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Selección y evaluación de proveedores de logística externa en la cadena de suministro: una revisión sistemática

Selection and evaluation of third party logistics in the supply chain: A systematic review

Rafael Granillo-Macías*, Isidro J. González-Hernández[a]

[a] *Universidad Autónoma del Estado de Hidalgo, Escuela Superior de Ciudad Sahagún, Área Academia de Ingeniería Industria. – Zona Industrial, km. 1. C.P. 43990, Tepeapulco, Hidalgo. (México) – igonzalez@uaeh.edu.mx – https://orcid.org/0000-0003-2805-6674*

* ***Corresponding author***: *Universidad Autónoma del Estado de Hidalgo, Escuela Superior de Ciudad Sahagún, Área Academia de Ingeniería Industria. – Zona Industrial, km. 1. C.P. 43990, Tepeapulco, Hidalgo. (México) – rafaelgm@uaeh.edu.mx – https://orcid.org/0000-0002-1015-667X*

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RESUMEN

A nivel mundial se estima que más del 85% de las principales empresas utilizan servicios logísticos externos, con tasas de crecimiento de este mercado de servicios proyectadas entre el 18 y 22% por año. Esta tendencia ha generado un creciente interés en los investigadores de la cadena de suministro por proponer diferentes enfoques para la selección y evaluación del desempeño de los proveedores de logística externa (3PL). En este artículo se propone una revisión sistemática analizando una muestra de artículos publicados en revistas indexadas con el objetivo de identificar las principales contribuciones sobre este tema. Este estudio muestra que la evaluación y selección de un 3PL es una decisión crítica y compleja, debido a la existencia de varios criterios de base imprecisa y subjetiva. Como resultado, se presentan características metodológicas, enfoques utilizados, modelos aplicados, atributos de las revistas e industrias que utilizan proveedores de logística externa. El costo, las tecnologías de la información implementadas por los proveedores de logística y la efectividad en los envíos y entregas a tiempo, son los criterios más valorados por las empresas para la evaluación y selección de 3PL. Los resultados de este estudio sirven a apoyo a los investigadores, como referencia que permite identificar algunas posibilidades para futuras investigaciones en el campo de los proveedores que ofertan servicios de logística externa, impulsando la competitividad en la cadena de suministro.

Palabras clave: logística, cadena de suministro, proveedores, selección, evaluación, 3PL

ABSTRACT

Worldwide it is estimated that more than 85% of the main companies used external logistics services, with growth rates of this services market projected between 18 and 22 percent per year. This trend has generated a growing interest in supply chain researchers to propose different approaches for the selection and evaluation of the performance of third party logistics (3PL). This article proposes a systematic review analyzing a sample of articles published in indexed journals in order to identify the main contributions on this topic. This study shows the evaluation and selection of a 3PL is a critical and complex decision, due to the existence of several criteria of imprecise and subjective basis. As a result, methodological characteristics, approaches used, models applied, attributes of the magazines, and industries that use external logistics providers are presented. Cost, information technology implemented by logistics providers, and the effectiveness of shipments and deliveries on time, are the most valued criteria by companies for the evaluation and selection of 3PL. The results of this study provide support to researchers, as a reference that allows identifying some possibilities for future research in the field of providers that offer external logistics services, promoting competitiveness in the supply chain.

Keyword: logistics, supply chain, supplier, evaluation, selection, 3PL

1. INTRODUCCIÓN

Como resultado de satisfacer las necesidades de los clientes de manera rentable, a partir de los años noventa se han promovido de forma intensiva los procesos de tercerización. La tercerización como estrategia en el área de logística se ha vuelto una práctica frecuente a lo largo de diferentes industrias a nivel mundial. Algunas estimaciones indican que más del 85 por ciento de las compañías en la lista *Fortune* 500 utilizan los servicios de tercerización de proveedores logísticos, con tasas de crecimiento de este mercado de servicios de entre 18 y 22% por año (Armstrong & Associates 2017). De acuerdo al *Estudio de logística de terceros: Estado de la subcontratación logística 2020* realizado por Langley y Capgemini (2020), más del 83% de los encuestados afirman que con el uso de servicios de logística externa se ha contribuido a mejorar los servicios de entrega hacia el cliente final.

El rol que asumen los proveedores logísticos es fundamental en la búsqueda de nuevos modelos operativos que aumenten la competitividad en las empresas. De acuerdo a Aguezzoul (2014) y Yang (2014) los términos «tercerización logística», «proveedores de logística externa», «logística por contrato» y «distribución por contrato» son utilizados de forma indiferente para identificar a los proveedores de servicios de tercerización. En este trabajo, se utilizará el término «proveedores de logística externa» o «3PL» para identificar a estos proveedores. Cabe mencionar que el acrónimo 3PL (*Third Party Logistics*) es usado comúnmente en la literatura para identificar a los proveedores de logística externa.

De acuerdo a APICS (2011) un proveedor de logística externa es una entidad que administra el total o parte de las operaciones de distribución, ya sea dentro o fuera de una compañía. Marasco (2008) agrega también que, la relación mutua entre vendedores y 3PL se realiza generalmente en el entorno de la cadena de suministro.

En general, un 3PL se puede considerar como una empresa o contratista que provee servicios, con el propósito de realizar actividades específicas dentro de un proceso o bien ejecutando el total de las actividades logísticas que desempeñaba previamente «en casa» el usuario contratante.

De acuerdo a Göl y Çatay (2007) la principal contribución de un 3PL es otorgar al contratante mayores niveles de flexibilidad, incrementar la productividad, reducir los costos logísticos, obtener mayor eficiencia operacional, mejorar los niveles de servicio al cliente y lograr una mejor atención en la competencia central del negocio. Otras ventajas intrínsecas de la contratación de un 3PL incluyen la reducción en los costos de personal y equipos, la mejora en las habilidades de la empresa, así como un mayor conocimiento del mercado que contribuye en la creación de una ventaja competitiva en diferentes ámbitos (Yang 2014). En el estudio sobre 3PL de Langley y Capgemini (2020), la mejora en el servicio al cliente y la innovación para la eficacia de la logística, son algunas de las aportaciones y beneficios percibidos por los actores, los cuales son interacciones positivas para el éxito en la cadena de suministro.

Dentro de la cadena de suministro, un 3PL se involucra y ejecuta principalmente las funciones de transporte, almacenamiento, administración del inventario, procesamiento de órdenes y el empaquetado (Singh *et al.* 2017), además de asumir las funciones enfocadas en la administración de los sistemas de información para el seguimiento y trazabilidad de los productos que se distribuyen a lo largo de la cadena.

Para seleccionar a un 3PL, es esencial elegir los métodos de evaluación más adecuados. Estudios realizados por Aguezzoul y Pires (2016) señalan que la evaluación y selección del desempeño logístico de los 3PL es una decisión estratégica y un proceso complejo que involucra diversos criterios cualitativos y cuantitativos. Con base en estos antecedentes, en este artículo se analiza cómo los investigadores de la cadena de suministro han examinado el papel de los 3PL respondiendo las siguientes preguntas de investigación:

PI1: ¿Cuáles son las principales características de la estructura bibliométrica de los estudios realizados en torno a la evaluación y selección de 3PL?

PI2: ¿Cuáles son las herramientas y metodologías más utilizadas para la evaluación y selección de 3PL?

PI3: ¿Cuáles son los criterios más utilizados para la evaluación y selección de 3PL?

La conjetura que se estableció es que, mediante una revisión sistemática de la literatura, se pueden identificar diferentes aportaciones científicas en el contexto de la evaluación y selección de 3PL en la cadena de suministro, cubriendo específicamente aspectos como: características metodológicas, enfoques y modelos utilizados, industrias en las que se aplican, revistas en las que se publican estos trabajos, así como identificar aspectos que podrían ser abordados como trabajos futuros en torno a los 3PL.

El resto del este artículo está organizado de la siguiente manera: La metodología aplicada para este estudio se muestra en la sección 2. Posteriormente, en la sección 3 se describen de forma general las contribuciones científicas encontradas utilizando la metodología propuesta. En la sección 4 se analiza la estructura bibliométrica y los resultados descriptivos, enfocados en las herramientas, metodologías y criterios específicos para la selección de 3PL, con base en los autores y artículos encontrados. Finalmente, en la última sección se realizan las conclusiones de este estudio.

2. MÉTODO

La literatura analizada en este artículo se basa en una revisión sistemática sobre una muestra de artículos publicados en el área de cadena de suministro, y específicamente sobre el tema de evaluación y selección de 3PL. En esta revisión, como primer paso se seleccionaron las palabras clave «proveedor de logística externa», «evaluación», «selección», «cuantitativa» y «3PL» con el propósito de distinguir a los artículos que abordan estas temáticas en su conjunto. Cabe mencionar que estos términos se buscaron en idioma inglés en las bases de datos.

Como segundo paso se determinó la base de datos sobre la cual se recolectaría la información. En este caso, se seleccionó la base de datos WoS (*Web of Science*), debido a que es una de las principales bases de datos a nivel internacional y que de acuerdo a estudios propuestos por Bramer *et al.* (2017) garantiza una cobertura adecuada y eficiente en una revisión sistemática. Posteriormente se definió el periodo de tiempo en que se publicaron los artículos. En este caso, no se restringió la búsqueda permi-

tiendo la inclusión de artículos publicados en WoS en cualquier año (es decir, desde 1980 hasta 2019). Después se determinaron las categorías para la recolección de datos; para este estudio se eligieron «*administración*», «*investigación de operaciones*», «*ingeniería industrial*», «*aplicaciones interdisciplinarias de matemáticas*», «*tecnología de ciencias del transporte*», «*aplicaciones interdisciplinarias de informática*», «*finanzas empresariales*», «*negocios*», «*sistemas de información computacional*», «*economía*», «*transporte*» e «*ingeniería multidisciplinaria*», debido a que este estudio se enfoca a estas áreas del conocimiento.

La búsqueda fue realizada en enero de 2019; como resultado se encontraron 48 artículos que coincidieron con estos criterios. El texto completo de cada artículo fue revisado con el propósito de eliminar aquellos que no se relacionaban con la evaluación y selección de 3PL. Como resultado se seleccionaron 33 artículos que abordan específicamente aspectos relacionados al tema de estudio. El último paso consistió en exportar la información a una herramienta de software llamada «VOSviewer» para realizar el análisis sistemático de la literatura. Este software o herramienta permite construir y visualizar redes bibliométricas a partir de la información extraída en cada uno de los artículos seleccionados.

3. EVALUACIÓN Y SELECCIÓN DE 3PL

De los 33 artículos seleccionados con base en la metodología de la sección anterior, el primer antecedente relacionado con la evaluación y selección de 3PL de acuerdo a nuestro análisis lo presenta Tsamboulas y Kapros (2000), los cuales formulan un marco metodológico cuya principal contribución es comprender las oportunidades y barreras para el uso de proveedores de transporte intermodal. Los autores utilizan la técnica estadística de análisis factorial para correlacionar los problemas conductuales y de percepción relacionados con el uso del transporte intermodal, tomando en cuenta 14 criterios físicos y económicos para la elección. Este estudio concluye con la identificación de tres actitudes distintas que pueden conducir a la diferenciación de la intensidad del uso del transporte intermodal por grupo de actores: 1) El grupo «orientado a los costos», 2) El grupo «orientado al costo-calidad» y 3) El grupo «específico» orientado a características específicas de la política de transporte.

