Kaynak and Hartley, 2008).

More recently, El Mokadem (2016) has demonstrated empirically the positive effect of ISO 9000 in aligning SC activities with the environment, but the study's findings must be confirmed with subsequent research given its small sample size. Likewise, Sila et al. (2006) find that implementing quality practices in a firm leads to aligned actions among the firm, its customers, and its suppliers. Theodorakioglou et al. (2006) propose that QM practices lead to better alignment between the organization and its suppliers. More specifically, they affirm that firms with QM practices have greater SC performance, since these practices encourage intra-organizational integration among the firm's various operating processes, facilitating inter-organizational integration among the firms composing the SC through closer relationships with suppliers and distributors. The authors even conclude that implementation of QM practices facilitates SC management, since these practices provide internal integration, a prerequisite for ability to manage relationships with suppliers and distributors.

A minority of authors find, however, that the ISO 9000 certification could have a negative effect on due to the increased bureaucratization the standard introduces (Casadesus and De Castro, 2005). For the reasons given above, we propose the following hypothesis:

H3: The ISO 9000 standard has a positive and significant influence on Supply Chain Flexibility.

4.3. Research methodology

4.3.1. Sample

To bring empirical evidence to bear on the research hypotheses, we established the set of Spanish manufacturing firms as the object of study. The study population was obtained from the SABI 2014 database, which is composed of 45,166 firms. Of the total number of firms, we included only those in the manufacturing sector that provided a full record of data and that had more than ten workers, which reduced the number to 2517 firms. The data were obtained through computer-assisted telephone interviews (CATI) in May, 2014, and the informants were the general manager or the person in charge of the firm's SC. We obtained a total of 302 valid questionnaires, representing a response rate of 12%. Sampling error was 5.23%, with a confidence level of 95% (Z=1.96) for p=q=0.5. Table 4.1 shows the characteristics of our sample.

Table 4.1: Sample characteristics

	N	Percentage (%)
Manufacturing industry[1]		
Food products, beverages, and tobacco	3	1
Textile and wearing apparel	5	1.65
Chemistry and pharmaceuticals	26	8.61
Plastics	28	9.27
Computers, electronics, and optical equipment	23	7.61
Electrical equipment	30	9.93
Machinery and equipment	110	36.42
Furniture	47	15.57
Automobile	25	8.29
Other	5	1.65
Total	302	100

Size of firm (no. employees)	N	Percentage (%)
10-49	69	22.85
50-250	142	47.02
251-1000	58	19.20
Over 1000	33	10.93
Total	302	100

Total company annual sales	N	Percentage (%)
-1 million €	50	16.56
1-7 million €	94	31.12
more than 7 and less 40 millions €	100	33.11
over 40 million €	58	19.21
Total	302	100

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

To evaluate the possibility of non-response bias, we compared the mean value of the size variables for all firms in the population to the mean of firms in our sample (Fawcett et al., 2014). The values obtained were similar in both cases, indicating that the firms that did not respond to our survey did not introduce significant bias in the results. Further, the firms in the sample came from ten different industries, so tests were also performed to confirm whether statistically significant differences based on firm sector existed, and none were found (for α=0.05).

To avoid the risk of common method bias (CMV), we implemented the procedural measures for data collection recommended by Podsakoff et al. (2003). We also analyzed the risk of CMV statistically by including a latent common variable in the model, which included all questionnaire items (Liang et al., 2007; Williams et al., 2003). This procedure permits us to compare the substantial variance with the model variance and to conclude that, given the small magnitude of method variance, the risk of CMV is not a problem in this study.

4.3.2. Measurement scales

To obtain information with which to test our hypotheses, we developed a questionnaire to evaluate exploration and exploitation practices, the dimensions of SCF, and implementation of ISO 9000. The questionnaire was designed by implementing the three-phase classification procedure developed by Moore and Benbasat (1991) to guarantee content validity. The scales used to measure the variables were adapted from prior literature to guarantee their validity and reliability. All items were answered using a 7-point Likert scale, on which 1 indicated maximum disagreement and 7 maximum agreement with each item.

ASCS is measured multidimensionally through exploration and exploitation practices in the SC, following Kristal et al. (2010). The dimensions of SCF —sourcing flexibility, operating system flexibility, distribution flexibility, and information system flexibility— were measured using scales developed by Moon et al. (2012). Finally, the ISO 9000 standard was analyzed using a categorical variable that measured whether or not the firm had implemented this standard.

4.3.2.1. Measurement scale properties

The measurement model was evaluated using confirmatory factor analysis (CFA) (Gerbing and Anderson, 1988). EQS 6.2 software was used to evaluate the measurement model and, subsequently, the structural model. Reliability of the scales was evaluated through the composite reliability statistic (CR), average variance extracted (AVE), and Alpha Cronbach (Hair et al., 2004). Alpha Cronbach coefficients measure internal consistency of the constructs. Since this study employed scales used widely in the prior literature, the Alpha Cronbach values should be greater than 0.8 (Nunnally, 1978). All statistics obtained for CR took values higher than 0.7, and values obtained for the AVE were above the minimum of 0.5. These results are acceptable for the scale's reliability and internal consistency (Hair et al., 2004), as can be confirmed from Table 4. 2.

Table 4.2: CFA of measurement scales of first-order constructs

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

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

We performed a second CFA to demonstrate the multidimensionality and goodness of fit of the second-order construct employed in the study: ASCS. As Table 4.3 shows, the results obtained guarantee good fit of the scale. To evaluate the measurement model for this second-order construct, we employed widely used fit indicators: root mean square error of approximation (RMSEA), Bentler-Bonett normed fit index (NFI), comparative fit index (CFI) (Bentler and Bonett, 1980), incremental fit index (IFI), adjusted goodness-of-fit index (AGFI), and global fit index (GFI). A RMSEA value lower than 0.08 is acceptable, although a value lower than or equal to 0.05 indicates

better fit (Byrne, 2001). Values above 0.9 for NFI, CFI, IFI, AGFI, and GFI indicate good fit (Bentler, 1992; Byrne, 2001).

Table 4.3: CFA of second-order constructs

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

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

To evaluate the constructs' discriminant validity, we followed the recommendations by Voorhees et al. (2016) -to use the Fornell and Larcker (1981) criterion and the heterotrait-monotrait ratio of correlations (HTMT) (Henseler et al., 2015)-. Table 4.4 displays the results for the former. Since the square root of the AVE is greater than the correlations among constructs, we affirm the existence of discriminant validity. The results for the second criterion are shown in Table 4.5. The HTMT ratio was calculated for each pair of constructs. As Table 4.5 shows, the HTMT ratio is lower than 0.85 for each pair of constructs, confirming discriminant validity.

Table 4.4: Correlation matrix

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

*** Significant at 0.01.

The square root of the AVE appears on the main diagonal in bold.

Table 4.5: HTMT ratio

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

4.4. Data analysis

To test our study hypotheses, we first divided the sample into two groups. The first group was composed of firms that said they had not implemented ISO 9000 (total of 145 firms). The second group was composed of firms that had implemented ISO 9000 (total of 157 firms). We justify dividing the sample into these two groups because the prior literature shows differences between firms that have implemented QM initiatives and firms that have not —differences in performance, way of competing, and strategic behavior—. In fact, the most recent empirical QM research tends to use subgroup analysis (Tamayo-Torres et al., 2014).

