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TESIS DOCTORAL

ORIENTACIÓN A LA INNOVACIÓN ABIERTA Y CAPACIDADES DINÁMICAS COMO FUENTES DE LA COMPETENCIA PARA LA GESTIÓN DE LA CADENA DE SUMINISTRO

MENCIÓN DE DOCTORADO INTERNACIONAL

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Ellos son la expresión de que *"El amor es comprensivo, el amor es servicial y no tiene envidia. Disculpa sin límites, cree sin límites, espera sin límites, soporta sin límites. El amor no pasa jamás"* (Lectura de la Primera Carta del Apóstol San Pablo a los Corintios 12, 31-13,8).

A Clara y Juan Blas,

para que algún día puedan leerlo

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INTRODUCCIÓN

1. 1. Introducción al tema objeto de estudio

1.1.1. Introducción

En un contexto de crisis económica, resulta esencial analizar aquellos aspectos que permiten a las organizaciones superar esta situación y mantener una ventaja competitiva sostenida en el tiempo. La innovación, constituye una fuente de ventaja competitiva (Ruíz y Fuentes, 2013), siempre y cuando se desarrolle en el menor tiempo posible. Es decir, las organizaciones han de innovar "más y más rápido" (Manceau et al., 2011; p. 4). Ello se debe, entre otros factores, a que sus clientes están cada vez más informados, las necesidades de los mismos son más cambiantes y su competencia ejerce una gran presión (Menon et al., 2002). Ante esta situación, las organizaciones han de mejorar la funcionalidad del proceso de innovación, logrando un compromiso con un nuevo paradigma, la innovación abierta.

El tradicional concepto de innovación, ha quedado superado por un nuevo paradigma, la innovación abierta. Desde que Chesbrough le diera nombre en 2003, han proliferado los estudios para esclarecer la relación entre innovación abierta y mejora del desempeño. La ausencia de consenso entre ellos, hace pensar que se trata de una relación compleja que depende de las prácticas de innovación abierta que se consideren (explorar el conocimiento externo de partners como proveedores, clientes, usuarios, universidades, competidores, centros de investigación *[outside-in open innovation}*, explotar el conocimiento propio con los partners mencionados anteriormente *[inside-out open innovation]* o desarrollar procesos conjuntos con ellos [*coupled processes:* explorar y explotar conocimiento simultáneamente]).

El presente trabajo se centra en el estudio de la propensión a innovar de forma abierta en una organización y su relación con la mejora del desempeño, teniendo en cuenta una serie de variables que pueden ayudar a explicarla. Dicha propensión a innovar de forma abierta, la entendemos de forma limitada. Es decir, este trabajo se centra en el estudio de la orientación a la innovación abierta de una organización, pero

puesta en práctica con un partner concreto, los proveedores (*supply network*). Hasta ahora, el estudio en detalle de los proveedores como fuente de innovación para las organizaciones ha sido escaso en la literatura. Es por ello, que pretendemos suplir este vacío, analizando la orientación a la innovación abierta de una organización con su *supply network*, sus antecedentes y sus efectos en la mejora del desempeño.

1.1.2. Delimitación del tema objeto de estudio

El presente trabajo de investigación analiza la influencia de la innovación abierta en la mejora del desempeño innovador y de la competencia para la gestión de su cadena de suministro. Nos aproximamos a este paradigma centrándonos en una fuente de innovación concreta, su red de proveedores, estudiando la orientación a innovar de esta organización integrando a éstos.

Este trabajo se ha dirigido a empresas españolas que innovan de forma conjunta con sus proveedores, es decir adoptan una de las prácticas de innovación abierta, *coupled processes*. Se trata de un estudio de carácter multisectorial, pues pretendemos mostrar como otros trabajos, que innovación abierta es posible en sectores tradicionales, que no se caracterizan por su intensidad tecnológica.

La importancia de los proveedores como fuentes de ideas e innovación exitosas, ha sido reconocida de forma amplia en la literatura que genéricamente ha analizado las fuentes de innovación en innovación abierta (Von Hippel, 1998; Laursen y Salter, 2006; Un et al., 2010; Mention, 2011; West y Bogers, 2014). Así, el trabajo de Enkel y Gassmann (2008) muestra a los proveedores como la segunda fuente de innovación empleada por las organizaciones (61%) y Enkel et al. (2009) señalan que el 69% del conocimiento externo proviene de éstos. Las propuestas que pueden hacer los proveedores pueden ser de igual o mayor calidad a las que pueden producirse internamente en la organización, como ya expuso Chesbrough (Wagner, 2010). Ello se debe a que los proveedores son los stakeholders que mejor conocen a la organización,

al deberse a la misma por ser su cliente, concretamente conocen en detalle sus productos y procesos (Bessant, 2003; Petersen et al., 2003; Von Hippel, 1998). Asimismo, disponen de información valiosa sobre los usuarios finales, ésto es, sobre los clientes de la organización a la que sirven, ofreciendo información sobre nuevas formas de proceder, permitiendo a la organización suministrada disponer de una base de comparación de sus prácticas con otras presentes en la realidad empresarial y superar a su competencia por no tener que realizar en solitario todas las funciones de la cadena de valor (Groher, 2003 en Brem y Tidd, 2012). Por su parte, el informe de Manceau et al. (2011) apunta a algunas de las razones que justifican la importancia de innovar conjuntamente con los proveedores. Entre ellas, se encuentran la complementariedad de habilidades y recursos entre la organización y sus proveedores, así como la posibilidad de hacer uso de la capacidad financiera y posición competitiva en el mercado de éstos.

Aunque considerar a los proveedores como fuente de innovación no está exento de riesgos, este trabajo pretende mostrar los beneficios que se derivan de la orientación a innovar de forma conjunta con ellos a nivel operativo e innovador. Dado que la competencia ha pasado de producirse entre empresas, a tener lugar entre cadenas de suministro, las organizaciones han de ser conscientes de que contribuyen a ella desarrollando su competencia a la hora de gestionar su cadena de suministro. Resulta pues, esencial atender a aquellos factores que pueden incidir en el fortalecimiento de dicha competencia. Nosotros intentamos contribuir a la literatura en ese sentido, vinculando la orientación a la innovación abierta con la mejora de la misma, teniendo en cuenta una serie de factores que anteceden dicha orientación o fortalecen la transferencia de conocimiento. Así pues, nuestro trabajo estudia una serie de factores que explican la orientación a la innovación abierta de una organización con sus proveedores, su influencia a nivel operativo e innovador y los factores que pueden fortalecer la misma (percepción de dependencia, capacidad de absorción y desorción, certificación en ISO 9000, entre otros). De este modo, respondemos a la necesidad de estudiar esta fuente de innovación de forma pormenorizada, tal y como reclama la

literatura en trabajos recientes como el de Obal y Lancioni (2013).

Entendemos por orientación a la innovación abierta de una organización, el grado en el que una organización pone en práctica este nuevo paradigma, concretamente, la medida en que desarrolla procesos conjuntos con su *supply network*. Siguiendo a Narasimhan y Narayanan (2013), entendemos por *supply network*, "la posible red de proveedores directos e indirectos en el sistema de valor de una organización"(p. 28). Nosotros estudiamos la proclividad de la organización a emplear inputs procedentes de una gran variedad de proveedores, pequeños y grandes, así como a desarrollar procesos conjuntos con ellos. En consecuencia, estos proveedores que se compromenten con los procesos de innovación abierta de una organización pueden o no haber mantenido una relación previa con la organización (Narasimhan y Narayanan, 2013).

Una vez delimitado nuestro trabajo, exponemos las principales preguntas de investigación que abordaremos en él:

1. ¿Qué factores explican la orientación a la innovación abierta de una organización? ¿Determina la satisfacción con experiencias previas en innovación abierta, una mayor o menor proclividad a dicha orientación en un futuro?

2. ¿Puede la orientación a la innovación abierta mejorar el desempeño operativo de una organización? ¿Contribuye la mejora de la competencia para la gestión de la cadena de suministro a la mejora del desempeño organizacional?

3. ¿Cómo influyen las relaciones de poder en la obtención de desempeño como consecuencia de la adopción de innovación abierta? ¿Qué rol ejercen las capacidades de absorción y desorción de una organización en la mejora del desempeño?

4. ¿Cuál es la influencia de la implantación de las normas ISO 9000 en la obtención de desempeño innovador como resultado de una orientación a la innovación abierta? ¿Depende la relación entre calidad e innovación abierta de factores adicionales?

5. ¿Existen diferencias entre los beneficios derivados de la orientación a la innovación abierta en función del número de proveedores que integren su *supply network* o el tamaño o sector de la organización?

1.1.3. Evolución de los estudios sobre innovación abierta e integración de proveedores

El desarrollo de la literatura acerca de este nuevo paradigma se encuentra en un estadío inicial. Es por ello, que en la primera década de su aparición, se han producido confrontaciones entre la comunidad científica. Una de ellas fue el debate que tuvo lugar en torno a la diferencia entre innovación abierta y gestión de la cadena de suministro. En él, se llegó a criticar este nuevo paradigma por no ofrecer nada nuevo en relación a la gestión de la cadena de suministro (Von Hippel, 2010). Finalmente, fue resuelto apuntando a los distintos objetos que persiguen cada rama de la literatura (eficiencia, reducción de costes vs efectividad del proceso de innovación), así como su distinto alcance y procesos. A continuación se presenta una tabla (**Tabla 1.1**) en la que figuran los distintos trabajos que se pronunciaron al respecto.

Autor	Is open innovation a field of study or a communication barrier to theory development?
Groen and Linton (2010)	Plantean la necesidad de reflexionar sobre el término open innovation. Apuntan la posibilidad de que se solape con el ya existente supply chain management.
Von Hippel (2010)	Señala la existencia de cierta similitud entre ambos términos.
Badawy (2011)	Sostiene que ambos conceptos son muy diferentes: 1. OI como paradigma-SCM herramienta para lograr eficiencia en cadena de suministro. 2. OI centrado en la búsqueda de nuevas ideas, productos, servicios como base para colaborar o partnerships. SCM centrado en la reducción de costes y eficiencia a través de una red de sistemas interconectados que permiten controlar el flujo de materias primas, elaboradas y productos finales desde el punto de origen al de consumo. 3. SCM persigue coordinar las funciones tradicionales de una empresa. OI relacionada con actividades no tradicionales como la creatividad, invención, orientación a la innovación… 4. OI equivale a efectividad, mientras que SCM eficiencia.
Lichtenthaler (2011)	OI no es una nueva teoría pero puede enriquecerse de la literatura existente para su desarrollo teórico.
Van de Vrande and Man (2011)	Señalan las semejanzas y diferencias entre ambos conceptos. SEMEJANZAS: Énfasis en la integración de proveedores, usuarios y clientes para que el cliente reciba mayor valor. DIFERENCIAS: 1. OI presta más atención a la colaboración con terceros. 2. OI va más allá de la integración de proveedores, usuarios y clientes, teniendo en cuenta el conocimiento de universidades y competidores. 3. Las técnicas de OI son más amplias que las de SCM. Es el caso de corporate venture capital, el empleo de intermediarios del conocimiento y la comercialización de la propiedad intelectual. 4. El elemento central de OI es el análisis de la exploración y explotación del conocimiento por las organizaciones. 5. OI además de incidir en el empleo de fuentes externas de conocimiento, requiere un cambio organizacional. Subrayan la necesidad de integrar diferentes marcos teóricos para lograr un avance a nivel teórico como OI, SCM**, la literatura sobre alianzas y redes y estilos de aprendizaje.**
Von Krogh (2011)	Señala la importancia de OI por dos motivos: 1. Permite organizar las actividades de innovación con stakeholders en las empresas que integran su cadena de suministro. 2. Permite explorar nuevas formas de innovar con expertos y partner organizations. **La exploración del conocimiento de OI se solapa con la literatura previa sobre cadenas de suministro. Las características de los procesos de innovación abiertos difieren de los propios de la cadena de suministro.**

Tabla 1.1. Is open innovation a field of study or a communication barrier to theory development? Elaboración Propia. Nota: OI=Innovación abierta. SCM=Gestión de la cadena de suministro.

Hemos querido destacar esta polémica para explicar la necesidad de atender a la evolución de los estudios sobre relaciones interorganizacionales en el contexto de una cadena de suministro e integración de proveedores, hasta llegar a la literatura que ha tratado de forma exclusiva a los proveedores en innovación abierta y explicar en qué medida contribuye nuestro trabajo a la misma.

1.1.3.1. Las relaciones interorganizacionales en el contexto de una cadena de suministro. La integración de proveedores en el desarrollo de nuevos productos

Las relaciones interorganizacionales pueden clasificarse atendiendo a su mecanismo de gobierno en un continuo que va desde aquellas basadas puramente en el mercado, pasando por las relaciones de cooperación, encontrándonos en el otro extremo la integración vertical (Rinehart et al., 2004; Golicic y Mentzer, 2006; Contractor y Lorange, 1988; Heide, 1994) en la que las relaciones se basan en el sistema de propiedad, al controlar una de las partes las mismas e imponer las actuaciones a realizar (Daugherty, 2011). En la práctica, las relaciones entre proveedor-comprador han evolucionado hacia una mayor integración y colaboración (González Benito et al., 2013), partiendo de meras transacciones basadas en el mercado (arms length transactions), pese a su escaso apoyo inicial (Sandberg, 2007).

Toda colaboración requiere el intercambio de recursos: humanos, tecnología, información… y se orienta a la mejora continua y a la creatividad en sus distintas manifestaciones como la resolución de problemas o la satisfacción del cliente, contando con mecanismos de gobierno informales o formales como los contractuales (Fawcett et al., 2008). A largo plazo, las relaciones de colaboración interorganizacionales permiten maximizar el beneficio de las transacciones que tienen lugar en la misma mitigando el riesgo que se deriva de inversiones específicas (Ganesan, 1994), acceder a recursos y tecnologías valiosos, así como a las habilidades del proveedor. Ello les permite el alcance de sinergias mediante el intercambio de información (Daugherty, 2011),

mejorar la calidad, los procesos (Kalwani y Narayandas, 1995), la flexibilidad y reducir el ciclo de tiempo (Daugherty et al., 2006), así como mermar el nivel de inventario y los costes de logística para vendedores y minoristas y el coste de los productos (Rinehart et al., 2004).

El grado de integración, colaboración y, en definitiva, la cercanía entre el proveedor y la empresa compradora dependerá de que se considere al proveedor estratégico o no, ya que en el segundo caso se mantiene una cierta relación de distancia para que se conserve la rivalidad con sus competidores (Gadde y Snehota, 2000).

1.1.3.1.1. Integración de los proveedores en el desarrollo de nuevos productos

Existe una rama de la literatura que profundiza en la colaboración entre una organización y sus proveedores para innovar, abogando por incorporar al proveedor en el desarrollo de nuevos productos.

Así, el trabajo de Petersen et al. (2003) apunta a los beneficios de incluir a los proveedores en el equipo de desarrollo de nuevos productos. Por su parte, el trabajo de Primo y Amundson (2002) muestra la mejora de la calidad, al integrar a los proveedores en el desarrollo de nuevos productos, al igual que el trabajo de Ragatz et al. (2002), pero señala que en la mejora del desempeño innovador tienen mayor importancia los nuevos proveedores frente a los ya existentes en una organización.

Los beneficios de la integración del proveedor en innovación radical han sido mostrados en el trabajo de Song y Benedetto (2008), aunque son objeto de controversia en la literatura. Así, el trabajo de Phillips et al. (2006) pone en tela de juicio la obtención de desempeño innovador, al integrar a proveedores con los que se mantiene una relación previa. En este sentido, el trabajo de Staudenmayer et al. (2005) enfatiza la necesidad de atender a una mayor variedad de partners para mejorar el desempeño innovador de una organización, algo que está en línea con el nuevo paradigma

(innovación abierta) en el que se centra este trabajo.

Los trabajos citados hasta ahora contemplan como unidad de análisis la relación interorganizacional. Sin embargo, se viene reclamando la necesidad de atender al estudio de redes, así como obviar los proyectos de desarrollo de nuevos productos como unidad de análisis (Johnsen, 2009).

Es por ello, que nuestro trabajo estudia la orientación a innovar de una organización con su *supply network*, es decir, con proveedores diversos, con independencia de que la organización haya mantenido o no una relación previa con ellos, para solucionar sus problemas de innovación y desarrollar procesos conjuntos. Este trabajo se enmarca, pues, dentro del nuevo paradigma de innovación, innovación abierta, aunque entendido de forma limitada. Es lo que se ha señalado como vertical open innovation (Thomas, 2013) o partner-oriented open innovation (ver figura 1.2) (Manceau et al., 2011). La figura 1.1, muestra algunos de los actores con los que una organización puede practicar innovación abierta. En ella se destaca el actor al que atiende este trabajo.

Figura 1.1. Actores en la configuración de innovación abierta de una organización.
Adaptado de Manceau et al (2011).

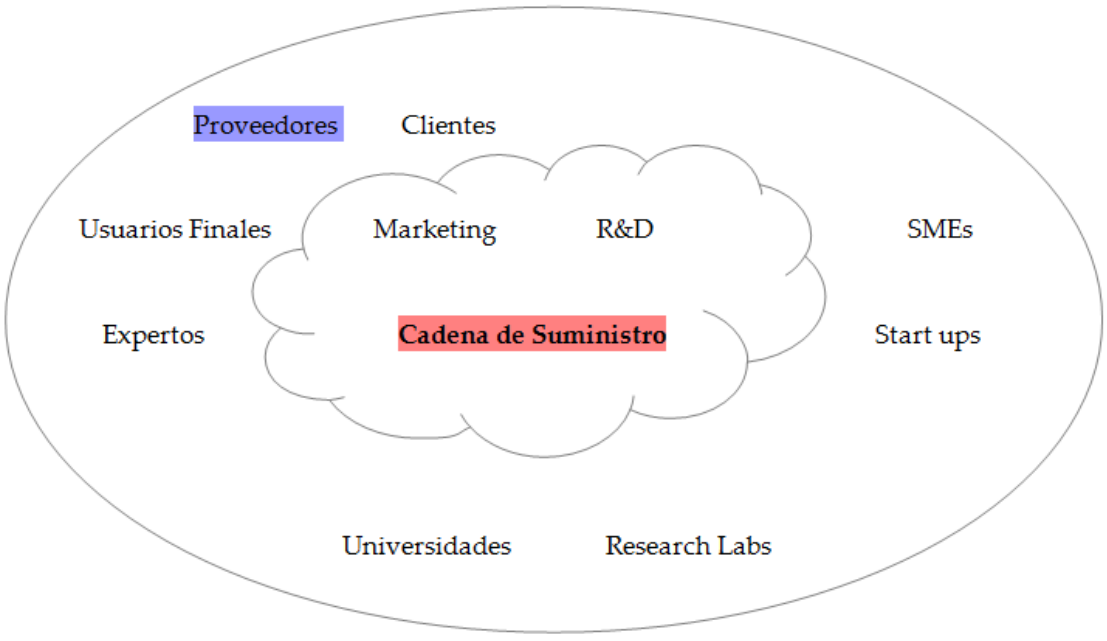
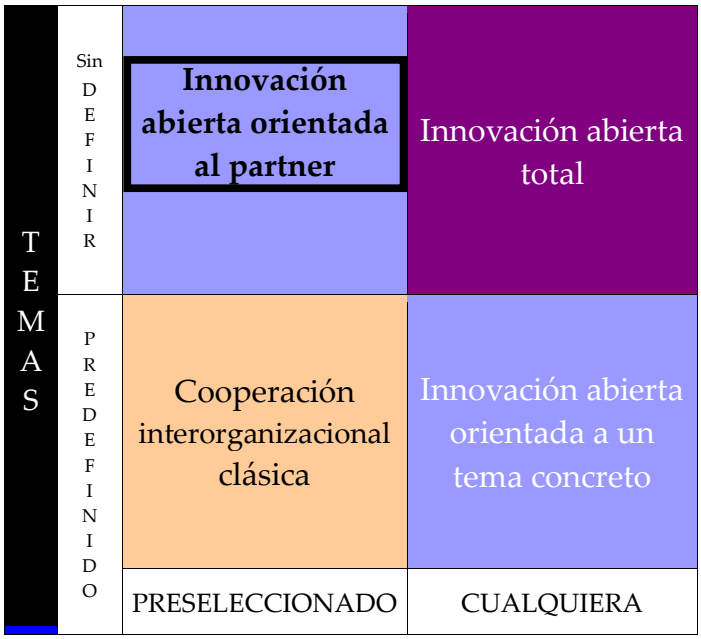


Figura 1.2. Estrategias de innovación abierta y grado de apertura.
Adaptado de Manceau et al. (2011).



1.1.4. Interés de la investigación

El interés de esta investigación reside en la relevancia y actualidad del tema de estudio, su carácter novedoso, el desarrollo teórico que realiza y la formalidad en el análisis empírico.

Relevancia y actualidad del tema de estudio

Este trabajo contribuye al desarrollo de la literatura sobre innovación abierta y gestión de la cadena de suministro, dos aspectos fundamentales a tener en cuenta para lograr la supervivencia de una organización y el mantenimiento de su ventaja competitiva. Así pues, este trabajo proporciona respuestas a las organizaciones que son cada vez más conscientes de que el talento reside en el exterior y que han de contribuir a la mejora de la competitividad de la cadena de suministro a la que pertenecen.

Carácter novedoso

Este trabajo aborda relaciones que, o bien, han sido analizadas por la literatura pero existen resultados contradictorios en relación a las mismas (adopción de innovación abierta-desempeño innovador), o bien no han sido tratados hasta ahora (mejora del desempeño operativo como resultado de la orientación a la innovación abierta; relación entre calidad e innovación abierta; relaciones de poder y su influencia en innovación abierta), o se hacen en este estudio con un enfoque distinto (aplicación de la teoría del intercambio social como factor explicativo de la orientación a la innovación abierta; teoría de la complementariedad en el estudio de la innovación abierta).

Desarrollo teórico

Las relaciones que se estudian en este trabajo atienden a distintos marcos teóricos que se han considerado idóneos en cada caso. En los Capítulos 2, 3 y 4 se emplea la literatura existente hasta el momento sobre el nuevo paradigma al que contribuimos.

De forma específica, el capítulo 2 se apoya en la teoría del intercambio social como marco teórico que explica la orientación hacia la innovación abierta de una organización. Asimismo, la teoría de recursos y capacidades constituye la base sobre la que vinculamos la orientación a la innovación abierta con la mejora de la competencia para la gestión de la cadena de suministro.

También se ha tenido en cuenta en el desarrollo de este capítulo la literatura previa sobre la colaboración y cooperación en el contexto de una cadena de suministro, dado que la innovación abierta se apoya en relaciones de colaboración y cooperación. Este trabajo contribuye al desarrollo de la literatura sobre innovación abierta, pero también sobre la gestión de la cadena de suministro, al analizar un aspecto que puede facilitar la competencia que tiene una organización para dicha gestión.

El Capítulo 3 se apoya en la literatura que vincula la percepción de dependencia de una organización en la relación que mantiene con otras organizaciones y la transferencia de conocimiento en dicho contexto. En él se comprueba empíricamente la influencia de una serie de factores en la obtención de desempeño en innovación abierta. Concretamente, se evidencia empíricamente el marco teórico (capacidad de absorción y desorción) expuesto en el trabajo de Lichtenthaler y Lichtenthaler (2009), teniendo en cuenta tanto la perspectiva de la organización como de su *supply network*.

Este Capítulo contribuye al desarrollo de la literatura sobre innovación abierta, que viene reclamando la atención de las relaciones de poder en este nuevo paradigma. Asimismo, supone una aportación a la literatura sobre transferencia de conocimiento que reclama el estudio de la perspectiva del emisor y el receptor en dicha transferencia. También contribuye al estudio de la capacidad de absorción y su efecto en la mejora de desempeño operativo de una organización. Finalmente, en él se muestra la idoneidad de la teoría de la complementariedad en el estudio de las capacidades que toda organización ha de tener para obtener beneficio de innovación abierta.

Por su parte, el Capítulo 4 propone un contexto organizacional a tener en cuenta en el estudio de la relación entre innovación abierta y desempeño innovador, contribuyendo así a la literatura sobre este nuevo paradigma. Además, el contexto seleccionado, implantación de normas ISO 9000, no se ha empleado hasta ahora en el estudio de la innovación abierta. Sin embargo, sí se ha empleado aunque de forma escasa en los trabajos que vinculan calidad e innovación cerrada.

Dicha literatura, nos ha servido de apoyo para proponer una serie de factores que pueden influir en la relación propuesta en nuestro trabajo. Dichos factores provienen de la teoría de recursos y capacidades, concretamente, el aprendizaje organizacional y las tecnologías de la información. Sin embargo, al abordar en este trabajo un paradigma nuevo que pasa por la apertura de las fronteras de la organización y la constante interacción con su entorno, analizamos dichos recursos y capacidades desde la perspectiva de la teoría de la complementariedad,

comparándolos con el *supply network* de la organización. Las conclusiones de este Capítulo contribuyen al desarrollo de la literatura sobre gestión de la calidad, mostrando cómo es posible su compromiso con innovación abierta, siempre y cuando se den las condiciones idóneas.

Formalidad en el análisis empírico

La rigurosidad metodológica preside este trabajo de investigación. Las escalas fueron desarrolladas tras un proceso de revisión de la literatura y consultadas a expertos en la temática y un grupo de empresas para su refinamiento. Posteriormente, se han realizado los tests oportunos para asegurar su validez y fiabilidad y se ha aplicado la técnica estadística más adecuada en cada caso para probar nuestras hipótesis de investigación. Los paquetes estadísticos utilizados han sido EQS y SPSS.

1.2. Objetivos de la investigación

El objetivo general de este trabajo es profundizar en el estudio de la relación entre la orientación a la innovación abierta en una organización (puesta en práctica con su *supply network*) y la obtención de desempeño para la organización que la adopta.

Los objetivos específicos son los siguientes:

En el segundo capítulo, el objetivo es conocer qué aspectos de la relación entre una organización y su *supply network* explican una mayor orientación hacia la innovación abierta de ésta. Asimismo, nos planteamos como objetivo estudiar el efecto de dicha orientación en la mejora de la competencia para gestionar la cadena de suministro y, por ende, del desempeño organizacional.

En el tercer capítulo, el objetivo es analizar cómo la percepción de dependencia (nivel percibido de la capacidad de absorción de su *supply network*) y las capacidades de una organización (capacidad de absorción y desorción en relación a su *supply network*) influyen en mejora de la competencia para la gestión de la cadena de suministro de la organización que se orienta a innovar de forma abierta con su s*upply network*.

En el cuarto capítulo el objetivo es esclarecer la relación entre orientación a la innovación abierta de una organización y desempeño innovador, atendiendo a la implantación o no de las normas ISO 9000, así como al carácter moderador de la complementariedad entre los estilos de aprendizaje y la compatibilidad entre las tecnologías de la información de la organización y su *supply network*.

1.3. Estructura del trabajo de investigación

Además del presente capítulo introductorio, este trabajo de investigación está formado por tres capítulos para desarrollar más específicamente la temática central de este estudio y un último capítulo de conclusiones.

El Capítulo 2 parte del reconocimiento de que la competencia no se produce a nivel interorganizacional hoy día, sino que ésta tiene lugar entre cadenas de suministro. Cada organización puede contribuir a la competitividad de su cadena de suministro mejorando su propia competencia para gestionar la misma. La competencia en gestión de la cadena de suministro se desarrolla a medida que se ponen en marcha las prácticas de gestión de la misma y se resuelven los problemas derivados de dicha gestión (Chow et al., 2008).

Dada su importancia, existe un marcado interés a nivel teórico y práctico, en conocer cómo las empresas pueden fortalecer su competencia en gestión de la cadena de suministro y sus implicaciones en el desempeño organizacional. Es por ello, que este trabajo propone la orientación a la innovación abierta de una organización como una orientación cultural que ayuda a la mejora de la competencia de una organización en la gestión de la cadena de suministro. Asimismo, estudiamos los aspectos que explican dicha orientación, concretamente, el análisis coste-beneficio de la organización que adopta este paradigma.