Yan *et al.* (2003) plantean un marco estructural sistemático para el soporte de decisiones para la evaluación dinámica y selección de 3PL en la administración de la cadena de suministro mediante el uso del método de Razonamiento Basado en Casos (CBR, por sus siglas en inglés). Otros autores como Zhang *et al.* (2006) presentan un modelo para la selección de proveedores 3PL donde integran el Proceso Analítico de Jerarquía (AHP, por sus siglas en inglés) junto con la metodología Análisis Envolvente de Datos (DEA, por sus siglas en inglés), el modelo propuesto combina la opinión subjetiva de los tomadores de decisiones con los datos objetivos de los factores relevantes. A partir de una encuesta, los autores identificaron 19 criterios de evaluación los cuales se basan en la combinación de las opiniones subjetivas de los tomadores de decisiones con datos cuantitativos.

A través de un sistema inteligente, Işiklar *et al.* (2007) integran CBR, Razonamiento Basado en Reglas (RBR, por sus siglas en ingles) y técnicas de programación de compromisos en ambientes difusos con el propósito de facilitar la toma de decisiones inteligente para la evaluación y selección efectiva de un 3PL. Su objetivo de acuerdo a estos autores es eliminar los datos innecesarios que no son valiosos para la solicitud dada, partiendo del grado de importancia de los criterios de evaluación del cliente en términos de aspectos estratégicos y del negocio del proveedor.

Mediante un enfoque difuso integrado, Liu y Wang (2009) proponen un método de evaluación y selección que consiste en tres técnicas: Delphi Difuso (FD, por sus siglas en inglés), Inferencia Difusa (FI, por sus siglas en inglés), y Asignación Lineal Difusa (FLA, por sus siglas en inglés). Los autores aplican el método FD para identificar los criterios de evaluación importantes. Posteriormente, emplean el método FI para eliminar proveedores no adecuados y finalmente desarrollan un enfoque de FLA para la selección final. Este método emplea 26 criterios de evaluación considerando como los de mayor relevancia el sistema de información logística, el servicio al cliente, los envíos y las entregas a tiempo, la capacidad para manejar requisitos comerciales específicos, la capacidad de respuesta y el acceso a los recursos humanos.

Otro estudio como el de Jayaram y Tan (2010) desarrolla un instrumento de encuesta basado en una revisión de literatura y entrevistas con profesionales y académicos, para identificar los factores estratégicos que influyen en el rendimiento de las empresas que se integran con proveedores 3PL, en comparación con las que no lo hacen. Los autores utilizan un análisis factorial exploratorio mediante componentes principales en rotación varimax para identificar los principales factores estratégicos.

Autores como Chen *et al.* (2010) proponen un marco de referencia para seleccionar al mejor 3PL basado en el Método de Organización de Clasificación de Preferencias para Evaluaciones Enriquecidas (PROMETHEE, por sus siglas en inglés) y el Método de Desviación Máxima (MDM, por sus siglas en inglés) para determinar el orden de clasificación de los proveedores. Los autores proponen criterios basados en el precio, las entregas a tiempo, la calidad del servicio, la estructura financiera, la cercanía de las relaciones de negocio y la tecnología de la información. Por otro lado, Wolf y Seuring (2010) presentan un estudio utilizando el Diseño de Estudio de Caso Múltiple (MCSD, por sus siglas en inglés) para analizar si los problemas ambientales, forman parte de los criterios de evaluación y selección de proveedores 3PL en las empresas que requieren de servicios de logística. En su estudio los autores concluyen que los principales objetivos de la evaluación de un 3PL se basan en el precio, la calidad y la entrega oportuna. Mientras que, los temas ambientales son solo un requisito mínimo para el desempeño.

Çelebi *et al.* (2010) presentan una aplicación del Proceso Analítico en Red (ANP, por sus siglas en inglés) basado en factores cualitativos y cuantitativos, los cuales son utilizados para evaluar alternativas en la administración de la logística. Los resultados mostrados por los autores sugieren contratar proveedores logísticos, como una estrategia que genera una ventaja competitiva.

Basado en un enfoque híbrido que integra la metodología AHP con lógica difusa, Soh (2010) presenta un marco metodológico que establece criterios de decisión para la evaluación de proveedores de 3PL. Los resultados de este trabajo sugieren que

la capacidad de la tecnología de la información con la que cuenta un proveedor, es el criterio más importante para la selección.

A través del método de Análisis Envolvente de Datos Ocasional Restringido (CCDEA, por sus siglas en inglés) Azadi y Saen (2011) evalúan a proveedores de 3PL en términos de factores estocásticos. Falsini *et al.* (2012), por su parte, proponen un método matemático que combina AHP, DEA y programación lineal para respaldar la evaluación multi-criterio. El modelo propuesto por estos autores considera 37 criterios de evaluación que fusiona las opiniones de los expertos con los juicios objetivos que se originan en el análisis de datos históricos. Otros autores como Li *et al.* (2012) y Wong (2012) presentan modelos basados en conjuntos difusos, Proceso de Red Analítica Difusa (FANP, por sus siglas en inglés) y Programación Entera de Metas con Preferencia Difusa (PFIGP, por sus siglas en inglés) los cuales permiten establecer criterios cuantitativos y cualitativos que se integran en los procesos de decisión. Li *et al.* (2012) presentan 20 criterios de evaluación mientras que Wong (2012) considera 128 criterios en un entorno global de cadena de suministro.

Perçin y Min (2013) proponen un modelo híbrido, que combina el Despliegue de la Función de Calidad (QFD, por sus siglas en inglés), Regresión Lineal Difusa (FLR, por sus siglas en inglés), y el Enfoque de Programación Multiobjetivo para resolver el problema de evaluación y selección de 3PL. En su trabajo el QFD se utiliza para estructurar necesidades específicas del cliente y unir esas necesidades a las características de los candidatos 3PL. Posteriormente, se emplea la FLR para determinar una relación funcional entre las necesidades del servicio del usuario y las características del 3PL. Finalmente, se usa un modelo de programación de metas cero-uno para seleccionar al proveedor más deseable bajo múltiples criterios de decisión.

A través de una revisión de la literatura, Aguezzoul (2014) presenta un análisis sobre los criterios y métodos para la selección de 3PL. Con base en una investigación de artículos publicados en el periodo 1994-2013, el autor revela que la selección de 3PL es de naturaleza empírica y está relacionada con una región/país, el sector industrial y las actividades logísticas subcontratadas. En términos de los criterios para la selección de 3PL, Aguezzoul (2014) identifican 11 criterios clave: costo, relación con el cliente-proveedor, servicio, calidad, sistema de información y equipamiento, flexibilidad, entrega, profesionalismo, situación financiera, ubicación y reputación. Para el caso de los métodos usados para la evaluación y selección de 3PL, Aguezzoul (2014) los clasifica en 5 grupos: técnicas de toma de decisiones multi-criterio (MCDM, por sus siglas en ingles), enfoques estadísticos, inteligencia artificial, programación matemática y métodos híbridos.

Por otra parte, Leuschner *et al.* (2014) emplean un enfoque meta-analítico para proporcionar una revisión cuantitativa de la literatura y examinar constructos (criterios) relevantes sobre 3PL. De acuerdo a Leuschner *et al.* (2014) el objetivo de este estudio fue obtener correlaciones entre los constructos que fueron utilizados en los artículos y que describen el impacto de 3PL en el rendimiento de la empresa. El enfoque utilizado para el análisis de datos fue un meta-análisis de coeficientes aleatorios.

Considerando un modelo para la evaluación y selección de 3PL, Sahu *et al.* (2015) proponen en un entorno difuso la teoría de Números Difusos con Valores de Intervalo (IVFNs, por sus siglas en inglés). El modelo formulado por los autores evalúa individualmente a los proveedores para verificar su nivel de rendimiento con respecto a diversos atributos, estimando una métrica del rendimiento general.

En otro estudio, Yayla *et al.* (2015) presentan una metodología híbrida para la toma de decisiones multi-criterio utilizando el algoritmo Buckley's AHP-difuso con el objetivo de determinar ponderaciones de criterios y posteriormente aplica el método de Técnica Difusa para Orden de Preferencia por Similitud con Solución Ideal (TOPSIS, por sus siglas en ingles) para determinar los mejores proveedores de servicios.

Mediante un marco estratégico en el que se involucraron múltiples criterios y múltiples partes involucradas para evaluar los proveedores 3PL, Wang *et al.* (2015) emplea el método PROMETHEE como una herramienta de evaluación especifica en donde considera 19 criterios. Momeni *et al.* (2015), por otra parte, proponen una red aditiva multi-objetivo basado en el modelo DEA.

En el estudio de Hwang *et al.* (2016), la metodología de triangulación incluyendo la discusión de grupos focales, AHP y una entrevista exhaustiva de prueba, son expuestos con el propósito de identificar los criterios clave para la selección de 3PL. La metodología propuesta por el autor inicia con un enfoque cualitativo para establecer un marco de referencia para la toma de decisiones, después mediante el AHP se evalúa de forma cuantitativa la importancia relativa en los criterios de selección. Finalmente, se realiza una entrevista exhaustiva de prueba para proporcionar una interpretación objetiva de los resultados.

Govindan *et al.* (2016) utilizan el método de Laboratorio de Prueba y Evaluación en Entornos Grises para la Toma de Decisiones (DEMATEL) con el propósito de facilitar criterios para la selección de 3PL. El modelo DEMATEL permite construir un modelo estructural que, de acuerdo a los autores, incluye la evaluación de relaciones causales entre criterios de evaluación. El estudio concluye indicando que el criterio relacionado con la estabilidad financiera es considerado como el de mayor influencia causal sobre otros criterios.

Por último, los estudios más recientemente publicados de acuerdo a nuestra muestra son los presentados por autores como Ramírez-Florez *et al.* (2017) los cuales aplican una metodología fundamentada en la utilización del AHP-difuso con el objetivo de evaluar el desempeño de los 3PL considerando la administración del riesgo. El estudio concluye que uno de los principales desafíos presentes es el riesgo operacional, el cual debería ser monitoreado a lo largo de toda la cadena de suministro. Otro autor como Jung (2017) propone un marco de referencia para la evaluación de 3PL considerando criterios de evaluación apoyados en la sustentabilidad social. El autor selecciona dentro de la metodología de MCDM, el modelo de AHP-difuso. En este estudio se propone que, además de los criterios más comúnmente utilizados para evaluar el desempeño de los 3PL se consideren criterios relacionados con la sustentabilidad social. La sustentabilidad social en los 3PL es definida por Jung (2017), como la capacidad de operar servicios teniendo en cuenta su impacto en las partes involucradas tanto internas (empleados) como externas(sociedad), en términos de bienestar y seguridad.

Ilgin (2017) propone un método para la solución en un problema de selección, basado en una metodología en cuatro

etapas. En una primera etapa, se utilizan criterios cuantitativos y cualitativos para la selección de procesos. En la segunda fase se calculan los pesos de los criterios usando AHP-difuso. En una tercera etapa, Ilgin (2017) emplea modelos de simulación para determinar los valores de los criterios cuantitativos para la selección del 3PL. En la última etapa el autor utiliza la técnica de TOPSIS para la toma de decisiones multicriterio considerando criterios cuantitativos y cualitativos. Por otra parte, Haldar *et al.* (2017) presentan una propuesta en la que aplica el modelo DEA para evaluar la eficiencia de cada 3PL con base en determinados criterios, y posteriormente se aplica TOPSIS para ordenar de forma jerárquica cada opción y programación lineal para encontrar una solución que maximice la eficiencia de cada proveedor.

El objetivo de este estudio de acuerdo al autor es proponer un marco de referencia para la evaluación y selección de los mejores 3PL. Haldar *et al.* (2017) concluyen que a través de su propuesta de modelo jerárquico en tres etapas es posible estructurar sistemáticamente un marco de referencia para mejorar la toma de decisiones en el proceso de evaluación y selección.