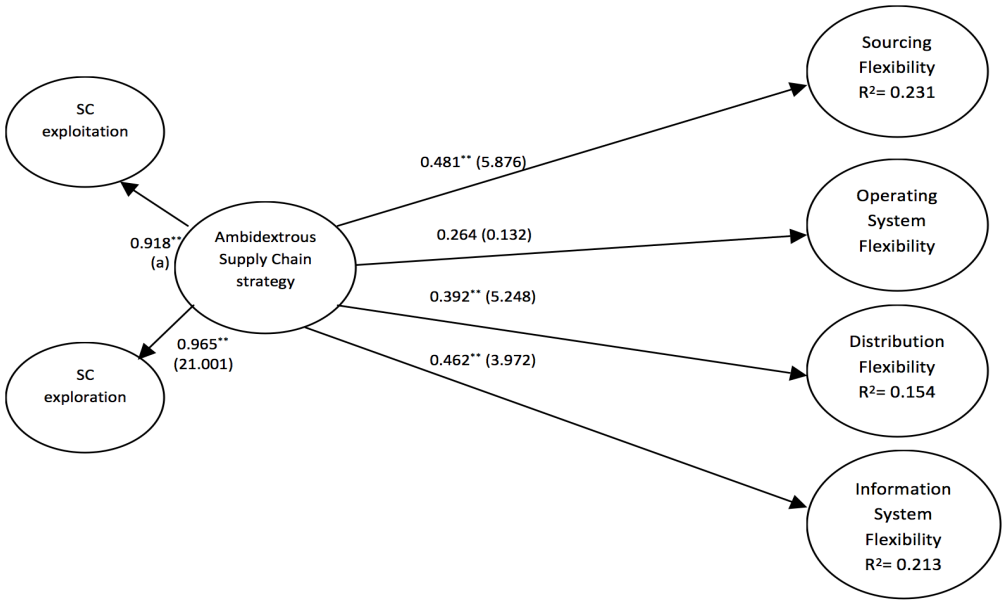
4.4.1. Structural equations modeling (SEM)

To contrast Hypotheses 1 and 2, and to analyze the relationships between the variables in the theoretical model, we used structural equations modelling (SEM) with EQS 6.2 software. This methodology is based on confirmatory modelling, which consists of specifying a model according to prior theory so that one can then evaluate its significance. We estimated one model for each group of firms (with and without the ISO 9000 standard) to compare whether the relationships between ASCS and the dimensions of SCF change depending on whether the firm has implemented this standard. Both groups are larger than the minimum sample size required given the number of estimation parameters (Hair et al., 2004). Since the multivariate normality test showed non-normality of the data in both groups (Group 1: Mardia's coefficient=

46.892; t value=9.084) (Group 2: Mardia's coefficient=41.434; t value=8.352), we used the robust ML estimation method (Bentler, 1995).

Figure 4.1 presents the results of the relationships between ASCS and the dimensions of SCF for firms that have not implemented the ISO 9000 standard. The global fit indices for the model (NFI=0.917, NNFI=0.966, CFI=0.970; IFI=0.970, GFI=0.954, AGFI=0.917, RMSEA=0.050) and the Chi-square value (258.378, p<0.001) indicate that the theoretical model fits the data well (Bollen, 1989). Following Riedl et al. (2014), we calculated the statistical power for the structural equations model using the approach developed by MacCallum et al. (1996). The value of 0.85 (for ε_0 =0.05; ε_a=0.08) obtained falls between 0.8 and 1, confirming validity and reliability of the results.

Figure 4.1: Structural modelling for the relationships between the variables in ISO 9000 non-certified firms



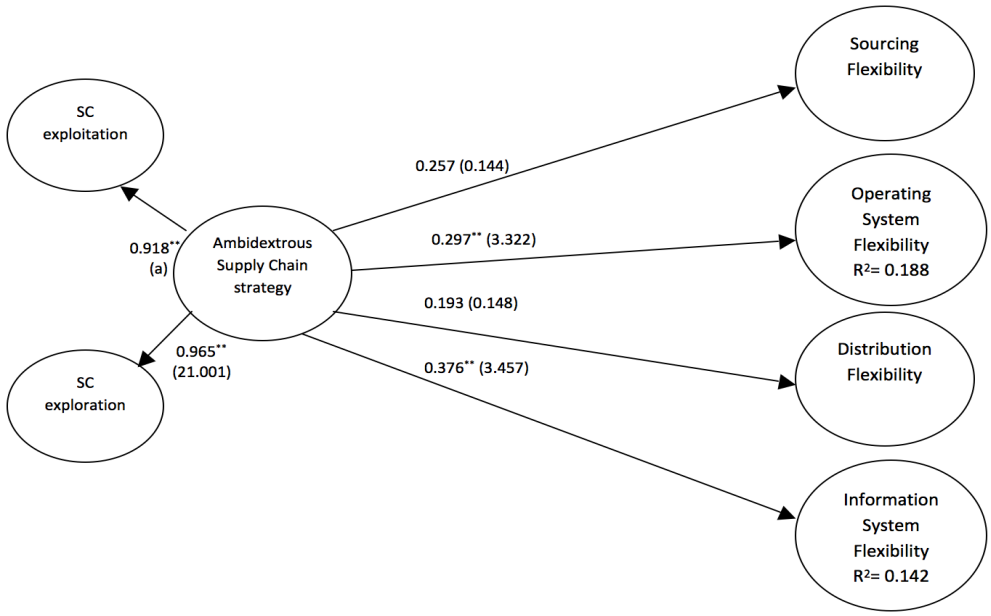
**significant at a significance level of 0.05

a indicates that the parameter was set at 1.0. If a different parameter is set at 1.0, the indicator of the scale is also statiscally significant.

Similarly, Figure 4.2 shows the results of the relationships between ASCS and the dimensions of SCF for firms without the ISO 9000 standard. The global fit indices for

the model (NFI=0.944, NNFI=0.947, CFI=0.953; IFI=0.954, GFI=0.929, AGFI=0.914, RMSEA=0.050) and the Chi-square value (338.012, p<0.001) indicate that the theoretical model fits the data well (Bollen, 1989). As with the previous model, we calculated the statistical power for the structural equations model and obtained a value of 0.84 (for ε_0 =0.05; ε_a=0.08), confirming validity and reliability of the results.

Figure 4.2: Structural modelling for the relationships between the variables in ISO 9000 certified firms



**significant at a significance level of 0.05

a indicates that the parameter was set at 1.0. If a different parameter is set at 1.0, the indicator of the scale is also statiscally significant.

The results obtained show that ASCS influences sourcing flexibility, distribution flexibility, and information system flexibility positively in firms without the ISO 9000 standard, confirming H1a, H1c, and H1d for this group of firms. For firms with the ISO 9000 standard, the results show that the strategy analyzed improves the dimensions of operating system flexibility and information system flexibility, confirming H1b and H1d for the second group of firms. These results show that the significance or non significance of the relationships examined depends on the group of firms analyzed, with

the exception of the relationship between ASCS and information system flexibility, which is significant for both groups, partially confirming H2.