Para ello, utilizamos la teoría del intercambio social. Esta teoría explica las interacciones entre las organizaciones en función de que éstas perciban un beneficio mutuo, para lo que realizan un análisis de los costes que les supone mantener dicha relación y los beneficios asociados a la misma. El reciente trabajo de Wu et al. (2014) realiza una revisión de la literatura que ha aplicado dicha teoría en el contexto de una cadena de suministro, identificado los siguientes elementos: la confianza, el compromiso, el poder y la dependencia. Estos elementos se han señalado en la literatura como factores que explican el intercambio de información y la colaboración

interorganizacional (Mohr y Spekman, 1994; Morgan y Hunt, 1994; Nyaga y Whipple, 2011; Tomlinson y Fai, 2013), aspectos que son esenciales para que la innovación abierta sea efectiva en la organización que la implanta. De ahí, que hayamos seleccionado este marco teórico para explicar la orientación a la innovación abierta de una organización con su *supply network*.

Concretamente estudiamos cómo la justicia procedimental percibida por una organización en relación a su *supply network*, y el cumplimiento o superación de las expectativas previas en relación a la confianza y el compromiso experimentado respecto a su *supply network*, influyen en la orientación a la innovación abierta de una organización. Es decir, evaluamos la satisfacción de la organización con el trato y desempeño de su *supply network*. Dicha experiencia previa, puede ser un factor explicativo de su predisposición a innovar de forma abierta.

La mejora del desempeño en una organización como resultado de su orientación a innovar de forma abierta, está siendo objeto de debate en la literatura. Existen trabajos que apoyan su efecto positivo en la mejora de las competencias de una organización (Gassmann, 2006; Bilgram et al., 2008; Cheng y Chen, 2013). Nosotros proponemos la mejora de la competencia que tiene una organización para la gestión de su cadena de suministro como resultado de orientarse a innovar de forma abierta con su *supply network*. Para ello, partimos de que la orientación a la innovación abierta implica la transferencia de conocimiento entre una organización y su *supply network* y nos apoyamos en la literatura que señala que la información que se intercambia en relaciones de colaboración y cooperación permiten la mejora del desempeño operativo de una organización (Kotabe et al., 2003; Paulraj et al., 2008; Nagati y Rebolledo, 2013).

La metodología usada ha sido un análisis de ecuaciones estructurales aplicado sobre una muestra de 286 directores de compras de empresas manufactureras y de servicios. Se seleccionaron estos directivos por ser los más familiarizados con la base de proveedores y la evaluación de la competencia que una organización tiene para gestionar su cadena de suministro.

El Capítulo 3 de este trabajo responde, en primer lugar, a la necesidad de atender a la influencia que tiene el poder en la orientación a la innovación abierta de una organización (Vanhaverbeke et al., 2007; Vanhaverbeke y Cloodt, 2014). En él se estudia cómo la percepción de dependencia de la organización que se orienta a innovar de forma abierta influye en la obtención de desempeño como resultado de este nuevo paradigma.

Para ello, atendemos a la literatura sobre innovación abierta y asimetría de poder en la transferencia de conocimiento, empleando el nivel que la organización percibe de la capacidad de absorción de su *supply network* (Andersén y Kask, 2012). Así, proponemos que una organización obtiene beneficios como resultado de su orientación a innovar de forma abierta, si el nivel percibido de capacidad de absorción de su *supply network* no es excesivo. Ello se debe a que se reduce el riesgo a perder poder de negociación y de un comportamiento oportunista de su *supply network* (Nyaga et al., 2013).

En segundo lugar, este capítulo estudia el carácter moderador de las capacidades de absorción y desorción de una organización, en la relación entre orientación a la innovación abierta y mejora de la competencia para la gestión de la cadena de suministro, en los casos en los que la organización percibe menor dependencia respecto a su *supply network*. La literatura reconoce una serie de capacidades que facilitan que el conocimiento fluya más allá de las fronteras de una organización como son la capacidad de absorción y de desorción (Vanhaverbeke et al., 2007; Lichtenthaler y Lichtenthaler, 2010). Las teorías de gestión del conocimiento defienden que el éxito en la transferencia de conocimiento depende de las características del emisor y receptor del mismo (Easterby-Smith et al., 2008; Chang et al., 2012).

Dado que se estudia la orientación a la innovación abierta de una organización con su *supply network* como la orientación cultural a desarrollar procesos conjuntos *(coupled processes)*, resulta esencial atender tanto a la capacidad de absorción como de

desorción del conocimiento puesto que el conocimiento fluye en ambos sentidos tal y como se viene reclamando en la literatura sobre este nuevo paradigma. Desde un punto de vista teórico, se ha destacado los beneficios de carácter no económico como el acceso a información adicional que le permita acceder a nuevos mercados... (Lichtenthaler y Lichtenthaler, 2010).

Asimismo, se viene reclamando el estudio de la capacidad de absorción de forma relativa, en relación a una fuente de innovación concreta (Dyer y Singh, 1998; Wagner, 2012). Este Capítulo contribuye al desarrollo de esta rama de la literatura, estudiando la capacidad de absorción que una organización tiene en relación a su *supply network* y contribuye a poner orden al debate existente en torno a la relación entre innovación abierta y capacidad de absorción (Vanhaverbeke et al., 2008). La mera presencia de su *supply network* como fuente de innovación no lleva aparejado el éxito de orientarse a innovar de forma abierta, siendo necesario apoyarse en una serie de capacidades como puede ser la de absorción en relación a esa fuente de innovación. Además, vinculamos esta capacidad a la mejora del desempeño operativo de una organización, aspecto que no ha sido tratado lo suficientemente en la literatura (Sáenz et al., 2014).

Este capítulo incluye un análisis post-hoc en el que se estudia la influencia de la capacidad de desorción de *supply network* cuando éste presenta una capacidad de absorción excesiva, y, la organización percibe una mayor dependencia respecto al mismo. El resultado de este análisis muestra que la manera en que *supply network* emplea su poder, mitigando el desequilibrio percibido entre ambos al desarrollar su capacidad de desorción, palía la situación. Del mismo modo, muestra cómo las organizaciones que se orientan a innovar de forma abierta han de lograr un ajuste entre sus capacidades de absorción y desorción y las de su *supply network*, siendo aplicable el enfoque teórico de la teoría de la complementariedad (Cassiman y Veugelers, 2006).

La metodología empleada ha sido la regresión lineal jerárquica sobre una muestra de 262 directores de compras de empresas manufactureras y de servicios. Se

seleccionaron estos directivos, por ser los más familiarizados con la base de proveedores y la evaluación de la competencia que una organización tiene para gestionar su cadena de suministro y de las capacidades de absorción y desorción (propias y de su supply network).

El Capítulo 4 de este trabajo parte de la necesidad de profundizar en el estudio de la relación entre apertura y desempeño innovador, que depende de factores tales como el contexto organizacional (Di Benedetto, 2010; Huizingh, 2011; Lichtenthaler, 2011) y la práctica de innovación abierta concreta (Parida et al., 2012) que se considere. En respuesta a esta necesidad, este Capítulo se centra, por un lado, en una práctica de innovación abierta concreta, el desarrollo de procesos conjuntos con su *supply network*. Por otro lado, este Capítulo atiende a la implantación de las normas ISO 9000 como contexto organizacional, es decir, al compromiso con la calidad, a la par de que existe un compromiso con la innovación abierta en una organización.

Además de contribuir al desarrollo de la literatura sobre innovación abierta, este capítulo, al atender a la implantación de las normas ISO 9000, contribuye al desarrollo de la literatura que estudia el efecto de la calidad en la innovación. Esta literatura apenas si ha tratado el efecto de la implantación de estas normas en innovación (Huo et al., 2014 y Terziovski y Guerrero, 2014). De forma genérica, no existe consenso acerca de la relación entre innovación y calidad, constituyendo una relación compleja que depende, entre otros factores, de cómo una organización emplea sus recursos para obtener desempeño innovador de un compromiso con la calidad (Pekovic y Galia, 2009). Siendo conscientes de ello, nuestro trabajo atiende al carácter moderador del ajuste entre los estilos de aprendizaje y las tecnologías de la información entre la organización y su *supply network*, para obtener beneficios de un doble compromiso con la calidad y la innovación abierta.

Siguiendo la literatura sobre innovación abierta y gestión de la calidad, y, apoyándonos en la teoría de recursos y capacidades, consideramos que la complementariedad entre los estilos de aprendizaje permite a la organización que se

orienta a innovar de forma abierta, disfrutar de los beneficios de un elevado nivel de exploración y explotación en su organización. Por su parte, las tecnologías de la información constituyen un recurso que permite conseguir los objetivos de calidad y la adopción de la innovación abierta (Dodgson et al., 2006; Pérez Arostegui et al., 2012).

La metodología usada ha sido la regresión lineal jerárquica, previa determinación del ajuste entre los estilos de aprendizaje de la organización y su supply network, siguiendo el trabajo de Azadegan y Doley (2010). Además, se dividió la muestra (262 directivos de compras entrevistados) en dos grupos para extraer conclusiones en función de la certificación o no en normas ISO 9000.

El Capítulo 5 constituye un capítulo que recopila las conclusiones genéricas de este trabajo. También encontramos en él, las principales implicaciones teóricas y prácticas que se derivan de esta investigación, junto con las limitaciones y las futuras líneas de investigación que presenta la misma.

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"Cuando confías te abres a nuevos caminos, a nuevas posibilidades y a nuevas oportunidades"
(Código de luz)

CAPÍTULO 2

OPENING UP INNOVATION IN BUYER-SELLER RELATIONSHIPS. AN EMPIRICAL EVIDENCE OF ITS ANTECEDENTS AND ITS EFFECT ON SUPPLY CHAIN COMPETENCE

Opening up innovation in buyer-supplier relationships: Empirical evidence of antecedents and its effect on supply chain competence

Abstract:

This paper focuses on an organization´s orientation to open innovation with its supply network. Drawing on social exchange theory, we identify some antecedents of this orientation. We measure some of these constructs in terms of gap by comparing perceptions with previous expectations. We also analyze open innovation performance in terms of competence improvement. Both the proposed model and the hypotheses were tested on a sample of 286 firms. The results confirm that trust, commitment, and procedural justice on its supply network enable open innovativeness and the effect of this relationship on supply chain competence. We also confirm the positive effect of supply chain competence on firm performance.

Keywords: supply chain management, social exchange theory, open innovation, supplier integration, supply chain competence, firm performance.

2.1. Introduction

The development of new products and services or the improvement of those an organization already provides constitutes one of the key mechanisms that permit the organization to maintain its competitive advantage. The time between development and launching of products and services is key to this success. Being first, that is, getting ahead of the competition, is the condition sine qua non for achieving a competitive advantage. This condition is imperative, among other factors, because an organization's customers (with increasingly changing needs) are becoming better informed and the pressure the competition exerts on the organization is increasing (Menon et al., 2002; Tamayo Torres et al., 2014). When facing this reality, organizations must improve the functionality of their innovation process, for example, by initiating new business practices characteristic of open innovation (Chesbrough, 2003).

Open innovation analyzes the exploration and exploitation of knowledge to improve an organization's performance so as to maintain its competitive advantage over time. Increasingly conscious that talent is found outside their boundaries, companies can use the knowledge in their customers, suppliers, and competitors and in universities, and vice versa. Such practices are inherent in this new paradigm, whose adoption is key to proper management of the organization's relationships with its stakeholders. These potential sources of innovation have been treated generically in the literature on open innovation, specifically for the case of users, universities (Ortín Ángel and Vendrell-Herrero, 2014), etc. The particular case of the supplier as a source of innovation has hardly been tackled (Enkel et al., 2009; Lichtenthaler, 2011; Thomas, 2013), however, despite its widely recognized importance in the literature that analyzes generally the sources of innovation in an organization operating under open innovation (Laursen and Salter, 2006; Mention, 2011; Un et al., 2010; Von Hippel, 1998; West and Bogers, 2014). Along these lines, the study by Enkel and Gassmann (2008) shows suppliers to be the second source of innovation that organizations use (61%), and Enkel et al. (2009) indicate that 69% of knowledge sources come from suppliers.

One must thus take into account that the prior literature and the literature based on this new paradigm (Von Krogh, 2011) indicate that technological development takes place thanks to links maintained, especially with suppliers with whom companies share competences in a close relationship (Tomlinson and Fai, 2013). Given the importance of the supplier as a source of innovation and in response to the scarcity of literature analyzing this topic, our research focuses on the orientation to open innovation (open innovativeness) an organization has.

We understand open innovativeness to be the degree to which an organization puts this new paradigm into practice, specifically the extent to which it develops joint processes with its supply network. We thereby address the need to examine the specific innovation practice to understand the effect of this new paradigm on innovative performance. This study seeks to develop deeper understanding of the benefits derived from an organization's orientation to open innovation, understood in a limited way, as related to its supply network. Following Narasimhan and Narayanan (2013), we understand supply network as the possible network of upstream suppliers in the firm's value system directly or indirectly (p. 28). We study the organization's inclination to employ inputs from a great variety of suppliers, small and large, as well as to develop joint processes with them. Therefore, these suppliers committed to the organization's open innovation processes may or may not have maintained a prior relationship with the organization (Narasimhan and Narayanan, 2013).

Our study thus joins those by Chiang and Hung (2010) and Sisodiya et al. (2013) in believing that organizations must focus their efforts on close relationships with few knowledge sources characterized by strong, frequent contacts that enable knowledge transfer through boundary-spanning activities.

Since the paradigm on which our study is based is in the early stages of development, we need antecedents or elements that explain its adoption in an organization. Because open innovation is established in collaborative relationships in which a spirit of information exchange presides, we believe it is useful to apply some

elements from social exchange theory, which has been used in the context of the supply chain to identify elements facilitating information exchange and collaboration. Specifically, we propose verifying the extent to which the level of trust, commitment, and procedural justice influence greater or lesser orientation to open innovation (practiced with its supply network).

If we examine studies based on the positive effects this paradigm has on the performance of the organization that adopts it, we find that some studies indicate possible strengthening of the competences in an organization as a result of their implementation (Bilgram et al., 2008; Cheng and Chen, 2013; Gassmann, 2006). One competence the entire organization possesses is management of the supply chain to which it belongs. This competence is essential, since the supply chain members contribute to the chain's competitiveness when they strengthen and stimulate this competence. This importance increases if we consider that organizations today depend to a greater extent on the competitiveness of the supply chain of which they form part than on their own. There is thus marked interest at the theoretical and practical levels in understanding how firms can strengthen their competence in supply chain management and the implications of this management for organizational performance. Our research attempts to show the connection between an organization´s open innovativeness and the strengthening of its competence in managing its supply chain.

This study aims to contribute to entrepreneurial literature and practice, given the lack of research on inclusion of the supplier as a source of innovation in the development or improvement of products or services. We seek to fill the gap in the literature that analyzes the conditions facilitating participation in and government of open innovation, as well as the literature on incentives for knowledge transfer (Gambardella and Panico, 2014; Mucelli and Marinoni, 2011). We also seek to address the absence of alternative measures of performance in open innovation, such as strengthening of the organization's competences (Knudsen and Mortensen, 2011). To achieve this goal, our investigation has three specific objectives. First, it attempts to

determine what aspects of interorganizational exchange foster open innovativeness. Second, it analyzes the implications of orientation to open innovation for the organization's competence in managing the supply chain and, ultimately, the effects of this competence on performance measured in different dimensions.

To fulfill these objectives, the next section reviews the literature on open innovation and supplier integration, social exchange theory, and supply chain competence. The hypotheses are developed based on assumptions drawn from the open innovation and supplier integration literatures and from social exchange theory. Subsequently, we discuss the methodology, including data collection, construct measurement, and steps of analysis using structural equations modeling. The empirical results are then presented, followed by a discussion of findings. Finally, we present the theoretical and managerial implications, research limitations, and directions for future research.

2.2. Literature review

2.2.1. Open innovation and supplier integration

Traditionally, organizations have believed that maintaining a competitive advantage over time involves internal development and tough control of the innovations from which this advantage originates (Thomas, 2013). This conception of innovation, termed "closed innovation" in the literature, has been questioned by the proliferation of a series of factors characteristic of our era/the twenty-first century. Some of these factors are the mobility of workers between organizations, the need to shorten the time of new product development, and the presence of increasingly informed and demanding suppliers and customers (Chesbrough, 2003).

As a result, organizations have begun to understand innovation as a process that requires constant contact with the surrounding environment, opting to a greater

extent for collaboration with members of the supply chain to which the organization belongs and with other interest groups (Mention, 2011). Firms are increasingly conscious of the need to have permeable boundaries, as is seen in practices such as the acquisition of ideas or innovations developed by others or the commercialization of innovations developed by the organization when they do not constitute sources of competitive advantage for the firm.

These entrepreneurial practices have given rise to a new paradigm derived from the entrepreneurial context and termed open innovation. Open innovation has been defined as "the use of internal and external knowledge by firms to perform their R&D projects and expand markets that make use of them" (Chesbrough, 2006, p.1). The literature advocates a balance between closed and open innovation, providing products and services more rapidly than the competition but protecting intellectual property and reinforcing their firms' capacities (Enkel et al., 2009).

An essential aspect of this new paradigm in any of its dimensions is the establishment of interorganizational relationships with interest groups such as universities, research centers, suppliers, customers, etc. A study by Felin and Zenger (2014) indicates the need for mechanisms to govern open innovation that permit access to knowledge, such as markets, alliances, and partnerships, contests, or platforms, and user innovation. Caetano and Amaral (2011) recognize the importance of establishing partnerships under this new paradigm. Depending on the stakeholder with whom the partnership is maintained, their study distinguishes between partnership based on the market and partnership based on science. The members of market-based partnerships are those with special connection to the market, such as suppliers and customers (Du et al., 2014).

Recently, the literature has signaled a change in buyer-supplier relations in the context of new product/service development, since, as Chesbrough explains (Wagner, 2010), suppliers' proposals may be equal to or better than those that occur internally in the organization. The literature on supply chains has thus begun to analyze how to

facilitate learning and knowledge flow within these chains (Azadegan et al., 2008). Under the paradigm of open innovation, the study by Wagner (2012) shows that organizations must open their boundaries to suppliers and collaborate with them in the exchange of knowledge. Similarly, Ozman (2008) demonstrates that one way of ensuring the success of innovations is to improve their relational capacity, taking into account both potential and actual suppliers. (Other studies have shown the importance of relying on current providers to solve problems, e.g., Azadegan, 2011; Azadegan et al., 2008; Dyer, 1996; 1997; Petersen et al., 2003; Wagner, 2012).

This approach stems from the fact that suppliers are the stakeholders who know the organization best, since as customers they depend on it. Specifically, suppliers have detailed knowledge of the organization's products and processes (Bessant, 2003; Petersen et al., 2003; Von Hippel, 1998), as well as valuable information on end users—that is, on the customers that the organization serves. Suppliers provide information on new ways of proceeding, providing the buying organization with a basis for comparing its practices to others in the entrepreneurial environment, as well as for overcoming its competition by not having to perform all of the functions of its value chain alone (Brem and Tidd, 2012). The literature analyzing supplier integration in the different phases of the innovation process shows how participation in design improves the quality, cost, and delivery time of products and services. Participation in development also contributes to improvement in the quality, cost, application of technology, and launch time, with suppliers providing knowledge of the feasibility of production as well as the market situation (Tan, 2002). In any case, one must take into account that the goal of developing new products and services is to satisfy customers' needs (Ruiz Moreno et al., 2014) and must affect the supply chain's capacity to do this, through reliable delivery and efficiency (Tracey and Vonderembse, 2000).

Considering the supplier as a source of innovation is not risk-free, however. Risks include knowledge leaks by the supplier, which also prevent the organization from achieving competitive advantage sustainable over time, since the supplier serves

competing organizations that can use the knowledge the supplier possesses and thus need not contribute to innovative performance themselves (Du et al., 2014). In the face of such risks, various studies point to developing a climate of reciprocal trust to overcome them (Huston and Sakkab, 2007; Nagati and Rebolledo, 2013). The study by Tomlinson (2010), for example, includes a vision of interorganizational cooperation halfway to the markets and hierarchies whose success depends on the development of trust, relational hiring, and frequency of interaction.

2.2.2. Antecedents of orientation to open innovation. Social Exchange Theory

Based on the paradigm of open innovation, the study by Sisodiya et al. (2013) shows the importance of constructing relational capacity to obtain benefits from implementing this new focus in the organization. Vanhaverbeke (2006) also argues that proper management of this relationship can enable the organization to overcome risks involved in opening its boundaries to these partners. The prior literature on supplier integration in the development of new products and services, highlights the importance of orienting the relationship to the long term and ensuring that it has high levels of trust, commitment, and open communication. The literature has not reached consensus, however, about the effects of this relationship on innovative performance. Factors must thus be taken into account that can influence performance, such as trust, commitment, or quality of the collaboration (Cai et al., 2013; Nagati and Rebolledo, 2013; Sambasivan et al., 2013; Wagner, 2012; Walter, 2003). Along these lines, Murat and Baki (2011) show how a total quality management practice, the relationship with suppliers, can affect product and process innovation. Likewise, Walter (2003) argues that the way the relationship with the supplier develops can be key for the supplier's participation, as well as the level of trust and commitment that the supplier feels toward the organization it supplies (He et al., 2014; Morgan and Hunt, 1994; Walter, 2003). An extensive literature argues that collaboration relationships are grounded in certain elements of relational exchange, including a high level of trust, as in the studies

by Morgan and Hunt (1994) and Wu et al. (2014). Studies by Kumar et al. (1995), Ring and Van de Ven (1994) and Tomlinson (2010) also refer to trust as an antecedent of cooperative relationships.

These elements identified in the literature as promoters of information exchange, collaboration, and innovation in organizations' relationships maintained over time (Tomlinson and Fai, 2013) are present in social exchange theory. This theory has been used to analyze relationships that occur in the supply chain, justifying them in their continuous achievement of benefits for both parties. Originally, this theory claimed that interaction originated in a cost-benefit analysis of the individuals forming part of the relationship (Wu et al., 2014). The study by Wu et al. (2014) performs a literature review of studies that include this theory in analyzing supply chain relationships and identifies the following four elements: trust, commitment, power, and reciprocity. Following this theoretical framework, our study analyzes the trust, commitment, and procedural justice an organization perceives in the supplier with which it maintains a relationship.

2.2.3. Supply Chain Management. Supply Chain competence

Supply Chain Management is "the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole"(Mentzer et al., 2001; p. 18)

Open innovation has been criticized for not contributing anything new to the literature on supply chain management (Von Hippel, 2010) and has even sparked a debate among researchers on the topic. This debate can be resolved if one attends to the different objects of study defined by each side of the debate. Whereas supply chain management focuses on efficiency and cost reduction in the context of the supply chain

(Groen and Linton, 2010), open innovation enables effectiveness of the innovation process (Badawy, 2011). We must also take into account that open innovation has its own processes (Von Krogh, 2011) and is broader in scope (Van De Vrande and Man, 2011).

The literature has shown that, in addition to a series of routine practices, supply chain management includes problems that derive from the chain, and capacity for management of the chain (Ellinger et al., 2012). The study by Simchi-Levi et al. (2000) identifies three key factors for supply chain management: strategic, tactical, and operational factors. Swaminathan et al. (1998) identify configuration, coordination, and contracts to strengthen the quality of the supply chain and its competitive position. Supply chain management attempts in the short term to increase productivity and reduce inventory and delivery time, whereas the longer time frame seeks to obtain market share, satisfy customers' needs, and contribute to organizational performance (Tan, 2002).

The idea that the organization's success depends to a greater extent on the capacity of the supply chain to which it belongs than on its own organizational capacities is gaining wider acceptance (Chow et al., 2008; Green et al., 2014). The competitive position and quality of the supply chain are strengthened by the competence that each organization has to manage the chain. This competence is constructed as practices are adopted and problems solved in managing the supply chain (Chow et al., 2008). It is the result of continuous learning by the organization (Spekman et al., 2002), and it permits the organization to attend to demand under any circumstances, that is, to be more flexible and to meet the changing demands of the market it serves, as well as to achieve excellence in the supply chain in its area of operation (Kuei et al., 2005).

Capacity for supply chain management has been defined by Chow et al. (2008) in the following terms: "a portfolio of organizational, managerial, technical and strategic capabilities and skills developed by enterprises over time" (Chow et al., 2008,

p. 667). For Fisher et al. (2000), it is essential to develop the following capacities: foresight, inventory planning, speed of the supply chain, and precision of data.

The study by Kumar and Nambirajan (2014) analyzes the interrelation between the components of supply chain management and their effect on performance. This study highlights the need to focus attention on the problems that stem from supply chain management and the capacity for this management to improve an organization's efficiency, due to the mediating role of the supply chain between supply chain management practices and performance. Given the clear importance of more in-depth study of this competence, our research analyzes how to strengthen supply chain management and its effect on various aspects of organizational performance, an issue that will be explained in greater detail in the hypotheses, which are developed in the next section.

2.3. Development of hypotheses and proposed model

Orientation to open innovation can improve the resources and capacities present in an organization, especially those that are strategic in character (Bilgram et al., 2008; Cheng and Chen, 2013; Gassmann, 2006). This study investigates the enablers and effects of open innovativeness focusing our attention on an organization´s supply network as a source of innovation. Specifically, our research proposes that open innovativeness influences supply chain competence levels. The hypotheses are developed based on assumptions made in the open innovation and supplier integration literatures and in social exchange theory.

2.3.1. Trust and open innovation

A firm's trust in the supplier with which it maintains a relationship can be defined based on the level of honesty and benevolence perceived in the supplier, which translates into behavior by the provider that is respectful of the buying organization's interests (Kwon and Suh, 2004; Morgan and Hunt, 1994; Sako and Helper, 1998). Trust has been recognized as a promoter of knowledge exchange, the essence of open innovation, in studies by Nagati and Rebolledo (2013), Rebolledo and Nollet (2011) and Squire et al. (2009), among others.

This is due to the fact that, if organizations trust in each other, they will be more willing to share ideas and information and to approach the relationship by orienting it to problem solving, since they have reduced the risk inherent in their exchange. Trust will thus promote a climate of transparency and openness facilitating exchange (Cheung et al., 2010; Dyer and Nobeoka, 2000; Tseng, 2014). One of the risks in adopting this paradigm is transmitting key information to the supplier, who will in turn work for one's competitors. A climate of sufficient trust reduces the attendant risks of open innovation with the supplier, increasing the inclination toward such innovation. In a case study, Bunduchi (2013) identifies the presence of trust among

organizations as an explanatory variable for collaboration in new product development.

Under this new paradigm, it is not possible to exert control over the development of innovation, as occurred under the traditional model. The key to adopting open innovation is to establish relationships and develop trust in them. This is why, if the organization improves the trust initially perceived in its relation to its supply network, it will be more likely to orient itself to innovating openly. Based on the foregoing, we propose the following hypothesis:

H1. A fit in the level of perceived trust to its supply network that is greater than or equal to that expected initially, has a positive influence on an organization´s open innovativeness.

2.3.2. Commitment and open innovation

Commitment to the relationship with the supplier exists when one is believes that the relationship underway is worth maintaining over time, without setting a date for its end, and thus the relationship is expected continue indefinitely (Morgan and Hunt, 1994).

Commitment is an essential factor in the success of any interorganizational relationship (Mohr and Spekman, 1994), since its presence permits the stability so necessary in a supply chain, which fosters investment in specific assets for the relationship between its members (Fynes and Voss, 2002; Fynes et al., 2005). The presence of commitment facilitates maintaining relationships over time with behavior that supports or favors the interests of the buying organization. In general, we can argue that, the greater the expectation that a relationship will last, the greater the willingness to exchange information between its members, thereby increasing the probability for exchange of new practices and ideas (Yang et al., 2008).