En el trabajo de Marchet *et al.* (2017) los autores se enfocan en la identificación y evaluación de la eficiencia operacional de los 3PL proponiendo el modelo no paramétrico DEA. Este estudio analiza conjuntamente los criterios de eficiencia e innovación en el sector de 3PL desde un enfoque cuantitativo. A través de un análisis comparativo, los autores concluyen que la adopción de estrategias basadas en la eficiencia y la innovación son fundamentales para la selección y competitividad de los 3PL. Otro estudio fundamentado en la metodología MCDM en donde se propone un modelo basado en Importancia a través de la Correlación entre Criterios (CRITIC, por sus siglas en inglés) y el método de Evaluación del Producto de Suma Agregada Ponderada (WASPAS, por sus siglas en inglés) es presentado por Ghorabaee *et al.* (2017). Estos autores modelan en su propuesta la incertidumbre como parte del proceso de la toma de decisiones, a través de Conjuntos Difusos de Intervalo Tipo-2 (IT2FSs, por sus siglas en inglés). El estudio concluye que los criterios de mayor relevancia para la evaluación de los 3PL de acuerdo al ejemplo propuesto son posición financiera, nivel de riesgo y nivel de servicio.

El trabajo de Sen *et al.* (2017) conceptualiza un marco de referencia como soporte a la toma decisiones bajo ambientes de incertidumbre (grises). Los autores proponen la «teoría de conjunto de números grises» utilizando el enfoque de Toma de Decisiones Interactiva y de Criterios Múltiples (TODIM, por sus siglas en ingles) y PROMETHEE. El objetivo del estudio de Sen *et al.* (2017) involucra un sistema de toma de decisiones que permite su rápida aplicación evitando la complejidad computacional.

Para la evaluación de los 3PL desde la perspectiva de la sustentabilidad ambiental, Raut *et al.* (2018) implementan una metodología MCDM en dos fases: DEA y ANP. Los autores proponen un método integrado para la toma de decisiones en el proceso de selección y evaluación de 3PL basado en el desempeño desde una perspectiva de sustentabilidad ambiental. El estudio concluye indicando la relevancia que tiene la relación del desempeño ambiental como una ventaja diferenciadora desde la perspectiva de los 3PL.

La propuesta de Bianchini (2018) aplica la metodología basada en MCDM con el propósito de evaluar nuevos 3PL. Los autores explican la integración en dos fases de AHP y TOPSIS. En una primera fase, el autor propone una serie de reuniones con las partes involucradas de la empresa (administradores) los cuales definen los criterios fundamentales para la evaluación, posteriormente AHP y TOPSIS son utilizadas como base en el proceso de benchmarking. En general, TOPSIS es utilizado para clasificar a los potenciales 3PL y, el AHP da soporte a los pesos relativos de los diferentes criterios de evaluación. Al final, Bianchini (2018) propone un análisis de sensibilidad para determinar la confiabilidad de los resultados.

Finalmente, Dubey *et al.* (2018) presentan dentro de la evaluación y selección de 3PL, un marco de referencia basado principalmente en dos teorías organizacionales con el propósito de evaluar determinadas habilidades para el desempeño de la cadena de suministro. A través de la aplicación de encuestas en empresas de 3PL, los autores validan su propuesta, la cual vincula aspectos como teoría de la agencia humana, teoría de capital social y habilidades para la cadena de suministro. En este estudio los autores clasifican 14 habilidades de la cadena de suministro dentro de tres categorías como: habilidades administrativas, habilidades cuantitativas y habilidades clave de la cadena de suministro.

4. HALLAZGOS Y DISCUSIÓN

Después de una breve descripción de los artículos encontrados, en esta sección se aborda el análisis y discusión de los principales hallazgos con base en las preguntas de investigación.

4.1. Estructura bibliométrica y resultados descriptivos

La Tabla 1 ilustra los aspectos relevantes de la estructura bibliométrica que se obtuvo de la base de datos de WoS, mostrando los cuatro resultados descriptivos principales: revista, factor de impacto, número de artículos y puntaje de citas. Los artículos obtenidos en nuestra muestra se publicaron en 27 títulos de revistas. El factor de impacto de acuerdo al *Journal Citation Report* (JCR) de estas revistas se encuentra entre 0,391 y 6,105. Las revistas *Benchmarking*: *An International Journal, Computers and Operations Research, Expert Systems with Applications*, *International Journal of Logistics Research and Applications* e *International Journal of Production Research* publicaron en conjunto 11 artículos, lo cual representa el 34% de la muestra, siendo la revista *Benchmarking*: *An International Journal* la que contiene un mayor número de artículos relacionados con la evaluación y selección de 3PL. Las 22 revistas restantes (66% del total) publicaron solo un artículo cada una.

En cuanto al puntaje de citas en la base de datos WoS, 7 artículos publicados sobre esta temática en las siguientes revistas: *Expert Systems with Applications, Computers and Operations Research*, *International Journal of Physical Distribution and Logistics Management*, *International Journal of Production Economics* y *Omega*. Donde recibieron en conjunto 401 citaciones lo que representa el 59 % de las citas totales en esta muestra.

Tabla 1
Artículos en revistas, factor de impacto y citas

Revista	Factor de Impacto JCR	Artículos en la muestra	Puntaje de citas en WoS
Expert Systems with Applications	3,768	2	120
Computers & Operations Research	2,962	2	86
International Journal of Physical Distribution & Logistics Management	4,215	1	74
International Journal of Production Economics	4,407	1	64
Omega	4,311	1	57
International Journal of Production Research	2,623	2	47
Expert Systems	1,43	1	43
Journal of Supply Chain Management	6,105	1	32
International Journal of Logistics Research and Applications	1,82	2	25
International Journal of Computational Intelligence Systems	0,391	1	20
African Journal of Business Management	1,105*	1	17
Journal of Intelligent Manufacturing	3,667	1	16
Computer Supported Cooperative Work	0,725	1	14
Computers & Industrial Engineering	3,195	1	14
Industrial Management and Data Systems	2,948	1	14
Benchmarking: An International Journal	1,97	3	12
Supply Chain Management: An International Journal	3,833	1	7
International Journal of Shipping and Transport Logistics (IJSTL)	0,609	1	6
Transport	1,163	1	6
Transportation Journal	1,686	1	4
International Journal of Information Technology & Decision Making	1,775	1	0
International Journal of Sustainable Engineering	1,16**	1	0
Journal of Modelling in Management	1,44	1	0
Management Decision	1,525	1	0
Revista Facultad de Ingenieria, Universidad Pedagogica y Tecnologica de Colombia	***	1	0
Sustainability	2,075	1	0
Transportation Research Record. Journal of the Transportation Research Board	0,695	1	0
Total		**33**	**678**

*Factor de impacto en 2009 según la edición JCR, **Índice Scopus, ***Índice de citas de fuentes emergentes
Fuente: Elaboración propia.

Otra característica analizada en los artículos de esta muestra, fue el año de publicación en las diferentes revistas. El lapso analizado fue dividido en tres periodos de 6 años cada uno, con el propósito de identificar tendencias en la progresión cronológica de la investigación, tal como sugiere Aguezzoul (2014). El primer antecedente según la consulta realizada fue en el año 2000 en el que se publicó en el WoS un artículo, entre 2001-2006 se publicaron 2 artículos; posteriormente entre 2007-2012 se publicaron 11 artículos, finalmente entre 2013 y principios de 2019 se tiene el mayor registro de publicaciones con 19 trabajos que abordan esta temática de los 3PL (ver Figura 1).

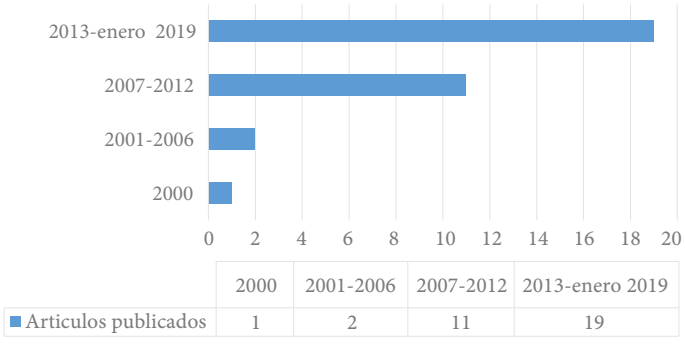

Figura 1
Distribución de artículos por periodo
Fuente: Elaboración propia.

De este análisis, se obtienen que el 57,57% de los artículos fueron publicados en el último periodo (2013-2019), este porcentaje puede indicar un creciente interés de los académicos en este tema. Seguramente este número de publicaciones irá incrementando de forma significativa en los próximos años debido a la intensa competencia global que hay en los mercados, además los proveedores de logística externa se están enfrentando a la nueva revolución digital. La combinación del e-comercio, el cómputo en la nube y el análisis de grandes datos, todos ellos impulsados por la Internet de las Cosas (IoT), está cambiando la forma en que las empresas 3PL realizan sus operaciones. Por lo tanto, habrá un profundo interés en los investigadores de cómo esta revolución digital está siendo adoptada por los 3PL.

En cuanto a los resultados de las autorías, el número de autores en el mismo artículo varía entre 1 y 6. Existen 17 artículos con 2 y 3 autores, lo cual representa el 50% del total de las publicaciones. Con el propósito de entender el impacto que tienen algunos autores y sus artículos para el desarrollo de otros estudios relacionados con los 3PL, se desarrolló un análisis de red de citas. Para este análisis sólo se consideraron artículos que recibieron citas de los mismos artículos de la muestra. El principal autor fue Aguezzoul (2014) el cual fue citado 15 veces por otros artículos de la muestra seguido por Liu y Wang (2009) y Işikla *et al.* (2007) con 14 citas cada uno. La Figura 2 ilustra los resultados en los cuales los círculos representan los artículos y las líneas son las conexiones que representan las citas que reciben de otros artículos, entre mayor sea el tamaño del circulo mayor será el número de citas que recibe este artículo. Los artículos más recientes, generalmente tienden a tener menos citas que los artículos más antiguos.

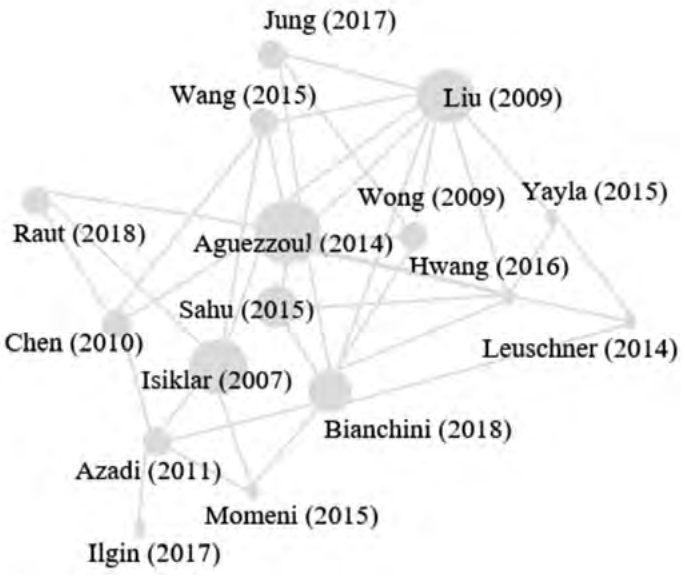

Figura 2
Red de citas
Fuente: Elaboración propia.