To ensure that the proposed model does not suffer from problems of endogeneity, a test of robustness was performed (Rojo et al., 2016). We developed an alternative model which assumed that the different dimensions of SCF impact ASCS and tested it on the two groups of firms to compare its global fit with the models in Figures 1 and 2 (Jöreskog, 1993; Tanriverdi, 2005). The fit indices for the alternative model, for both Group 1 (Chi-square= 594.188, NFI=0.905, NNFI=0.907, CFI=0.862; IFI=0.862, GFI=0.877, AGFI=0.846, RMSEA=0.100) and Group 2 (Chi-square=416.510, NFI=0.907, NNFI=0.909, CFI=0.874; IFI=0.864, GFI=0.877, AGFI=0.874, RMSEA=0.095) show that this second model does not fit the data well, confirming that the proposed model provides better explanation of the data.

4.4.2. Multivariate analysis of variance (MANOVA)

To contrast the last of our hypotheses, we perform an analysis of variance to compare whether the degree of SCF varies based on the ISO 9000 standard. Variance analysis has been used widely in the prior literature and is a good test for comparing the mean a variable takes in two different groups (Lu et al., 2008; Tamayo-Torres et al., 2014b).

Since theoretically a degree of correlation exists between dependent variables (the dimensions of SCF), the best technique to control for Type I error is multivariate analysis of variance (MANOVA) rather than an independent ANOVA for each dimension of SCF (Hair et al., 2004). We establish that the dependent variables are indeed correlated by performing Bartlett's sphericity test (5962.458, p=0.000), confirming appropriate use of the MANOVA.

Determining the reliability of the results obtained with a MANOVA requires confirming the assumptions that permit its application (Hair et al., 2004):

— Minimum sample size of 20 observations in each group, a limit this study exceeds by a large margin.

— Independence of the observations, ensured by the cross section nature of our data.

— Equality of variance and covariance matrices. We performed Box's M test, and the result (223.541, p= 0.001) does not support that the variance and covariance matrices are the same for both groups. Violation of this condition is not crucial when the groups are approximately equal in size (size of largest group divided by size of smallest group is less than 1.5) (Hair et al., 2004), and our groups are roughly the same in size (n1= 145 and n2=157).

— Multivariate normality. Although Section 4.4.1. confirmed the absence of normality of our data, it is not crucial to fulfill this assumption when sample sizes are sufficiently large (Hair et al., 2004), as is the case in this study.

— Absence of multicollinearity among dependent variables. To test for this assumption, we calculated the variance inflation factors (VIF) for each dimension of SCF. The VIF obtained (Table 4.6) take values below the maximum recommended, ensuring that there is no risk of multicollinearity (Hair et al., 2004).

Table 4.6: Variance Inflation Factors

	VIF
Sourcing Flexibility	1.129
Operating System Flexibility	1.149
Distribution Flexibility	1.110
Information System Flexibility	1.168

Table 4.7 displays the results obtained, which show that, whatever the approach used, the ISO 9000 standard does not influence the degree of any dimension of SCF or any combination of dimensions. We do not, therefore, obtain empirical evidence to support Hypothesis 3.

Table 4.7: Multivariate Analysis of Variance (MANOVA)

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

4.5. Discussion and implications for theory and practice

4.5.1. Discussion of results

Our results strengthen and refine prior empirical research that has begun to analyze the impact of ambidexterity in the area of operations and SC (Adler et al., 2009; Patel et al., 2011; Kristal et al., 2010). First, the results show that ASCS has a positive effect on the dimensions of SCF (sourcing flexibility, operating system flexibility, and information system flexibility). They also show that the significance of these relationships depends on the presence or absence of the ISO 9000 standard, with the exception of the relationship between ASCS and information system flexibility, which is always positive and significant, independently of whether the firm has implemented the ISO 9000 standard. Significant differences thus exist in the relationships between ASCS and sourcing flexibility, operating system flexibility, and distribution flexibility, depending on whether the firm has implemented the ISO 9000 standard, whereas the relationship between ASCS and information flexibility is the same for both groups of firms.

For firms without the ISO 9000 standard, ASCS impacts sourcing flexibility, distribution flexibility, and information system flexibility and has no effect on operating system flexibility. For firms with the standard, ASCS impacts operating system flexibility and information system flexibility but has no effect on sourcing either distribution flexibility. We will first examine the relationships for which differences exist based on whether the firm has implemented the ISO 9000 standard (relationships between ASCS and sourcing flexibility, operating system flexibility, and distribution flexibility) and then examine the relationship in which no significant differences exist between the two groups of firms (between ASCS and information systems flexibility).

Note that it is precisely in firms without the ISO 9000 standard that ASCS has a positive effect on sourcing and distribution flexibility, and that neither relationship is significant if the firm implements the standard. This result can be explained by the fact that ISO 9000 requires the organization to capture and record necessary information on requirements of products to be bought, establishes systems to verify products purchased, and sets criteria for selection, evaluation, and reevaluation of suppliers and distributors (El Mokadem, 2016). This bureaucratization and formalization of the relationships between the firm and members of the SC impedes the ASCS in improving sourcing flexibility and distribution flexibility. Normalization of processes, procedures, and products could benefit firm, suppliers, and distributors insofar as it facilitates process management (orders, payments, delivery, etc.) (Llorens-Montes and Fuentes-Fuentes, 2008). The bureaucratization involved, however, prevents true alignment of actions, activities, and goals among SC members and the manufacturing firm (Buttle, 1997). This finding also contradicts the results of Fernandez-Perez and Gutierrez-Gutierrez (2012), who argue that ISO 9000 aids in strategies of development of organizational networks to which the firm belongs.

Second, ASCS improves operating system flexibility in firms with the ISO 9000 standard, while this relationship ceases to be significant if the firm does not implement the standard. One plausible explanation for this finding is that ISO 9000 certification generates an environment of continuous improvement and perfection of processes in the firm, making it possible for ambidextrous strategy to develop this type of flexibility.

The different role (facilitating in some cases, hindering in others) that ISO 9000 plays in relationships between ASCS and the dimensions of SCF is explained by the process management that accompanies the standard. ISO 9000 requires preparation of a set of documentary records that increases bureaucratization, but this bureaucratization can serve to clarify and systematize processes and activities, and thus to improve and rationalize the firm's processes (Llorens-Montes and Fuentes-Fuentes, 2008). In light of our results, we affirm that ISO 9000 process management makes it easier for ASCS to have a positive effect on operating system flexibility, which involves the SC's intraorganizational processes. Due to the bureaucratization required, the same process management prevents ASCS from having a positive effect on sourcing and distribution flexibility, as these dimensions involves the SC's interorganizational processes. This

result is also consistent with Llorens-Montes et al. (2004), who find that ISO 9000 facilitates flexibility of the firm's internal processes.

In the relationship between ASCS and information system flexibility, this dimension of SCF does not depend on ISO 9000. Since ambidextrous strategy affects information system flexibility positively in any firm, the process management that ISO 9000 introduces neither hinders nor facilitates the influence of ASCS on this dimension. The neutral effect of ISO 9000 on the relationships between ASCS and information system flexibility confirms the descriptive analysis of Casadesus and De Castro (2005), which finds that this standard does not affect the degree of integration of automated system management between the firm and SC members. The lack of influence of ISO 9000 on this relationship may be explained by the fact that the standard's bureaucratization and formalization (Kuo et al., 2009) compensate for the positive effect of normalization and specification of processes.