Since interorganizational relationships that operate under the new paradigm of open innovation are essentially collaboration relationships, it makes sense to extend the literature that argues this element as essential for cooperation and collaboration to occur (Mohr and Spekman, 1994; Morgan and Hunt, 1994; Nyaga and Whipple, 2011; Wu et al., 2014). The study by Bidault and Castello (2009), which analyzes alliances oriented to new product development, indicates the fundamental character of trust and commitment as triggers of innovation in these alliances. This study shows that the quality of the relationships maintained in alliances influences the resources that each of the members contributes, making these resources key in fostering the creativity that triggers innovation (Gomes et al., 2014). This is why, if the organization's commitment to its supply network is greater than initially expected, the exchange of information may be enriched and thus also its orientation to open innovation.

Based on the foregoing, we propose verifying the following hypothesis:

H2. A fit in the level of perceived commitment to its supply network that is greater than or equal to that expected initially has a positive influence on an organization´s open innovativeness.

2.3.3. Procedural justice and open innovation

Procedural justice is defined as the perception of equity in the development and administration of policies in the relationship maintained with the supplier (Griffith et al., 2006). The influence of procedural justice both on prolonging the relationship and on the behavior of the parties composing it has been shown.

When a supplier and the firm it supplies perceive that procedural justice is present, there is greater willingness to exchange and transfer knowledge between them, among other reasons, because both have a greater will to cooperate (Liu et al., 2012; Wu et al., 2014). Acting in the interest of the relationship, as well as outside its normal parameters, thus depends on the perception by both parties who maintain the

relationship that the treatment received is just (Narasimhan et al., 2013). Acting outside the normal parameters in a relationship between supplier and buyer firms may include exchange of information on the market situation, the competition, other suppliers, end user preferences, etc., ultimately exchange of additional information beyond what normally occurs in the supply context. The motivation for this exchange, as well as the supplier's support to the firm it supplies in the innovation process, lies not only in the potential economic benefit to the parties but also in the perception of fair treatment received (Franke et al., 2013).

As a result, the presence of procedural justice grants relational value that supports the innovation activities the supplier can perform (Luo, 2007) and thus becomes essential to enabling open innovativeness. The presence of procedural justice has thus been associated with the promotion of change and the development of innovative products and services (Lee and Sukoco, 2011). The perception of procedural justice promotes the exchange of ideas with the provider in conceiving and executing the development of new products and services (Tjosvold et al., 2010). Further, it fosters effectiveness of processes, among them innovation (Luo, 2008), providing indirect control of these processes by the weaker party in the relationship (Ireland and Webb, 2007). The prior literature shows that the presence of procedural justice motivates cooperation and its performance, the flow of information and knowledge between organizations. As we have argued, open innovation is based on relationships of cooperation and collaboration grounded in knowledge transfer. Based on the foregoing, we propose verifying the following hypothesis:

H3. Perceived Procedural justice from its supply network has a positive influence on an organization´s open innovativeness.

2.3.4. Open innovation and supply chain competence

Competence in an organization's supply chain management permits improvement of quality and excellence in supply chain operations, constituting a source of competitive advantage for the organization that possesses it.

The literature indicates that more effective use and strengthening of the organization's own resources and capacities, especially those that are strategic in character, is one benefit of adopting open innovation (Bilgram et al., 2008; Cheng and Chen, 2013; Gassmann, 2006). Further, Erzurumlu (2010) argues that it is possible to obtain advantages from open innovation at the operating level, which can be considered a strategic asset practiced between an organization and its supply network. To this, one must add that the supplier is the only stakeholder with valuable, easily understood information about the end customers, information that the organization can access if it is oriented to open innovation, since practice of open innovation involves extensive knowledge exchange (Mucelli and Marinoni, 2011). Along these lines, Liu et al. (2012) argue that knowledge exchange helps organizations to understand their products and processes, and the competition they face, as well as markets, enabling improvement of their problem-solving capacity and their foresight and coordination of production and delivery activities, activities related to inventory, etc. (Kotabe et al., 2003; Paulraj et al., 2008; Wu et al., 2014). The information accessed within a relationship of collaboration or cooperation is thus considered a resource that provides competitive advantage and is associated with improvement of operating performance (Nagati and Rebolledo, 2013).

Since open innovation is established in collaboration relationships, we must take into account a series of studies that argue that collaborative links between organizations permit shared learning, knowledge transfer, exchange of technical information between the supplier and the buying organization, and development of new capacities and strengthening of existing ones that influence innovative performance (Molina et al., 2007; Tomlinson and Fai, 2013). Cook et al. (2011) join arguments in the literature

that show how the capacities of supply chain members improve as the level of interaction increases. A successful collaboration relationship involves exchange of ideas and experiences that permits the collaborating organizations to obtain a more complete vision when facing their everyday situation and the problems that threaten them, as well as a greater variety of solutions to these problems and thus better performance in reducing their errors (Zacharia et al., 2011). Grant (1996) shows that integrating knowledge derived from links in the supply chain in production and delivery decisions leads to better operating performance. Further, it has been confirmed that interorganizational collaboration and innovation provide the customer with better delivery service, among other benefits (McGinnis and Vallopra, 1999a; 1999b; Narasimhan and Das, 1999; Tracey and Vonderembse, 2000), since the supplier acquires deeper knowledge of how the buying organization functions, enabling better coordination of supply chain activities that permits the organization to satisfy the expectations of the end users. The opposite, that is, lack of coordination between supplier and customer, brings poor performance in inventory and service, as well as erroneous predictions (Lee et al., 1997). Based on the foregoing, we propose validation of the following hypothesis:

H4: An organization´s open innovativeness has a positive effect on its supply chain competence.

2.3.5. Supply chain competence and performance

Competence in supply chain management is key to maintaining a competitive advantage over time, in determining the distribution, quality, and service delivered to the customer—ultimately, in achieving excellence in supply chain operations. This competence derives from experience and continuous learning in the organization (Spekman et al., 2002), which guarantee its flexibility by enabling attention to customers' needs in form, place, and quantity and at the moment (Chow et al., 2008).

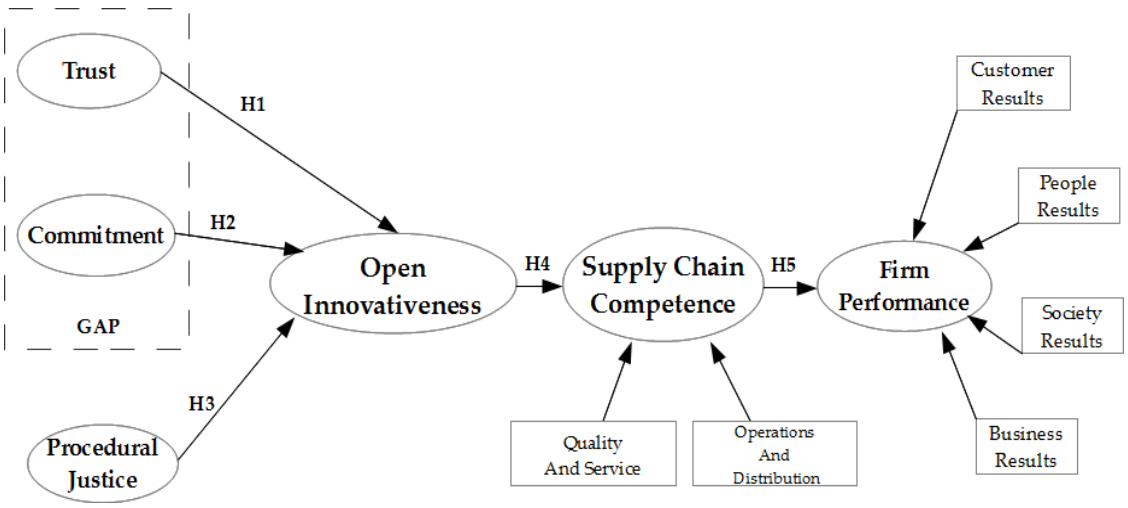
Studies by Chow et al. (2008), Kannan and Tan (2005), Kuei et al. (2005) and Lin et al. (2005) show the positive impact of these capacities on performance. Further, research confirms that improving the service provided to the customer has a positive influence on organizational performance (Liao and Kuo, 2014). An organization improves its performance through capacities that are a source of competitive advantage and that, as a result, contribute to improving performance (Tamayo Torres et al., 2011; Tjosvold et al., 2010).

Thus, excellence in supply chain management permits customer satisfaction and the achievement of competitive advantage if one performs better than the competition in this respect (Flint et al., 2008), permitting improvement in organizational performance (Bustinza et al., 2013; D'Avanzo et al., 2003). Excellence also permits better financial performance, since greater liquidity is obtained by reducing inventory, and prices can increase when the service provided improves (Johnson and Templar, 2011). Thus, D'Avanzo et al. (2004) argue that leadership in supply chain management leads to financial leadership. As a result, we propose validating the following hypothesis:

H5. An organization's capacity for supply chain management positively influences its performance.

The joint consideration of these hypotheses produces the structural model in Figure 2.1. This figure shows how the fit between expectations and actual perceptions of trust and commitment and the level of procedural justice from its supply network explain open innovativeness. An organization´s orientation to open innovation strengthens its supply chain competence, which will affect its performance positively.

Figure 2.1. Research Model



2.4. Research design

2.4.1. Sample design

To test the different hypotheses, we performed an empirical study of manufacturing and service firms. The SABI databases were used to obtain the study population. The questionnaire, specially designed for this study, examines primarily the antecedents of open innovativeness and its effect on supply chain competence. A sample of 2000 firms (1400 manufacturing firms and 600 service firms) was chosen at random. In all cases considered valid, the informants were logistics/purchasing executives. These managers are more likely to establish the supply network with whom an organization is oriented to open innovation/practices open innovation and to evaluate an organization´s supply chain competence. A CATI (computer-assisted telephone interviewing) survey method was used for the study. The responses were collected from June-October 2013.

2.4.2. Sample demographics

Initially, a pretest was used to determine the scale. The scale was carefully examined by selected practitioners and academicians in this area for translation, wording, structure, and content. The scale's content validity should be acceptable. 286 valid responses were collected, giving a response rate of 14.3%. Table 2.1 depicts the sample demographics. Possible bias due to non-respondent firms was analyzed. Considering the late group of respondents as those most likely to be similar to non-respondents, we compared the early and the late groups of respondents to obtain information on non-response bias in the sample (Armstrong and Overton, 1977; Subramani, 2004). Early and late sub-samples were identified as 176 and 110 respondents, respectively. The results of comparing the two groups indicate no systematic non-response bias in the survey data.

Table 2.1. Demographic.

Characteristics	Frequency	Percent
Industry type		
High-tech Manufacturing	96	34.78
Traditional Manufacturing	109	39.49
Services	81	29.33
Annual revenue		
<1000M	0	0
1000-10.000M	88	31.88
10.000-100.000M	168	60.87
>100.000M	30	10.85
Number of employees		
0-49	19	6.85
50-250	217	78.62
>250	50	18.13
Number of suppliers		
<100	240	86.95
100-300	38	13.77
>300	8	2.88
Work experience		
<5	16	5.79
5-10	63	22.82
10-20	86	31.15
>20	121	43.84

2.4.3. Measurement model

2.4.3.1. Trust and commitment

We measured trust and commitment using a 7-point Likert scale (1=Much worse than expected; 7=Much better than expected) to evaluate the level perceived relative to each question asked about the respondent's prior expectations. Introducing this response scale is one of the contributions of our research, since no study to date has integrated measurement of expectations and perceptions in a single measurement scale. We can thus measure the relationship between these two aspects over time, something requested in the previous literature.

Following Andersen et al. (2009), we believe that expectations about the relationships firms maintain with its supply network form at the beginning of the relationship and are conceived as "a belief held by someone of what is most likely to happen in a specific future event" (Andersen et al., 2009, p. 816).

The measurement items for trust were adapted from the instrument developed by Kwon and Suh (2004) and Kumar et al. (1995), including six items. This construct was measured by the level of honesty and benevolence, that is, based on the degree to which the partner with which an organization relates has the organization's well-being in mind, a definition largely accepted in the literature (Doney and Cannon, 1997). We analyzed the scale's internal consistency and reliability. Factor analysis showed that the items loaded on a single factor, providing proof of one-dimensionality. The Cronbach's alpha value for internal consistency was 0.893, indicating an acceptable level of internal consistency.

To measure commitment, we adapted the scale developed by Morgan and Hunt (1994), which contains three items to indicate the importance of the relationship for the surveyed organization, as well as the effort that this organization is willing to make to maintain the relationship. This scale has been used extensively in studies in the area of operations (Fynes and Voss, 2002; Fynes et al., 2005; Wu et al., 2014 and Zhao et al.,

2011). Internal consistency (0.826) was analyzed, as was one-dimensionality, using an exploratory factor study.

2.4.3.2. Procedural justice

A 7-point Likert-type scale (1 = ''totally disagree'' to 7 = ''totally agree'') was developed to measure the perception of procedural justice through three items validated in the study by Griffith et al. (2006). These items permit us to evaluate the procedural equity of our supply network (fairness in treatment and policies) in the relationships maintained with its partners, including our organization. Analysis of the scale's internal consistency and reliability through factor analysis showed that the items loaded on a single factor, which provides proof of one-dimensionality. The Cronbach's alpha value for internal consistency was 0.822, indicating an acceptable level of internal consistency.

2.4.3.3. Open innovativeness

This section measures the extent to which an organization is oriented to open innovation. Because no such scale existed in the literature, we constructed our own scale. Measurement items were adapted from the instrument developed by EFQM (2013). The EFQM model has incorporated this new paradigm as one of the eight fundamental concepts of excellence on which "taking advantage of creativity and innovation" is based relative to their interest groups, which includes suppliers. Following EFQM's operationalization of open innovation, our study conceives it as the extent as it is promoted the generation of ideas and innovation by others and in which clear goals and objectives for innovation are established jointly and perfected based on the results obtained. Likewise, the organization and its supply network use innovation as an instrument in capturing the talent of other members with which they wish to interact,

and conceive innovation beyond technological changes, where innovation shows new ways of satisfying the customer, as well as new ways of working that take maximum advantage of resources, competition, and alliances.

We measured this construct using seven items, for which the survey respondents were to indicate their degree of agreement or disagreement with the statements proposed on a Likert scale from 1 to 7 (1=totally disagree; 7=totally agree). The Cronbach's alpha is 0.936, indicating the scale's reliability. To ensure one-dimensionality, we checked that all items loaded on a single factor.

2.4.3.4. Supply Chain Competence

The measurement items for supply chain competence were adapted from the instrument developed by Chow et al. (2008), containing eight items. Supply chain competence was measured as a variable composed of quality and service issues and operations and distribution issues. A 7-point Likert-type scale (1 = ''totally disagree'' to 7 = ''totally agree'') was developed. The Cronbach's alpha is 0.905, indicating the scale's reliability.

2.4.3.5. Firm performance

We use different measures to evaluate firm performance. The scale was adapted from the instrument developed by EFQM (2013) as a multidimensional construct composed of the following dimensions: customer results, people results, society results and business results. All dimensions include three items except business results, which includes two items. After the scale had been adapted, the purchasing managers were asked what they valued in the past three years, according to a 7-point Likert-type scale (1 = ''has decreased considerably'' to 7 = ''has increased considerably''). The Cronbach's

alpha values are 0.85, 0.892, 0.792, and 0.868 respectively, indicating the scale's reliability.

2.4.4. Validity and reliability of scales

After analyzing one-dimensionality and internal consistency of the scales taken individually, we performed a confirmatory factor analysis using the EQS 6.0 software package. The estimation method chosen was Robust ML, once non-normality was confirmed (Bentler, 1995).

The factor loadings are shown in Table 2.2. All are highly significant and exceed the normally accepted level of 0.4 (Nunnally, 1978). Internal consistency had been studied previously, using the Cronbach's alpha indicator. Fornell and Larcker (1981) state, however, that composite reliability is a more appropriate indicator, since it is calculated by taking the scale into account in the context of the measurement model. The minimum recommended value is 0.7. This analysis was completed by calculating the average variance extracted, whose minimum recommended value is 0.5. Table 2.2 shows the scales in all cases to be within the accepted limits, indicating that the measurement model is good.

We also studied all indicators of the measurement scale's goodness of fit by analyzing the absolute and incremental goodness of fit and the model's parsimony. In all cases, the indicators are within the levels recommended as acceptable in the literature (Hair et al., 1998). We then studied the discriminant validity of the different scales using the square root of the AVE for each construct larger than its correlations with all other constructs (Fornell and Larcker, 1981). Table 2.3 shows the descriptive statistics and the correlations between the constructs.

Table 2.2. Convergent validity.

	Construct Items	Item Loadings	Composite Reliability	AVE	Cronbach´s Alpha
Trust	6	.73-.78	.89	.57	0.893
Commitment	3	.71-.93	.88	.71	0.826
Procedural justice	3	.72-.92	.83	.63	0.822
Open Innovativeness	7	.74-.87	.94	.68	0.936
Supply Chain Competence	8	.70-.83	.91	.57	0.905
Customer results	3	.71-.92	.86	.67	0.85
People results	3	.82-.93	.90	.73	0.892
Society results	3	.73-.79	.80	.57	0.792
Business results	2	.83-.92	.87	.76	0.868

Table 2.3. Discriminant validity

Construct	TR	CO	PJ	OI	SC C	CU R	PE R	SO R	BR
TR	**.75**								
CO	.634	**.85**							
PJ	.468	.385	**.80**						
OI	.406	.381	.309	**.83**					
SC C	.553	.343	.428	.353	**.75**				
CU R	.338	.257	.229	.432	.555	**.82**			
PE R	.418	.337	.341	.423	.555	.602	**.86**		
SO R	.379	.245	.316	.178	.614	.470	.614	**.76**	
BR	.154	.110	.139	.012	.131	.257	.336	.199	**.87**

Note: TR=Trust; CO=Commitment; PJ=Procedural Justice; OI=Open Innovativeness; SCC=Supply Chain Competence; CU R=Customer Results; PE R=People Results; SO R=Society Results; BR=Business Results;

2.5. Results

EQS 6.0 was used to analyze the structural model. The evaluation was performed in three steps according to Chin (1998). First, we estimated the path coefficients and statistical significance for the influential paths. Next, we computed the determination coefficient for the endogenous variables to assess their predictive power. Finally, we examined the relative importance of the first-order indicators for the second-order constructs in terms of indicator weights (Chin, 1998).

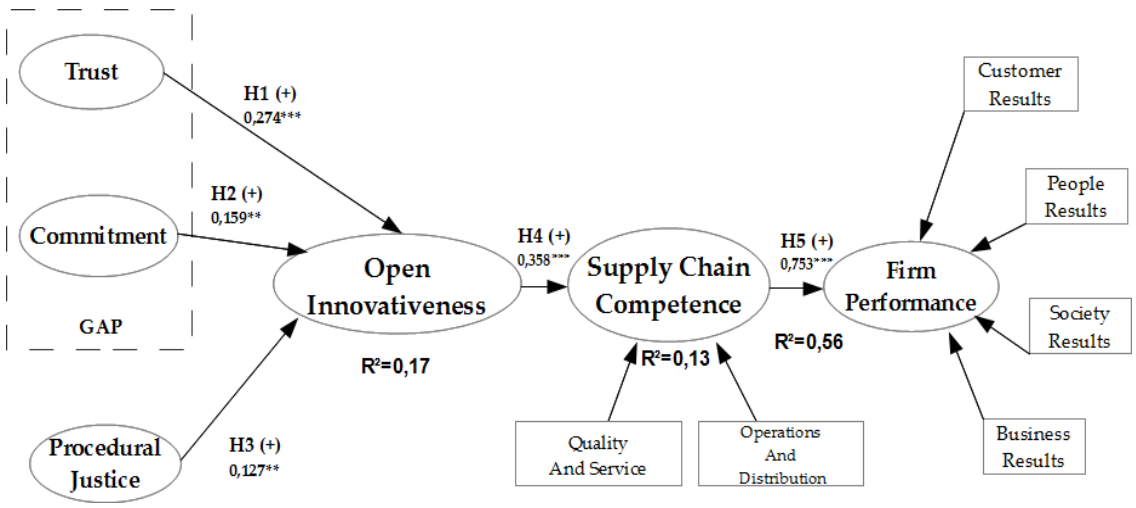
The results of the structural analysis are shown in Figure 2.2. First, the model's goodness-of-fit must be studied. In all cases, we have taken into account the indicators and the recommended values presented in Hair et al. (1998). We thus examined three types of indicators of the model's goodness of fit: absolute, incremental, and parsimonious fit measurements. First, with regard to the model's absolute fit, the indicators that can be applied to non-competitive analysis strategies are the goodness-of-fit index (GFI) and the root-mean-square error of approximation (RMSEA). The GFI indicator is restricted to the interval of values [0, 1]. High values indicate better fit, but no threshold of acceptability has been established. In our case, this indicator took a value of 0.862. The RMSEA is an indicator based on the error of approximation per expected degree of freedom in the population. The lower the indicator, the better the fit, and fit is acceptable for values below 0.08 or even 0.10. In our model, the indicator takes a value of 0.03 and, with the GFI, indicates the model's good overall fit.

It is also necessary to ensure that the model has good incremental fit. Our analysis focuses on checking the increase in the fit between a base model (normally the null model) and the proposed model. In all cases, values above 0.90 are considered acceptable. In the model proposed, all the indicators were well above the minimum threshold (AGFI= 0.834; NFI= 0.87; NNFI= 0.96; CFI=0.97; IFI=0.97). The final aspect to be studied is the proposed model's parsimony. Of the measurements proposed, only the normed chi-square is of use in the confirmatory analysis. This measurement must take values above 1 and below 3 or even 5 to ensure that the data are not overfitted

(Hair et al., 1998) and to be truly representative of the data. In our case, the value reached is 1.82, within the accepted limits. The results of the analysis are consistent with the hypotheses advanced, confirming the hypotheses proposed. All relationships are significant.

We find that trust, commitment, and procedural justice are reported as important antecedents. Their path coefficients are 0.274 with $p<0.001$, 0.159, and 0.127 respectively, with $p<0.01$. Hypotheses 1, 2, and 3 are thus accepted. They jointly explain 17% of the variance in open innovativeness. Open innovativeness had a significant impact on supply chain competence with a path coefficient of 0.358 with $p<0.001$. Hypothesis 4 is thus accepted, explaining 13% of the variance in supply chain competence. Supply chain competence is very important in determining firm performance with a path coefficient of 0.753 with $p<0.001$. Hypothesis 5 is thus accepted, as it explains 56.8% of the variance in firm performance. We presented the relative importance of the indicators in shaping the latent variables. Further, all of these indicators are significant in composing firm performance.

Figure 2.2. Structural equation estimation. Structural equation.



***p<0.001

**p<0.01

x^2= 1187.8851; degrees of freedom=653

RMSEA=0.03; GFI=0.862;

AGFI= 0.834; NFI= 0.87; NNFI= 0.96; CFI=0.97; IFI=0.97

x^2/d.f.=1.82

2.6. Discussion

The current situation, marked by a world economic crisis, shows the need for organizations to focus on the issues that grant them competitive advantage, such as innovation and the position they hold in the supply chain to which they belong.

The literature shows that firms are increasingly aware that their competitive advantage does not rest only with them. Advantage may also be linked to the resources and capacities of their stakeholders, among them members of the supply chain. An organization that wishes to possess an advantage over its competitors must thus open its boundaries, considering the possibility of developing innovations more rapidly, using knowledge from other organizations such as suppliers, or acquiring their

innovations, as well as making profitable innovations that it has developed that are not strategic in character. Ultimately, entrepreneurial excellence involves a more open conception of orientation to innovation that permits access to new markets and development or improvement of products and services in less time and with less risk. On the other hand, the capacity of the very supply chain of which the organization forms part is a more powerful source of competitive advantage than advantage within the organization, and the organization must contribute to this external advantage by improving its competence in managing the chain.

The main conclusion to emerge from our study is that competence in supply chain management becomes stronger to the extent that an organization is oriented to open innovation with its supply network; that is, one of the benefits of open innovation is to strengthen an existing capacity operating in the organization. Prior studies in this area, such as those by Bilgram et al. (2008), Cheng and Chen (2013), Erzurumlu (2010) and Gassmann (2006) have argued this conclusion at the theoretical level.

Identification of two possible sources of competitive advantage for an organization, open innovativeness and the need to improve competence in supply chain management, led us to propose identifying the aspects that contribute to this competence. Hypothesis 4 thus proposed the effect of orientation to open innovation on improved competence in supply chain management of the surveyed organization. As expected, the results support the hypothesis proposed.

Hypothesis 5 proposed the effect of supply chain management on improvement in organizational performance measured globally as a second-order construct. This hypothesis derives from the need to confirm the direct effect of this competence on performance in its different aspects, as well as on customer satisfaction, which has already been demonstrated. This relationship derives from the theory of resources and capacities, which argues that an organization in possession of a competence that leads to a competitive advantage can obtain better performance (Hult et al., 2003).

This result is explained by the fact that having a higher competence available—in our case, in matters of supply chain management—enables the organization to excel in operations such as preparation and filling of orders, management of inventories, prediction of demand, etc. This competence is thus a source of competitive advantage and leads to better performance in the organization that possesses it. The development of abilities in matters of quality and service at the operating level, such as responding to the customer on time and fulfilling the delivery date while providing quality products and services that answer to customers' needs, improves the satisfaction perceived by the customer (Flint et al., 2008) and thus contributes to improved performance for the customer.

An organization that pursues excellence on the operating level and opens itself to the outside in matters of innovation will foster improvement in workers' performance, as it is not possible to exploit external resources and capacities properly without strengthening internal ones. Finally, improvement in management of inventory and prediction of sales, among other issues, contributes to improvement of financial performance, since it involves a reduction in costs (D'Avanzo et al., 2004; Johnson and Templar, 2011).

Hypotheses 1, 2, and 3 proposed the elements that influence the orientation to open innovation maintained with its supply network. These elements come from social exchange theory, which has been used to analyze the development of relationships within the framework of a supply chain (Kwon and Suh, 2005; Wei et al., 2012; Wu et al., 2014).

These variables are all significant in determining the orientation an organization has to open innovation put into practice with its supply network. Among the SET-based antecedents in particular, meeting or exceeding the expectations of trust has a stronger influence on the open innovativeness than does commitment. This may be the case because trust is an antecedent of commitment (Kwon and Suh, 2004), such that the level of trust determines the long-term orientation of the relationship. According to Wu

et al. (2014), commitment and other issues of social exchange, such as procedural justice, are possible because a high level of trust is present.

Trust has a significant effect on open innovativeness. Therefore, Hypothesis 1 is accepted. A firm that trusts another is aware that knowledge leaks occur, but precisely because this relational element exists, each hopes that the other party will not use leaks against it, a relation that leads to joint learning (Larsson et al., 1998) and an increase in the veracity of the knowledge transmitted (McEvily et al., 2003; Squire et al., 2009). This element becomes key for achieving joint action and fulfilling objectives (Sambasivan et al., 2011). It is thus worth arguing generally that, when the members of a supply chain relate among themselves, they can promote the generation in ideas of the other members of the chain in order subsequently to adopt these ideas, or vice versa, contributing to innovation by other members of the supply chain. Further, in such a context, they can take advantage of these relationships to commercialize innovations that are not useful for them or to access new markets.

Commitment also has a significant but less powerful effect on open innovativeness enabling us to accept Hypothesis 2. This result agrees with the study by Fawcett et al. (2012), which shows how greater capacity for relational commitment translates into greater exchange of all types of information between the parties, even strategic information such as information on new markets or the development of technologies. Some studies thus recognize that the process by which knowledge is shared with the supplier strengthened by the presence of commitment to close social ties constitutes a fundamental source of benefit for the organization (Mucelli and Marinoni, 2011; Nagati and Rebolledo, 2013).