En los trabajos publicados, existen 16 países en los que se ubican las instituciones donde los autores están afiliados, la mayoría de estos son de Estados Unidos con un 17% de los artículos, sin embargo se observa un importante interés por este tema coincidentemente en países que han alcanzado un ranking entre el 12 y el 47 en los indicadores de desempeño logístico promovidos como el Banco Mundial como son Turquía, India, Taiwán y China los cuales suman en conjunto el 34% de la filiación de los autores en nuestra muestra.

4.2. Herramientas y metodologías utilizadas para la evaluación y selección de 3PL

Evaluar y seleccionar al mejor 3PL es una tarea difícil, ya que este proceso de toma de decisiones requiere la realización de una serie de pasos críticos destinados a incorporar criterios cualitativos y cuantitativos, así como atributos independientes o en conflicto. Estos pasos incluyen: selección, priorización, clasificación y ranking. Nuestra muestra de artículos menciona que la selección de 3PL es un problema complejo de toma de decisiones multi-criterio ya que involucra varios criterios cualitativos y cuantitativos según los requisitos y las especificaciones de la empresa que requiere de 3PL.

Se analizó el enfoque o el diseño del estudio adoptado por los trabajos citados, considerando: 1) un enfoque cualitativo; 2) un enfoque cuantitativo; y 3) una combinación de los dos anteriores. Se identificó el método utilizado para evaluar y seleccionar al 3PL, como se muestra en la tabla 2. De los 33 artículos, 6 (18%) se basan en un diseño cualitativo y 27 (81%) presentan un diseño cualitativo y cuantitativo, esto sugiere una tendencia muy fuerte a considerar ambos criterios en el que se pueden incorporar un gran número de criterios de selección.

Con respecto a los métodos de evaluación y selección identificados en esta revisión, se encontraron 25 métodos diferentes, como se muestra en la tabla 2. El método AHP es el más utilizado, ya que aparece en 9 (27%) de los trabajos citados, le sigue DEA con 7 (21%), modelos basados en conjuntos difusos con 5 (15%), TOPSIS con 4 (12%), ANP y PROMETHEE con 3 (9%), programación lineal con 2 (6%) y el resto sólo son mencionados una vez. Además, el análisis de resultados en la muestra indica que, 14 (42%) utilizan un método, 7 (21%) consideran 2 métodos y 8 (24%) aplican 3 métodos de forma integral en su proceso de evaluación y selección de 3PL.

También se examinó si el trabajo presenta: (1) un modelo analítico o es (2) puramente teórico/conceptual. De los 33 artículos, 28 (84%) proponen un modelo analítico con una o más técnicas mencionadas en el párrafo anterior. De estos 28 trabajos, 19 de ellos aplicaron su modelo en un caso de estudio o caso real; los otros 9 artículos probaron su modelo con datos secundarios o con un ejemplo numérico. Por otra parte, los otros 5 (15%) artículos de los 33, son trabajos teórico/conceptual, de los cuales 2 de ellos son una revisión de la literatura y los otros 3 trabajos aplicaron encuestas para identificar los principales criterios de evaluación de 3PL.

Con respecto al tipo de industria, 36% de los casos de estudio en los cuales se aplicaron las diferentes metodologías propuestas por los autores se refieren a empresas del sector automotriz, principalmente fabricantes de partes automotrices, un 22% no especifican la industria, el 12% de los artículos mencionan a la industria del sector electrónico y el porcentaje restante (30%) sugieren como ejemplo de aplicación otras industrias como la del consumo de bienes perecederos, ropa, minería, cemento, fabricación de muebles así como sectores relacionados con empresas de tercerización.

Tabla 2
Enfoques y métodos para la evaluación y selección de 3PL

Enfoque	Método de evaluación	Referencia
Cualitativo	Marco de referencia conceptual	Dubey *et al.* (2018)
	Enfoque meta-analítico	Leuschner *et al.* (2014)
	Revisión de literatura	Aguezzoul (2014)
	Estudio multi casos	Wolf y Seuring (2010)
	Rotación varimax	Jayaram y Tan (2010)
Cuantitativo	Análisis Envolvente de Datos Ocasional Restringido (CCDEA)	Azadi y Saen (2011)
Cualitativo / Cuantitativo	Análisis Envolvente de Datos (DEA)	Raut *et al.* (2018), Marchet *et al.* (2017), Haldar *et al.* (2017), Momeni *et al.* (2015), Falsini *et al.* (2012), Zhang *et al.* (2006)
	Proceso Analítico en Red (ANP)	Raut *et al.* (2018), Çelebi *et al.* (2010)
	Técnica Difusa para Orden de Preferencia por Similitud con Solución Ideal (TOPSIS)	Bianchini (2018), Haldar *et al.* (2017), Ilgin (2017), Yayla *et al.* (2015)
	Toma de decisiones interactiva y de criterios múltiples (TODIM)	Kumar Sen *et al.* (2017)
	Método de Organización de Clasificación de Preferencias para Evaluaciones Enriquecidas (PROMETHEE)	Kumar Sen *et al.* (2017), Wang *et al.* (2015), Chen *et al.* (2010)
	Importancia a través de la Correlación entre Criterios (CRITIC)	Ghorabaee *et al.* (2017)
	Evaluación del Producto de Suma Agregada Ponderada (WASPAS)	
	Laboratorio de Prueba y Evaluación en Entornos Grises para la Toma de (DEMATEL)	Govindan *et al.* (2016)
	Números Difusos con Valores de Intervalo (IVFNs)	Sahu *et al.* (2015)
	Despliegue de la Función de Calidad (QFD)	Perçin and Min (2013)
	Proceso Analítico de Jerarquía (AHP)	Bianchini (2018), Hwang *et al.* (2016), Falsini *et al.* (2012), Soh (2010), Zhang *et al.* (2006)
	Proceso Analítico de Jerarquía Difuso (AHP Difuso)	Ilgin (2017), Jung (2017), Ramírez-Flores *et al.*(2017)
	Buckley's AHP Difuso	Yayla *et al.* (2015)
	Regresión Lineal Difusa (FLR)	Perçin y Min (2013)
	Programación Multi Objetivo	
	Proceso de Red Analítica Difuso (ANP Difuso)	Wong (2012)
	Programación Entera de Metas con Preferencia Difusa (PFIGP)	
	Algoritmos genéticos	
	Modelos basados en conjuntos difusos	Li *et al.* (2012), Soh(2010), Liu and Wang (2009), Işiklar *et al.* (2007)
	Razonamiento Basado en Casos (CBR)	Işiklar *et al.* (2007)
	Razonamiento Basado en Reglas (RBR)	
	Análisis factorial	Tsamboulas and Kapros (2000)

Fuente: Elaboración propia.

4.3. Criterios de evaluación

Después de examinar cuidadosamente los trabajos, se identificó que con base en la revisión sistemática de los artículos, cada uno de los autores estudiados determinó una serie de criterios de evaluación en función de la problemática de estudio, para incorporarlos al modelo o método propuesto en su trabajo para seleccionar a un 3PL. En la mayoría de los trabajos se menciona que la forma de selección de los criterios se basó en encuestas y/o entrevistas con expertos (ventas, finanzas, logística y departamentos de producción). Por ejemplo, Wong (2012) presenta 130 criterios de evaluación. Sin embargo, la cantidad varía en cada trabajo, desde 5 hasta 130 criterios. Por lo tanto, en esta revisión sólo se presentan los criterios que se repiten más de dos veces por diferentes autores, obteniendo un total de 43 criterios (Figura 3). La Tabla 3 muestra los 10 criterios principales para la selección y evaluación de 3PL encontrados en este estudio, los cuales han sido aplicados con diferentes metodologías y tipos de industrias.

Tabla 3
Criterios para la evaluación y selección de 3PL

Criterios de evaluación	Autores	Metodologías utilizadas	Tipos de industria
Costo del servicio	Bianchini (2018); Raut *et al.* (2018); Kumar Sen *et al.* (2017); Ghorabaee *et al.* (2017); Haldar *et al.* (2017); Ilgin (2017); Jung (2017); Govindan *et al.* (2016); Hwang *et al.* (2016); Momeni *et al.* (2015); Wang *et al.* (2015); Yayla *et al.* (2015); Sahu *et al.* (2015); Perçin y Min (2013); Wong (2012); Falsini *et al.* (2012); Soh (2012); Çelebi *et al.* (2010); Chen *et al.* (2010); Liu y Wang (2009); Işiklar *et al.* (2007); Zhang *et al.* (2006); Tsamboulas y Kapros (2000)	AHP, TOPSIS, DEA, ANP, CRITIC,WASPAS, programación lineal, AHP difuso, simulación, DEMATEL, PROMETHEE, CBR, IVFN´s, QFD, FLR, FANP, lógica difusa, FD, FLA, enfoques híbridos, análisis de factores	Sector alimentario, minería, manufactura, industria del cemento, sector electrónico, comercio electrónico, automotriz, textil
Capacidad de tecnología de información/ sistemas de información	Dubey *et al.* (2018); Kumar Sen *et al.* (2017); Govindan *et al.* (2016); Wang *et al.* (2015); Yayla *et al.* (2015); Sahu *et al.* (2015); Perçin y Min (2013); Wong (2012); Li *et al.* (2012); Falsini *et al.* (2012); Soh (2012); Çelebi *et al.* (2010); Chen *et al.* (2010); Jayaram y Tan (2010); Liu y Wang (2009); Işiklar *et al.* (2007); Tsamboulas y Kapros (2000)	DEMATEL, PROMETHEE, CBR, IVF, QFD, FLR, FANP, lógica difusa, ANP, FD, FLA, enfoques híbridos, análisis de factores	Automotriz, textil, alimentaria
Envíos y entregas a tiempo	Raut *et al.* (2018); Kumar Sen *et al.* (2017); Ghorabaee *et al.* (2017); Ramirez-Flores *et al.* (2017); Govindan *et al.* (2016); Hwang *et al.* (2016); Momeni *et al.* (2015); Yayla *et al.* (2015); Wong (2012); Falsini *et al.* (2012); Çelebi *et al.* (2010); Chen *et al.* (2010); Jayaram y Tan (2010); Liu y Wang (2009); Işiklar *et al.* (2007)	CRITIC, WASPAS, DEMATEL, AHP, DEA, CBR, FANP, ANP, PROMETHEE, FD, FLA	Manufactura, automotriz, sector electrónico, textil, alimentaria
Estabilidad financiera	Ghorabaee *et al.* (2017); Govindan *et al.* (2016); Hwang *et al.* (2016); Wang *et al.* (2015); Yayla *et al.* (2015); Sahu *et al.* (2015); Wong (2012); Li *et al.* (2012); Soh (2012); Chen *et al.* (2010); Jayaram y Tan (2010); Liu y Wang (2009); Işiklar *et al.* (2007); Yan *et al.* (2003)	CRITIC, WASPAS, DEMATEL, AHP, CBR, IVFN´s, FANP, lógica difusa, PROMETHEE, FD, FLA, enfoques hibridos	Manufactura, automotriz, sector electrónico, textil
Flexibilidad y capacidad de respuesta	Raut *et al.* (2018); Kumar Sen *et al.* (2017); Ghorabaee *et al.* (2017); Haldar *et al.* (2017); Govindan *et al.* (2016); Hwang *et al.* (2016); Sahu *et al.* (2015); Perçin y Min (2013); Wong (2012); Falsini *et al.* (2012); Soh (2012); Chen *et al.* (2010); Jayaram y Tan (2010); Liu y Wang (2009); Tsamboulas y Kapros (2000)	DEA, TOPSIS, programación lineal, CRITIC, WASPAS, DEMATEL, AHP, IVFN´s, QFD, FLR, FANP, lógica difusa, FD, FLA, análisis de factores	Manufactura, industria del cemento, automotriz, sector electrónico, alimentaria
Nivel de calidad y eficiencia	Kumar Sen *et al.* (2017); Ghorabaee *et al.* (2017); Marchet *et al.* (2017); Ramirez-Flores *et al.* (2017); Govindan *et al.* (2016); Hwang *et al.* (2016); Perçin y Min (2013); Wong (2012); Li *et al.* (2012); Falsini *et al.* (2012); Wolf y Seuring (2010); Chen *et al.* (2010); Jayaram y Tan (2010); Liu y Wang (2009); Işiklar *et al.* (2007); Yan *et al.* (2003)	CRITIC, WASPAS, DEMATEL, AHP, QFD, FLR, FANP, DEA, PROMETHEE, FD, FI, enfoques híbridos	Manufactura, automotriz, sector electrónico, alimentaria
Nivel de servicio al cliente	Bianchini (2018); Raut *et al.* (2018); Kumar Sen *et al.* (2017); Govindan *et al.* (2016); Momeni *et al.* (2015); Wang *et al.* (2015); Wong (2012); Li *et al.* (2012); Chen *et al.* (2010); Jayaram y Tan (2010); Liu y Wang (2009); Zhang *et al.* (2006); Tsamboulas y Kapros (2000)	DEMATEL, DEA, PROMETHEE, FANP, FD, FLA, análisis de factores	Automotriz
Experiencia en la industria	Bianchini (2018); Marchet *et al.* (2017); Hwang *et al.* (2016); Wang *et al.* (2015); Sahu *et al.* (2015); Perçin y Min (2013); Wong (2012); Li *et al.* (2012); Soh (2012); Jayaram y Tan (2010); Liu y Wang (2009); Zhang *et al.* (2006); Tsamboulas y Kapros (2000)	AHP, PROMETHEE, IVFN´s, QFD, FLR, FANP, lógica difusa, FD, FLA, análisis de factores	Automotriz, sector electrónico
Integración de la información	Dubey *et al.* (2018); Hwang *et al.* (2016); Sahu *et al.* (2015); Perçin y Min (2013); Wong (2012); Li *et al.* (2012); Falsini *et al.* (2012); Çelebi *et al.* (2010); Jayaram y Tan (2010); Zhang *et al.* (2006); Yan *et al.* (2003)	AHP, IVFN´s, QFD, FLR, FANP, DEA, ANP	Automotriz, sector electrónico
Ubicación geográfica	Bianchini (2018); Govindan *et al.* (2016); Wang *et al.* (2015); Perçin y Min (2013); Wong (2012); Chen *et al.* (2010); Liu y Wang (2009); Zhang *et al.* (2006); Yan *et al.* (2003);	DEMATEL, PROMETHEE, QFD, FLR, FANP, FD, FLA	Automotriz