Finally, our results show that the ISO 9000 standard has no significant effect on SCF. This result clarifies the debate surrounding the relationship between flexibility and ISO 9000. Traditionally, the literature has been divided between authors who argue a positive relationship between the two variables and authors who argue that the relationship takes the opposite sign. The first group includes, among others, Llorens-Montes et al. (2004) and Gómez-Gras and Verdu-Jover (2005), who demonstrate a positive relationship between QM initiatives and organizational and operating flexibility, as firms with improvements in quality are found both to be more market-oriented and more inclined to adapt to changes in the environment. The continuous improvement and customer orientation emphasized in QM contribute to this effect. In contrast, authors in the second group, such as Lundmark and Westelius (2006), and Vouzas and Gotzamani (2005) suggest that the ISO 9000 standard has a detrimental effect on flexibility, as standardization, conformity, and excessive bureaucracy lead the organization to a situation of statism. Our study does not fall within either of these two traditional lines of research, as it finds no significant relationship between ISO 9000 and SCF. This result is consistent with Martinez-Costa et al. (2009), who find that this standard does not affect time cycle, and confirms Terziovski et al. (1997), who do not find evidence of difference in delivery time for goods and services between certified and noncertified firms. Our study also confirms the analysis of Casadesus and De Castro (2005), which

concludes that the ISO 9000 standard has no effect on inventory management (specifically on rotation of stock, supplier's delivery time to manufacturer, and lead time). Like the most recent studies, our findings confirm that the SC does not reproduce the debate between flexibility and ISO 9000 taking place in the firm. This result can be explained by the fact that the standard exerts its strongest effect in intraorganizational processes and is more limited at the interorganizational level.

4.5.2. Implications and contribution to theory

First, to the best of our knowledge, our study pioneers in analyzing the impact of ambidexterity and the effect of the ISO 9000 standard in the area of the SC. This study answers various calls for research. Moreno-Luzón and Valls-Pasola (2011) recommend empirical studies that relate ambidexterity to QM, and Blome et al. (2013) signal the need for more research on antecedents of SCF. Further, our research follows the line of studies by Kristal et al. (2010), Patel et al. (2012), and Tamayo-Torres et al. (2014) analyzing the effect of ambidexterity in operations and the SC. Although the benefits of ambidexterity are widely known in other areas (O'Reilly and Tushman, 2013), study of its effect on the SC is very recent and limited.

Second, our study develops in-depth knowledge from analyzing the antecedents that permit development of SCF, along the lines of Tachizawa and Gimenez (2009), who find that strategies to improve SCF act differently on different dimensions of flexibility. Our study analyzes not only the different effect on each dimension but also the contingency of ISO 9000 implementation. We thus confirm the conceptual model of Mellat-Parast (2013), which argues that firm-level QM practices affect relationships in the whole SC.

Third, prior studies have not reached consensus on whether ISO 9000 implementation affects performance (Kuo et al., 2009). The prior literature (Tamayo-Torres et al., 2014b) affirms that this discrepancy is due to the lack of studies that analyze strategic behavior, such as ambidexterity, in firms with quality initiatives. Our study advances knowledge on this question by analyzing the differences between firms with and without the ISO 9000 standard in matters of ambidexterity and SCF.

Finally, our study is the first to analyze the effect of ISO 9000 on SCF, showing empirically that it has on average no significant effect on this variable. Our findings thus contribute to resolving the controversial debate on the relationship between flexibility and ISO 9000 (Casadesus and De Castro, 2005; Llorens-Montes et al., 2004) in the specific area of the SC.

4.5.3. Implications and contributions for practice

The results obtained facilitate business decision-making to adapt the SC to the environment. The framework developed in this article permits managers to configure their SCF strategy based on the specific dimension they seek to develop by implementing ambidexterity.

Further, the results provide managers with clear knowledge enabling them to evaluate the reasons for implementing ISO 9000 appropriately in the context of SC management. The differences found between the two groups of firms analyzed confirm the need to integrate QM into SC management (Flynn and Flynn, 2005) and the influence of ISO 9000 on the development and results of strategies in the SC. When making the business decision to adopt ISO 9000, managers must take into account that this standard can help ASCS to influence development of SCF, specifically operating system flexibility, since formalization facilitates more efficient management of intraorganizational processes. It is also true, however, that such formalization bureaucratizes relationships with suppliers and distributors, and thus hinders ASCS from developing sourcing and distribution flexibility. What the firm gains in operating system flexibility may thus be lost in sourcing and distribution flexibility. For business practice, these results suggest that, to prevent ISO 9000 from interfering with the relationships between ASCS and SCF, its implementation must be accompanied by careful and efficient process management to avoid increasing the complexity of relationships with members of the SC.

Finally, the finding that ISO 9000 certification has no effect of any kind on the degree of SCF is very useful for practice. The finding is important for two reasons. First, other QM systems have demonstrated that they facilitate development of a flexible SC (Kaynak and Hartley, 2008). Second, some authors (Casadesus and De Castro,

2005) indicate that the ISO 9000 standard has the disadvantage of increasing bureaucratization and rigidity. Our study demonstrates that this drawback does not occur at SC level. In conclusion, our study provides guidance on the decision to adopt the ISO 9000 standard relative to its effects on the SC.

4.5.4. Limitations and future lines of research

The results of this study must be interpreted with its limitations. First, our study is based on cross sectional data and requires longitudinal data to permit causal inferences. Second, the ISO variable has been recorded as a categorical variable, only measuring whether or not the firm possesses the certification. This limitation prevents analysis of other issues that would enrich the research, such as amount of time since the firm earned the certification (Kuo et al., 2009) and distinction between basic and advanced implementation (Prajogo et al., 2012). Third, our study is restricted to Spain, making it necessary to test our hypotheses in other geographical contexts to address the growing importance of context dependency in the QM literature (Nair and Prajogo, 2009). Finally, we use only one informant per SC and thus only the perspective of the manufacturing firm. Future studies should incorporate more informants, as well as the perspective of suppliers and distributors.

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CAPÍTULO 5

CONCLUSIONES E IMPLICACIONES PARA LA TEORÍA Y PARA LA PRÁCTICA

CONCLUSIONES E IMPLICACIONES PARA LA TEORÍA Y PARA LA PRÁCTICA

El objetivo de este Capítulo final es recopilar y sintetizar de una forma global las principales aportaciones que se derivan de los trabajos de investigación contenidos en los Capítulos 2, 3 y 4. De este modo, presentamos las conclusiones e implicaciones para el desarrollo de la teoría así como las implicaciones para la gestión empresarial. Finalizamos el Capítulo con las limitaciones de nuestra investigación, a la luz de las cuales se han de interpretar nuestros resultados, así como con las posibles líneas de investigación futuras que pueden completar las aportaciones que se derivan de esta tesis doctoral.

5.1. Conclusiones e implicaciones teóricas del trabajo de investigación

El objetivo principal de esta tesis doctoral es, tal como se ha mencionado, el estudio de la relación entre ambidiestrismo y flexibilidad de la cadena de suministro. Antes de entrar a analizar dicha relación hemos profundizado en cada uno de estos términos por separado, analizando su conceptualización en la literatura previa. La revisión de la investigación desarrollada hasta el momento nos ha permitido, en primer lugar, detectar las limitaciones que existen en torno al estudio del ambidiestrismo y de la flexibilidad de la cadena de suministro y, en segundo lugar, tratar de solventar aquéllas.