As to procedural justice, we accept Hypothesis 3, due to its positive and significant effect on open innovativeness. Luo (2008) also shows the importance of this element for sharing information and increasing interorganizational cooperation by reducing the possibility of opportunism. Further, it is related as a promoter of cooperative behavior and social harmony at the inter- and intra-organizational levels

(Kim and Mauborgne, 1991; 1993; Korsgaard et al., 1995; Sapienza and Korsgaard, 1996).

2.7. Conclusions and suggestions

In this study, we find that trust, commitment, and procedural justice perceived by an organization toward its supply network influence its orientation to open innovation. We have also analyzed the effect at the operating level of open innovativeness. We show how innovating openly with its supply network leads the organization surveyed to improved competence in supply chain management. Finally, we show empirically the positive effect of capacity for supply chain management on performance, measured multidimensionally.

2.7.1. Implications for theory

We have confirmed empirically the influence on open innovation of some elements that the literature has argued on the theoretical level. These elements are key aspects for good management of relationships oriented to innovate with other stakeholders. This study contributes to the literature analyzing these success factors in an interorganizational relationship by evaluating trust and commitment differently than they have traditionally been measured by researchers. We measured the level of trust and commitment toward the supply network with which open innovation is practiced in terms of fit, since these two constructs evolve as the relationship develops. We believe that comparing expectations and perceptions in a single construct provides a broader vision of how the relationship developed over time, to a certain extent overcoming the limitation of cross-sectional studies. We believe that this procedure constitutes an alternative measurement method to be incorporated in future research. The measurement in terms of gap in the constructs indicated constitutes a significant

contribution at the theoretical level.

We have also performed more in-depth study of one of the possible sources of competence in supply chain management, an area that studies like that by Kristal et al. (2010) argue needs fuller development. The literature on open innovation has pointed to its possible effects on the improvement of capacities existing in the organization or on the promotion of new capacities in general. Our study contributes to the development of the literature on this new paradigm by demonstrating empirically the effect of open innovation on a specific operating capacity in the organization, competence in supply chain management.

We have measured performance as a second-order construct, and this measurement constitutes a contribution on the theoretical level. Studies usually measure performance by differentiating at most between financial and nonfinancial performance, whereas we analyze in greater depth the different dimensions of nonfinancial performance. We believe that this way of measuring performance can represent a valuable tool for use in future studies.

2.7.2. Implications for practice

This study contributes to entrepreneurial practice in clarifying which aspects explain the orientation to open innovation an organization has with its supply network. Managers should not scrimp in their efforts to foster a high-quality relationship based on trust and commitment that meets or exceeds previous expectations. If the trust organizations feel toward their supply network is not violated, it will be equal to or greater than that expected at the start, reducing the fear of opportunistic behavior from the other party with whom they relate. Likewise, if the commitment maintained has not waned over time—or if it has grown even stronger, also influenced by a good level of trust—the organization will be willing to adopt unconventional practices, including those in the framework of open innovation. In

addition, good treatment on the part of the supply network also encourages willingness to collaborate and exchange information and knowledge, which constitutes the basis of this new paradigm. This study is thus useful for organizations, insofar as it shows that the presence of trust, commitment, and procedural justice in relationship maintained with an organization´s supply network with which it practices open innovation, explains the extent an organization is oriented to open innovation.

Purchasing managers must recognize the necessity of choosing suppliers based on the capacity and resources that the suppliers have to innovate. This selection criterion, together with a good climate in the relations maintained in the course of the relationship, will explain the buying organization´s proclivity toward open innovation and the enhancement of its competence in managing the supply chain, by achieving better coordination with its supply network. Thus, managers must take into account that implementing open innovation in their organization translates not only into improvement in their innovative performance but also into strengthening the contribution that each company makes to the supply chain to which it belongs.

Further, this study shows how improving the capacity of supply chain management strengthened by an orientation to open innovation with its supply network, improves organizational performance in different areas: in the customer, in society, in people, and in the organization's business results. Organizations must thus understand that one way to achieve entrepreneurial excellence is to strengthen their competence in managing the supply chain to which they belong.

2.7.3. Limitations and further research

In spite of the results obtained, this study is not exempt from limitations. First, the perceptions of an organization are not uniform, as using a single informant can bias our research. This study would be enriched by using more than one informant per organization surveyed.

Second, as the measures, not only of dimensions of performance but also of the open innovativeness, have been newly developed for this study, further validation of their respective scales is an important step for future research.

Third, the results are naturally limited to the empirical and geographical context in which data was collected. Similar studies in other countries would provide useful and interesting comparative analyses. As Sisodiya et al. (2013) argue, open innovation is a complex phenomenon that may be influenced by other factors that we have not taken into account in this study. Knowledge of this new paradigm would be enriched by using longitudinal instead of cross-sectional data.

We also propose as a future line of research analyzing the extent to which dynamic capacities (Barrales-Molina et al., 2013) affect open innovativeness and the buying firm's competence in supply chain management.

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"De la Ley Principal que llegó a la existencia en la Dimensión de la Dualidad, ha surgido el Principio de Compensación entre dar y recibir. En proporción a lo que des, volverás a recibir, y darás energía por lo que recibas.
Todo se encuentra en un constante flujo".
(Código de Luz).

CAPÍTULO 3

SUPPLY NETWORK-ENABLED INNOVATIONS. AN ANALYSIS BASED ON DEPENDENCE AND COMPLEMENTARITY OF CAPABILITIES.

Supply Network-Enabled Innovations. An analysis based on dependence and complementarity of capabilities

Abstract

This paper responds to the need to study innovation in the context of a supply chain, analyzing the relationship between orientation to open innovation and improvement of the buyer organization's competence in managing this chain. Following the literature on open innovation and power asymmetry in knowledge transfer, we first study the influence of this asymmetry on the relationship between orientation to open innovation and improvement of the buyer organization's competence in managing its supply chain. Second, we examine the moderating role of the absorptive and desorptive capacity of the buyer organization in this relationship, in response to calls in the literature on open innovation and supply chain management for the need to study this role. To perform this study, we use data collected from 262 manufacturing and service firms. The results confirm both the influence of power asymmetry on obtaining benefits that derive from orientation to open innovation in the context of our study and the moderating effect of absorptive capacity. The results do not, however, support the moderating effect of the buyer organization's desorptive capacity. Subsequent analyses confirm the appropriateness of using the theory of complementarity to study the benefits of orientation to open innovation using its supply network. Organizations that achieve complementarity among their own absorptive capacity and the capacities of its supply network manage to obtain benefits from greater orientation to open innovation.

Keywords

Open Innovation, Supply Chain Competence, Power Asymmetry, Absorptive Capacity, Desorptive Capacity.

3.1. Introduction

Innovation, in its different perspectives, enables the organization both to satisfy its customers and to outdo the competition. This condition is imperative, among other factors because an organization's customers are becoming better informed and because the pressure the competition exerts on the organization is increasing (Menon et al., 2002; Tamayo Torres et al., 2014). Entrepreneurial reality has thus imposed practices that pursue improvement of innovation efficiency in terms of cost and time. From the theoretical perspective, this reality has been called open innovation.

Open innovation analyzes the exploration and exploitation of knowledge to improve an organization´s performance so as to maintain its competitive advantage over time, including the use of both internal and external ideas. Increasingly conscious that talent is found outside their boundaries, companies can use the knowledge in their customers, suppliers, competitors and universities, and vice versa.

These potential sources of innovation have been treated generically in the literature on open innovation, specifically for the case of users, customers (Payne et al., 2008) universities, etc. Yet the particular case of suppliers as a source of innovation has hardly been tackled (Enkel et al., 2009; Thomas, 2013), despite its widely recognized importance in the literature that analyzes the general sources of innovation in an organization operating under open innovation (Garriga et al., 2013; Laursen and Salter, 2006; Von Hippel, 1998). Along these lines, the study by Enkel et al. (2009) indicates that 69% of knowledge sources come from suppliers.

Given suppliers' potential as a source of innovation and the need to study innovation in the context of a supply chain (Narasimhan and Narayanan, 2013), the first contribution of our study is to analyze how orientation to open innovation improves an organization's performance in the context of supply chain management. The research on open innovation to date has been limited to contrasting the relation between open innovation and organizational performance, without reaching any

consensus. If we examine studies based on the positive effects open innovation has on the performance of the organization that adopts it, we find that some studies indicate possible strengthening of an organization's competences as a result of its implementation (Cheng and Chen, 2013; Gassmann, 2006). One competence the entire organization possesses is management of the supply chain to which it belongs, a competence essential for its competitiveness. However, the literature has hardly treated how to improve this competitiveness. We seek to fill this gap by studying how orientation to open innovation influences improvement in competitiveness in a supply chain context.

We understand open innovativeness to be the degree to which an organization puts this new paradigm into practice, specifically, the extent to which it develops joint processes with its supply network. We therefore address the need to examine the specific innovation practice in order to understand the effect of this new paradigm on innovative performance. This study seeks to develop deeper understanding of the benefits derived from an organization's orientation to open innovation, understood in a limited way, as related to its supply network. Following Narasimhan and Narayanan (2013), we understand supply network as the possible network of upstream suppliers in the firm's value system directly or indirectly (p. 28). We study the organization's inclination to employ inputs from a great variety of suppliers, small and large, as well as to develop joint processes with them. Therefore, these suppliers committed to the organization's open innovation processes may or may not have maintained a prior relationship with the organization (Narasimhan and Narayanan, 2013).

The second contribution of this study is its attempt to resolve the debate in the literature on the relationship between open innovation and performance. To do this, we examine the power relationships that arise in the context of our study. The importance of analyzing power relationships has been shown in the literature on open innovation (Vanhaverbeke et al., 2007; Vanhaverbeke and Cloodt, 2014), although this factor has not been analyzed to date. We use the absorptive capacity an organization perceives

among its supply network as an expression of their power, due to its possible influence on the relationship between improvement of competence to manage its supply chain as the result of open innovativeness. We thus respond to voices (Tsai, 2009) that state the need to consider a series of factors that can influence the relationship between open innovation and performance.

Our third contribution is to examine the moderating character of absorptive and desorptive capacities inherent in the buyer organization in obtaining the benefits derived from open innovation. We acknowledge that these capacities have been recognized in the literature, due to their importance in facilitating the flow of knowledge between organizations (Lichtenthaler and Lichtenthaler, 2009; Vanhaverbeke et al., 2007), and that they have been developed only slightly in the literature on supply chain management.

To summarize, the general purpose of this study is to analyze how perception of dependence and the capacities of an organization itself influence improvement of competence in managing its supply chain, as a result of its orientation to open innovation. This goal takes concrete form in three individual objectives. The first objective consists of analyzing how the level of absorptive capacity that the buyer organization perceives among its suppliers influences the relationship between orientation to open innovation and supply chain competence. The second is to analyze the moderating character of the buyer organization's absorptive capacity in this relationship. Finally, the third objective is to examine the moderating character of the buyer organization's desorptive capacity in the above-mentioned relationship.

To fulfill these objectives, this study is structured as follows. The next section provides a conceptualization of supplier integration and open innovation, followed by the articulation of how suppliers' absorptive capacity and buyer's absorptive and desorptive capacity might enable performance gains from open innovation. First, we study the level of the suppliers' absorptive capacity as perceived by the buyer organization as one of the criteria that determine the buyer's perception of dependence.

Next, we analyze in greater depth the moderating character of absorptive and desorptive capacity of the buyer organization in the appropriation of benefits as a result of open innovativeness. We then develop hypotheses based on assumptions about knowledge transfer, open innovation, and complementarity theory. Subsequently, methodology, including data collection and measurement instruments and control variables, is discussed. Empirical results are then presented, followed by a discussion of findings. Finally, we develop theoretical and managerial implications, research limitations, and future lines of research.

3.2. Theory development

3.2.1. Open innovation and supplier integration

The literature has signaled a change in buyer-supplier relations in the context of new product/service development, since, as Chesbrough explains (Wagner, 2012), suppliers' proposals may be equal to or better than those that occur internally in the organization. The literature on supply chains has thus begun to analyze how to facilitate learning and knowledge flow within these chains (Azadegan et al., 2008). Under the paradigm of open innovation, the study by Wagner (2012) shows that organizations must open their boundaries to suppliers and collaborate with them in the exchange of knowledge.

This approach stems from the fact that suppliers are the stakeholders who know the organization best, since as customers they depend on it. Specifically, suppliers have detailed knowledge of the organization's products and processes (Petersen et al., 2003; Von Hippel, 1998), as well as valuable information on end users—that is, on the customers the organization serves. Suppliers provide information on new ways of proceeding, offering the buyer organization a basis for comparing its practices to others in the entrepreneurial environment, as well as for outdoing the competition by not having to perform all functions of its value chain alone (Brem and

Tidd, 2012). Further, suppliers are the only stakeholders with valuable, easily understood information about the end customers, information that the organization can access if it is oriented to open innovation, since the practice of open innovation involves extensive knowledge exchange (Mucelli and Marinoni, 2011).

Considering suppliers as a source of innovation is not risk-free, however. Risks include knowledge leaks by suppliers, which also prevent the organization from achieving a competitive advantage that is sustainable over time, since suppliers serve competing organizations that can use the knowledge suppliers possess and thus need not contribute to innovative performance themselves (Du et al., 2014).

Since open innovation is established in collaboration relationships, we must take into account a series of studies that argue that collaborative links between organizations permit shared learning, knowledge transfer, exchange of technical information between suppliers and the buying organization, and the development of new capacities and strengthening of existing ones to influence innovative performance (Molina et al., 2007). Paton and McLaughlin (2010) point to knowledge transfer as a key success factor in an organization's operating and innovative performance. The members of a supply chain that achieve effective knowledge transfer come to know the members with which they relate on the operating level and can thus achieve efficiency (Hernández Espallardo et al., 2010; Hult et al., 2002).

A successful collaborative relationship involves exchange of ideas and experiences that permits the collaborating organizations to obtain a more complete vision when facing their everyday situation and the problems that threaten them, as well as a greater variety of solutions to these problems and thus better performance in reducing their errors (Zacharia et al., 2011). The information accessed within a relationship of collaboration or cooperation is thus a resource that provides competitive advantage and is associated with improvement in operating performance (Nagati and Rebolledo, 2013).

Along these lines, Liu et al. (2012) argue that knowledge exchange helps organizations to understand their products and processes, and the competition they face, as well as markets, enabling improvement of their problem-solving capacity and their foresight and coordination of production and delivery activities, inventory-related activities, etc. (Kotabe et al., 2003; Wu et al., 2014). Further, it has been confirmed that inter-organizational collaboration and innovation provide the customer with better delivery service, among other benefits (Narasimhan and Das, 1999), since suppliers acquire deeper knowledge of how the buying organization functions, enabling better coordination of supply chain activities and thus permitting the organization to satisfy end users' expectations.

3.2.2. Open innovation and its effects on supply chain competence

The idea that the organization's success depends to a greater extent on the capacity of the supply chain to which it belongs than on its own organizational capacities is gaining wider acceptance (Chow et al., 2008). The competitive position and quality of the supply chain are strengthened by the competence that each organization has to manage the chain. Competence in supply chain management has been defined by Chow et al. (2008) in the following terms: "a portfolio of organizational, managerial, technical and strategic capabilities and skills developed by enterprises over time." It is the result of continuous learning by the organization (Spekman et al., 2002), and it permits the organization to attend to demand under any circumstances, that is, to be more flexible and to meet the changing demands of the market it serves, as well as to achieve excellence in the supply chain in its area of operation (Kuei et al., 2005).

One branch of the literature argues that more effective use and strengthening of the organization's own resources and capacities, especially those that are strategic in character, is one benefit of adopting open innovation (Cheng and Chen, 2013; Gassmann, 2006). Erzurumlu (2010) argues that it is possible to obtain advantages from open innovation at the operating level, and open innovation can be considered a strategic asset practiced between members of a supply chain. A study by Blome et al.

(2013) indicates the possibility that organizations can improve their efficiency through innovation. We agree with this study, which argues that organizations can pursue multiple objectives simultaneously, although with differing intensity, with the result that pursuit of innovation and efficiency are not incompatible. We thus propose that open innovativeness (hereafter OI) can lead to competence in supply chain management in the buyer organization (hereafter SCC), based on the exploration and exploitation of knowledge with its supply network.

The focus of this study, the relation between OI and SCC, is established based on the knowledge transfer that takes place with the supply network with which open innovation is practiced. One factor to take into account when studying inter-organizational knowledge transfer is asymmetry in the distribution of power between the parties (Easterby-Smith et al., 2008). Initially, this asymmetry stems from the difference in the negotiating power of the parties in the relationship. As the relationship develops, however, the rhythm of the parties' knowledge acquisition constitutes one of the factors determining a possible imbalance of power. We therefore consider it advisable to analyze this factor in the relationship studied here. To do so, we use the level of absorptive capacity that the buyer organization perceives its supply network to have as an expression of their rhythm of knowledge acquisition and thus of the power the supply network has in knowledge transfer, transfer that is essential in OI.

3.2.2.1. Relations of dependence and open innovation. Absorptive capacity as an expression of power

The literature has recognized that an organization's position of dominance in a relationship with other organizations is determined, among other factors, by the resources and capacities that the organization possesses (Cox, 1999; Kähkönen, 2014). Likewise, one branch of the literature indicates the influence of the capacities of the

organizations in a relationship on the development of the relationship (Dussauge et al., 2000).

In our case, the connection between OI and SCC is based on inter-organizational knowledge transfer, to which the capacities that enable open innovation are essential. The development of these capacities can facilitate the obtaining of benefits for an organization that adopts open innovation, granting the organization that develops them dominance based on its greater capacity for learning and/or knowledge transfer. The study by Andersén and Kask (2012) thus proposes theoretically the influence of the perceived asymmetry of an organization's (realized) absorptive capacities relative to that of others to which it relates. Specifically, this study argues that greater learning capacity, determined by the organization's absorptive capacity, decreases the level of dependence perceived by the organization that has this capacity. Following their study, we use absorptive capacity as an approximation of an organization's learning capacity and as a key variable for establishing the balance of power in an inter-group relationship. Thus, an organization's perception of its supply network' absorptive capacity can explain the dependence it perceives in the relationship it maintains with them.

If the supply network has great absorptive capacity, that is, capacity to learn from the firms that they supply, the members of the supply network will feel more motivated to participate in the relationship and practice open innovation. In contrast, the buyer firm may then be placed in a position of greater risk of losing negotiating power and may fear possible opportunistic behavior from its supply network (as Nyaga et al., 2013 show for power asymmetry) if it perceives an excessive level of absorptive capacity in its supply network. Relationships with power asymmetry are thus associated with less stability and greater propensity to a climate of distrust (Hoejmose et al., 2013).

We must remember that, because the supply network with which an organization practices open innovation also supply firms that compete with the buyer

organization, it may be more difficult to maintain the competitive advantage derived from OI over time (Thomas, 2013). Further, if the supply network has a higher level of absorptive capacity, the buyer organization can perceive greater risk of opportunistic behavior on the part of its supply network and thus greater dependence on them. In such situations, the competence of the buyer organization in managing its supply chain cannot be improved as a result of OI.

For this reason, we propose that the level of absorptive capacity the buyer organization perceives in its supply network is one of the determinants of its perception of dependence, which, in turn, influences the possibility of obtaining benefits from OI. Thus, when the conditions needed to enable collaboration between the parties arise—among them, that the buyer organization does not feel threatened by the excess of absorptive capacity among its supply network—a greater propensity to exchange of ideas and experiences occurs that permits improvement of SCC.

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

H1: The effect of OI on SCC will be positive and significant when the buyer organization perceives a lower level of absorptive capacity among its supply network.

3.2.3. Open innovation capacities. Absorptive and desorptive capacity of the buyer firm

An organization's orientation to open innovation may not be sufficient to obtain benefits derived from it, making it necessary to examine the factors that can lead to its success (Sisodiya et al., 2013).

The literature recognizes the importance of a series of capacities that contribute to making the flow of knowledge possible beyond the boundaries of an organization (Haro Domínguez et al., 2007; Lichtenthaler and Lichtenthaler, 2010; Vanhaverbeke et al., 2007), capacities that enable management and transfer of the organization's external

knowledge, such as the absorptive and desorptive capacity of each member in the relationship. We must recognize that the capacity of acquiring and using knowledge effectively is a key factor for supply chain performance and the success of the innovative activities that take place within it (Storer and Hyland, 2009). Desorptive capacity, in turn, constitutes the inverse of absorptive capacity in an organization.

Next, we will analyze the role of the absorptive and desorptive capacities of the buyer organization on improvement of SCC as a result of OI, taking into account perception of the organization's dependence.

3.2.3.1. Moderating effect of desorptive capacity of the buyer organization relative to its suppliers

Desorptive capacity is key in achieving external exploitation of an organization's knowledge (Lichtenthaler, 2007), since it enables inter-organizational knowledge transfer. This capacity is present in an organization when the organization can identify the opportunities for exploiting its knowledge, transferring this knowledge effectively (Lichtenthaler and Lichtenthaler, 2009). Theories of knowledge management indicate that the success of knowledge transfer depends on the characteristics of the sender and the receiver (Chang et al., 2012; Easterby-Smith et al., 2008).

An organization that has the capacity to transfer knowledge effectively to other organizations enjoys a competitive advantage over organizations without this capacity (Lawson and Potter, 2012; Najafi Tavani et al., 2013). Possessing this capacity can bring non-economic benefits for the organization that possesses it, such as access to external knowledge, entry in new markets, or establishment of the standards of the industry in which it operates, as well as greater knowledge of the market it serves or others that it can serve (Lichtenthaler and Lichtenthaler, 2010). In the case studied here, we propose that the buyer organization's capacity to transfer knowledge to its supply network

strengthens improvement of SCC as a result of OI, since this capacity can bring access to relevant external knowledge. Further, we must take into account that, in a context of lower absorptive capacity among its supply network, a buyer organization's development of desorptive capacity complements the lower level of absorptive capacity among its supply network. As indicated by the literature, buyer-supplier collaboration in product development enables the parties to complement each other's capacities (Inemek and Matthysens, 2013). We therefore seek to verify the following hypothesis:

H2: The desorptive capacity of the buyer organization relative to its supply network positively and significantly moderates the relationship between open innovativeness and SCC when the buyer organization perceives a lower level of absorptive capacity among its supply network.

3.2.3.2. Moderating effect of absorptive capacity of the buyer organization relative to its suppliers

An organization's absorptive capacity varies based on the source of external knowledge to which it relates and is thus said to be partner-specific (Dyer and Singh, 1998; Wagner, 2012). Thus, the organization's ability to recognize, assimilate, transform, and exploit knowledge (Zahra and George, 2002) is not uniform but is greater or less based on the relation it maintains with the possible knowledge sources—customers, suppliers, universities, competitors, etc.—and it is constructed over time (Teece et al., 1997).

This construct has only recently begun to be analyzed in the context of buyer-seller relations, the focus of this study (Azadegan, 2011; Chen et al., 2009; Sáenz et al., 2014). We must start from the fact that knowledge transfer in this framework is based on close relationships and that the boundaries of the members in the transfer are permeable (Dyer and Singh, 1998; Sáenz et al., 2014; Volberda et al., 2010). The study by Azadegan (2011) indicates that the buyer firm's absorptive capacity enables this firm to

exploit its suppliers' knowledge well, since this capacity enables understanding and assimilation of their knowledge.

The study by Vanhaverbeke et al. (2008) indicates that absorptive capacity and open innovation are not connected *per se*. The study by Clausen (2013) attempts to justify this conclusion, in which studies prior to open innovation related absorptive capacity to intra-organizational activities, hardly granting importance to external sources of innovation. From a traditional perspective, a low level of absorptive capacity will lead an organization to have greater interest in cooperation activities (Barge-Gil, 2010). As a result, the relation between absorptive capacity and open innovation is the object of controversy. Some studies indicate the counterproductive character of this capacity—for example, the study by Robertson et al. (2012)—as insufficient to possess the capacities needed for incremental process innovation in this context.

There is, however, increasing support in the literature for the need to have capacities that facilitate adoption of open innovation. This branch of the literature, to which we subscribe, holds that the mere presence of knowledge sources valuable for the organization does not guarantee success, as it is necessary to examine, among other factors, the absorptive capacity of the parties in the relationship. It has been indicated generally that the presence of a sufficient level of absorptive capacity relative to the supplier enables effective application of knowledge external to the organization (Chen et al., 2009; Najafi Tavani et al., 2013; Tranekjer and Knudsen, 2012; Wagner, 2012), which translates into greater innovative performance.

Studies have been calling, however, for the need to analyze its effect on the operating level, that is, on improving the organization's efficiency (Volberda et al., 2010). Along these lines, the study by Sáenz et al. (2014) recognizes that, as the parties learn among themselves, they develop deeper knowledge of each other's needs, resulting in better functioning of the supply chain. This impact affects not only innovation (Liu et al., 2012), but also efficiency on the operating level, as shown in the study by Malhotra et al. (2005), which considers operating performance as the initial

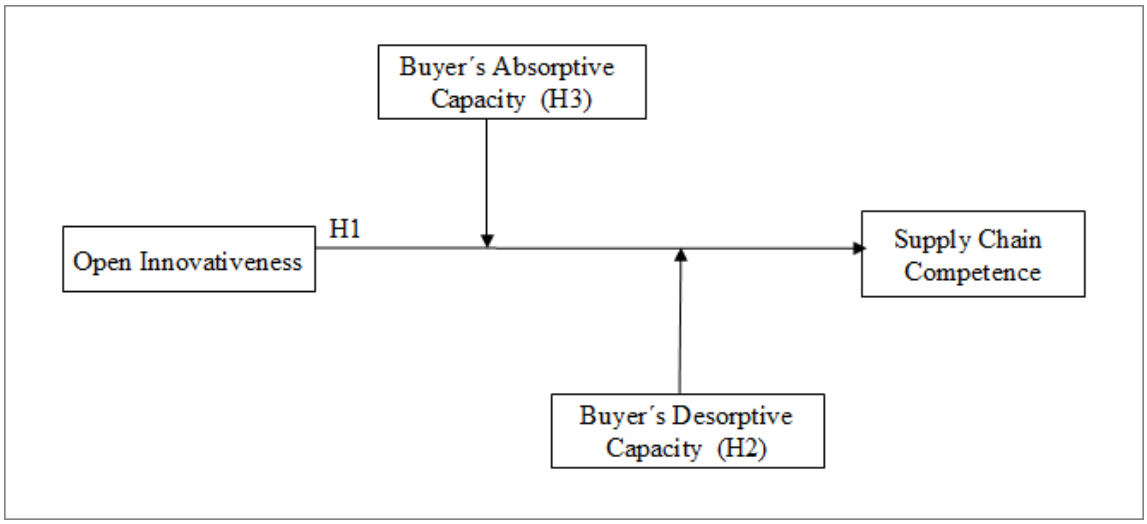
goal of constructing absorptive capacity in the supply chain. Thus, absorptive capacity can bring with it cost reduction, more efficient use of resources, or improvement in quality and reliability, effects that have not been analyzed sufficiently in the literature (Sáenz et al., 2014).

Taking the foregoing into account, that is, the joint consideration that absorptive capacity is crucial for proper exploitation of external knowledge and the effects of this capacity at the operating level, we propose the following hypothesis:

H3: An organization's absorptive capacity relative to its suppliers positively moderates the relationship between OI and SCC when the buyer organization perceives a lower level of absorptive capacity among its supply network.

The joint consideration of these hypotheses produces the theoretical model in Figure 3.1.

Figure 3.1. Theoretical model



Lower Supply Network´s Absorptive Capacity

3.3. Methodology

The context of this study is manufacturing and service firms. The unit of analysis was the buyer firm collaborating with its supply network. The size of the buyer firms was distributed as follows: 79% buyer firms had fewer than 250 employees, 18% had 250-1000 employees, and 3% had 1000-5000 employees. The questionnaire examined primarily the moderating effect of absorptive capacity on the relation between the orientation an organization has to open innovation and its supply chain competence.