Fuente: Elaboración propia.

Con el fin de identificar los criterios clave que se han utilizado en el proceso de selección de proveedores de servicios 3PL, esta revisión muestra que el «costo» es el criterio más adoptado, ya que, el 75% (25) de los artículos considera este criterio en su metodología de evaluación. Por otra parte, la disponibilidad de tecnologías de la información y sistemas de información (TI/SI) se han convertido en el centro de las capacidades que son esenciales para que los clientes y los 3PL puedan gestionar de manera efectiva la cadena de suministro, de tal forma que, la capacidad de TI/SI es el segundo criterio más utilizado en 60% (20) de los trabajos. Como menciona Gong *et al.* (2018) las capacidades de tecnología de la información son un factor relevante para la ventaja competitiva de sectores como el de la logística y en particular de los 3PL.

Los envíos y entregas a tiempo son otro de los principales desafíos en las operaciones actuales de la logística y la cadena de suministro. Estos desafíos provienen de varios factores como el e-comercio, expectativas más altas del cliente y ciclos de vida más cortos del producto. En este sentido, los envíos y entregas a tiempo es el tercer criterio más utilizado, ya que es mencionado en 54% (18) de los artículos.

Los criterios de estabilidad financiera, flexibilidad y respuesta, y nivel de calidad y eficiencia son utilizados en 48% (16) de los trabajos, seguidos de nivel de servicio al cliente con el 42% (14), integración de la información y experiencia de la industria con el 39% (13), ubicación geográfica con el 33% (11), disponibilidad de talento calificado con el 30% (10). El resto de los criterios son utilizados en menos del 28% (9) de los artículos citados.

En el sector 3PL, las preocupaciones ambientales se han vuelto más estrictas debido a que las actividades de transporte y logística son el segundo mayor contribuyente a las emisiones de gases de efecto invernadero después de la producción de electricidad (Evangelista *et al.* 2018). En este sentido, sólo el 12% (4) de los trabajos consideran el criterio «desempeño ambiental» como un criterio clave para evaluar a los 3PL.

Además de identificar los criterios de evaluación utilizados en los artículos, se analizó la forma en cómo fueron elegidos considerando tres enfoques: (1) a través de una revisión de la literatura, (2) una encuesta, (3) entrevista con expertos en logística y académicos. De los 33 artículos, 15 (45%) de los trabajos realizaron una revisión de la literatura para identificar los criterios, 15 (45%) aplicaron una encuesta, y 16 (48%) realizaron una entrevista con expertos para identificar y depurar los criterios de evaluación.

5. CONCLUSIONES

El presente trabajo contribuye a la investigación de varias maneras. En primer lugar, nuestro estudio contribuye a la literatura sobre los criterios que se han aplicado de forma implícita o explícita para evaluar y seleccionar al mejor proveedor de logística externa. Esta investigación es una respuesta a los desafíos que están enfrentando las empresas debido la globalización de las actividades comerciales y a las nuevas tendencias digitales. Como se analizó en este estudio, la evaluación y selección de un 3PL es una decisión muy crítica y compleja debido a la existencia de varios criterios de base imprecisa y subjetiva, tales como: la credibilidad y cultura, reputación, respuesta a problemas, innovación y confiabilidad en los datos. Además, la incertidumbre es una parte inevitable de la información en el proceso de toma de decisiones y su importancia en el proceso de selección es relativamente alta y debe considerarse cuidadosamente

Estudios previos realizados por Marasco (2008) sugieren que la investigación alrededor de las operaciones que realizan los proveedores logísticos ha provocado un creciente interés. En nuestra muestra se observa un crecimiento en las publicaciones en torno a los 3PL a partir del 2009.

Para realizar operaciones de tercerización logística, los proveedores de 3PL deben evaluarse con respecto a los criterios de selección de la empresa. El proceso de evaluación y selección de los proveedores de 3PL puede definirse como un problema de Toma de Decisiones Multi-Criterio. El reto de proceso de evaluación y selección implica información difusa que no puede abordarse mediante valores nítidos, de tal forma que, en nuestra revisión, encontramos 21 métodos diferentes que se han aplicado para evaluar y seleccionar a los proveedores 3Pl, en donde AHP, TOPSIS, ANP y PROMETHEE son los más utilizados. Además, nuestros resultados muestran que los enfoques híbridos que integran técnicas difusas con otros modelos de toma de decisiones para la evaluación y selección de 3PL son los que poseen una considerable influencia sobre otras investigaciones, teniendo estos el mayor número de citas y, por consiguiente, constituyen una tendencia para investigaciones futuras.

En cuanto a los criterios que se utilizan en la evaluación, se observa que la tendencia en los procesos de evaluación de 3PL se basa en un considerable número de atributos cada uno dependiendo de las características propias del sector industrial en el cual se aplican.

En nuestros resultados, uno de los principales factores que determina la selección de un 3PL es el costo del servicio, seguido de la capacidad de tecnología de la información. Esta última es sin duda un factor importante para las empresas porque les permite optimizar sus operaciones, considerando además que las inversiones de un proveedor 3PL en su infraestructura de TI y recursos humanos de TI son necesarias para desarrollar capacidades superiores que les permitan mejorar su ventaja competitiva en la industria de la logística, y a su vez, contribuyan al rendimiento de la empresa.

Por otra parte, se identificó que los criterios relacionados con la sostenibilidad son una tendencia para desarrollar nuevas líneas de investigación y además se presentan como una necesidad actual a considerar sobre otros criterios básicos basados en el costo, relación, servicio, calidad, flexibilidad y entrega.

En cuanto a la industria o sector en donde se aplican los modelos propuestos en este estudio, la mayor parte de contribuciones se tienen en sectores relacionados con casos de estudios en la manufactura de países localizados en Asia y Europa, principalmente relacionados con el sector automotriz y la fabricación de componentes electrónicos.

La estrategia de tener socios 3PL en la cadena de suministro tiene una importancia creciente en todo el mundo, ya que esta asociación permite a las empresas reducir costos, centrarse en sus principales actividades de diferenciación y, en consecuencia, les permite alcanzar niveles más altos de rendimiento. Sin embargo, los 3PL soportan una gran presión para satisfacer las

necesidades de sus clientes: los clientes demandan tiempos de entrega más cortos y envíos a diferentes partes del mundo, a precios más bajos. Además, la fuerte competencia en el sector logístico está obligando a las empresas 3PL a evaluar su desempeño para cumplir con la eficiencia operativa de la logística y para ser más competitivos en la industria. De tal forma que, después de evaluar, seleccionar y contratar a un 3PL, existe la necesidad de desarrollar un modelo que les permita identificar los indicadores clave de desempeño logístico y determinar sus interrelaciones con el objetivo de supervisar las operaciones y el desempeño de los proveedores 3PL.

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ANEXO

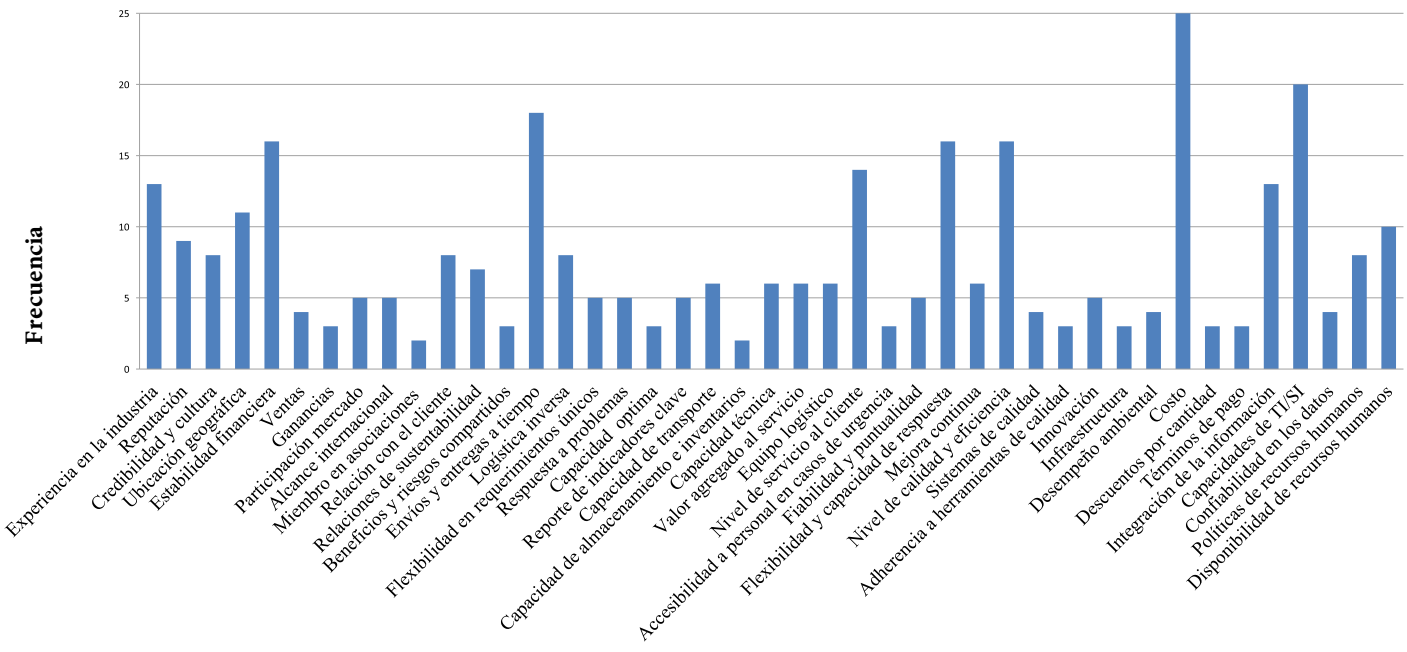

Figura 3
Criterios de selección 3PL
Fuente: Elaboración propia.