En lo que respecta al ambidiestrismo en la cadena de suministro éste es un concepto que apenas si ha sido desarrollado por la literatura anterior. Por esta razón, a partir de la conceptualización que realiza Kristal et al. (2010), procedemos a su mejor delimitación. La delimitación realizada abarca los siguientes aspectos: enfoque empleado, forma de medición consistente con el enfoque seleccionado, relación que se establece entre las prácticas de exploración y explotación y niveles de los que se predica el ambidiestrismo en la cadena de suministro. Para efectuar esta delimitación nos hemos basado fundamentalmente en las principales y más extensas revisiones de la literatura realizadas sobre ambidiestrismo hasta el momento (Birkinshaw y Gupta, 2013; Junni et al., 2013). Esta profundización y mayor delimitación del concepto de ambidiestrismo

en la cadena de suministro salva una de las principales limitaciones detectadas en la investigación previa sobre esta área (Cao et al., 2009; Birkinshaw y Gupta, 2013), que es la ausencia de delimitación, precisión y reporte de los extremos señalados *ut supra*, lo que ha restado rigurosidad a la investigación realizada hasta el momento y ha conducido a resultados, en ocasiones, inconsistentes.

En lo referente a la literatura sobre flexibilidad de la cadena de suministro ya hemos mencionado que uno de las principales gaps en la misma es la ausencia de instrumentos de medida válidos y fiables (Stevenson y Spring, 2007). Se produce la particularidad de que han sido escasos los instrumentos desarrollados y la mayoría de ellos no han sido testados ni validados ampliamente, además de que ignoran uno de los elementos que incluyen todas las definiciones teóricas de la flexibilidad de la cadena de suministro, que es la adaptación y congruencia con el entorno. De este modo, los instrumentos de medida desarrollados hasta el momento evalúan la flexibilidad de la cadena de suministro sin atender a los específicos requerimientos del entorno. Por esta razón, en la presente tesis doctoral se desarrolla y valida una nueva escala de medida de la flexibilidad de la cadena de suministro, que tiene en cuenta el grado de flexibilidad de la cadena de suministro en relación con las exigencias del entorno y que hemos denominado ajuste de flexibilidad de la cadena de suministro. De esta manera, junto con las escalas desarrolladas hasta el momento, que podemos calificar como "absolutas", se propone el ajuste de flexibilidad de la cadena de suministro como medida "relativa", que atiende a los requerimientos del entorno y que permite calibrar si el grado de flexibilidad obtenido es el óptimo, así como establecer comparaciones entre diferentes cadenas de suministro. Ésta es una de las principales ventajas de la escala de medida desarrollada, máxime conociéndose que la inversión en flexibilidad es costosa y arriesgada (Fantazy et al., 2009; He et al., 2012) y que no todos los entornos y momentos requieren el mismo grado de flexibilidad.

Una vez solventadas las limitaciones que han rodeado el estudio del ambidiestrismo y la flexibilidad de la cadena de suministro, analizamos el impacto que la estrategia de ambidiestrismo tiene sobre la flexibilidad de la cadena de suministro. Planteamos este objetivo porque se ha demostrado recientemente que el ambidiestrismo es importante no sólo porque tiene un impacto positivo sobre el desempeño, sino porque también en entornos de incertidumbre facilita la supervivencia de la organización o

unidad que implanta esta estrategia (March, 1991; O´ Reilly y Tushman 2013). La literatura previa no ha abordado directamente la cuestión de indagar qué procesos hacen posible que esta estrategia incremente la tasa de supervivencia de las unidades que lo implantan. No obstante sí que existe evidencia de que por medio del aprendizaje adquirido vía exploración y explotación se consigue una mejor adaptación y ajuste al entorno (Santos Vijande et al.,2013; McNiff; 2000; Lumpkin y Lichestein,2005). Y la adaptación al entorno exige disponer de flexibilidad. Por esta razón, consideramos que el ambidiestrismo tendría la capacidad de fomentar la flexibilidad al permitir la implementación de operaciones basadas en la eficacia (explotación) y en la innovación (exploración).

Dado que el epicentro de nuestra investigación lo constituye la relación entre el ambidiestrismo y la flexibilidad de la cadena de suministro testamos dicha relación de tres modos distintos:

— Utilizando para medir la flexibilidad de la cadena de suministro la escala que se desarrolla y valida en la presente tesis doctoral, el ajuste de flexibilidad de la cadena de suministro, que es una medida "relativa" de la flexibilidad.

— Utilizando para medir la flexibilidad de la cadena de suministro una escala "absoluta" de la flexibilidad, la escala propuesta por Moon et al. (2012).

— Teniendo en cuenta el efecto del ambidiestrismo sobre cada una de las dimensiones que conforman el constructo flexibilidad de la cadena de suministro. Este último enfoque permite obtener una información más detallada, a nivel de constructo de primer orden, que evita la posible pérdida de información por la utilización en los dos supuestos anteriores de un constructo multidimensional.

Al constatarse en los tres supuestos el efecto positivo del ambidiestrismo sobre la flexibilidad de la cadena de suministro estamos triangulando este resultado, proporcionando una mayor robustez a nuestro hallazgo. Esta tesis doctoral contribuye así a la literatura que proclama que el ambidiestrismo tiene un efecto positivo sobre la supervivencia organizacional (O´Reilly y Tushman, 2013). Pese a conocerse dicho efecto, los mecanismos por virtud de los cuales se produce el mismo, habían permanecidos

inexplorados. De modo que este estudio colma dicha laguna conceptual, al evidenciar que, a nivel de cadena de suministro, el efecto positivo sobre la supervivencia se debe a que el ambidiestrismo facilita el ajuste de flexibilidad con el entorno. Esto es, en la literatura previa se ha demostrado que el ambidiestrismo tiene un efecto positivo sobre el desempeño y sobre la tasa de supervivencia y nosotros arrojamos luz sobre esa relación al demostrar que dicho efecto es debido a que mejora la capacidad de adaptación al entorno, esto es, la flexibilidad. Resulta destacable el hallazgo de que el ambidiestrismo no sólo conduce a una mejora de la flexibilidad de la cadena de suministro, sino también al logro del nivel óptimo de flexibilidad.

Adicionalmente, este resultado es especialmente importante en tanto que contradice la visión tradicional de que altos niveles de exploración se vinculan a una mayor flexibilidad y altos niveles de explotación tienen un efecto negativo sobre la misma (Miller et al., 2006), pues queda demostrado que llevadas a cabo simultáneamente las prácticas de exploración y explotación (es decir, la implementación de una estrategia de ambidiestrismo) conducen no sólo a una mayor flexibilidad sino a un nivel de flexibilidad adecuado a las demandas del entorno. Este hallazgo se halla en la misma línea que el reciente trabajo de Tamayo-Torres et al. (2014).

En este trabajo nos hemos planteado como objetivo el estudio tanto de los antecedentes como de las consecuencias de la flexibilidad de la cadena de suministro. Una vez demostrado empíricamente que la estrategia de ambidiestrismo es adecuada para el desarrollo de la flexibilidad de la cadena de suministro pasamos a analizar las consecuencias de dicha flexibilidad, tanto a nivel de cadena de suministro como a nivel de empresa.