3.3.1. Sample and data collection

The SABI databases were used to obtain the study population. A sample of 2000 firms (1400 manufacturing and 600 service firms) was chosen at random. In all cases considered valid, the informants were logistics/purchasing executives. These managers are more likely to establish close relationships with suppliers specifically oriented to innovation and its impact on supply chain competence. The study used a CATI (computer-assisted telephone interview) survey method and electronic surveys. The literature recommends this mixed-mode method to compensate for the weaknesses of individual method. The responses were collected from June to October 2013.

Initially, a pretest was used to determine the scale. The scale was carefully examined by selected practitioners and academicians in the field for translation, wording, structure, and content. The scale's content validity should be acceptable. We received 290 responses, for a response rate of 14.5%. Accounting for missing responses, we obtained a final sample of 262 usable responses, yielding a final response rate of 13.1%. Table 3.1 shows the sample demographics. Possible bias due to non-respondent firms was analyzed. Considering the late group of respondents as those most likely to be similar to non-respondents, we compared the early and the late groups of respondents to obtain information on non-response bias in the sample (Armstrong and Overton, 1977). Early and late sub-samples were identified as 162 and 99 respondents,

respectively. The results of comparing the two groups indicate no systematic non-response bias in the survey data (p=.05).

Table 3.1. Demographic

Characteristics	Frequency	Percent
Industry type		
High-tech Manufacturing	79	30.2
Traditional Manufacturing	96	36.6
Services	87	33.2
Annual revenue		
<1000M	0	0
1000-10,000M	81	30.91
10,000-100,000M	152	58.02
>100,000M	29	11.07
Number of employees		
0-49	13	4.96
50-250	195	74.43
>250	54	20.61
Number of suppliers		
<100	219	83.6
100-300	38	14.5
>300	5	1.9

3.3.2. Instrument and measures

Our research incorporates preexisting perceptual measures whenever possible. As no measures existed for open innovation in a supply chain context and desorptive capacity, we developed new measures for these variables.

3.3.2.1. Open innovativeness

This section measures the extent to which an organization is oriented to open innovation. Because no such scale existed in the literature, we constructed our own scale. Measurement items were adapted from the instrument developed by EFQM (2013). The EFQM model has incorporated this new paradigm as one of the eight fundamental concepts of excellence on which "taking advantage of creativity and innovation" is based relative to their interest groups, which includes suppliers. Following EFQM's operationalization of open innovation, our study conceives it as the extent as it is promoted the generation of ideas and innovation by others and in which clear goals and objectives for innovation are established jointly and perfected based on the results obtained. Likewise, the organization and its supply network use innovation as an instrument in capturing the talent of other members with which they wish to interact, and conceive innovation beyond technological changes, where innovation shows new ways of satisfying the customer, as well as new ways of working that take maximum advantage of resources, competition, and alliances.

We measured this construct using seven items, for which the survey respondents were to indicate their degree of agreement or disagreement with the statements proposed on a Likert scale from 1 to 7 (1=totally disagree; 7=totally agree). Factor loadings ranged from 0.71 to 0.89. The Cronbach's Alpha is 0.934, indicating the scale's reliability. To ensure one-dimensionality, we checked that all items loaded on a single factor.

3.3.2.2. Desorptive capacity

The absence of a scale to measure desorptive capacity led us to fill this gap in the literature by developing our own measurement scale. To do so, we drew on the literature reviewed concerning this construct (theoretical in character), especially the study by Lichtenthaler and Muethel (2012). As a result of this analysis, we proposed measuring desorptive capacity based on three items measured on a Likert scale from 1

to 7 (1=totally disagree; 7=totally agree), which permits evaluating the appropriateness of knowledge transfer from the organization surveyed to suppliers based on proper identification of the knowledge that could be relevant to suppliers, good organization of the transfer process, and support for this process. Factors loading ranged from 0.84 to 0.95. The scale's validity was confirmed with a Cronbach's Alpha of 0.921.

The desorptive capacity of the supply network was measured by adapting the construct supplier-specific desorptive capacity to the suppliers' point of view in order to measure the buyer organization's perception of desorptive capacity of the suppliers with which open innovation is practiced. Factor loadings ranged from 0.79 to 0.89, with validity confirmed by achieving a Cronbach's Alpha of 0.882, well above the required level.

3.3.2.3. Supply chain competence

The measurement items for supply chain competence were adapted from the instrument developed by Chow et al. (2008), which contains eight items. Supply chain competence was measured as a variable composed of quality and service issues, and operations and distribution issues. A 7-point Likert-type scale (1=totally disagree to 7=totally agree) was developed. Factor loadings ranged from 0.71 to 0.83. The Cronbach's Alpha of 0.915 indicates the scale's reliability.

3.3.2.4. Absorptive capacity—supplier-specific

A firm's absorptive capacity relative to its supply network was measured through a first-order construct composed of three items validated in the study by Wagner (2012). Again, we requested that the respondent evaluate degree of agreement or disagreement with the statements proposed on a Líkert scale from 1 to 7 (1=totally disagree to 7=totally agree). Factor loadings ranged from 0.7 to 0.9. The scale's reliability was analyzed (Cronbach's Alpha=0.868).

3.3.2.5. Suppliers' absorptive capacity—buyer firm-specific

The absorptive capacity of the supply network with which the firm practices open innovation was measured by adapting the previous construct (absorptive capacity—supplier-specific), logically changing the perspective to evaluate the buyer organization's perception of its suppliers' absorptive capacity. We used the three previous items, for which the organization surveyed was asked to indicate on a Likert scale from 1 to 7 its degree of agreement or disagreement with the statements proposed relative to its suppliers. Factor loadings ranged from 0.8 to 0.89, producing a Cronbach's Alpha of 0.880, which indicates an acceptable level of internal consistency.

3.3.2.6. Control variables

The literature indicates the importance of considering factors characteristic of the organization analyzed or its context that can influence the possibility that performance is affected by an organization's adoption of open innovation (Sisodiya et al., 2013). As a factor inherent in the organization, we studied size using number of employees, as this is a factor determining the capacity for commitment of resources and capacities (Moorman and Slotegraaf, 1999) and thus of the results of innovation in an organization.

As a contextual factor, we considered the sector to which the organization belongs (secondary or service). Open innovation is present in all kinds of organization, not only high-technology sectors (Chesbrough and Crowther, 2006).

Research has, however, urged the need for differential study of the service and secondary sectors, making it crucial to use the variable of sector to control for significant differences in the perceptions of managers from one sector to the other / effects of OI between the manufacturing and the tertiary sector (Mina et al., 2014). Since our study connects OI to SCC, we must take into account that various studies indicate the influence of sector on achieving good supply chain management (Wu et al., 2014).

Finally, the number of suppliers with which an organization practices open innovation was included as control variable, since this number can affect the suppliers' response capacity and thus the organization itself, the coordination that both need to achieve efficiency, and the results in supply chain innovation (Choi and Krause, 2006). Consistent with research convention, we used logarithmic transformations for employees and number of suppliers.

3.4. Results

3.4.1. Measure validation and descriptive statistics

We assessed validity with a confirmatory factor analysis for the reflective scales. The results of the confirmatory analysis show that all indicators fulfil the three requirements: all factor loadings are significant ($t>1.96$; $p<0.05$)—greater than 0.5—and the value for individual reliability is above 50%. Following Fornell and Larcker (1981), we used average variance extracted to evaluate convergent validity. The AVEs for OI (0.67), SCC (0.5815), buyer's absorptive capacity (0.7144), buyer's desorptive capacity (0.8017), SN's absorptive capacity (0.7186), and SN's desorptive capacity (0.7283) exceed the 0.5 criterion. The composite reliability for OI (0.935), SCC (0.917), buyer's absorptive capacity (0.881), buyer's desorptive capacity (0.924), SN´s absorptive capacity (0.884), and SN´s desorptive capacity (0.889) exceed the 0.7 criterion.

Discriminant validity is assumed to exist if the squared average variance extracted for each construct exceeds their shared variance (correlation). This was found in all combinations of paired constructs, providing evidence of discriminant validity for all scales. Table 3.2 shows the descriptive statistics, correlations among constructs, and squared average variance extracted for each construct.

Table 3.2. Mean, standard deviation, correlations, and square root of AVE

	1	2	3	4	5	6	7	8	9
1. OI	**0.8215**								
2. SCC	0.341**	**0.7625**							
3. Buyer's AC	0.392**	0.565**	**0.8452**						
4. Buyer's DC	0.324**	0.623**	0.616**	**0.8954**					
5. SN' s AC	0.471**	0.449**	0.658**	0.526**	**0.8477**				
6. SN' s DC	0.377**	0.501**	0.544**	0.692**	0.6**	**0.8534**			
7. Sector	0.152*	0.031	0.038	-0.004	0.062	0.060	-		
8. Employees (n)	-0.042	0.160**	-0.109	0.168**	-0.077	-0.134*	0.186**	-	
9. Suppliers	0.101	0.006	0.033	0.083	0.011	0.034	-0.057	0.096	-
Mean	4.67	5.84	5.34	5.22	5.02	5.19	0.66	4.95	2.97
St Dev	1.26	0.76	0.89	1.03	0.88	0.93	0.47	0.83	1.33

Note: ***p<0.001; **p<0.05; *p<0.01

3.4.2. Common method bias

We used Harmon's single-factor test (Podsakoff et al., 2003) to control for common method bias. The results suggest minimal common method bias, as the largest extracted component accounts for only 46%.

3.4.3. Hypothesis testing

To contrast the hypotheses, we used hierarchical regression analysis. In a preliminary stage, we performed a regression among the dependent and control variables. We then performed a regression among the dependent and moderating variables. The next phase included the independent variable. Finally, we added two terms that represented the interactions between the independent variable and each of the moderators. To avoid problems of multicollinearity, we centered the interaction terms relative to the mean before calculating their product. The tolerance value and the

variance inflation factor (VIF) of the independent variables are within the accepted limited for rejecting the presence of multicollinearity.

Given the prior formulation of the hypotheses, contrasting them requires dividing the sample based on the level of the SN's absorptive capacity perceived by the buyer organization. To do this, following the recommendation of Jaccard et al. (1990), we classified SN´s absorptive capacity values of an above-average standard deviation as high-level and values below the average standard deviation as low-level. We thus proposed two regression models, one for organizations that perceive their suppliers as having less absorptive capacity, and the other for organizations that perceive their suppliers as having a higher level. The goal of this separation was to study the influence of perceived level of suppliers' absorptive capacity on the relationship between OI and SCC, as well as the role of the moderating variables.

The results of the hierarchical regression are presented in Table 3.3. Hypothesis 1 proposes that the relation between OI and SCC will only be positive and significant when the buyer organization perceives the SN's level of absorptive capacity to be lower. As can be seen in Model 3 of the first regression (supplier AC < or equal to 5.02), which incorporates the independent variable OI, this variable has a positive and significant effect on SCC (ß=0.074; $p<0.1$). Introducing this variable indicates an increase in the variance, meaning a change in $R^2=0.01$ ($p<0.1$). Model 3 of the second regression (SN´s AC>5.02), which incorporates the independent variable OI, shows that this variable has a positive but non-significant effect on SCC (ß=0.05; $p>0.23$). Introducing this variable indicates an increase in the variance, meaning a change in $R^2=0.011$, but this change is not significant. These results thus support the validity of H1.

Hypothesis 2 proposes that the buyer organization's desorptive capacity positively moderates the relation between OI and SCC in organizations that perceive its supply network to have lower absorptive capacity. If we examine the first regression, in Model 4, the resulting term of the product of OI and desorptive capacity produces a negative but non-significant sign, indicating that this interaction does not

predict the SCC significantly (ß= -0.044; p<0.6). These results do not support the validity of H2.

Hypothesis 3 holds that the buyer organization's absorptive capacity moderates the relation between OI and SCC positively in organizations that perceive its supply network to possess lower absorptive capacity. If we examine the first regression, in Model 4, the interaction between the organization's own absorptive capacity and OI correlates positively and significantly with SCC (ß=0.087; p<0.05), supporting H3. To complete the contrast of the hypotheses on moderation, we confirmed that there was a significant moderating effect and then analyzed the sign and significance of the slope of the relation between OI and the dependent variable. Our procedure follows that proposed by Jaccard et al. (1990), based on the values taken by the moderating variable. We then performed an additional analysis, in which we evaluated the effect of the independent variable on the dependent variable, while distinguishing between different levels of the moderating variable. Analysis of the interaction term shows that OI is positively related to SCC under the condition of high buyer's absorptive capacity (ß=0.103; p<0.05), as can be seen in Table 3.4. Because this effect is not significant when we establish the condition of low buyer's absorptive capacity, we confirm that the multiplicative term is significant in the multiple regression analysis, providing support for H3. To understand this interaction pattern, we plotted the predicted values of SCC for high and low levels of OI and buyer's absorptive capacity (Figure 3.2). Based on Figure 3.2, the highest levels of SCC are observed for high levels of both OI and buyer's absorptive capacity. Other combinations show lower levels of SCC.

Table 3.3. Effects of OI and its moderators on SCC

	Supply Chain Competence							
	Low SN´s AC n=158				High SN´s AC n=104			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Constant	6.457c	2.9c	2.752c	2.415c	6.764	4.831c	4.779c	5.676c
Sector	-0.011	0.027	-0.01	0.013	-0.064	-0.035	-0.046	-0.048
Employees	-0.159a	-0.027	-0.018	-0.017	-0.147a	-0.109a	-0.121a	-0.017a
Suppliers	-0.01	-0.041	-0.049	-0.045	0.062b	0.026	0.024	0.031
Buyer's AC		0.279c	0.255c	0.358c		0.042	0.021	-0.081
Buyer's DC		0.320c	0.311c	0.247c		0.277c	0.275a	0.295c
OI			0.074b	0.093a			0.05	-0.051
OI x B AC				0.087a				0.169a
OI x B DC				-0.044				0.003
R^2	0.027	0.431	0.441	0.458	0.066	0.213	0.225	0.273
Adjusted R^2	0.008	0.412	0.419	0.429	0.037	0.173	0.177	0.212
F	1.409	23.038c	19.864c	15.724c	2.337c	5.315c	4.682c	4.468c
Change in R^2		0.404	0.01	0.017	0.066	0.148	0.011	0.049
F		54.026c	2.702b	2.287b	2.337b	9.207c	1.404	3.192a

Note: The present coefficients are unstandardized regression results. a Significant at 0.05; b Significant at 0.1; c Significant at 0.01

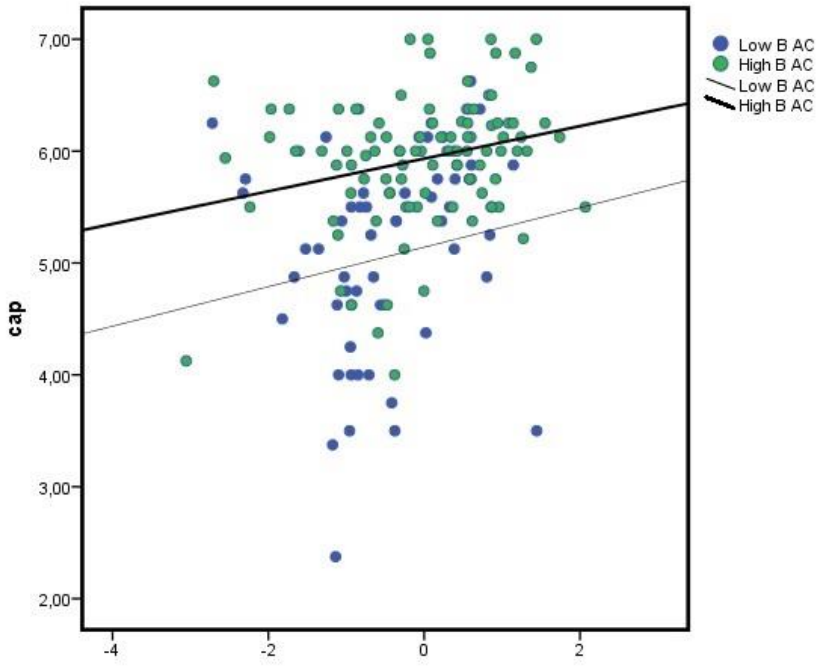
Table 3.4. Effects of OI on SCC for different levels of buyer's absorptive capacity (organizations with low SN´s AC).

Low SN´s AC

	Model 1 High B AC a		**Model 2 Low B AC b**	
Constant	6.134c	5.629c	6.288c	5.684c
Sector	0.043	0.001	-0.102	-0.226
Employees	-0.074	-0.048	-0.172	-0.177
Suppliers	0.045	0.022	-0.097	-0.104
OI		0.103a		0.186
R^2	0.021	0.065	0.039	0.086
Adjusted R^2	-0.009	0.027	-0.018	0.012
F	0.709	4.624	0.685	2.505

Note: (a) n=104; (b) n=54;

Figure 3.2. Moderation of OI-SCC relationship by buyer´s absorptive capacity (organizations with low supply network´s absorptive capacity).



3.4.4. Post-hoc analyses

We performed post-hoc analyses to clarify the role of supply network´s desorptive capacity as perceived by the buyer organization in the appropriation of benefits from OI by organizations that perceive its SN to have greater absorptive capacity. *A priori*, we would expect organizations that perceive greater absorptive capacity and less desorptive capacity in its SN to find themselves in a position of greater disadvantage if they maintain OI. But if its SN mitigates the buyer organization's situation of dependence by developing its own desorptive capacity OI can be beneficial in operating terms. The level of desorptive capacity that the buyer organization perceives represents the extent to which the party that finds itself in a situation of dominance does not abuse its power (He et al., 2011). We thus distinguish two possible scenarios based on the perceived desorptive capacity of the SN (in organizations that perceive their suppliers to possess higher absorptive capacity).

Scenario 1: Perceived high level of SN's desorptive capacity. When the buyer organization perceives the supply network to have great absorptive capacity as well as great knowledge transfer capacity, the buyer organization's sense of dependence is attenuated. Muthusamy and White (2005) indicate this in their study, which shows how limiting the dominant party's exercise of power reduces the perception of dependence in the other party in the relationship. In our case, an organization that perceives its supply network to have great learning capacity but also the capacity to transfer knowledge to it find its situation of imbalance compensated to a certain extent when the supply network puts its desorptive capacity into practice. These indexes are confirmed by the results of the regression shown in Table 3.5 (in Model 3 of the second regression, OI [ß=0.105; $p<0.05$] has a positive and significant influence on SCC). Maintaining OI thus brings operating benefits for the buyer organization, although its absorptive and desorptive capacity have no moderating effect on this relationship.

Scenario 2: Perceived low level of SN´s desorptive capacity. When the supply network has great absorptive capacity but has not developed a sufficient level of desorptive capacity, the perception of dependence in the relationship is accentuated. The loss of power leads the organization to protect the knowledge it could transfer to its supply network, as the buyer organization is in a position of greater vulnerability (Provan and Skinner, 1989). Rejecting knowledge transfer occurs above all if the potential receiver is known to have a prominent role in the market in which it operates, since this could mean a loss of competitive advantage for the organization that sends knowledge (Lichtenthaler and Lichtenthaler, 2010). In our case, the buyer organization may be afraid to orient to open innovation, as its possibility to learn is not assured if the supply network does not develop its knowledge transfer capacity. In such a situation, orientation to open innovation does not generate advantages in operating terms. The results of the regression performed, shown in Table 3.5 and represented graphically in Figure 3.3, support this conclusion (ß=-0.217; $p<0.1$). The graphics show that greater levels of OI reduce SCC when the desorptive capacity perceived in its supply network is lower, and vice versa. If we examine the moderating role of the

capacities of the buyer organization itself, we find that its absorptive capacity (in Model 4 of the first regression, the interaction between its absorptive capacity and OI [ß=0.420; p<0.1]) correlates positively and significantly with SCC) attenuates the disadvantages in operating terms of OI. Desorptive capacity has no effect, however, due to the fear the organization may feel about the use that could be made of the knowledge it transfers, since it does not perceive reciprocity in the relationship. Table 3.5 and Figure 3.4 show these results.

Table 3.5. Effects of OI and its moderators on SCC (organizations with high SN´s AC).

	Supply Chain Competence							
	Low SN´s DCa				**High SN´s DCb**			
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Constant	7.198c	6.608c	6.211c	5.138c	6.674c	3.899c	3.673c	3.559c
Sector	0.13	0	0.029	0.165	-0.072	-0.043	-0.073	-0.077
Employees	-0.323a	-0.207	-0.132	-0.054	-0.123b	-0.096	-0.117a	-0.12a
Suppliers	0.176	0.115	0.132	0.178	0.053	0.017	0.014	0.02
Buyer's AC		-0.093	0.09	0.018		0.059	0.033	0.011
Buyer's DC		0.156	0.157	0.312b		0.406c	0.4c	0.416c
OI			-0.217b	-0.227b			0.105a	0.136
OI x B AC				0.420b				0.053
OI x B DC				0.143				-0.076
R^2	0.245	0.295	0.452	0.640	0.048	0.266	0.317	0.326
Adjusted R^2	0.094	0.024	0.178	0.352	0.013	0.219	0.264	0.255
F	1.622	1.09	1.65	2.22	1.377	5.722c	6.03c	4.585c
Change in R^2	0.245	0.05	0.056	0.188	0.049	0.217	0.051	0.009
F	1.622	0.465	3.426b	2.612	1.377	11.694c	5.823a	0.488

Note: The present coefficients are unstandardized regression results. a Significant at 0.05; b Significant at 0.1; c Significant at 0.01.
(a) n=46; (b) n=58

Figure 3.3. OI effects on SCC for different levels of SN´s DC.

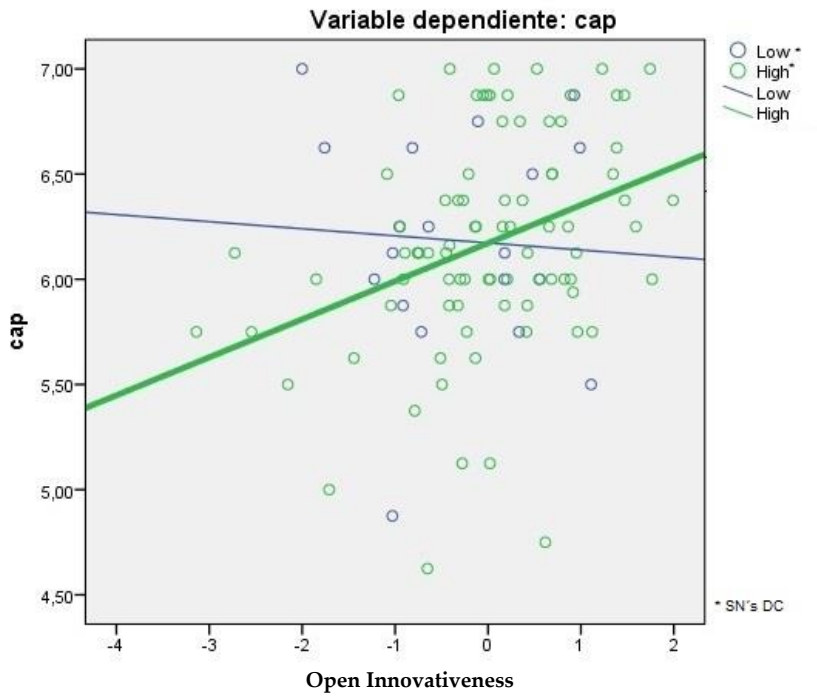
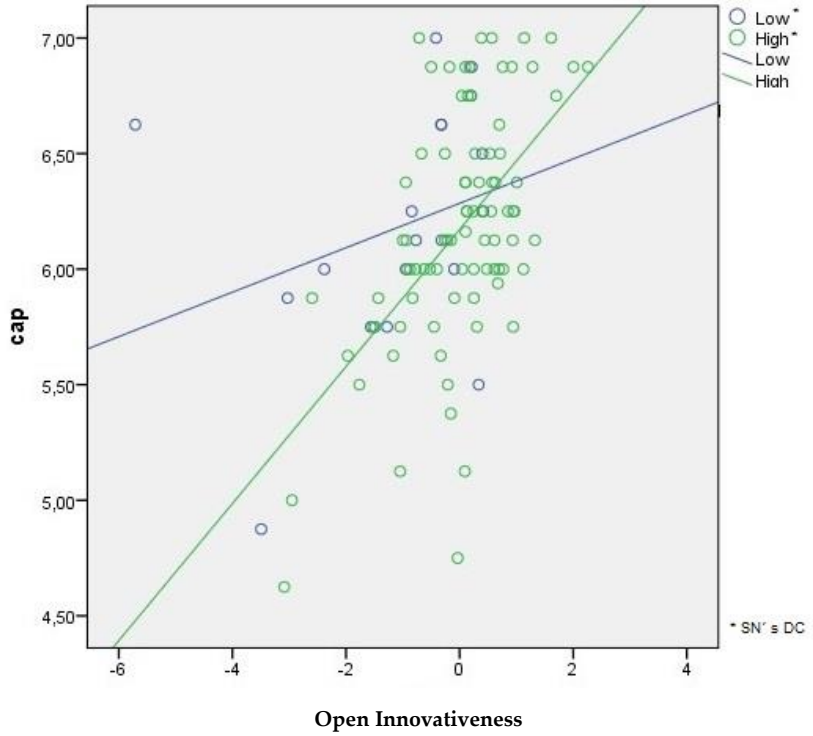


Figure 3.4. OI and its moderator effects on SCC for different levels of SN´s DC



3.5. Discussion

The relationship between open innovation and performance is currently the subject of debate in the literature, as the importance of considering additional factors that can influence this relationship is gaining recognition. To date, researchers have not studied the benefits of adopting this new paradigm beyond organizational performance, although they have indicated its importance in improving an organization's competences and the importance of studying it in the context of a supply chain.

The first noteworthy finding of this study is the influence on the relationship between OI and SCC in the buyer organization of factors such as the buyer organization's perception of dependence relative to its supply network. Our results show that a greater level of perceived dependence in the buyer organization's relationship to its supply network impedes that organization's ability to obtain benefits from OI (a result in line with the literature on interorganizational collaboration and knowledge transfer, such as studies by He et al., 2011 and Hoejmose et al., 2013). In contrast, this perception of dependence is attenuated when the buyer organization perceives a lower level of absorptive capacity among its supply network. Our results thus verify empirically the first research hypothesis proposed. We have shown that a buyer organization manages to improve SCC as a result of OI if it perceives less absorptive capacity among its supply network relative to the knowledge that resides in its own organization. This first finding contributes to the literature that claims that the relation between open innovation-performance depends on other factors that can moderate or influence it (Hung and Chou, 2013; Tsai, 2009). Our case shows that a decisive factor to take into account is the buyer organization's perception of dependence on its supply network, since this factor contributes to producing the conditions necessary in the buyer organization for effective knowledge transfer, making the buyer more inclined to practice open innovation with the supply chain.

Our study also examines, in organizations that perceive that its supply network has a lower level of absorption capacity, the moderating role of the organization's own capacities on the relation between OI and SCC as additional factors to take into account when analyzing this relationship. Our study shows empirically the positive direction of absorptive capacity's moderating character in the relationship between OI and SCC. This result follows the lines of studies by Clausen (2013), Revilla et al. (2013), Tsai (2009) and Wagner (2012), and contributes to developing literature that advocates the importance of studying this moderating effect in a context of supply chain management. Studies like those by Najafi Tavani et al. (2013) and Wagner (2012) also stress the need to analyze this effect in open innovation due to its importance for the ability to exploit external knowledge, a need to which our study responds.