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Life settlements: análisis descriptivo y aspectos cuantitativos

Life settlements: descriptive analysis and quantitative aspects

Jorge De Andrés-Sánchez[a], Laura González-Vila Puchades[*]

[a] *Social and Business Research Laboratory. Departamento de Gestión de Empresas. Universidad Rovira i Virgili. Av. de la Universitat 1, 43204 Reus (España) – jorge.deandres@urv.cat – http://orcid.org/0000-0002-7715-779X*

[*] ***Corresponding author**: Departamento de Matemática Económica, Financiera y Actuarial. Universidad de Barcelona. Av. Diagonal 690, 08034 Barcelona (España) – lgonzalezv@ub.edu – http://orcid.org/0000-0003-4824-5894*

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RESUMEN

Un *life settlement* es una transacción financiera por la que el tomador de un seguro de vida, pagadero al fallecimiento del asegurado, vende su póliza a un inversor por un precio superior al que obtendría en caso de rescatar dicha póliza. De esta forma, el inversor asume el compromiso de pagar, si existen, las primas pendientes y adquiere el derecho de cobro de la suma asegurada cuando el asegurado fallezca. En el presente trabajo se realiza tanto un análisis descriptivo de este tipo de transacciones, como un estudio de sus principales aspectos cuantitativos. Así, entre otros aspectos, se ofrece una visión general del producto y se describen sus principales actores, la naturaleza de los parámetros que intervienen en su valor y los riesgos asociados en relación a éste. Desde el punto de vista cuantitativo, se introduce una nueva forma de analizar la sensibilidad del precio de un *life settlement* frente a variaciones de la esperanza de vida del asegurado. En efecto, extendemos los indicadores duración y convexidad de Stone y Zissu (2008), que usan un enfoque determinista, al marco analítico que proporciona el método de valoración denominado probabilístico y proponemos medir la sensibilidad del valor de este producto frente a variaciones del multiplicador de la probabilidad de mortalidad del asegurado, y no de su esperanza de vida. Asimismo, se describe la aplicabilidad de las nuevas medidas para la gestión de riesgos.

Palabras clave: Life settlement, Seguro de vida, Esperanza de vida, Análisis de sensibilidad, Multiplicador de mortalidad.

ABSTRACT

A life settlement is a financial transaction by which an existing life insurance policy is sold to an investor for a greater price than its cash surrender value. In this way, the investor undertakes to pay, if any, the outstanding premiums and has the right to receive the death benefit when the insured dies. This work carries out a descriptive analysis of this type of transaction and a study of its main quantitative aspects. Thus, among other aspects, an overview of the product is offered and its main agents, the nature of the parameters involved in its value and the risks related to it are described. In regards to the quantitative point of view, a new way of analysing the sensitivity of the price of a life settlement to changes in the insured's life expectancy is introduced. Indeed, we extend the duration and convexity indicators of Stone and Zissu (2008), which use a deterministic approach, to the analytical framework provided by the probabilistic valuation method. Then, we propose to measure the sensitivity of this product to changes in the insured's mortality multiplier, and not in their life expectancy. The paper also describes the applicability of the new measures for risk management purposes.

Keywords: Life settlement, Life insurance, Life expectancy, Sensitivity analysis, Mortality multiplier.

1. INTRODUCCIÓN

El presente trabajo analiza un producto del ramo de vida asociado, habitualmente, a personas con una esperanza de vida (EV) inferior a la que podría imputárseles según su edad y sexo: los *life settlements*[1] (*LSs*). Siguiendo a Ingraham y Salani (2004), los *LSs* pueden definirse, de forma básica, como la venta de una póliza, por parte del tomador de un seguro de vida en caso de fallecimiento, a un inversor. Éste, por su parte, asume el compromiso de pagar las primas pendientes y adquiere el derecho de cobro de la suma asegurada cuando el asegurado fallezca.

Tal y como señalan Mendoza y Monjas (2011), el volumen de primas brutas de seguros de vida sobre el PIB en España es muy inferior al del promedio de los países de la UE15, EE.UU. o Reino Unido. Además, según indica el Servicio de Estudios de MAPFRE (2019), la evolución del grado de penetración (medido como la ratio entre primas y PIB) del seguro de vida riesgo (asociado únicamente al fallecimiento del asegurado) se sitúa, en nuestro país, en valores muchos menores al del seguro de ahorro (relativo a la supervivencia del asegurado), con un valor del 0,39% en 2018.

Las transacciones de *LSs* configuran un mercado secundario de pólizas de seguros que permite a los tomadores, si la salud del asegurado presenta una EV por debajo del promedio, vender dichas pólizas anticipadamente por un valor superior al de rescate. Así, el mercado de *LSs* pone fin al monopsonio de los aseguradores, situación en que son los únicos compradores posibles de sus pólizas emitidas con anterioridad (Ingraham y Salani 2004). Por otra parte, como afirman Doherty y Singer (2003), el mercado de *LSs* permite dotar de mayor liquidez a los seguros, lo que acaba generando una mayor demanda y eficiencia en su mercado primario.

La posible implantación de un mercado de *LSs* en España, analizada detalladamente en Mendoza y Monjas (2011), supone un desafío para el sector asegurador, pero, a la vez, una oportunidad para la expansión de su negocio. Además, la actual situación demográfica (con pirámides poblacionales de tipo romboidal, un incremento a medio plazo sin precedentes de la población jubilada por el acceso de los *baby boomers* a su jubilación, etc.) demanda a este sector a realizar un notable esfuerzo de innovación en los productos del ramo de vida. Por otra parte, si bien un contexto de bajos tipos de interés reduce el atractivo de estos productos ya que su rentabilidad suele estar muy ligada a la de la deuda pública, su capacidad para diseñar estrategias de previsión les proporciona una gran oportunidad para alcanzar más relevancia en el ahorro de las familias. El objetivo de un seguro de vida en el mercado primario consiste en proporcionar protección económica ante el fallecimiento de una persona, no cubrir su longevidad. Sin embargo, la posibilidad de vender la póliza de seguro mediante un *LSs* proporciona una mayor versatilidad al seguro de vida. En efecto, aparte de cubrir la posibilidad de fallecimiento, este producto puede realizar la función de fondo de ahorro que ha cubierto la contingencia de mortalidad mientras ha sido necesario (hijos menores a cargo del asegurado, hipoteca sobre la vivienda familiar, etc.) y que se revaloriza por encima de su valor de rescate ante una pérdida de salud importante del asegurado que le lleve, incluso, a situaciones de dependencia, lo cual es mucho más probable en edades posteriores a la jubilación. La mayor parte de transacciones de *LSs* corresponden a contratos de personas jubiladas con una mortalidad por encima de la estándar (Rosenfeld 2009). De hecho, según Doherty y Singer (2004), las motivaciones que llevan a los tomadores (asegurados) de seguros de vida a liquidarlos vía *LSs* están vinculadas a la jubilación: se quiere reemplazar la cobertura de fallecimiento, que ya no se considera necesaria, por una renta de jubilación que permita mejorar el nivel de vida; se desea mejorar el cuidado de la salud contratando un seguro de cobertura médica; y, en el caso de enfermedad grave, se pretende acceder a tratamientos médicos novedosos y, probablemente, más costosos que los tradicionales.

El resto del trabajo ha sido estructurado como se indica a continuación. En la sección 2 se ofrece un análisis descriptivo de los *LSs* que incluye, entre otros aspectos, una visión general del producto, los principales actores en este tipo de transacciones, la naturaleza de los parámetros que intervienen en su valor económico (o, simplemente, valor), los riesgos asociados, etc. La sección 3 se centra en los aspectos cuantitativos de los *LSs*. Así, se indica cómo se determinan las dos magnitudes que afectan a su valoración (EV y TIR), se describen los tres métodos de determinación del precio de estos acuerdos y, finalmente, se introduce una nueva forma de analizar la sensibilidad de dicho precio frente a variaciones de la EV del asegurado. En efecto, extendemos los indicadores duración y sensibilidad de Stone y Zissu (2008), que usan un enfoque determinista, al marco analítico del método de valoración probabilístico, más correcto desde el punto de vista de la matemática actuarial, y proponemos medir la sensibilidad del valor de un *LS* frente a variaciones del factor de riesgo que induce modificaciones de la EV y no directamente sobre las posibles variaciones de esta última. Asimismo, reflexionamos sobre la aplicabilidad de dichos indicadores en la medición y control del riesgo. La última sección recoge las conclusiones del trabajo.

2. *LIFE SETTLEMENTS*: CONCEPTO Y FUNCIONAMIENTO

2.1. *Definición y visión general de los* life settlements

Un *LS* es un acuerdo en el que un tomador de un seguro de vida (habitualmente para caso de fallecimiento) transfiere la propiedad de la póliza a un tercero. El comprador adquiere el derecho de cobro de las prestaciones convenidas entre el asegurador y el tomador y la obligación de satisfacer las primas pendientes. En el mercado de *LSs* más importante, el de los EE.UU., las pólizas que se negocian habitualmente son seguros universales y de vida entera.

Según Braun *et al.* (2019), el inicio del mercado de *LSs* en EE.UU. se basa en la sentencia Grigsby vs. Russell de 1911 de la Corte Suprema de ese país, que estableció que una póliza de

[1] La traducción literal de *life settlement* es «acuerdo de vida» y así lo traducen Mendoza y Monjas (2011). Dada la inexistencia de este producto en el mercado español, hemos optado por mantener su denominación anglosajona.

vida es un activo que, como cualquier otro, puede venderse por su poseedor a una tercera parte. En cualquier caso, según Giacalone (2001), no es hasta los años 80 del siglo pasado cuando empieza su expansión con los denominados *viatical settlements*[2] (*VS*s), denominación que tienen los *LSs* cuando el asegurado es un enfermo terminal. La epidemia de SIDA iniciada en dicha década, que era entonces una enfermedad incurable y detectable sólo en fase terminal, provocó que los afectados buscaran hacer líquidos sus activos para hacer frente a los costosos e inefectivos tratamientos existentes. La liquidación de las pólizas de vida se realizaba mediante los *VS*s. MacMinn y Zhu (2017) indican que, a partir de los años 90, debido a los avances médicos, el SIDA deja de ser una enfermedad terminal y los *VS*s sobre dicha enfermedad declinan, empezando entonces el crecimiento de los *LSs*. En las operaciones de *LSs* los asegurados no son enfermos terminales, pero sí suelen ser personas mayores de 65 años con circunstancias relativas a su salud que sitúan su EV por debajo del estándar según su edad y sexo (Giacalone 2001). El estímulo para el tomador por establecer acuerdos *LSs*, en lugar de ejercer el rescate, viene dado por el mayor precio de venta que puede obtenerse con los primeros, ya que el precio es calculado con la EV real, situada por debajo del promedio. En cambio, el valor de rescate se obtiene a partir de una EV estándar. Así, Ingraham y Salani (2004) afirman que los tomadores pueden llegar a obtener precios de hasta 4,5 veces mayores en el mercado secundario de *LSs* que con el rescate.