En primer lugar, pasamos a analizar el impacto que la flexibilidad de la cadena de suministro tiene sobre la propia cadena de suministro. El modo en que hemos conceptualizado el ajuste de flexibilidad de cadena de suministro (como el gap o la comparación de la percepción de los directivos de la flexibilidad de su cadena de suministro y de la de aquélla que consideran excelente en su sector) nos permite evaluar si la estrategia de reproducción de las prácticas en materia de flexibilidad de las empresas consideradas más exitosas (estrategia que de forma genérica recibe el nombre de isomorfismo) tiene un impacto positivo sobre el nivel de competencia de la cadena de suministro. El

impacto de la estrategia de isomorfismo en la literatura es controvertido, pues existen opiniones tanto que abogan por su uso (DiMaggio y Powell, 1983; Levitt y March, 1988; D´Aunno et al., 1991), como que evidencian que tienen un impacto negativo sobre la competencia (Miemczyk, 2008; Heugens y Lander, 2009). Adicionalmente, a nivel de gestión de la cadena de suministro, este enfoque, que procede de la teoría institucional, apenas ha sido utilizado. Por lo que nuestros resultados, que demuestran que el ajuste de flexibilidad de la cadena de suministro influye positivamente sobre su nivel de competencia, suponen una triple contribución a la literatura. En primer lugar, se demuestra que la flexibilidad de la cadena de suministro, pese a tener un coste y suponer un riesgo (He et al., 2012), es beneficiosa para su nivel de competencia o desempeño. En segundo lugar, hallamos que la estrategia de isomorfismo es adecuada para la mejora de la competencia de la cadena de suministro y, por tanto, una fuente de ventaja competitiva. Finalmente, hemos ampliado el poder explicativo de la teoría institucional al aplicarla al ámbito de la gestión de las relaciones en la cadena de suministro, siguiendo la línea de los recientes trabajos de Cai et al. (2010), Liu et al. (2010) y Wu et al. (2012). Además, se ha de notar que éste es uno de los primeros estudios que evalúa el impacto de la flexibilidad de la cadena de suministro sobre la propia cadena de suministro. Hasta el momento, la investigación en gestión de cadena de suministro ha estado dominada por un enfoque basado en la empresa, que ignora que la cadena de suministro en la que la empresa se integra es sujeto de competencia (Spekman et al., 2002). Por esta razón, han sido mucho los autores que reclaman la utilización de la cadena de suministro como unidad de análisis (Blome et al., 2013), y nuestro estudio satisface dicha condición.

En segundo lugar, pasamos a analizar el impacto que la flexibilidad de la cadena de suministro tiene sobre la empresa. Desde un punto de vista teórico, es posible encontrar multitud de trabajos que proclaman el efecto positivo de la flexibilidad y de la competencia de la cadena de suministro sobre el desempeño empresarial (Fisher, 1997; Martínez-Sánchez y Pérez-Perez, 2005; Chow et al., 2008). Sin embargo, apenas existen estudios que lo contrasten empíricamente (Qrunfleh y Tarafdar, 2014). Por esta razón, nuestra tesis doctoral, al confirmar empíricamente que la flexibilidad de la cadena de suministro tiene un impacto positivo sobre el desempeño empresarial, a través de la mejora de la competencia de la cadena de suministro, colma la citada laguna de la literatura previa y contribuye a la validación y expansión de dicho conocimiento teórico.

Tal como se ha mencionado, el objetivo central de esta tesis doctoral es el estudio de la relación entre ambidiestrismo y flexibilidad de la cadena de suministro. Una vez que se ha verificado empíricamente, así como sus consecuencias, nuestro propósito es explorar el papel que otras variables pueden jugar en esta relación. Adoptamos, así, la óptica que afirma que sólo puede conocerse una relación en profundidad si se analiza el papel que otras variables pueden jugar en la misma. Como indicamos en el primer Capítulo, optamos por la consideración de dos variables: la competencia en TI y el estándar ISO 9000; la primera se encuentra relacionada con los componentes de gestión y la segunda con los procesos de negocio de la cadena de suministro (Cooper et al., 1997).

Respecto a la competencia en TI, su inclusión respondía a una doble necesidad de investigación que había señalado la literatura previa. Por una parte, desde la investigación en sistemas de información y de cadena de suministro, se ha reclamado un mayor estudio de la competencia en TI en el ámbito de la cadena de suministro dado que el incremento de la inversión en TI es una práctica empresarial constante y que es muy habitual el uso de diferentes tecnologías de la información para la gestión de la cadena de suministro (Zhang et al., 2011; Zhang et al., 2016), por lo que es crucial evaluar el papel que juega la competencia de la empresa en la gestión de la TI en el ámbito de la cadena de suministro. Por otro lado, la competencia en TI ha demostrado desempeñar un rol fundamental en la gestión del conocimiento (Perez-Lopez et al., 2009; Chuang et al., 2013), en tanto que facilita el desarrollo de estructuras organizacionales que permiten la expansión del conocimiento. Por tanto, es trascendental analizar la relación entre competencia en TI y ambidiestrismo, que es el paradigma más estudiado actualmente en el campo de la gestión del conocimiento. Este el primer estudio que explora esta relación.

Para estudiar la relación entre ambidiestrismo, flexibilidad de la cadena de suministro y competencia en TI utilizamos el marco teórico proporcionado por la Teoría de Recursos y Capacidades y la jerarquía de capacidades (Barney, 1991; Teece et al., 1997; Ray et al., 2005; Rai et al., 2006; Grewal y Slotegraal, 2007). Este enfoque nos ha permitido explicar el rol moderador que la competencia en TI ejerce en la relación entre ambidiestrismo y flexibilidad de la cadena de suministro, así como ofrecer una explicación de por qué la flexibilidad de la cadena de suministro es fuente de ventaja competitiva para la empresa.

Siguiendo esta línea de argumentación se ha constatado que la flexibilidad de la cadena de suministro es una capacidad de orden superior o capacidad dinámica. Para ello se examinó si reúne las condiciones que la literatura ha señalado que dichas capacidades deben poseer (Barney, 1991). Esto nos ha permitido encontrar justificación, desde el plano de la teoría, del poder competitivo de la flexibilidad de la cadena de suministro (Gerwin, 1993; Aprile et al., 2005; Blome et al., 2013). Además, siguiendo la corriente de literatura dominante sobre competencia en TI (Wade y Hulland, 2004; Liu et al., 2013), se demostró que ésta es una capacidad de orden inferior que impacta en la organización a través de relaciones complementarias con otros activos. Específicamente, se constató que la competencia en TI amplifica el efecto positivo del ambidiestrismo sobre la flexibilidad de cadena de suministro siempre que dicha competencia sea elevada.

Finalmente, en relación al estándar ISO 9000, su inclusión se debe a que es una variable con la capacidad de influir en los procesos de negocio, elemento clave en la gestión de la cadena de suministro (Cooper et al., 1997). Además, pese a que la literatura previa ha señalado la conexión entre las prácticas de gestión de calidad y ambidiestrismo, apenas existen estudios teóricos o empíricos que relacionen el ambidiestrismo con el estándar ISO 9000 (Moreno-Luzón y Valls-Pasola, 2011; Tamayo-Torres et al., 2014; Moreno-Luzón et al., 2014). Al mismo tiempo, una de las premisas centrales de ISO 9000 es regular las actividades y operaciones de la cadena de suministro. Sin embargo, apenas si se ha estudiado en la literatura precedente el efecto de este estándar sobre la cadena de suministro (Prajogo et al., 2012; Mellat-Parast, 2013; El Mokadem, 2016).