Although the second hypothesis proposed the positive moderating role of desorptive capacity on the relationship studied, our results produce a negative and non-significant result for this role. We thus reject the hypothesis proposed, although the literature shows economic and non-economic benefits of knowledge transfer for an organization (Tranekjer and Knudsen, 2012). This result may be due to the fact that the development of desorptive capacity has not received sufficient attention in practice, which means that the benefits derived from its development are not obtained immediately, but rather in a medium- or long-term timeframe, due to the learning that the organization must undertake (Lichtenthaler and Lichtenthaler, 2010).

Our study shows that improving the SCC of the buyer organization that is oriented to open innovation is possible when the organization perceives a lower level of absorptive capacity among its supply network. Having answered our research questions, we propose a post-hoc analysis of the effect of the level of desorptive capacity that the buyer organization perceives among the organizations in its supply network when the buyer organization perceives a higher level of absorptive capacity in them. This analysis shows that, when the buyer organization perceives greater development of desorptive capacity among its supply network, this organization's SCC

improves as a result of OI. These results show that SCC improves as the supply network uses their power to compensate for their greater learning capacity with greater knowledge transfer capacity. The results are due to the fact that desorptive capacity is key to achieving effective knowledge transfer to the buyer organization. Our finding contributes to the development of prior literature (He et al., 2013; Nyaga et al., 2013) demonstrating that the way a party that holds power exercises it influences the operating performance and knowledge transfer of the other party in the relationship. In the opposite case—that is, when the supply network does not restrain its power—practicing open innovation jeopardizes SCC.

When in the post-hoc analyses we examine the moderating role of the buyer organization's capacities when the perceived level of absorptive and desorptive capacity among its supply network is higher, we find that these capacities have no effect. Although one would expect *a priori* that desorptive capacity would have a positive effect due to the presence of a climate advantageous for knowledge transfer, our study does not show this to be the case. Likewise, absorptive capacity itself does not strengthen the obtaining of benefits as a result of OI. This result may be explained with the study by Ceccagnoli and Jiang (2013), who show greater dependence on transfer capacity in cases in which the buyer of technology shows less desorptive capacity. That is, desorptive capacity developed by the supply network benefits organizations with less absorptive capacity.

When the absorptive capacity perceived among the supply network is greater but their desorptive capacity is not, we find that the buyer organization does not improve its situation by developing desorptive capacity in the relationship with its supply network but does improve its situation by developing absorptive capacity. The moderating role of the buyer organization's own absorptive capacity in this case compensates for the lower level of perceived desorptive capacity among its supply network, attenuating the disadvantages of OI in a situation of greater dependence of the buyer organization (Jean et al., 2012; Lawson and Poter, 2012). These results

confirm the theoretical proposals in the study by Lichtenthaler and Lichtenthaler (2010), which indicates that organizations that develop their absorptive capacity do not need the organizations with which they have a relationship to develop a high level of desorptive capacity, as synergies occur between the two capacities.

The post-hoc analysis developed in our study shows that one must attend to the theory of complementarity when studying the benefits of open innovation in a supply chain context. This theory refers to the value added by combination of resources and capacities relative to their value individually (Cassiman and Veugelers, 2006). If we start from the fact that absorptive and desorptive capacity are keys to obtaining benefits of open innovation in an organization, the organization must also take into account the way the parties' capacities interact. As a result, the organization will obtain greater benefits when it is oriented to open innovation with suppliers that it perceives to have a level of absorptive and desorptive capacity complementary to its own absorptive capacity. In this way, greater development of external capacities can be used to compensate for lower levels of one's own capacities, and vice versa.

3.6. Conclusions and implications

This study shows that the mere existence of sources of innovation such as suppliers is not sufficient to obtain benefits from adopting open innovation in an organization. Organizations must attend to certain factors that can be key in achieving exploitation of both internal and external knowledge. Among these, it is essential to attend to the power relationships that arise in this context, as they influence the effectiveness of knowledge transfer between the buyer organization and its suppliers. One way of evaluating the presence of power asymmetries is to analyze the level of absorptive capacity that the buyer organization perceives among its supply network. When this level is lower, the buyer organization's fear of opportunistic behavior from its supply network decreases. In the opposite case, SCC will improve as a result of OI

only if the buyer organization perceives its supply network to develop their desorptive capacity to a greater extent, attenuating the buyer organization's perception of dependence.

Absorptive capacity is in turn key for exploiting knowledge from the organization's supply network, especially when they do not develop their desorptive capacity to a great extent. The organization's own desorptive capacity did not show influence on achieving benefits as a result of OI. We thus demonstrate that the buyer organization's development of absorptive capacity permits it to capture value from OI only when this capacity is complemented by the perceived level of development of absorptive and desorptive capacities among its supply network.

3.6.1. Implications for theory

This study demonstrates empirically the influence of power and perception of dependence on obtaining benefits from open innovation in the context of a supply chain. The way the parties composing the relationship perceive that power is exercised is essential for inter-organizational collaboration and adaptation to occur. This study contributes to developing the literature that advocates the need to attend to power relationships and perception of dependence in open innovation (Vanhaverbeke and Cloodt, 2014), as well as the literature on supply chain management.

Using perceived level of supply network's absorptive capacity as an expression of their power contributes to developing the literature's demand for analysis of the relationship between power and innovation from the buyer organization's perception of its supply network's capacity. This focus also constitutes a theoretical contribution. The literature recognizes the need to take into account not only the capacities of the organization studied but also the capacities of the parties with which it practices open innovation (Lichtenthaler and Lichtenthaler, 2010; Tranekjer and Knudsen, 2012).

The connection between absorptive capacity and open innovation verified in our research shows that these two constructs are not mutually exclusive or in competition. This study thus joins the literature that argues that the presence of absorptive capacity in an organization does not reduce its predisposition to be oriented to open innovation, but that it strengthens the appropriation of value for the organization as a result of this orientation.

Finally, this study shows the appropriateness of the theory of complementarity for analyzing the synergies produced between the capacities of the parties to achieve appropriation of benefits from open innovation, making it possible to compensate for greater development of internal capacities with external ones, and vice versa.

3.6.2. Implications for practice

Our study shows that achieving greater innovative performance does not conflict with simultaneous pursuit of efficiency. Organizations must take into account that adopting OI improves SCC under the right conditions; that is, improvement occurs with a supply network that has lower potential for opportunistic behavior, because the latter constrain their position of domination or simply are not in such a position. From a practical point of view, one must recognize that the learning capacity that the supply network may have with respect to the buyer organization both reflects their negotiating power and feeds back into it.

Organizations cannot control how its supply network develops its absorptive and desorptive capacity, but they can control this development relative to their own capacities. Although due importance has not been given to this issue in practice, it is crucial to develop desorptive capacity to obtain benefits derived from knowledge transfer under the right circumstances, that is, when one perceives equity in OI and there is no risk of opportunism. The development of absorptive capacity relative to

one's suppliers is also key when the suppliers have lower absorptive capacity, since this situation strengthens the buyer organization's capacity to exploit external knowledge. The same must occur when supply network´s absorptive capacity is greater but the buyer organization perceives that they have not developed sufficient desorptive capacity. In this situation, which is unfavorable for the buyer organization, developing absorptive capacity permits the buyer to attenuate the risk it may incur. It is not advisable, however, for the buyer organization to develop its absorptive capacity if the supply network´s absorptive and desorptive capacity are high. From a practical point of view, the results of this study must be taken into account for organizations to develop their capacities in a way that achieves complementarity with its supply network and efficiency in appropriation of value, the fruit of OI.

Those responsible for purchasing must thus be conscious of the need to evaluate the position their suppliers hold in the supply chain, based on their capacity for learning and desorption, when deciding whether to adopt an orientation to open innovation with them. Examining the suppliers' capacities as perceived by the buyer organization also enables the buyer organization to determine the degree to which it must develop its own capacities to achieve complementarity with its suppliers or as a criterion for choosing them.

3.7. Limitations and future research

This study is not exempt from limitations, which must be taken into account when interpreting the results. The first limitation is the use of self-reported and single-respondent data. A single informant per organization participated in the survey and answered all questions for this research. While the results of Harman's single-factor test suggest that common method variance is not a serious concern, some common method bias may affect the research findings. It would be fruitful for future studies to attempt to obtain data from multiple respondents within a firm to minimize the potential

impact of common method bias. Although firm size, industry effects, and complexity of a network were considered to be control variables, we were unable to control for other network-based characteristics. It would be interesting to examine whether other control variables explain variance in performance.

Second, as the measures not only of dimensions of OI but also of DC were developed for this study, further validation of their respective scales is an important step for future research.

Third, results are naturally limited to the empirical and geographical context in which data were collected. Similar studies in other countries would provide useful and interesting comparative analyses. As Sisodiya et al. (2013) argue, open innovation is a complex phenomenon that may be influenced by other factors that we have not taken into account in this study. Knowledge of OI would be enriched by using longitudinal instead of cross-sectional data.

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"Open Innovation is not just another way of doing R&D, but of doing business"
Dr. Graham Cross,
Director of Supplier Innovation and Innovation Acceleration, Unilever.

CAPÍTULO 4

OPEN INNOVATION AND ISO 9000. THE MODERATING ROLE OF COMPLEMENTARY LEARNING STYLES AND INTERORGANIZATIONAL IT INFRASTRUCTURE

Open innovation and ISO 9000: The moderating role of complementary learning styles and interorganizational IT infrastructure

Abstract

This paper analyzes the relationship between an organization's orientation to open innovation as put into practice with its supply network and achievement of innovative performance for both parties, based on whether or not the organization has implemented ISO 9000 standards. An organization's commitment to quality improvement can contribute to its innovative performance when the organization makes effective use of its resources and capabilities, such as information technologies and learning. Based on a sample of 262 firms, our study results show that uncertified organizations obtain better performance than certified organizations in orientation to open innovation. ISO 9000-certified organizations that manage to complement their learning style with that of their supply network and that possess information technologies compatible with those of their supply network do, however, gain more benefit from orientation to open innovation than organizations that do not achieve this synergy.

Keywords

Innovation; supply network; ISO 9000; organizational learning styles, interorganizational IT infrastructure.

4.1. Introduction

Organizations coexist with complex, dynamic environments and have in the past decade faced factors such as high cost of technological development, reduced product life cycle, increase in the mobility of qualified workers (Laursen and Salter, 2006), and the emergence of the Internet . This business reality has made the traditional concept of innovation obsolete; organizations are increasingly conscious of the need to open the boundaries of their R&D departments to the exterior and orient themselves to open innovation.

Open innovation is "a process of distributed innovation based on intentionally managed knowledge flows beyond the boundaries of an organization. They use pecuniary and/or non-pecuniary mechanisms according to the organization's business model" (Chesbrough and Bogers, 2014). The relation between openness and innovative performance has been considered a key aspect of analysis in studies of innovation (Knudsen and Mortensen, 2011; Love et al., 2014a; Mazzola et al., 2012; Parida et al., 2012), but no consensus exists in the literature, as studies reach disparate conclusions. Researchers thus recognize a need to examine the practice of open innovation specific to each case when analyzing the relationship between openness and innovative performance.

The literature on open innovation has treated potential sources of innovation generically for any organization that embraces this paradigm, and integration of suppliers has received little study (Enkel et al., 2009; Thomas, 2013). Yet the importance of suppliers as a source of successful ideas and innovation has been widely recognized in the literature that analyzes the sources of innovation generically in an organization operating under open innovation (Laursen and Salter, 2006; Mention, 2011; Un et al., 2010; Von Hippel, 1998). The study by Enkel et al. (2009) indicates that 69% of knowledge sources come from suppliers.

The literature has also shown the benefits on the level of innovation of using the

organization's suppliers' orientation to innovation, taking the supply network as the unit of analysis (Bellamy et al., 2014). There has also been a call for using the firm's supply network as unit of analysis rather than studying dyadic buyer-seller relationships (Capaldo and Giannoccaro, 2015; Sloane and O´Reilly, 2012). To date, studies show that a firm's supply network is composed not only of an organization's direct links to its supply network partners, but also of the indirect links to the partners of its direct partners (Choi et al., 2001). Narasimhan and Narayanan (2013) provide a definition of supply network that focuses on an organization's upstream suppliers and includes the paradigm of open innovation. Their study thus defines the supply network as "the possible network of upstream suppliers in the firm's value system directly or indirectly" (p. 28).

Following this definition, our study seeks to contribute to the literature that analyzes the relationship between open innovation and innovative performance, focusing attention on a specific innovation source. We understand open innovativeness to be the degree to which an organization puts this new paradigm into practice, specifically the extent to which it develops joint processes with its supply network. We thereby address the need to examine the specific innovation practice to understand the effect of this new paradigm on innovative performance.

The relationship between openness and innovation depends not only on the specific practice of open innovation considered here, but also on the context of the organization committed to innovation (Di Benedetto, 2010; Huizingh, 2011; Lichtenthaler, 2011), given that we must deepen our analysis of the relationship between openness and innovation as a function of the organizational context. We analyze the influence of ISO 9000 certification on obtaining benefits from an organization's orientation to open innovation using its supply network. The series of ISO norms emerged initially as a framework for implementing quality assurance, although it subsequently incorporated principles such as continuous improvement, which bring it closer to the philosophy of total quality management. Controversy exists

in the literature concerning the effect of ISO standards on innovation. Detractors point to excess bureaucracy as the main disadvantage, whereas defenders indicate the standards' importance in permitting cultural change and permeability of the organization's boundaries. This issue is especially important for an organization committed to open innovativeness and quality. The lack of consensus in the literature that studies the relationship between innovation and quality indicates the need to take other factors into account in explaining this relationship, however. We must therefore examine the fit between an organization's resources and capabilities and its supply network. More specifically, we will analyze the moderating character of the complementarity between learning styles and compatibility of an organization's information technologies with those of its supply network in the relationship between openness and innovative performance.

Complementarity between learning styles can be linked to a high level of exploration and exploitation in the organization committed to improving quality and open innovation, an aspect essential to maintaining competitive advantage over time (Rothaermel and Alexandre, 2009; Tushman et al., 2006; Wei et al., 2014). Since information technologies have been shown to constitute an essential factor for knowledge transfer and improvement in performance for organizations that pursue quality (Sánchez Rodríguez and Martínez Lorente, 2011), their compatibility can be essential for organizations that adopt open innovation and have implemented ISO 9000 norms.

In sum, this study has detected various gaps in the literature. The first are the need to examine specific practices of open innovation to study its influence on innovative performance and the context of the organization itself as an object of study. Second, the absence of consensus on the relationship between quality and innovation requires examining other factors that explain this relationship, as we have not found studies that tackle the relationship between open innovation and quality.

The general goal of our study is to clarify the relationship between an

organization's orientation to open innovation, understood in relation to the development of joint processes with its supply network, and innovative performance. This goal takes concrete form in three individual objectives. The first is to study the relationship between an organization's orientation to open innovation and innovative performance based on whether or not the organization analyzed has implemented ISO 9000 standards. The second is to analyze the moderating character of complementarity between the organization's learning styles and its supply network in organizations with ISO 9000 certification. The third is to analyze the moderating character of establishing interorganizational IT infrastructure in organizations with ISO 9000 certifications.

To fulfill these objectives, the study is structured as follows. The first section provides a review of the most relevant literature, followed by our proposal of a theoretical model and hypotheses. Next, we present the methodology, including data collection, measurement instruments, and control variables. The empirical results are then presented, followed by a discussion of findings. Finally, we discuss the theoretical and managerial implications, research limitations, and future lines of research.

4.2. Theoretical background

4.2.1. Open innovation and supplier integration

The traditional concept of innovation has been questioned by the proliferation of a series of factors such as mobility of workers between organizations, need to shorten time of new product development, and presence of increasingly informed and demanding suppliers and customers (Chesbrough, 2003).

As a result, organizations have begun to understand innovation as a process that requires constant contact with the surrounding environment, opting to a greater extent for collaboration with members of the supply chain to which the organization

belongs and with other interest groups (Mention, 2011). Firms are increasingly conscious of the need to have permeable boundaries, as is seen in practices such as acquisition of ideas or innovations developed by others, or commercialization of innovations developed by the organization when they do not constitute sources of competitive advantage for the firm.

These entrepreneurial practices have given rise to a new paradigm derived from the entrepreneurial context and termed open innovation. Open innovation has been defined as "the use of internal and external knowledge by firms to perform their R&D projects and expand markets that make use of them" (Chesbrough, 2006, p.1).

An essential aspect of this new paradigm in any of its dimensions is the establishment of interorganizational relationships with interest groups such as universities, research centers, suppliers, customers, etc. Caetano and Amaral (2011) recognize the importance of establishing partnerships under this new paradigm. Depending on the stakeholder with whom the partnership is maintained, their study distinguishes between partnership based on the market and partnership based on science. Members of market-based partnerships have special connection to the market, such as suppliers and customers (Du et al., 2014). Recently, the literature has signaled a change in buyer-supplier relations in the context of new product/service development, since, as Chesbrough explains (Wagner, 2010), suppliers' proposals may be equal to or better than those that occur internally in the organization. Under the paradigm of open innovation, the study by Wagner (2012) shows that organizations must open their boundaries to suppliers and collaborate with them in the exchange of knowledge.

This is due to the fact that the suppliers are the stakeholders who know the organization best, since they are responsible to the organization as its customers. Specifically, suppliers know the organization's products and processes in detail (Bessant et al., 2003; Petersen et al., 2003; Von Hippel, 1998). They also have valuable information on end users, that is, on the customers of the organization they serve, and they provide information on new forms of proceeding, giving the organization they

supply a basis for comparing its practices with others present in the business reality, as well as for outdoing its competition because it has not performed all of its value chain functions alone (Groher, 2003 in Brem and Tidd, 2012).

This study seeks to develop deeper understanding of the benefits in innovative performance derived from an organization's orientation to open innovation, understood in a limited way, as related to its supply network. Following Narasimhan and Narayanan (2013), we understand supply network as the possible network of upstream suppliers in the firm's value system directly or indirectly (p. 28). We study the organization's inclination to employ inputs from a great variety of suppliers, small and large, as well as to develop joint processes with them. Therefore, these suppliers committed to the organization's open innovation processes may or may not have maintained a prior relationship with the organization (Narasimhan and Narayanan, 2013).

4.2.2. Open innovation and innovative performance

The benefits associated with adoption of open innovation in an organization are the subject of debate in the literature. Some studies show the benefits of adopting open innovation in terms of profitability and growth (Chiang and Hung, 2010; Lichtenthaler, 2009), R&D performance (Chiesa et al., 2008), customer satisfaction (Chesbrough, 2010; Cheng and Huizingh, 2014; Wagner, 2010), degree of product innovation (Cheng and Huizingh, 2014; Ebersberger et al., 2012; Gassmann, 2006; Grimpe and Sofka, 2009; Laursen and Salter, 2006), commercial success of new products (Barge-Gil, 2013; Cheng and Huizingh, 2014; Ebersberger et al., 2012, Love et al., 2014b; Rohrbeck et al., 2009) and the results of exploratory and exploitative innovation (Faems et al., 2005).

If we examine the types of innovation, we find that the positive effect of both product and process innovation has been confirmed (Huang and Rice, 2012). As to the degree of radicality of innovation resulting from adoption of open innovation, the

study by Parida et al. (2012) argues theoretically the possibility of obtaining both incremental and radical innovations, although this result depends on the practice of open innovation considered. Chiang and Hung (2010) argue that the way external knowledge is accessed determines organizational learning and thus the radicality of the innovation, asserting that open search depth leads to incremental innovations, in contrast to open search breadth, contradicting the conclusions of Laursen and Salter (2006). The positive effects of co-development or joint research between partners are shown generally on the theoretical level by Chesbrough and Schwartz (2007), and the necessity of fit between the partners' business models is also stressed. Collaboration with suppliers, the topic of our study, has been shown to influence innovative performance significantly (Mazzola et al., 2012; Un et al., 2010), in addition to influencing achievement of radical innovation (Köhler et al., 2012; Pullen et al., 2012).

Among the drawbacks, another branch of the literature analyzes the possible disadvantages of excessive openness in the organization, which include incurring excessive costs in exploration of knowledge (Katila and Ahuja, 2002; Laursen and Salter, 2006) or the drawback of certain organizational attitudes toward open innovation (Lichtenthaler and Lichtenthaler, 2010). Other studies, such as those by Spithoven et al. (2011) and Suh and Kim (2012) show the absence of an effect on innovative performance, or a substitution effect between internal and external openness, as in the case of Knudsen and Mortensen (2011), who disagree with the study by Dahlander and Gann (2010).

The clear absence of consensus in the literature has prompted calls to examine the different organizational contexts that can explain this relationship, as it is more complex than it seems (Di Benedetto, 2010; Huizingh, 2011; Lichtenthaler, 2011). Our study responds to these calls by analyzing the influence of ISO certification on the relationship between orientation to open innovation and innovative performance. As this factor has not been taken into account to date, our study both contributes to clarifying the relationship between open innovation and innovative performance and

opens a line of future research on the influence of commitment to quality and the adoption of open innovation.

4.2.3. ISO standards, suppliers, and innovation

The family of ISO 9000 standards is an international standard of quality management introduced in 1987 (Prajogo et al., 2012) but that still continues to generate debate concerning its effect on organizational performance. We have seen that one branch of the literature proclaims its positive effects by promoting continuous improvement in the certified organization, thereby constituting a precedent to total quality management. Detractors argue, however, that implementation brings not commitment to quality but more bureaucratization and less flexibility and innovation (Kuo et al., 2009). Following Pekovic and Galia (2009), we believe that employing these standards as a reference for quality has advantages over total quality management, since the latter gives rise to greater variability of interpretation (because there are different definitions of some characteristics and no clarity as to which practices each organization applied).

Among the benefits derived from ISO 9000 standards, we find maintenance of close relationships with suppliers and customers, one of the eight key principles of quality management (Prajogo et al., 2012). Section 7.4 of the Standards establishes the aspects to take into account managing relationships with suppliers. This section indicates that the selection, evaluation, and reevaluation of suppliers must be done according to criteria previously determined by the organization. It also establishes the minimum information to request from suppliers in the purchase.

The literature indicates that implementation of ISO 9000 promotes the establishment of beneficial relationships for the organization and its suppliers (Singh et al., 2006; Singh, 2008). Along these lines, López Mielgo et al. (2009) indicate strengthening of the relationships an organization maintains with its suppliers under

this standard. Implementing the standard at an advanced level seeks greater integration between the organization and its suppliers, orienting their relationship to long-term collaboration, led by information exchange (Prajogo et al., 2012). Molina et al. (2004) are not able to show the effect of implementing these standards on the relationship between cooperation with suppliers and knowledge transfer, even though they argue theoretically the importance of knowledge codification and generation of a common language between the parties. They therefore assert the importance of ensuring that practices that enable greater knowledge transfer are accompanied by a culture that fosters this transfer.

As shown by Huo et al. (2014) and Terziovski and Guerrero (2014), the literature has hardly treated the relationship between ISO standards and innovation (as compared to total quality management). This relationship is the focus of our study. Despite this gap, no direct relationship has been shown between these terms, as the relationship depends on the level to which these standards are implemented: basic or advanced (Naveh and Marcus, 2005; Prajogo et al., 2012). Huo et al. (2014) demonstrate that innovation is promoted in organizations that adopt these standards as a real commitment to quality, since they facilitate management of the flow of products and processes, constituting a complement that strengthens innovation activities (Wang, 2014). Despite these results, one branch of the literature denies their relationship to innovation, arguing that the search for standardization, low variability, attention to detail, and adherence to standards can contradict the goals of innovation (Gotzamani and Theodorakioglou, 2010; Wang, 2014). The literature's absence of consensus on the effect of implementing ISO 9000 standards on innovation requires us to examine additional factors to explain this relationship. Based on the foregoing, our study proposes that the relationship between quality and open innovation can be strengthened if the certified organization achieves complementarity of learning styles and compatibility of information technologies with its supply network.

4.2.4. Organizational learning styles and ISO 9000

Organizational learning takes place when the organization "makes use of its prior experience and assimilates external knowledge" (Dong and Yang, 2015, p.112). Following the seminal study by March (1991), an organization's learning style can be classified into two types, exploratory and exploitative learning. Exploitation involves "learning based on certainty," whereas exploration is "learning based on probability" (Azadegan and Doley, 2010, p.490). March (1991, p.71) defines the term exploration as ''search, variation, risk-taking, experimentation, play, flexibility, discovery, and innovation'' and exploitation as ''refinement, choice, production, efficiency, selection, implementation, and execution.''

These two learning styles pursue different ends, but neither by itself is a panacea, as both styles are necessary to the organization's survival and the maintenance of a competitive advantage in terms of efficiency and creativity. This reasoning supports the benefits of coexistence of the two styles in the organization. The main drawbacks for the organization have been identified as the difficulty of establishing the right balance between exploration and exploitation, and limitation in the resources an organization possesses (Azadegan and Doley, 2010). Defenders of ambidexterity in organizations propose its advantages based on the complementarity of the two styles, especially for organizations that access external resources, and propose dynamic management of resources to overcome the limitation identified by detractors (Gupta et al., 2006; Wei et al., 2014). Chaston (2013) also shows that organizations committed to open innovation follow learning that is both exploratory and exploitative.

The notion of a-mbidexterity has been interpreted extensively. One interpretation holds that ambidexterity is the coexistence of a high level of exploration and low level or exploitation, or vice versa (Atuahene-Gima and Murray, 2007; Benner and Tushman, 2003; Nerkar, 2003).

Exploratory and exploitative learning must be seen as antecedents to organizational activities such as innovation and organizational performance (Lee et al., 2013). The positive effect of these learning styles on innovative performance is conditioned to the organization's market orientation. Yannopoulos et al. (2012) show the positive effects of exploratory learning on radical innovation (in organizations with a proactive attitude to the market) and of exploitative learning in incremental innovation (in organizations with a reactive attitude to the market). Benner and Tushman (2003) attempt to determine the role of ISO in an organization's exploratory or exploitative behavior, indicating that the founders of managing by processes pursue primarily incremental innovation, encouraging exploratory learning over exploitative. Their study shows that managing by processes promotes continuous innovation and change but induces the use, first, of existing knowledge and capabilities in the organization, tipping the balance toward highly exploitative learning.

Some studies deny the relationship between ISO standards and radical innovation. Among these, Atuahene-Gima (1996) refers to the negative relationship between market orientation and product newness. Likewise, Wind and Mahajan (1997) relate a philosophy of customer focus to incremental improvement. Pekovic and Galia (2009), in contrast, show that ISO standards influence both incremental and radical innovation in products and processes, but that one must take into account other organizational resources to obtain maximum benefit from this certification in different dimensions of innovation. Tamayo Torres et al. (2014) thus show the importance of analyzing exploration and exploitation in organizations that operate under this standard due to the possible effects of managing by processes associated with it. Studies also indicate the importance of analyzing the learning style of the organization and of other partners with which it relates to understand how interorganizational learning occurs (Azadegan et al., 2008; Azadegan and Dooley, 2010). We will treat this issue in the section on hypothesis development.

4.2.5. Interorganizational IT infrastructure

IT infrastructure determines an organization's IT portfolio and is composed of four elements: IT components (hardware and software), human IT infrastructure, shared IT services (data management), and shared and standard applications (application interface) (Weill and Vitale, 2002). These components may be classified into two types: technical, or applications, data, and technology; and human, or knowledge and capabilities to manage these resources (Chung et al., 2003). At the organizational level, information exchange facilitates coordination of processes and strengthens learning (Roberts and Grover, 2012).

We understand interorganizational IT infrastructure as "shared technology and technology services across supply chain partners" (Kim et al., 2012, p.41). Through it, an organization can make use of its IT resources (databases, software, etc.) to access other resources in other organizations that form part of its supply chain (Weill and Vitale, 2002). These resources include knowledge, which can also reduce the cost of accessing knowledge (Colombo and Mosconi, 1995). Among the benefits derived from interorganizational IT infrastructure is improvement in operating performance of the organization that possesses information technologies compatible with those of its supply chain (Obal and Lancioni, 2013).