Sin duda, el principal mercado de *LSs* es el de EE.UU., pero no es el único pues estos acuerdos tienen cierta presencia en otros países tales como Alemania, Reino Unido o Japón (Gatzert 2010; Mendoza y Monjas 2011). Tampoco es el más antiguo. Gatzert (2010) data la primera transacción de *LSs* en Reino Unido en el año 1844, fijándose el precio de ésta mediante un procedimiento de subasta.

Asimismo, en varios de estos países los seguros objeto de transacción no son necesariamente los de fallecimiento. Así, en Reino Unido y Alemania las pólizas objeto de negociación suelen ser seguros mixtos (*endowments*) donde el capital de supervivencia puede revalorizarse en función de las ganancias que obtiene el asegurador con la inversión de las primas. En estos seguros una parte o el total de esta revalorización únicamente es realizable en caso de que el seguro no sea cancelado anticipadamente. Si el tomador quiere liquidar anticipadamente (rescatar) el seguro y no quiere perder la revalorización que ha ido consolidando, la única alternativa que se le presenta es la venta del seguro en el mercado secundario. Así, el contrato suscrito en el mercado primario queda en vigor, aunque el propietario final es un inversor y no el tomador original. Gatzert (2010) estima que en Reino Unido los tomadores obtienen un precio en las ventas de las pólizas un 10-15% superiores a su valor de rescate, mientras que en Alemania esta ganancia ronda el 7%. En este caso, los *LSs* tienen un bajo componente actuarial y se asemejan a la venta de activos estrictamente financieros como, por ejemplo, participaciones de fondos de inversión. De hecho, tal como indica Gatzert (2010), las motivaciones y el perfil del tomador en los *LSs* en EE.UU. y en Reino Unido o Alemania son radicalmente diferentes. Mientras que en EE.UU. el originador suele ser una persona mayor de 65 cuya frágil salud le permite liquidar la póliza en condiciones ventajosas y asignar el efectivo obtenido a alternativas que en ese momento pueden tener mayor interés, como por ejemplo[3] la contratación de un seguro de asistencia médica, en Alemania y Reino Unido la decisión tiene un carácter meramente financiero como, por ejemplo, hacer frente a deudas o una situación de paro de larga duración.

Centrándose en España, donde actualmente este tipo de acuerdos no existen, Mendoza y Monjas (2011) indican que no hay impedimentos normativos que descarten este tipo de operaciones, ya que nada prohíbe al tomador cambiar al beneficiario de la póliza una vez que ésta se ha iniciado. También señalan que la experiencia del sector asegurador en el manejo de nuevos productos financieros es un acicate para implantar este tipo de acuerdos. Por el contrario, la inexistencia de un mercado de derivados e índices de longevidad es un escollo importante para la implantación de este tipo de operaciones, que necesitan de los derivados sobre vida para modular su riesgo. Asimismo, siguiendo a Gatzert *et al.* (2009), el desarrollo de los *LSs* requiere una profundidad del mercado primario de seguro que, tal como sugiere el Servicio de Estudios de MAPFRE (2019) e indican los datos de Mendoza y Monjas (2011), el mercado español no posee, tanto si lo medimos como volumen absoluto de primas como si se mide por la proporción primas/PIB.

En este trabajo nos centramos, únicamente, en los *LSs* sobre pólizas con prestaciones de fallecimiento en las que el riesgo principal para el inversor que las adquiere es el riesgo de longevidad asociado a que el asegurado viva más de lo que se estimó en el momento de dicha compra.

2.2. *Procedimiento, actores y viabilidad de los* life settlements

La literatura sobre *LSs* distingue tres mercados: primario, secundario y terciario. En el mercado primario los tomadores contratan una póliza con una compañía de seguros. En el secundario, el tomador vende la póliza a un proveedor de *LSs* autorizado para operar con este tipo de productos y éste, a su vez, transfiere la póliza a los inversores finales. En el mercado terciario hay compra-venta de contratos de seguros entre inversores. Tal como indican Jori *et al.* (2010), es común que los proveedores de *LSs* que adquieren las pólizas movilicen parte de su cartera de seguros mediante su titulización. Así, en este último segmento es tan común la negociación de títulos respaldados por los cobros potenciales de las pólizas originarias como lo es la negociación de pólizas.

[2] La traducción literal de *viatical* (del latín *viaticum*) *settlement* es «acuerdo viático». Según el diccionario online Collins (2019), *viaticum* tiene dos acepciones aplicables al caso que nos ocupa. La primera es la suma de dinero que se proporciona a una persona para hacer frente a los gastos de un viaje o una tarea. La segunda, eclesiástica, es la Eucaristía que se suministra a los moribundos o las personas en peligro de muerte. Nuevamente, hemos optado por utilizar su denominación anglosajona. https://www.collinsdictionary.com/es/diccionario/ingles/viaticum. [Acceso 04/08/2019]

[3] Ver Freedman y Young (2015) para una enumeración exhaustiva.

El Gráfico 1 representa el proceso de un *LS*. Por parte de la venta observamos al *tomador* del seguro que, a través de un *bróker*, buscará en el mercado el mejor precio para su póliza. Su *mediador de seguros* debe haberle informado al contratar la póliza sobre la existencia de los acuerdos *LSs* como alternativa al rescate. Los intermediarios de la parte compradora son los *proveedores* de *LSs* que adquieren los seguros en nombre de inversores institucionales (fondos de *LSs*, fondos especializados en inversiones alternativas, compañías de seguros, etc.). Estos últimos negocian con su cartera en los mercados terciarios.

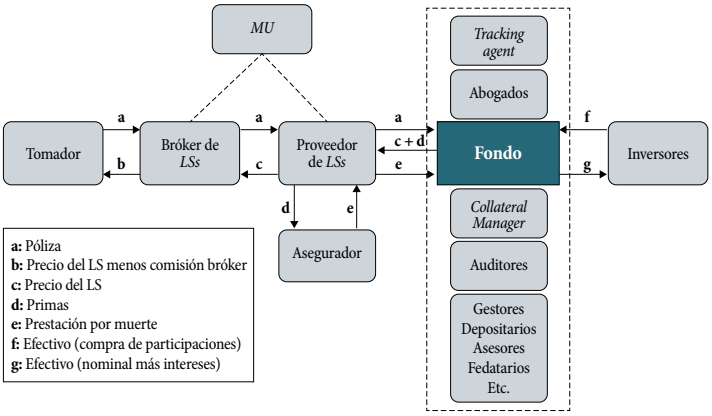

Gráfico 1
Proceso de una transacción de *LS*

Nota: La descripción más detallada de la labor principal de los distintos agentes que intervienen en una operación de *LS* puede consultarse, por ejemplo, en AM Best Company (2016).

Fuente: Elaboración propia a partir de AM Best Company (2016) y Braun *et al.* (2016).

La complejidad de ejecución de *LSs* implica la intervención de diversos agentes que facilitan que se desarrolle con las máximas garantías para todas las partes. Un servicio fundamental es el que proporcionan los *medical underwriters*[4] (*MUs*), profesionales o empresas especializados en estimar la EV del asegurado, que realizan y venden estimaciones de mortalidad y EV para la valoración de las pólizas. Tanto los brókeres de *LSs* como los proveedores de *LSs* compran estas estimaciones para determinar un precio para la póliza. Los *MUs* hacen las estimaciones de EV utilizando una combinación de expertos como médicos y enfermeras, actuarios de vida, etc. Asimismo, también cumplen su función los *gestores* del pago de primas, comunicando los fallecimientos y haciendo un seguimiento de la salud de las personas aseguradas; los *depositarios* de los documentos que se generan en los acuerdos; los *asesores legales* independientes; los *fedatarios públicos*; etc.

La descripción del proceso de un *LS* permite intuir que no todo seguro cuyo asegurado tenga una EV por debajo de la estándar es susceptible de ser negociado en el mercado de *LSs*. Si bien, la valoración de la póliza a vender en un *LS* es más favorable desde el punto de vista de las probabilidades utilizadas que la realizada mediante el valor de rescate (pues la primera utiliza unas probabilidades de fallecimiento mayores), dicha valoración se produce a un interés superior al técnico (utilizado para tarifar la póliza y para el cálculo del valor de rescate) y pueden presentarse unas comisiones más elevadas que las asociadas al rescate. Con independencia de que se rescate un seguro o se valore para su venta en el mercado secundario, podemos definir como valor de una póliza contratada hace t años, antes de comisiones, para un asegurado de edad actual x, como:

$$VP_x = \sum_{k=1}^{\omega-x} C_{t+k}(1+r)^{-k}\ {}_{k-1|}q_x - \sum_{k=1}^{\omega-x} P_{t+k}(1+r)^{-k}\ {}_k p_x \qquad (1)$$

donde se considera que el seguro es de vida entera, que la prestación se paga al final del año en que ocurre el fallecimiento del asegurado, que las primas se pagan mientras éste viva y que:

- C_{t+k} y P_{t+k}, prestación por fallecimiento y primas, respectivamente, pagaderas al final del año $t + k$ del contrato;
- r, tipo de interés utilizado en la valoración del contrato, siendo el interés técnico en el caso de rescate y la TIR (rentabilidad esperada) en el caso de *LS*;
- ${}_{k-1|}q_x$, probabilidad de que el asegurado de edad actual x fallezca entre las edades $[x + k - 1, x + k[$, usándose la probabilidad estándar en el caso de rescate y la corregida en el caso de *LS*;
- ${}_k p_x$, probabilidad de que el asegurado de edad actual x llegue vivo a la edad $x + k$, usándose la probabilidad estándar en el caso de rescate y la corregida en el caso de *LS*;
- ω, infinito actuarial (máxima edad posible según las tablas de mortalidad estándar).

En el caso en que el tipo de interés y las probabilidades utilizadas sean, respectivamente, el interés técnico del asegurador y las probabilidades estándar, VP_x es la provisión matemática pura del seguro, que denotamos por V_x.

Para obtener el importe que el vendedor de la póliza (tomador) obtiene efectivamente, debería deducirse de V_x las comisiones asociadas al rescate o a la venta mediante un *LS*. Así, el valor de rescate VR_x es aproximado por algunos autores como Gatzert *et al.* (2009) como:

$$VR_x = V_x\left(1 - \frac{\omega - x}{\omega - x^*}\right) \qquad (2)$$

Siendo x^* la edad del asegurado en la fecha de contratación del seguro, es decir, $x^* = x - t$.

[4] No existe una traducción literal de *medical underwriter* que refleje la labor de este tipo de profesional. Podrían decirse que sus labores principales son dos. Por una parte, en el momento de contratación de una póliza, analiza las condiciones de salud de una persona para determinar si su supervivencia o mortalidad es asegurable y bajo qué términos. Por otra, para una persona ya asegurada, estima su EV en base a las condiciones de salud que hayan aparecido con posterioridad a la contratación de la póliza. El informe de EV, que se ofrece para los mercados secundario y terciario, suele incluir la estimación de la EV, así como la probabilidad de fallecimiento de cada año en función de los factores específicos del asegurado.