Por las razones anteriormente expuestas, hemos considerado que el estándar ISO 9000 puede influir tanto en el efecto que el ambidiestrismo tiene sobre la flexibilidad de la cadena de suministro, como en el nivel de flexibilidad de la cadena de suministro. Dado que el estándar ISO 9000 ejerce su influencia principalmente a través de la gestión de los procesos, decidimos analizar su impacto separadamente sobre cada uno de los tipos de procesos involucrados en la gestión de la flexibilidad de la cadena de suministro, de acuerdo con Moon et al. (2012): flexibilidad de suministro, flexibilidad del sistema operativo, flexibilidad de distribución y flexibilidad de los sistemas de información.

Los resultados obtenidos evidenciaron que la significatividad de las relaciones entre ambidiestrismo y las distintas dimensiones o tipos de procesos que conforman la flexibilidad de la cadena de suministro depende de la presencia o no en la empresa del estándar ISO 9000. Así, para las empresas sin estándar ISO 9000, el ambidiestrismo tiene un efecto positivo sobre las dimensiones de flexibilidad de suministro, flexibilidad de distribución y flexibilidad de los sistemas de información y ningún efecto sobre la flexibilidad del sistema operativo. Sin embargo, en las empresas con el estándar implantado, la estrategia de ambidiestrismo tiene impacto sobre la flexibilidad del sistema operativo y la flexibilidad de sistemas de información, pero ningún efecto sobre la flexibilidad de suministro y la de distribución. De modo que, existen diferencias significativas en la relación entre ambidiestrismo y flexibilidad de cadena de suministro en función de si la empresa ha implantado dicho estándar o no.

El diferente papel (en unos casos facilitador y en otros obstaculizador) que el estándar ISO 9000 tiene en las relaciones entre ambidiestrismo y las distintas dimensiones de la flexibilidad de la cadena de suministro, se ha explicado por la gestión de los procesos que conlleva este estándar. ISO 9000 incrementa la burocratización. No obstante, dicha burocratización puede ayudar a la sistematización de los procesos y actividades y, por consiguiente, coadyuvar a la mejora y racionalización de los procesos organizacionales (Llorens-Montes y Fuentes-Fuentes, 2008). Nuestros resultados confirman que la gestión de procesos que conlleva ISO 9000 facilita que el ambidiestrismo tenga un efecto positivo sobre la flexibilidad del sistema operativo, que hace referencia a los procesos intraorganizacionales de la cadena de suministro. Sin embargo, esa misma gestión de procesos, por la burocratización que exige, impide que el ambidiestrismo tenga un efecto positivo sobre la flexibilidad de suministro y de distribución, dimensiones que se refieren a los procesos interorganizacionales de la cadena de suministro. Este resultado es además consistente con Llorens-Montes et al. (2004) que encontró que ISO 9000 era facilitador de la flexibilidad de los procesos internos de la empresa.

Como se ha mencionado, no sólo analizamos el impacto que ISO 9000 tiene en la relación entre ambidiestrismo y flexibilidad de la cadena de suministro, sino también su efecto sobre cada una de las dimensiones que componen la flexibilidad de la cadena de suministro. En general, la relación entre flexibilidad y estándar ISO 9000 se

caracteriza por su controversia. Podemos encontrar tanto estudios que postulan que el estándar incrementa la conciencia de la empresa por la mejora continua y, por tanto, incrementa la sensibilidad hacia los cambios del entorno y el desarrollo de la flexibilidad (Llorens-Montes et al., 2004), como trabajos que aducen que el certificado en ISO 9000, en la práctica desemboca en un simple incremento de la burocracia, que reduce la flexibilidad e innovación (Kuo et al., 2009). Nos planteamos extender este debate al ámbito de la cadena de suministro, por la razón de que existen evidencias de que las iniciativas en gestión de la calidad reducen el inventario de *stock* de ciclo y el índice de rotación de inventario (Flynn y Flynn, 2005), lo que puede influir positivamente sobre el nivel de flexibilidad de la cadena de suministro. En el mismo sentido, El Mokadem (2016) ha demostrado recientemente que este estándar ayuda a la alineación de las actividades de la cadena de suministro con el entorno. Al mismo tiempo que también encontramos trabajos que proclaman su efecto negativo por la burocracia que conlleva (Casadesus y De Castro, 2005). Nuestros resultados arrojaron luz sobre la debatida cuestión de la relación entre flexibilidad e ISO 9000 en el contexto específico de la flexibilidad de la cadena de suministro, demostrando empíricamente que este estándar no tiene efecto significativo sobre ninguna de las dimensiones que conforman la flexibilidad de la cadena de suministro.

5.2. Implicaciones para la práctica empresarial

La presente tesis doctoral realiza, igualmente, importantes contribuciones para la gestión empresarial que pasamos a enunciar a continuación:

— Comprender cómo conseguir una cadena de suministro flexible es muy valioso para los directivos en un entorno como el actual caracterizado por una competencia global y un alto grado de impredecibilidad de los cambios. La verificación de que el ambidiestrismo tiene un efecto positivo sobre la flexibilidad de la cadena de suministro significa, en términos de práctica empresarial, que una elevada eficiencia y refinamiento de los procesos actuales de la cadena de suministro no penaliza su flexibilidad, siempre que se acompañe de altos niveles de innovación e introducción de nuevos procesos. Por tanto, eficiencia e innovación son compatibles en la gestión de la cadena

de suministro y, además, altos niveles de ambas prácticas conducen a un nivel de flexibilidad óptimo. Los directivos no han de elegir entre eficiencia e innovación, sino que han de desarrollar ambos tipos de prácticas en gran medida si quieren una cadena de suministro tan flexible como lo exija el entorno. Nuestro hallazgo contradice así la visión tradicional de que altos niveles de prácticas de explotación perjudican la flexibilidad (Miller et al., 2006), pues siempre que se sumen a altos niveles de prácticas de exploración, éstas compensan a aquéllas y conducen al nivel óptimo de flexibilidad.

— Adicionalmente, la confirmación de que el ambidiestrismo tiene un efecto positivo sobre la flexibilidad de cadena de suministro significa que los directivos han de gestionar el aprendizaje en la red organizacional que conforman con sus proveedores y distribuidores, debiendo facilitar un clima de cooperación y colaboración con éstos.

— Proporcionar a los directivos un instrumento de medida de la flexibilidad de cadena de suministro que les permite diagnosticar el nivel de flexibilidad de la cadena de suministro que gestionan, identificar su correspondencia (o falta de la misma) con el nivel óptimo de flexibilidad y establecer comparaciones entre distintas cadenas de suministro o entre distintos momentos del tiempo para una misma cadena de suministro.

— El desarrollo del concepto de ajuste de flexibilidad de cadena de suministro y su efecto positivo sobre la competencia de cadena de suministro debe conducir a que los directivos reconsideren la idea de que la mejor cadena de suministro es la más flexible (Stevenson y Spring, 2007) y que la sustituyan por la convicción de que la cadena de suministro más competitiva será aquella que mejor ajuste tenga con el entorno. Por consiguiente, los directivos han de modificar la estrategia de flexibilidad de la cadena de suministro: han de seguir invirtiendo en el desarrollo de dicha flexibilidad, pero teniendo en cuenta que dicha inversión ha de estar limitada por las específicas circunstancias impuestas por el entorno. Esto es, no han de imponerse como objetivo conseguir la cadena de suministro más flexible posible, sino buscar el óptimo de flexibilidad (ajuste de flexibilidad).