The literature on information systems shows that information technologies are a key tool for achieving learning and innovation in an organization (Dong and Yang, 2015). Their influence on the acquisition and assimilation of external knowledge has also been shown (Tippins and Sohi, 2003; in relation to the supply chain: Subramani, 2004; Malhotra et al., 2007), as well as their ability to promote information exchange and knowledge transfer (Chong et al., 2011; Roberts and Grover, 2012) and their relationship to supply chain integration (Baihaqi and Sohal, 2013). Information technologies also influence coordination of processes between organizations and benefit development of new products and services (Roberts and Grover, 2012). IT has been linked to cultural change to open the organization's boundaries (Dodgson et al.,

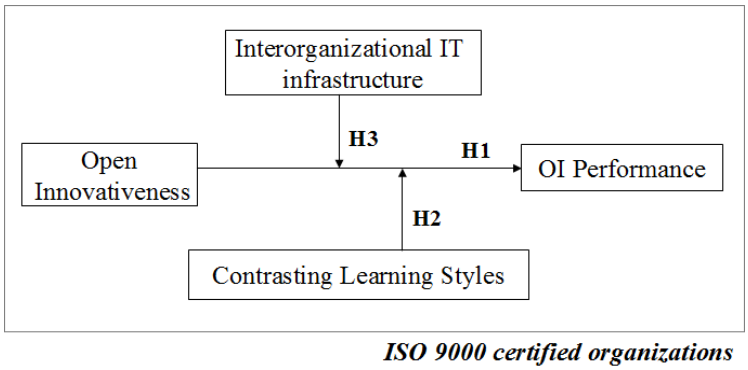
2006), stressing its ability to facilitate open innovation practices (Chesbrough, 2003; Obal and Lancioni, 2013; Westergren, 2011) and adoption of this new paradigm in generating ideas and their development and commercialization (Awazu et al., 2009). It is thus especially interesting for our study to consider that information technologies can serve to support quality management activities (Delic et al., 2014) and improve their performance (Pérez et al., 2012). For this reason, information technologies have been seen as complementary in character and as facilitating knowledge creation in organizations committed to quality (Sánchez Rodríguez and Martínez Lorente, 2011).

4.3. Theoretical framework and hypothesis development

4.3.1. Theoretical framework

This study analyzes the effect of ISO 9000 certification on innovative performance as a result of an organization's orientation to open innovation. Orientation to open innovation is analyzed in a limited way, by analyzing the tendency to explore and exploit knowledge with a single source of innovation, the organization's suppliers. The output of this orientation is the organization's innovative performance, which we measure as the joint development of new products, services, and processes that benefit both. After analyzing the influence of ISO 9000 certification on the relationship between orientation to open innovation and achievement of innovative performance, we examine some issues that may support obtaining such performance in certified organizations. Among these are complementarity of learning styles and compatibility of information technologies between the organization and the source of innovation considered (suppliers). The foregoing argument is synthesized visually in Figure 4.1.

Figure 4.1. Theoretical model



4.3.2. The effect of ISO 9000 standards on the relationship between open innovativeness and innovative performance

The literature review performed shows the complexity of the relationship between open innovation and achievement of radically innovative performance, with debate as to the aspect that can influence such performance: open search depth (Garriga et al., 2013; Laursen and Salter, 2006) or open search breadth (Chiang and Hung, 2010). It is thus necessary to examine each open innovation practice specifically, as well as the organizational context. Our study seeks to contribute to the literature by considering the effect of ISO certification and its philosophy on achieving new products, services, and/or processes that are developed jointly and that result in benefits for both the organization and its suppliers.

First, opening an organization requires cultural change that will guarantee permeability of its boundaries and two-way knowledge transfer. This change can be facilitated if the organizations have ISO certification, since several studies have shown that, independently of degree of implementation, quality programs based on these standards facilitate organizational change and proactiveness for innovation (Escanciano et al., 2001; López-Mielgo et al., 2009). An organization that follows the standards imposed by these norms achieves customer satisfaction while reducing

inefficiencies, a result achieved through management by processes, both internal and external (Naveh and Marcus, 2005). This philosophy is consistent with the new paradigm, since the principle of customer satisfaction assumes anticipating current customers' expectations and considering the needs of potential customers, thereby promoting an attitude that is proactive to innovating to achieve quality objectives. Further, if we consider this philosophy's emphasis on reducing inefficiency, this result is achieved in innovation, by adopting open innovation, opening the R&D department to the exterior, and combining internal and external knowledge to reinforce internal innovation by exploiting the synergies that can occur between an organization and the exterior. We therefore believe this new paradigm to be compatible with quality management through ISO 9000 standards.

Further, we propose that these norms can strengthen the positive effects of open innovation, in our case, by considering suppliers as a source of innovation for various reasons. We must start from the assumption that quality management promotes cooperation between the organization and its suppliers, understood as "commitment to noncompetitive activities and establishment and maintenance of open relationships with them" (Molina et al., 2007, p.683). Quality management in an organization can thus strengthen collaboration and cooperation when innovating with its suppliers.

Organizations that have a system of quality management and pursue open innovation possess prior experience in collaboration, which, as Love et al. (2014b) confirm empirically, strengthens the benefits that can be derived from adopting this new paradigm (having prior experience in collaboration). Specifically, the ISO 9000 philosophy can support open innovation by promoting knowledge transfer between the organization and the exterior. Singh et al. (2011) confirm that ISO 9000 standards facilitate exchange of resources between partners. Molina et al. (2004) analyze the influence of these norms on transfer of external knowledge, based on establishment of a common language between the parties that interact as a result of following these standards.

The presence of this quality management system can foster obtaining benefits by putting open innovation into practice in an organization with a specific source of innovation, suppliers. The degree of radicality of this innovativeness remains in question, however. Implementation of these standards fosters maintenance of relationships oriented to the long term between an organization and its suppliers (Prajogo et al., 2012). This orientation reduces the base of suppliers with which the organization can innovate, without the need to maintain such a close relationship, but they can contribute solutions to its innovation problems (Narasimhan and Narayanan, 2013). It does not impede achievement of innovative performance, but it can shrink such performance in organizations that follow these norms. Thus, following Benner and Tushman (2002), we believe that quality and innovation are not mutually exclusive, but it is essential to recognize that a higher degree of radicality in the innovations of an organization that operates under this quality management system involves examining other resources, whether organizational or interorganizational.

Based on the foregoing, we seek to verify the following hypothesis:

H1. The relationship between an organization's orientation to open innovation and achieving innovative performance for the organization and its suppliers is significantly more positive in organizations not certified in ISO 9000 than in those that possess the certification.

4.3.3. Complementarity in learning styles and IT interorganizational infrastructure: The case of ISO 9000 certified firms

The literature review performed proposes that the radical innovation that occurs in organizations following the ISO 9000 standard depends on how the organization uses the resources and capabilities available to it. Following this line of argument, and given that our study analyzes an organization's orientation to open innovation, we examine the influence of fit between an organization's resources and capabilities and its suppliers as factors that strengthen the relationship between open

innovativeness and innovative performance. Specifically, we study the effect of complementarity in learning styles and establishment of an interorganizational infrastructure of information technologies (compatibility of technologies) between an organization and the suppliers with which it practices open innovation. Complementarity between learning styles permits ambidexterity in the organization oriented to innovating openly, and it can lead to obtaining benefits from this orientation. Further, compatibility of information technologies ensures flow of knowledge beyond the boundaries of an organization, which is also key to obtaining benefits from orientation to open innovation.

4.3.3.1. Complementarity between the learning styles of an organization certified by ISO 9000 and its suppliers

Certified organizations that have a commitment to open innovation, as is the case of those in our study, must tend toward ambidexterity to achieve better results from adoption of this new paradigm. An organization can achieve efficiency by following the standards outlined in the ISO 9000 norms. As proposed above, these norms lead to exploitative learning through the management by processes on which they are based (Benner and Tushman, 2002). The commitment to open innovation of organizations that are also certified compels them, however, to a certain extent of exploratory behavior. Despite this, following the line of reasoning in Moreno-Luzon et al. (2014), we believe that the balance tips more toward exploitative than exploratory learning in these cases.

We must remember that, according to the literature, maintaining high levels of exploration and exploitation permits an organization to achieve better results (Rothaermel and Alexandre, 2009; Tushman et al., 2006; Wei et al., 2014). Our study proposes the possibility of compensating for lower levels of exploratory learning in an organization, if the organization is oriented to innovating openly with suppliers that

complement its learning style, that is, that are more exploratory. We thus ask whether it is better when pursuing radical innovativeness under the ISO 9000 standard to have orientation to open innovation with suppliers who have a similar learning style or a complementary one.

Azadegan et al. (2008) suggest that maintaining relationships with suppliers with a learning style complementary to that of the organization enables overcoming of rigidities that could emerge if the organization and its supply network have the same style of learning. Thus, the organization that exploits excessively can obtain benefits from exploring, and vice versa, if it achieves complementarity with its supply network. The literature shows that complementarity between the learning styles of partner firms constitutes a source of knowledge from which radical innovations develop (Dussauge et al., 2000; Gianiodis et al., 2010; Kyriakopoulos and de Ruyter, 2004; Rothaermel and Boeker, 2008). Since learning is a capability of the organization, it can be strengthened by maintaining relationships with partners that strengthen it in the style in which it is weaker, as proposed by Rothaermel and Boeker (2008). Dussauge et al. (2000) show that complementarity between resources and capabilities of partners permits greater interorganizational learning and fewer exploitative results.

Further, Molina et al. (2004) show that knowledge transfer with suppliers is more effective for organizations that operate under these standards if they have greater integration capacity. Since open innovation is grounded in knowledge transfer, we believe that one sign of an organization's integration capability is the complementarity of resources and capabilities with the partners to which it relates.

Based on the foregoing, we seek to verify empirically the following hypothesis:

H2: Complementarity between learning styles of certified organizations positively moderates the effect of open innovativeness on open innovation performance.

4.3.3.2. Interorganizational IT infrastructure between ISO certified organizations and their suppliers

Establishing interorganizational IT infrastructure can lead to greater integration between an organization and the members of its supply chain (Baihaqi and Sohal, 2013). We therefore include this aspect for certified organizations when they pursue internal and external organizational integration. The literature indicates the similarity between quality management and supply chain management (Chong et al., 2011).

This factor is present to a greater extent in interorganizational relationships oriented to the long term, due to the investment that the organization must make, which decreases the possibilities of ending this relationship (White et al., 2005). We believe this factor is especially relevant in our study, since certified organizations usually establish relationships with few suppliers and seem to maintain these relationships in the long term. Chiang and Hung (2010) and Sisodiya et al. (2013) hold that organizations must focus their efforts on close relationships with few knowledge sources characterized by strong, frequent contacts that enable knowledge transfer through boundary-spanning activities. The benefits of boundary-spanning activities will be possible when effective knowledge transfer is achieved. This effort can be supported by interorganizational IT infrastructure, that is, by compatibility of information technologies.

The literature identifies interorganizational IT infrastructure as a factor that facilitates knowledge transfer between organizations, permitting joint activity and rapid exchange of information between them. Studies also show its positive effect on interorganizational collaboration (Richey et al., 2007; Richey et al., 2012) and coordination (White et al., 2005). Further research finds that interorganizational IT infrastructure permits greater performance in interorganizational relationships and exploitation of the synergies between their members (Im and Rai, 2014; White et al., 2005).

Based on the foregoing, we propose to verify the following hypothesis:

H3: Interorganizational IT infrastructure in certified organizations positively moderates the effect of open innovativeness on open innovation performance.

4.4. Research methodology

4.4.1. Sampling and data collection

To test the different hypotheses, we performed an empirical study of manufacturing and service firms. The SABI databases were used to obtain the study population. A sample of 2000 firms (1400 manufacturing firms and 600 service firms) was chosen at random. Initially, a pretest was used to determine the scale. The scale was carefully examined by selected practitioners and academicians in this area for translation, wording, structure, and content. The scale's content validity should be sufficient.

In all cases considered valid, the informants were logistics/purchasing executives. These managers are more likely to establish close relationships with suppliers specifically oriented to innovation and its impact on new product/service/process development. These informants were also chosen for their appropriateness in determining the congruence between information technologies and learning styles of the organization to which they belong and its suppliers. A CATI (computer-assisted telephone interviewing) survey method and electronic surveys were used for the study. This mixed-mode method is used to compensate for the weaknesses of individual method, as argued in the literature (Dillman, 2007 in Sisodiya et al., 2013). The responses were collected from June to October 2013.

We received 290 responses, for a response rate of 14.5%. Accounting for missing responses, we obtained a final sample of 262 usable responses, yielding a final response rate of 13.5%. Table 4.1 depicts the sample demographics. As to the size of the firms

surveyed, 4.82% had fewer than 250 employees, 74.81% 250-1000 employees, and 20.37% 1000-5000 employees.

Possible bias due to non-responding firms was analyzed. Considering the late group of respondents as those most likely to be similar to non-respondents, we compared early and late groups of respondents to obtain information on non-response bias in the sample (Armstrong and Overton, 1977; Subramani, 2004). Early and late sub-samples were identified as 169 and 101 respondents, respectively. The results of comparing the two groups indicate no systematic non-response bias in the survey data (p=.05).

We used Harmon's one-factor test (Podsakoff et al., 2003) to control for the influence of common method bias. The results suggested minimal common method bias, since the largest extracted component accounted for only 39.97%.

Table 4.1. Demographic

Characteristics	Frequency	Percent
Industry type		
High-tech Manufacturing	79	29.26%
Traditional Manufacturing	100	37.04%
Services	91	33.7%
Annual revenue		
<1000M	0	0
1000-10,000M	83	30.74%
10,000-100,000M	158	58.52%
>100,000M	29	10.74%
Number of employees		
0-49	13	4.82%
50-250	202	74.81%
>250	55	20.37%
Number of suppliers		
<100	226	83.7%
100-300	38	14.08%
>300	6	2.22%

4.4.2. Measures

Our research incorporates preexisting perceptual measures whenever possible. As there were no previously constructed measures for open innovation in a supply chain context and its performance, we developed new measures.

Open innovativeness measures the extent to which firms promote an orientation to open innovation with their supply network. These measures were adapted from the instrument developed by EFQM (2013). Our study conceives open innovativeness as the extent to which generation of ideas and innovation are promoted by others and to which clear goals and objectives for innovation are established jointly and perfected based on the results obtained. Organizations use innovation as an instrument to capture the talent of other members with which they wish to interact and conceive innovation beyond technological changes, where innovation shows new ways of satisfying the customer, as well as new ways of working that take maximum advantage of resources, competition, and alliances. We measured this construct using seven items, for which the survey respondents were to indicate their degree of agreement or disagreement with the statements proposed on a Likert scale from 1 to 7 (1=totally disagree; 7=totally agree).

Complementarity between exploratory and exploitative learning styles was calculated following by Azadegan and Dooley (2010). We multiplied the difference between the score of the manufacturer and supply network (alignment) by its absolute value to obtain the degree to which the learning styles differed. Whereas exploratory learning shows predominant use of new ideas and procedures in an organization, causing its income from sales to proceed primarily from new products, exploitative learning assumes emphasis on improvement in efficiency, existing technologies, and continuous improvement of the organization's procedures, policies, and rules.

Interorganizational IT infrastructure was adapted from the scale developed by Kim et al. (2012), which contains three items. It indicates the compatibility between the

IT resources of the members in the relationship, such as databases and operating systems, as well as the consistency of the data, their security, and the difficulty of interpreting them. A 7-point Likert-type scale (1 = ''totally disagree'' to 7 = ''totally agree'') was developed.

OI Performance was developed following a literature review. It is defined as the effectiveness of the organization's orientation to open innovation with its supply network in development of new products, services, or processes that benefit both through three items. Indicators were captured using a 7-point Likert scale, from "not at all improved" to "significantly improved" over the past three years.

We examined the surveyed organization's size and sector as control variables, as well as the number of suppliers with which it maintained open innovativeness. ISO certification was analyzed through a categorical variable. Consistent with research convention, we used logarithmic transformations for employees and number of suppliers.

4.4.3. Construct validity

We assessed validity with confirmatory factor analysis for the scales. The results of the confirmatory analysis show that all indicators fulfil the three requirements: all factor loadings are significant ($t>1.96$; $p<0.05$) and greater than 0.5, and the value for individual reliability is above 50%. The measurement model fits the data well (normed chi square 2.4; non-normed fixed index (NNFI) =0.9; goodness-of-fit index (GFI) =0.845, confirmatory fit index (CFI) =0.91; incremental fit index (IFI) =0.91; root mean square error of approximation (RMSEA) =.07).

Following Fornell and Larcker (1981), we used the average variance extracted to evaluate convergent validity. The AVEs for OI (0.62), Buyer's exploratory learning (0.55), Supply Network (SN)'s Exploratory Learning (0.55), Buyer's Exploitative

Learning (0.71), Supply Network (SN)´s Exploitative Learning (0.67), Interorganizational IT infrastructure (0.67), and OI performance (0.66) exceeded the 0.5 criterion. Composite reliability exceeded the 0.7 criterion.

Discriminant validity is assumed to exist if the squared average variance extracted for each construct exceeds their shared variance (correlation). This was found in all combinations of paired constructs, providing evidence of discriminant validity for all scales. Table 4.2 shows the descriptive statistics, correlations among constructs and squared average variance extracted for each construct. Table 4.3 shows descriptive statistics and correlation matrices for the ISO and NON-ISO complementary learning models.

Table 4.2. Mean, standard deviation, correlations, and square root of AVE (complete model).

	1	2	3	4	5	6	7	8	9	10
1. OI	**0.78**									
2. Buyer´s EX L	0.517*	**0.74**								
3. SN´s EX L	0.456*	0.658*	**0.75**							
4. Buyer´s EXP L	0.184*	0.259*	0.331*	**0.84**						
5. SN's EXP L	0.458*	0.532*	0.581*	0.434*	**0.82**					
6. IT	0.295*	0.395*	0.412*	0.213*	0.409*	**0.82**				
7. OI Performance	0.422*	0.409*	0.406*	0.157*	0.365*	0.306*	**0.81**			
8. Sector	0.001	0.053	0.053	-0.043	-0.103	-0.026	-0.027	1		
9. Employees (n)	-0.068	-0.041	-0.034	0.023	-0.073	0.075	0.005	0.025	1	
10. Suppliers (n)	0.049	0.022	-0.057	0.007	0.02	0.070	0.075	-0.687*	0.092	1
Mean	4.64	5.01	4.3	4.77	4.94	4.77	4.59	0.66	4.94	3.02
St Dev	1.28	1.1	1.01	1.19	0.95	1.52	1.19	0.47	0.83	1.35
Mean Non-ISO	4.7	5.11	4.45	4.94	5.12	4.9	4.44	0.49	5.07	3.26
DT Non-ISO	1.28	1.12	0.83	1.15	0.89	1.54	1.19	0.5	0.99	1.5
Mean ISO	4.61	4.97	4.24	4.7	4.86	4.72	4.64	0.73	4.9	2.93
DT ISO	1.28	1.1	1.07	1.2	0.97	1.51	1.19	0.45	0.76	1.27

*p<0.01

Note: OI=Open Innovativeness; EX L=Exploratory Learning; EXP L=Exploitative Learning; IT=Interorganizational IT Infrastructure; SN= Supply Network.

Table 4.3. Descriptive statistics and correlation matrices for the ISO and NON-ISO complementary learning models.

	Means		Sds		1	2	3	4	5	6	7
	ISO	Non ISO	ISO	Non ISO							
1. OI	4.61	4.44	1.29	1.19	-	0.013	0.064	0.556***	-0.031	-0.052	0.143
2. FIT	-2.56	-2.17	6.79	4.95	-0.231***	-	0.177*	-0.125	-0.12	0.069	0.124
3. IT	4.72	4.90	1.51	1.54	0.384***	-0.108*	-	0.309**	-0.025	0.191**	0.16*
4. OI Performance	4.64	4.44	1.19	1.19	0.376***	-0.122**	0.312***	-	-0.005	0.102	0.155*
5. Sector	0.73	0.49	0.45	0.50	0.025	0.077	-0.01	-0.063	-	-0.063	-0.764***
6. Employees	4.89	5.07	0.76	0.99	-0.081	0.114*	0.011	-0.032	0.109*	-	0.144
7. Suppliers	2.93	3.26	1.27	1.50	0.002	-0.083	0.021	0.053	-0.644***	0.047	-

Note: First Mean and first SD scores are for ISO organizations. Lower Diagonal correlations are for ISO organizations. N= 195; Upper diagonal correlations are for NON-ISO organizations. N= 75;

***p<0,001; **p<0, 05; *p<0, 1;

OI=Open Innovativeness; FIT= Contrasting Learning Styles; IT=Interorganizational IT Infrastructure.

4.4.4. Hypothesis testing

To contrast the hypotheses, we used hierarchical regression analysis. Given the prior formulation of the hypotheses, contrasting them requires dividing the sample into two groups based on ISO 9001:2000 standard certification. To avoid problems of multicollinearity, we centered the interaction terms relative to the mean before calculating their product. The tolerance value and the variance inflation factor (VIF) of the independent variables are within the accepted limited for rejecting the presence of multicollinearity.

We thus proposed two regression models, one for organizations that stated that they possessed the ISO 9001:2000 certification (n=195) and the other for organizations that answered that they were not certified (n=75). The results of the hierarchical regression are presented in Table 4.4. Hypothesis 1 proposes that the relation between open innovativeness and OI performance will be statistically different among ISO and Non-ISO organizations. As can be seen in Model 3 of the first and second regression which incorporates the independent variable OI, this variable has a positive and significant effect in both cases, but ß is higher in the second case (ß(ISO)=0.275; ß (NON-ISO)=0.493). Introducing this variable shows a significant increase in the

variance in both cases, meaning a change in R^2=0.07 in the first regression and a change in R^2=0.27 in the second.

Hypothesis 2 proposes that complementary learning styles moderate the relation between OI and OI performance in ISO 9000 organizations. If we examine the first regression, in Model 4, the product of OI and complementary learning styles shows a positive and significant sign, indicating that this interaction predicts OI performance significantly (ß=0.018; p<0.01). These results support the validity of H2.

Hypothesis 3 holds that interorganizational IT infrastructure moderates the relation between OI and OI performance positively in ISO 9000 organizations. If we examine the first regression, in Model 4, the interaction between interorganizational IT infrastructure and OI correlates positively and significantly with OI performance (ß=0.103; p<0.01), supporting H3.

Table 4.4. The effects of OI and its moderators on OI performance.

	OI performance							
	ISO organizations n=195				Non-ISO organizations n=75			
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Constant	4.875c	3.694c	2.749c	2.797	2.823c	2.11c	0.105	0.131
Sector	-0.112	-0.112	-0.166	-0.093	0.623	0.44	0.202	0.185
Employees	-0.046	-0.035	-0.001	-0.041	0.082	0.037	0.094	0.102
Suppliers	0.025	0.013	0.066	0.001	0.274b	0.212	0.088	0.085
Learning FIT		-0.014	-0.005	-0.018		-0.046b	-0.046a	-0.047b
IT		0.239c	0.154c	0.18c		0.231c	0.215c	0.211c
OI			0.275c	0.256c			0.493c	0.486c
OI x L FIT				0.018c				0.005
OI x IT				0.103c				0.025
R^2	0.005	0.109	0.18	0.223	0.059	0.16	0.43	0.432
Adjusted R^2	-0.011	0.085	0.154	0.19	0.019	0.099	0.38	0.363
F	0.32	4.613c	6.871c	6.692c	1.487	2.625b	8.559c	6.275c
Change in R^2	0.005	0.104c	0.071c	0.044c	0.059	0.101	0.27	0.002
F	0.32	11.001c	16.295c	5.227c	1.487	4.135b	32.279c	0.101c

Note: The present coefficients are unstandardized regression results. a Significant at the 0.05 level; b Significant at the 0.1 level; c Significant at the 0.01 level. OI=Open Innovativeness; Learning FIT (L FIT)=Contrasting Learning Styles; IT=Interorganizational IT Infrastructure.

To complete the contrast of the hypotheses on moderation, we confirmed the presence of a significant moderating effect and then analyzed the sign and significance of the slope of the relation between OI and the dependent variable. Our procedure follows that proposed by Jaccard et al. (1990), based on the values taken by the moderating variable. We then performed an additional analysis, in which we evaluated the effect of the independent variable on the dependent variable, while distinguishing between different levels of the moderating variable. Analysis of the interaction term shows that OI is positively related to OI performance under the condition of highly complementary learning styles and interorganizational IT infrastructure, as can be seen in Table 4.5. Because this effect is not significant (or less significant) when we establish the condition of low complementarity of learning styles and interorganizational IT infrastructure, we confirm that the multiplicative term is significant in the multiple regression analysis, providing support for H2 and H3.

Table 4.5. Effects of OI on OI performance for different levels of complementary learning styles and interorganizational IT infrastructure (organizations with ISO 9001-2000).

	Model 1 High FIT n=143		**Model 2 Low FIT n=52**		**Model 1 High IT n=106**		**Model 2 Low IT n= 89**	
Constant	4.984c	3.027c	4.141c	3.584b	4.571c	2.768c	5.207c	4.152c
Sector	-0.128	-0.186	-0.109	-0.135	0.019	0.087	-0.341	-0.416
Employees	-0.084	-0.033	0.206	0.2	-0.013	-0.029	-0.099	-0.026
Suppliers	0.048	0.017	-0.087	-0.072	0.128	0.094	-0.063	-0.073
OI		0.410c		0.111		0.395c		0.19b
R^2	0.011	0.207	0.016	0.027	0.014	0.175	0.016	0.056
Adjusted R^2	-0.011	0.184	-0.046	-0.056	-0.015	0.142	-0.018	0.011
F	0.505	9.018c	0.256	0.327	0.494	5.36c	0.706	0.297

Note: The present coefficients are unstandardized regression results. a Significant at the 0.05 level; b Significant at the 0.1 level; c Significant at the 0.01 level. FIT=Contrasting Learning Styles. IT=Interorganizational IT Infrastructure.

4.5. Discussion and implications

This study analyzes the relationship between an organization's orientation to open innovation, put into practice with its supply network, and the improvement in innovative performance for both. Despite the importance of the supplier for putting open innovation into practice, few studies analyze this factor, a gap recognized in the literature on this new paradigm as in need of analysis (Thomas, 2013). Our study thus contributes doubly to understanding the benefits obtained from orientation to open innovation with one's supply network, by taking into account whether the organization has implemented ISO 9000 standards or not. Our results attest to the relationship between open innovativeness and innovative performance and are consistent with a branch of the literature that argues the benefits of adopting open innovation in an organization, benefits in product, process, or service innovation with differing degrees of radicality (Parida et al., 2012).

Our results show, however, that certified organizations obtain less benefit from orientation to open innovation than uncertified ones. This result may be explained by the fact that the base of suppliers with which the organization can develop joint innovations is smaller in organizations that operate under a system of quality management than in uncertified organizations. Quality management, specifically ISO 9000 standards, stresses the importance of maintaining mutually beneficial relationships oriented to the long term, with a small base of suppliers. In contrast, open innovation views suppliers as a source of innovation, independently of the strength of the relationship maintained and of the existence of a previous relationship. Open innovation seeks efficiency of innovation, using the partner who can provide the best solution to the problem to be solved. It is thus possible that certified organizations suffer from some myopia in relation to suppliers with which they practice open innovation. This would explain lower performance in radical innovation compared to uncertified organizations, as it is possible that the supply network of certified organizations is less varied, limiting the solutions to innovation problems that it can offer and leading more to incremental than to radical innovations. This result may also

conceal the complexity of the relationship between innovation and quality, as indicated in the prior literature, making it necessary to examine other factors that condition it, such as the resources available to the organization (Pekovic and Galia, 2009).