— Esta tesis doctoral es útil para el proceso de toma de decisiones relativas a la gestión de la flexibilidad de la cadena de suministro, pues identifica las dimensiones o procesos clave sobre las que actuar (flexibilidad de suministro, flexibilidad de distribución, flexibilidad del sistema operativo y flexibilidad del sistema de información) así como el punto de referencia para establecer objetivos (la empresa considerada excelente del sector). Además, en dicho proceso de toma de decisiones, si los directivos desean aumentar la competencia de la cadena de suministro, no sólo han de atender a criterios de eficiencia o beneficio, sino que deben satisfacer las presiones y demandas institucionales del sector en el que operen.

— Los directivos han de tomar conciencia de que el grado de competencia de su cadena de suministro tiene impacto directo sobre los beneficios empresariales. Esto implica un cambio de paradigma en la gestión empresarial: se difumina la distinción entre empresa y la red que conforma su cadena de suministro, pues los directivos han de comenzar a gestionar los activos y competencias, tanto de su propia empresa como de su cadena de suministro. Ello hace necesario que los directivos creen un clima de colaboración y cooperación con los miembros de su cadena de suministro.

— En los últimos años, en las empresas se han producido numerosas inversiones en TI que, sin embargo, no se han traducido en incrementos del nivel de beneficios (Liu et al., 2013), porque los directivos no han tenido en cuenta que la TI, por sí sola, no tiene efecto directo sobre los resultados empresariales, sino a través de otras capacidades de orden superior. Por ello este trabajo supone una guía para los directivos que les permite rentabilizar su inversión en TI, pues hemos demostrado que parte de su valor de negocio consiste en su impacto positivo sobre la flexibilidad de la cadena de suministro. Especialmente destacable es nuestro hallazgo de que la relación entre ambidiestrismo y flexibilidad de la cadena de suministro se ve fortalecida en presencia de la competencia en TI cuando ésta es alta. Esto implica que la transmisión del esfuerzo en TI a una capacidad de orden superior, como es la flexibilidad de la cadena de suministro, sólo se produce cuando se ha invertido en alto grado en TI, ya que en los niveles más bajos o iniciales

de esta competencia, dicho efecto no se produce. Por lo que si los directivos desean incrementar el nivel de flexibilidad a través de la competencia en TI, deberán realizar un análisis coste/beneficio, pues han de invertir en gran medida en el desarrollo de la competencia en TI, para que ésta tengo efecto sobre el nivel de flexibilidad de la cadena de suministro.

— Proporciona a los directivos un conocimiento claro para que puedan evaluar la decisión de implantación del estándar ISO 9000 en el contexto de la gestión de la cadena de suministro y la necesidad de integrar la gestión de la calidad con la gestión de la cadena de suministro (Flynn y Flynn, 2005). Los directivos han de ser conscientes de que el estándar ISO 9000 facilita que el ambidiestrismo influya positivamente sobre la flexibilidad de la cadena de suministro, específicamente sobre la flexibilidad del sistema operativo, pues la formalización que conlleva el estándar mejora los procesos intraorganizacionales de la cadena de suministro. Ahora bien, al mismo tiempo, dicha formalización y burocratización impide que la estrategia de ambidiestrismo desarrolle la flexibilidad de proveedores y la flexibilidad de distribuidores. Por lo que, para evitar el efecto obstaculizador de ISO 9000 sobre el desarrollo de estas últimas dimensiones, la implantación del estándar ha de acompañarse de una cuidadosa y eficiente gestión de los procesos interorganizacionales de la cadena de suministro, que evite el incremento de complejidad de las relaciones con los miembros de la cadena de suministro. Finalmente, resulta muy útil en la gestión de la cadena de suministro conocer que la implantación del estándar ISO 9000 no afecta en sentido alguno al nivel de flexibilidad de la cadena de suministro, ni positiva ni negativamente, a diferencia de lo que ocurre con otros sistemas de gestión de la calidad (Kaynak y Hartley, 2008).

5.3. Limitaciones y futuras líneas de investigación

A pesar de las contribuciones que realiza esta tesis doctoral, tanto en el plano de la teoría como en el de la gestión empresarial, la investigación que la conforma presenta una serie de limitaciones:

En primer lugar, nuestro objeto de estudio lo conforman empresas españolas pertenecientes al sector de fabricación, lo que puede limitar la generalización de nuestros resultados a otros contextos geográficos distintos. Por ello, sería interesante, la replicación de nuestro estudio en áreas geográficas distintas.

En segundo lugar, dado que hemos usado un único informante por organización, existe el riesgo del sesgo por método común. Para tratar de minimizar su incidencia hemos identificado a informantes que fueran expertos en las cuestiones objeto de estudio, así como hemos adoptado una serie de medidas procedimentales, que fueron ya descritas. No obstante, estas medidas no eliminan por completo el riesgo de dicho sesgo. Por tanto, futuros estudios podrían confirmar los resultados obtenidos en esta sede utilizando varios informantes por organización. De este modo, se seguiría la recomendación de Junni et al. (2013) que insta al uso de múltiples informantes para reportar adecuadamente el ambidiestrismo. Del mismo modo, aunque pedimos a los informantes que respondiesen a nuestra encuesta desde la perspectiva de su cadena de suministro, sería más oportuno el recurso a múltiples informantes de una misma cadena de suministro (pertenecientes a distintas organizaciones de la red), al efecto de captar la esencia y naturaleza de la misma (Gligor et al., 2015).

En tercer lugar, en esta tesis doctoral se han utilizado datos de corte transversal, lo que dificulta en gran medida establecer relaciones de causalidad. Del mismo modo, al evaluar la flexibilidad de cadena de suministro, se corre el riesgo de analizar una situación temporal en la organización y no la capacidad de flexibilidad a lo largo del tiempo. Es cierto que, al utilizar la escala de medida de ajuste de flexibilidad de cadena de suministro, nos aproximamos más a la medición de la capacidad de flexibilidad que a analizar una situación puntual (Llorens-Montes et al., 2004). No obstante, futuras investigaciones podrían utilizar datos de naturaleza longitudinal que confirmasen las hipótesis propuestas.

En cuarto lugar, dado que el ambidiestrismo es un fenómeno de naturaleza multinivel (Raish y Birkinshaw, 2008; Birkinshaw y Gupta, 2013), sería interesante que futuras investigaciones analizaran el ambidiestrismo de la cadena de suministro teniendo en cuenta distintos niveles simultáneamente, así como que incorporasen el análisis de los flujos de conocimiento que realiza Mom et al. (2009).

Finalmente, hemos de mencionar que la implantación del estándar ISO 9000 ha sido medida mediante una variable categórica, que lo único que recoge es si la empresa posee dicha certificación o no. De este modo se han obviado otros aspectos que enriquecerían futuras investigaciones como son el tiempo que hace que la empresa posee dicha certificación (Kuo et al., 2009), o la distinción entre implementación básica e implementación avanzada del estándar (Prajogo et al., 2012), así como la consideración de otras iniciativas de gestión de la calidad.

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