This study analyzes how complementarity between the learning styles of an organization and its supply network improve the results of innovation when an organization is committed to open innovation and quality. Our results show that open innovation is more effective in organizations that pursue quality and achieve complementarity in learning with their suppliers. This result confirms the benefits of ambidexterity in organizations that adopt open innovation. Complementarity between learning styles permits the organization that achieves fit with its supply network to enjoy the benefits of high levels of exploration and exploitation.

Our results also show the importance of compatibility between the organization's information technologies and those of its suppliers to obtain greater performance in certified organizations. These organizations usually pursue external integration of their organization, tending to make compatibility of information technologies vital. Our results show the greater importance of this factor in certified organizations than in uncertified ones. We therefore agree with studies showing that information technologies permit certified organizations to improve their performance. This result is consistent with Cheng et al. (2014), who show the importance of flexible technological infrastructure to achieving interorganizational innovative performance. In our case, this is a tool that permits constant flow of knowledge between the organization and its suppliers, a key issue for achieving benefits from orientation to open innovation.

4.5.1. Theoretical implications

This study contributes to developing the literature that analyzes the effects of adopting open innovation in an organization by examining its organizational context. The context used, commitment to quality by implementing ISO 9000 standards,

permits us to extend the literature that analyzes quality and innovation and opens a new line of research, since no studies to date link open innovation and quality. Given the minimal literature on this topic (Wiengarten et al., 2013), the influence of ISO 9000 standards on innovative performance is a field in need of study, one that offers, among other advantages, the uniformity typical of standards and that permits comparison of organizations with each other, unlike total quality management.

Likewise, analyzing an organization's orientation to open innovation relative to a specific partner responds to the need recognized in the literature to study this relationship in detail (Obal and Lancioni, 2013). Although it is necessary to consider open innovation holistically, detailed study of its practices is important for understanding its effect on performance. We also contribute to the literature that promotes studying supply network-enabled innovation, rather than drawing conclusions by focusing on a specific supplier (Narasimhan and Narayanan, 2013).

The results of the moderating variables used in this study contribute to developing the literature on quality management and open innovation. We contribute generally to the literature that rejects relating quality and innovation in a simple way. Our results support the study by Pekovic and Galia (2009), which indicates the importance of examining how the organization uses its resources to obtain advantage in innovation with commitment to quality. This study shows, then, the advisability of analyzing the relation between quality and open innovativeness, opening a line of research within the general line that relates quality and innovation, a line that examines complementarity between the organization's resources and capabilities oriented to innovating openly, and its supply network.

4.5.2. Managerial implications

Our results provide guidelines for managers to follow when putting open innovation into practice, specifically, for managers who maintain relationships with their suppliers to innovate jointly. These relationships permit improvement of

innovative performance for both parties. The benefit obtained from this practice will depend, however, on the context of the organization studied.

Implementing ISO standards does not impede achieving performance as a result of the relationship mentioned, but performance is lower and is conditioned by other factors. From a practical entrepreneurial perspective, one must thus be aware that quality and innovation are not irreconcilable. The coexistence of open innovativeness and quality involves ensuring compatibility of information technologies and complementarity of learning styles. These factors are not crucial for uncertified organizations, but certified organizations must ground their actions in the aspects that, first, strengthen the organization's supply chain integration to achieve improvement in their innovative performance and, second, balance exploratory and exploitative styles, achieving ambidexterity in their relationships with their suppliers.

Managers must stimulate the creativity of their supply network and, on the internal level, establish a process for joint creation with this network. More generally, they must also foster a culture that permits permeability of their boundaries with the exterior, eliminating internal barriers that impede benefitting from the adoption of open innovation in their organization.

4.6. Conclusions, limitations, and directions for future research

Our results show that an organization's orientation to open innovation, understood in relation to its supply network, permits achievement of radical innovations, in products, services, and processes. Our results show a smaller effect, however, on performance for ISO 9000-certified organizations. When these organizations achieve complementarity of learning styles with their supply network and compatibility of information technologies, they can counteract the smaller effect of orientation to open innovation on innovative performance in an organization committed to quality as represented by its adherence to ISO 9000 standards. This study confirms the conclusions of Obal and Lancioni (2013), who argue the beneficial

character of open innovation under the right circumstances.

Despite its contributions, this study has some limitations that must be taken into account. The first is the use of self-reported and single-respondent data. A single informant per organization participated in the survey and answered all questions for this research. While the results of Harman's one-factor test suggest that common method variance is not a serious concern, some common method bias may affect the research findings. It would be fruitful for future studies to attempt to obtain data from multiple respondents within a firm to minimize the potential impact of common method bias. Although firm size, industry effects, and complexity of a network were considered to be control variables, we were unable to control for other network-based characteristics. It would be interesting to examine whether other control variables explain variance in performance.

Second, as the measures of both open innovativeness and innovative performance were newly developed for this study, further validation of their respective scales is an important step for future research. Third, results are naturally limited to the empirical and geographical context in which data were collected. Similar studies in other countries would provide useful and interesting comparative analyses. Fourth, implementation of ISO 9001:2000 was measured as a categorical variable, which prevents us from taking into account the simultaneity of other quality management initiatives (e.g., Six Sigma, TQM). As Sisodiya et al. (2013) argue, open innovation is a complex phenomenon that may be influenced by other factors that we have not taken into account in this study. Knowledge of open innovativeness would be enriched by using longitudinal instead of cross-sectional data.

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CAPÍTULO 5

CONCLUSIONES, LIMITACIONES Y FUTURAS LÍNEAS DE INVESTIGACIÓN

5.1. Introducción

En este capítulo recogemos de forma resumida las conclusiones e implicaciones que se derivan de este trabajo de investigación. La estructura de este capítulo es la siguiente. En primer lugar, exponemos las conclusiones globales de este trabajo y las propias de cada Capítulo que lo compone. A continuación, se muestran las implicaciones teóricas y prácticas, seguidas de las limitaciones y las líneas de investigación a seguir en un futuro.

5.2. Conclusiones de este trabajo de investigación

Este trabajo de investigación profundiza en el estudio de la orientación a la innovación abierta de una organización, entendiéndose ésta cuando desarrolla procesos conjuntos con su *supply network*. El análisis de la orientación a la innovación abierta de una organización en relación a un partner concreto, responde a la necesidad de estudiar el mismo en detalle, tal y como ha sido reclamado en la literatura (Obal y Lancioni, 2013). Aunque es necesario contemplar la innovación abierta de forma holística, el estudio pormenorizado de sus prácticas es importante respecto a su efecto en el desempeño, tal y como se hace en este trabajo. En él, estudiamos los antecedentes y efectos en el desempeño innovador y en la mejora de la competencia para la gestión de la cadena de suministro de la orientación a la innovación abierta de una organización.

De forma genérica, cabe concluir que la relación entre innovación abierta y desempeño es compleja y requiere atender de una serie de factores a la hora de poder confirmarla o rechazarla, como puede ser la percepción de dependencia o el compromiso con la mejora de la calidad de la organización estudiada.

A continuación, se recogen las conclusiones específicas que se derivan de este trabajo de investigación.

En el capítulo dos, los resultados obtenidos muestran que la orientación a la innovación abierta de una organización, mejora su desempeño operativo, al reforzar su competencia para gestionar su cadena de suministro. Este resultado puede deberse a que la apertura de las fronteras de la organización, unida a la transferencia de conocimiento en la que se basa este nuevo paradigma, permite disponer de mayor información, lo que refuerza la capacidad de respuesta y la flexibilidad de la misma. Esta primera conclusión, la mejora de las capacidades de una organización y su desempeño operativo como resultado de la adopción de innovación abierta, ha sido señalada a nivel teórico en trabajos como los de Bilgram et al. (2008), Cheng y Chen (2013), Erzurumlu (2010) y Gassmann (2006).

En este capítulo se evidencia también la mejora del desempeño organizacional, evaluado en distintas dimensiones, como resultado de la mejora de la competencia para la gestión de la cadena de suministro de una organización. La orientación a la innovación abierta, permite mejorar el desempeño operativo de una organización, lo que repercute en mejores resultados para los clientes (al cumplir los tiempos de entrega mejorando constantemente la calidad...), el personal de la organización, la sociedad y los resultados clave de la organización (desempeño financiero).

En él también se analizan algunos elementos que componen la teoría del intercambio social (Kwon y Suh, 2005; Wei et al., 2012; Wu et al., 2014) y que explican la proclividad de una organización a innovar de forma abierta. El nivel percibido de justicia procedimental y el ajuste entre el nivel esperado y el percibido en confianza y compromiso en relación al *supply network* con el que una organización practica innovación abierta, son significativos a la hora de explicar una mayor orientación a innovar de forma abierta. Sin embargo, este estudio muestra que la variable confianza explica dicha orientación en mayor medida que el compromiso o la justicia procedimental. Este resultado se debe a que la confianza antecede al resto de elementos que integran la teoría del intercambio social (compromiso y justicia procedimental) como recogen los trabajos de Kwon y Suh (2005) y Wu et al. (2014). Así pues, la

confianza es un elemento esencial que ha de estar presente para que una organización se oriente a innovar de forma abierta, al constituir un elemento que protege a la organización de un posible comportamiento oportunista de su *supply network* (Bunduchi, 2013).

Los resultados del tercer capítulo muestran la influencia de la percepción de dependencia de una organización en la relación que mantiene con su *supply network*. A mayor percepción de dependencia, menor desempeño obtiene de orientarse a innovar de forma abierta. Este hallazgo confirma la importancia de atender a ciertos factores que pueden moderar la relación entre innovación abierta y desempeño, como también han señalado los trabajos previos de Hung y Chou (2013) y Tsai (2009).

Así pues, en este capítulo, hemos atendido, en primer lugar, a la percepción de dependencia de una organización, en función de la capacidad de aprendizaje que percibe de su *supply network*. En segundo lugar, hemos analizado el carácter moderador de las capacidades propias de absorción y desorción de la organización que se orienta a innovar de forma abierta para la muestra que percibe menor dependencia respecto a su *supply network*. La capacidad de absorción modera positiva y significativamente la relación entre orientación a la innovación abierta y mejora del desempeño. Este resultado sigue la línea de los trabajos de Clausen (2013), Revilla et al. (2013), Tsai (2009) y Wagner (2012). La capacidad de desorción, sin embargo, no modera significativamente la relación propuesta. Este resultado, puede deberse a que el desarrollo de esta capacidad no se encuentra valorado suficientemente en la práctica empresarial, pues los beneficios que se derivan del mismo, no se obtienen de forma inmediata (Lichtenthaler y Lichtenthaler, 2010).

El análisis post-hoc que se recoge en este capítulo, analiza el modo en el que la organización encuestada percibe que su *supply network* hace uso de su poder (He et al., 2013; Nyaga et al., 2013). Para los casos en los que las organizaciones encuestadas perciben que su *supply network* no hace un uso abusivo del mismo, es posible que obtengan beneficios como resultado de orientarse a innovar de forma abierta. No

sucede así, en caso contrario. Este análisis post-hoc muestra que las organizaciones que consiguen la complementariedad entre sus capacidades de absorción y desorción y las de su *supply network*, mejoran su situación frente a las que no lo logran (Cassiman y Veugelers, 2006). Así, un mayor desarrollo de las capacidades externas puede compensar un menor desarrollo a nivel interno o viceversa.

De acuerdo con los resultados del estudio que se hace en el Capítulo 4, las organizaciones no certificadas en ISO 9000, obtienen mayor desempeño innovador de su orientación a innovar de forma abierta que las que sí lo están. Este resultado puede deberse a que la base de proveedores con los que puede desarrollar innovaciones conjuntas es menor en las organizaciones que operan bajo un sistema de gestión de la calidad, que en las no certificadas. Así pues, la gestión de la calidad y, de forma concreta, las normas ISO 9000 enfatizan la importancia de mantener relaciones mutuamente beneficiosas y orientadas al largo plazo, con una base reducida de proveedores. Sin embargo, la innovación abierta contempla a los proveedores como fuente de innovación, con independencia de la fortaleza de la relación que mantienen, y de que mantuvieran una relación previa o no. De este modo, es posible que las organizaciones certificadas sufran una cierta miopía respecto a los proveedores con los que ponen en práctica la innovación abierta. Este resultado puede esconder también la complejidad de la relación entre innovación y calidad, tal y como ha señalado literatura previa, siendo necesario atender a otros factores que la condicionan, como los recursos de los que dispone la organización (Pekovic y Galia, 2009).

Así pues, los resultados de este capítulo muestran cómo la innovación abierta es más efectiva en organizaciones que persiguen la calidad y logran la complementariedad con el estilo de aprendizaje de sus proveedores. Este resultado, confirma los beneficios del ambidextrismo de las organizaciones que adoptan innovación abierta. La complementariedad entre los estilos de aprendizaje, permite disfrutar de los beneficios de un elevado nivel de exploración y explotación a la organización que alcanza un ajuste con su *supply network*.

Nuestros resultados también muestran la importancia de la compatibilidad de las tecnologías de la información de la organización y sus proveedores para obtener un mayor desempeño en organizaciones que se encuentran certificadas. Este resultado es coherente con el del trabajo de Cheng et al. (2014), que muestra la importancia de la flexibilidad de la infraestructura tecnológica en el logro de desempeño innovador interorganizacional. En nuestro caso, se trata de una herramienta que permite el flujo constante de conocimiento entre la organización y sus proveedores, aspecto clave para lograr beneficiarse de una orientación a la innovación abierta.

5.3. Implicaciones del trabajo de investigación

5.3.1. Implicaciones teóricas

El estudio en detalle de la práctica de la innovación abierta de una organización con su *supply network* no ha recibido la suficiente atención en la literatura, habiéndose reclamado su estudio previamente (Obal y Lancioni, 2013; Thomas, 2013). Al centrarnos en la práctica de la innovación abierta con su *supply network*, contribuimos a la literatura que promueve el estudio de *supply network-enabled innovation*, en lugar de atender a un proveedor concreto (Narasimhan y Narayanan, 2013).

Nuestro trabajo contribuye al desarrollo de la literatura sobre innovación abierta, profundizando en sus efectos a nivel innovador y en la mejora de la competencia para la gestión de la cadena de suministro. En consecuencia, también contribuye al desarrollo de la literatura que trata la gestión de la cadena de suministro.

La aplicación de la teoría del intercambio social, evaluando los constructos en términos de ajuste o gap (comparación entre expectativas y percepciones), supone una contribución a tener en cuenta en estudios futuros, pues ayuda a solventar las limitaciones de los estudios de corte transversal, permitiendo evaluar la calidad de una relación interorganizacional en el tiempo.

Asimismo, al mostrar que la orientación a la innovación abierta constituye una posible fuente para la mejora de la competencia para la gestión de la cadena de suministro, este trabajo responde a la necesidad expresada en trabajos como el de Kristal et al. (2010) de profundizar en los aspectos que favorecen el desarrollo de dicha competencia. Por su parte, la escala de medida del desempeño organizacional (en distintas dimensiones), es otra contribución a destacar, pues hasta ahora se ha diferenciado tan sólo entre desempeño financiero y no financiero en la literatura.

El estudio del efecto de la percepción de dependencia de una organización en la obtención de desempeño como resultado de su orientación a la innovación abierta,

contribuye al desarrollo de la literatura sobre este nuevo paradigma que ha apuntado a la necesidad de estudiar las relaciones de poder y dependencia, pero que no ha recibido atención hasta este momento (Vanhaverbeke y Cloodt, 2014).

Siguiendo esta línea de discurso, el empleo de la capacidad de absorción percibida por una organización de su *supply network* como determinante de su percepción de dependencia, contribuye al desarrollo de la literatura que subraya atender no sólo a las capacidades propias, sino también a las de las organizaciones con las que transfiere conocimiento (Tranekjer y Knudsen, 2012).

El empleo de la teoría de la complementariedad en el estudio de la obtención de provecho como resultado de la orientación a la innovación abierta, enriquece este nuevo paradigma. Asimismo, el estudio del carácter moderador de la capacidad de absorción propia en la relación entre orientación a la innovación abierta y mejora del desempeño operativo, muestra que innovación abierta y capacidad de absorción no se excluyen entre sí. Esta capacidad ha de ser estudiada en este nuevo paradigma. Además, su vinculación a la competencia para la gestión de la cadena de suministro, supone una aportación a una rama de la literatura que estudia los efectos de la misma (capacidad de absorción) en la mejora del desempeño operativo de una organización (Malhotra et al., 2005).

El estudio de la implantación de las normas ISO 9000 en la relación entre orientación a la innovación abierta y mejora del desempeño innovador, contribuye al desarrollo, por un lado, de la literatura que estudia la relación entre innovación abierta y mejora del desempeño, y, por el otro, a la que vincula calidad e innovación.

Este último aspecto, y, de forma específica, la atención a las normas ISO 9000 (y su efecto en innovación), es un campo a estudiar dada la escasez de literatura al respecto (Wiengarten et al., 2013), y, ofrece en relación a la gestión de la calidad total, uniformidad (permitiendo comparar organizaciones certificadas entre sí).

5.3.2. Implicaciones prácticas

Las implicaciones prácticas que se derivan de esta tesis doctoral son las siguientes:

1. La orientación a la innovación abierta de una organización constituye una fuente de ventaja competitiva para las organizaciones. Es por ello, que éstas han de estimular aquellos factores que facilitan su adopción y ser conscientes de sus posibles ventajas (*open innovativeness*), tanto a nivel innovador, como operativo. Así, resulta oportuno, sobre todo, que una organización establezca un clima de confianza en la relación que mantiene con el *supply network* con el que practica innovación abierta.

2. Las organizaciones ya no compiten sólo entre sí, sino que también lo hacen las cadenas de suministro a las que pertenecen. Las organizaciones han de ser conscientes de que la competitividad de la cadena de suministro a la que pertenecen es incluso más importante que su propia competitividad. Es por ello, que han de esforzarse por contribuir a la misma. Para ello, han de mejorar su competencia para la gestión de la cadena de suministro. Resulta, pues, necesario que éstas hagan hincapié en aquellos factores que contribuyen a la mejora de dicha competencia. Este trabajo de investigación, ha mostrado que, bajo las circunstancias oportunas, es posible su mejora si una organización se orienta a innovar de forma abierta, practicando ésta con su *supply network*.

3. La coexistencia entre objetivos diametralmente opuestos como eficiencia e innovación es posible, bajo las condiciones adecuadas. Así, las organizaciones pueden mejorar su desempeño operativo, como resultado de su orientación a innovar de forma abierta, cuanto menor sea su percepción de dependencia en relación al *supply network* con el que practica innovación abierta. Para evaluar su percepción de dependencia, las organizaciones pueden atender a la capacidad de aprendizaje percibida de su *supply network* en relación a la misma (capacidad de absorción relativa percibida).

4. El beneficio que se deriva de la orientación a la innovación abierta de una

organización puede verse fortalecido por el desarrollo de su capacidad de absorción y desorción. En todo caso, la capacidad de absorción refuerza la posibilidad de explotar conocimiento y palía los perjuicios asociados a una situación de dependencia en la que el *supply network* no desarrolla su capacidad de transferir conocimiento. Por su parte, la capacidad de desorción, puede conllevar beneficios en aquellos casos en los que las organizaciones perciban menor dependencia respecto a su *supply network*. La práctica empresarial tendría que hacerse eco de su importancia (capacidad de desorción) ya que la literatura ha señalado su potencial en el logro de ventajas económicas y no económicas. El nivel de desarrollo de dichas capacidades ha de ajustarse a las del *supply network* con el que practica innovación abierta, con el fin de aprovechar las sinergias que se derivan de dicha complementariedad.

5. El compromiso con la mejora de la calidad no impide la orientación a la innovación abierta de una organización y el logro de desempeño innovador como resultado de la misma, aunque lo merma. Las organizaciones han de ser conscientes de la necesidad de apoyarse en sus recursos y capacidades, para obtener desempeño innovador si se encuentran comprometidas con la mejora de la calidad. En el caso particular de organizaciones que han adoptado innovación abierta (puesta en práctica con su *supply network*) y están certificadas en ISO 9000, establecer infraestructuras interorganizacionales de tecnologías de la información y lograr la complementariedad entre los estilos de aprendizaje (de la organización y su *supply network*) son aspectos a tener en cuenta a la hora de alcanzar un mayor desempeño innovador.

6. Los directivos de compras han de considerar los recursos y capacidades que un posible proveedor puede tener para innovar a la hora de seleccionarlo. Asimismo, han de evaluar su capacidad de aprendizaje y de transferencia de conocimiento para determinar su percepción de dependencia y el grado en el que ha de desarrollar sus propias capacidades de absorción y desorción. Finalmente, los

managers han de estimular la creatividad de su *supply network* y, a nivel interno, el establecimiento de un proceso de creación conjunta con el mismo (*supply network*).

5.4. Limitaciones del trabajo de investigación

Como todo trabajo de investigación, esta tesis doctoral presenta sus propias limitaciones, que exponemos a continuación.

En primer lugar, hay que tener en cuenta que se ha utilizado un único informante por cada organización encuestada. Pese a los resultados favorables del Test de un único factor de Harman, somos conscientes de que las percepciones en las organizaciones no son uniformes. Emplear un único informante podría sesgar nuestros resultados. En un futuro, sería conveniente considerar la posibilidad de utilizar más de un informante por cada organización aunque la muestra sea más reducida, tal y como fomenta la revista MIS Quarterly.

Los estudios estadísticos realizados son de carácter transversal, por lo que no podemos extraer conclusiones derivadas de la evolución de las variables en el tiempo. Ello supone una limitación importante a tener en cuenta en un futuro. Sería interesante replicar este estudio a lo largo del tiempo para poder extraer conclusiones y compararlas con los resultados obtenidos en este trabajo de investigación.

Las escalas para medir la capacidad de desorción y desempeño en innovación abierta se han desarrollado para los fines de este estudio por primera vez. Su desarrollo, está precedido de una revisión teórica previa y un análisis pretest con expertos en el área pertenecientes a la comunidad científica y empresarial. Pese a haber sido validadas mediante un análisis factorial confirmatorio, su empleo en este trabajo supone tanto una contribución como una limitación. Resultaría, pues, conveniente su validación en futuros trabajos por la comunidad científica.

Aunque se empleó como variable de control el tamaño y la industria de la organización encuestada, así como la complejidad de la red de proveedores con las que

practica innovación abierta, no se han tenido en cuenta otras características propias de dicha red como variables de control. Dicha limitación habría de ser tenida en cuenta en un futuro, considerando como variables de control otras características que afectan al *supply network*.

Asimismo, la implantación de las normas ISO 9001:2000 se ha medido como una variable categórica, no teniéndose en cuenta la simultaneidad de otras iniciativas de gestión de la calidad (Six Sigma, TQM...). En un futuro, sería interesante considerar si las organizaciones, además de estar certificadas, siguen otras iniciativas de gestión de la calidad total. De este modo, podríamos comprobar si existen divergencias con los resultados obtenidos en esta tesis doctoral.

Como señala el trabajo de Sisodiya et al. (2013), el nuevo paradigma que se estudia de forma limitada en este trabajo de investigación, es un fenómeno complejo. Así, ha de ser estudiado teniendo en cuenta que existen una serie de factores que pueden influir en la relación innovación abierta-desempeño. Es por ello, que consideramos que este fenómeno puede verse influido por otros factores adicionales (al margen de la percepción de dependencia y el compromiso con la mejora de la calidad) que no se han tenido en cuenta en este estudio.

Por último, los resultados de este trabajo de investigación se encuentran limitados a un contexto geográfico concreto (empresas manufactureras y de servicios españolas que ponen en práctica la innovación abierta con su *supply network*). Ello dificulta extrapolar los resultados a otros contextos geográficos, por lo que este estudio debería realizarse en un futuro con una muestra de empresas pertenecientes a otros países.

5.5. Futuras líneas de investigación

En el apartado anterior se recogen, junto a las limitaciones, sugerencias para paliar en un futuro las mismas. En cierto modo, se expresan las líneas futuras a seguir como resultado de las limitaciones de la presente tesis doctoral.

A continuación, se señalan algunas de las líneas de investigación futuras a abordar derivadas de los resultados obtenidos en este trabajo de investigación. El Capítulo 2, mostraba ciertos antecedentes y efectos a nivel operativo de la orientación a la innovación abierta de una organización con su *supply network*. En un futuro, sería interesante estudiar el carácter mediador de las variables que componen la teoría del intercambio social (antecedentes de OI) en la relación entre OI y mejora de la competencia para la gestión de la cadena de suministro. Nos planteamos también atender al grado en el que los síndromes de no inventado aquí o no vendido aquí (Burcharth et al., 2014) se encuentran presentes en la organización objeto de estudio, como antecedentes de la orientación a la innovación abierta, es decir, la medida en que la organización ha eliminado las posibles barreras presentes en la organización para que la adopción de la innovación abierta sea efectiva.

La vinculación entre orientación a la innovación abierta y competencia para la gestión de la cadena de suministro, se profundizaría considerando la influencia de este nuevo paradigma en cada una de las funciones de la organización (al margen del departamento de I+D, marketing, compras, producción...), tal y como apunta en el reciente trabajo de West et al. (2014).

Por su parte, el Capítulo 3 analiza cómo la percepción de dependencia de la organización que se orienta a innovar de forma abierta influye en la obtención de desempeño como resultado de la misma, así como al rol moderador de las capacidades de absorción y desorción propias. Sería interesante contar, en lugar de con las percepciones de la organización encuestada, con las percepciones de la red de proveedores acerca de su propia capacidad de absorción, para así determinar de forma

objetiva la existencia de asimetría de poder entre las partes.

Otras variables moderadoras que se podrían tener en cuenta en la relación objeto de estudio en el Capítulo 3, serían variables organizacionales, culturales o de liderazgo como apunta el trabajo de Hung y Chou (2013).

El Capítulo 4 estudia la relación entre orientación a la innovación abierta y desempeño innovador de carácter radical, atendiendo a la certificación o no de un sistema de gestión de calidad. En un futuro, sería oportuno emplear medidas de desempeño innovador de carácter objetivo. Asimismo, sería interesante estudiar el efecto de OI en desempeño innovador de carácter incremental, además del ya estudiado desempeño innovador de carácter radical. Atender a las prácticas de gestión de la calidad total como elementos facilitadores de la adopción de la innovación abierta también resultaría interesante, entre otras razones, porque éstas pueden ayudar a combatir los síndromes organizacionales anteriormente citados. Otra línea de investigación a tener en cuenta es el análisis del carácter moderador de dichas prácticas, en la relación entre innovación abierta y desempeño.

De forma general, entre otros gaps detectados, sería conveniente analizar cómo la estructura de la red explica las diferencias en el desempeño obtenido como consecuencia de orientarse a innovar de forma abierta con su *supply network*. También cabría estudiar si existen diferencias entre la práctica de innovación abierta con proveedores con los que mantenía previamente una relación o no, y su influencia en la gestión de la cadena de suministro, evaluando el grado de ambidextrismo (partners previos vs partners nuevos) del *supply network*, siguiendo el trabajo de Bahemia y Squire (2010). Asimismo, sería interesante centrar futuros estudios en pequeñas y medianas empresas, categorizando en mayor medida las mismas, tal y como propone el trabajo de Spithoven et al. (2013). También, se podría comparar los efectos en gestión de la cadena de suministro de la orientación a la innovación abierta utilizando una muestra de empresas de culturas opuestas (western vs eastern) y cambiar la perspectiva de este trabajo a los proveedores que integran el *supply network* con el que

una organización se orienta a innovar de forma abierta.

Para finalizar, hay que tener en cuenta que esta tesis doctoral trata temas de gran actualidad e interés, por lo que consideramos que puede servir de guía a futuros trabajos de investigación.

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"Así como hay momentos en los que la vida cambia en un instante, habrá un momento en que lo que te parecía imposible se tornará en sueño hecho realidad. Todo sucede por una razón, todo ocurre a su debido tiempo" (Blog Tú eres Yo).