Tabla 1
Cuantificación y naturaleza de los parámetros en el valor de rescate y en el valor del *LS*

Parámetro	Rescate	LS
Primas y prestaciones pendientes	Los pactados entre tomador y asegurador	Los pactados entre tomador y asegurador
Probabilidades de vida y fallecimiento	Basadas en una tabla de mortalidad estándar	Estimadas por un *MU*. Se calculan ad-hoc para cada póliza susceptible de negociarse en *LS* corrigiendo una tabla de mortalidad estándar
Tipo de interés de valoración	El tipo técnico asegurador. En muchos países de la OCDE como en España, difícilmente supera el 1%	La rentabilidad negociada entre brókeres y proveedores. Según Januário y Naik (2013), la TIR suele suponer una prima de riesgo promedio de 1500 puntos básicos sobre la TIR de la deuda pública. No obstante, en Braun y Xu (2019) se comenta que sobre dicha prima inciden numerosos factores que provocan que en el mercado exista una gran variabilidad de la misma
Gastos	Básicamente los de gestión no amortizados. Difícilmente superan el 20% y para pólizas de cierta antigüedad pueden no ser superiores al 5%	Todos los necesarios para soportar la arquitectura de un *LS*. Suelen ser superiores a los de rescate

Fuente: Elaboración propia a partir de Rosenfeld (2009), Gatzer *et al.* (2009), Januário y Naik (2013), Braun y Xu (2019) y Xu (2019).

La Tabla 1 muestra la diferente cuantificación y naturaleza de los parámetros que se consideran en (1) y (2), lo que acabará decantando, cuando se busca liquidar anticipadamente el seguro, realizar el *LS* a partir de su valor económico, VEP_x, definido en (10), o, por el contrario, ejecutar el valor de rescate. Así, tal como indican Braun *et al.* (2019), el mercado de *LSs* tiende a preferir pólizas de duración ilimitada de asegurados con EV reducida. En efecto, la mayor parte de transacciones se realizan en asegurados mayores de 65 años, con salud por debajo de la estándar. Por otra parte, son preferibles seguros con una ratio primas pendientes/prestación reducida. Es decir, los inversores prefieren seguros pactados a prima única a los seguros con prima nivelada, y éstos a seguros con una estructura de primas crecientes. Por otra parte, dado que varios de los gastos asociados a las operaciones de los *LSs* son fijos e independientes del capital asegurado, la factibilidad de las operaciones de *LSs* aumenta a medida que aumenta dicho capital.

Caso práctico. A continuación, desarrollamos un caso práctico para un hombre que suscribe un seguro de vida entera, pagadero al final del año de fallecimiento, a la edad de $x^* = 45$ años. La(s) prima(s) se calcula(n) con las Tablas de Mortalidad de la Población Asegurada Española PASEM 2010, un tipo de interés técnico $r = 1{,}5\%$ y un capital asegurado de 1.000€. La prima única a satisfacer, Π_{45}, se calcula planteando:

$$\Pi_{45} = 1.000 \cdot A_{45} = 1.000 \cdot \sum_{k=0}^{\omega-45} 1{,}015^{-(k+1)}\, {}_{k|}q_{45} = 620{,}20€$$

En cambio, la prima prepagable, nivelada o constante, pagadera mientras viva el asegurado, P_{45}, surge de plantear:

$$P_{45} \cdot \ddot{a}_{45} = 1.000 \cdot A_{45} \Rightarrow P_{45} \cdot \sum_{k=0}^{\omega-45} 1{,}015^{-k}\, {}_k p_{45} = 1.000 \cdot A_{45} \Rightarrow P_{45} = 23{,}84€$$

Con los resultados de la Tabla 2 podemos sopesar hasta qué punto es más favorable para el tomador rescatar o vender la póliza en el momento de cumplir las edades $x = 60$, 65, 70 y 75. Para el cálculo de la provisión matemática y el valor de rescate se usan las probabilidades de mortalidad anuales estándar. Se ha considerado, sin embargo, que en el momento de venta del seguro estas probabilidades se han de aumentar con un multiplicador de mortalidad, tal como se define en (5), $\beta = 8{,}85$, como consecuencia de una EV del asegurado por debajo de la promedio. Además, para obtener el valor económico del seguro en el mercado de *LSs* se usa una TIR del 12%.

Tabla 2
Provisión matemática (V_x), valor de rescate (VR_x) y valor económico (VPE_x) de un seguro vida entera contratado por un hombre a la edad de $x^* = 45$ años, cuando éste cumple $x = 60$, 65, 70 y 75 años

	$x = 60$				$x = 65$			
	V_{60}	VR_{60}	VEP_{60}	$VEP_{60} - VR_{60}$	V_{65}	VR_{65}	VEP_{65}	$VEP_{65} - VR_{65}$
Prima nivelada	357,72	302,43	421,29	118,86	474,41	408,28	528,71	120,43
Prima única	748,54	632,86	512,27	–120,59	793,40	682,81	601,03	–81,78
	$x = 70$				$x = 75$			
	V_{70}	VR_{70}	VEP_{70}	$VEP_{70} - VR_{70}$	V_{75}	VR_{75}	VEP_{75}	$VEP_{75} - VR_{75}$
Prima nivelada	594,59	520,72	674,77	154,05	707,44	630,26	818,48	188,22
Prima única	839,60	735,28	721,71	–13,57	882,97	786,65	840,45	53,80

Nota: V_x y VR_x se han obtenido con las expresiones (1) y (2) y las bases técnicas originales (PASEM 2010 e interés técnico del 1,5%), mientras que VEP_x se ha calculado a partir de (1) con *TIR*=12% y un factor multiplicador en las PASEM 2010 $\beta = 8{,}85$.

Fuente: Elaboración propia.

La diferencia entre el valor económico del seguro (VEP_x) y su valor de rescate (VR_x), columna $VEP_x - VR_x$, nos da una primera indicación de la posible idoneidad del seguro para ser vendido en *LS*. Un valor negativo, que se da en los seguros pactados a prima única cuando la venta es hasta $x = 70$ años, supone descartar automáticamente la venta del seguro en el mercado secundario. Debemos indicar, sin embargo, que a un seguro pactado a prima única debería repercutírsele en el precio del *LS* un tipo de interés inferior que al que le queden primas por satisfacer[5]. Asimismo, un valor positivo de $VEP_x - VR_x$ no necesariamente supone que el *LS* sea viable, sino que indica el margen que tienen los diferentes intervinientes en una transacción de *LS* para repercutir sus comisiones y costes y que la operación sea factible. Podemos observar que a medida que el asegurado tiene mayor edad, la operación de *LS* parece ser más factible ya que existe un mayor margen para repercutir comisiones.

2.3. *Riesgos asociados a los* life settlements

Como en cualquier activo financiero, los inversores en *LSs* están expuestos a un conjunto de riesgos que pueden disminuir la rentabilidad inicialmente esperada, es decir, la TIR con la que se halla su precio. Obviamente, la TIR exigida a la póliza aumenta a medida que el riesgo de la póliza sea mayor. El principal riesgo de un *LS* es el *riesgo de longevidad*, debido a la eventualidad de que el asegurado del contrato suscrito en el mercado primario viva por encima de su EV. En este sentido, cabe remarcar que, además de que las estimaciones de las EV por parte de las cuatro empresas más importantes dedicadas a ello en el mercado de EE.UU. (AVS Underwriting, LLC; Fasano Associates, Inc.; ITM TwentyFirst, LLC y Longevity Services, Inc.) no pueden ser consideradas como homogéneas (Xu 2019), es un hecho ampliamente documentado que las estimaciones de los *MUs* sobre las EV se sitúan sistemáticamente por debajo de las reales (Cook y Ezel 2008). Ello explica el porqué, aunque la rentabilidad de los *LSs* suele situarse por encima de la de las acciones (Braun *et al.* 2012; Giaccotto *et al.* 2015), ésta se sitúa sistemáticamente por debajo de la TIR de valoración para la compra de las pólizas.

Las razones del sesgo en las estimaciones de las EV de los *MUs* son variadas. Así, Braun *et al.* (2016) sostienen que tanto proveedores como brókeres ejercen presión para inflar los precios de los *LSs*, lo que facilita la realización de los acuerdos y la obtención de mayores comisiones. Por otra parte, Ruß *et al.* (2018) sostienen la existencia de *selección adversa* y *riesgo moral*, dado que el mejor conocedor del estado de salud es el propio asegurado. Éste tiene interés en el *LS* cuando su EV es fijada por debajo de la que cree correcta o cuando el valor económico del *LS* es superior al que prevé. En caso contrario, no realiza el *LS*. Es decir, aunque los *MUs* hicieran estimaciones no sesgadas de las EV, únicamente tienen repercusión en el mercado las que fueron realizadas por debajo de la EV correcta. Por otra parte, puede aparecer riesgo moral cuando el asegurado, una vez vendida su póliza mediante *LS*, queda sin protección del seguro, por lo que se ve incentivado a cuidar mejor de su salud. De hecho, una de las principales motivaciones para pactar *LSs* es la contratación de coberturas de asistencia sanitaria (Freedman y Young 2015).

En cualquier caso, Freedman y Young (2015) y ELSA (2019) indican que a partir del 2008 se registra un mayor conservadurismo en las estimaciones de las EV de los cuatro principales *MUs* de los EE.UU y unas mediciones de éstas más ajustadas. Así, Bauer *et al.* (2017) observan con datos de Fasano Associates que, efectivamente, sus estimaciones de EV presentan sesgos hasta el año 2006 pero, a partir de dicho año, no puede rechazarse la hipótesis de que sus estimaciones sean insesgadas.

El *riesgo crediticio* es imputable a que el asegurador que emite las pólizas de seguro de vida sea incapaz, debido a la quiebra, a cumplir con los pagos contemplados en las coberturas. Asociado al riesgo de crédito, nos encontramos con el *riesgo de rescisión*, que se produce cuando el asegurador rescinde unilateralmente la póliza debido a la inexistencia de interés asegurado o de fraude al realizarse su suscripción. Braun *et al.* (2019) remarcan como un caso especialmente conocido el de Stephen Keller, fundador y propietario de Kelco Inc, empresa dedicada a transacciones con *VSs*. Esta empresa fue declarada culpable de fraude en relación a la contratación masiva de pólizas de vida para enfermos terminales de SIDA que eran conscientes de su situación, a sabiendas de que las compañías de seguros rechazan personas en estado terminal. El fin último era vender dichas pólizas en el mercado de *VSs*. Finalmente, el asegurador pudo inhibirse del pago de las coberturas ya que las pólizas fueron declaradas nulas y Stephen Keller condenado a una pena de 10 años de cárcel. Un tema relacionado es el de las pólizas *STOLI* (Stranger-originated life insurance policies); esto es, pólizas cuya motivación no es un interés asegurable, sino el interés de un tercero en especular sobre la vida de una determinada persona. Según Braun *et al.* (2019), el concepto de «interés asegurable» tiene precedentes en el siglo XVIII en Reino Unido, cuando se puso de moda entre la burguesía apostar sobre la muerte de celebridades con problemas de salud mediante la contratación de pólizas sobre su vida. Dicha práctica fue prohibida por el parlamento británico en 1774. Debido a lagunas legislativas y un interés de los inversores, las *STOLIs* se fabricaron en masa con el fin de ser negociadas en mercados de *LSs* a mediados de la década de 2000, lo que dio lugar a numerosos debates legales. Actualmente, las *STOLIs* están prohibidas debido a su naturaleza de apuestas en la vida y así, un asegurador puede inhibirse del pago de las prestaciones de una póliza si es capaz de demostrar su naturaleza *STOLI*.

El *riesgo operacional* se manifiesta en las pérdidas resultantes de procesos internos inadecuados o fallidos, errores imputables a personas y sistemas o de eventos externos. En el caso que nos ocupa, y sin ánimo de ser exhaustivos, podemos remarcar el no pagar las primas de las pólizas suscritas a tiempo por lo que la póliza pierde vigor, las tardanzas de la reclamación de las prestaciones de mortalidad por un seguimiento inadecuado del asegurado, o el riesgo de que la compañía de seguros aumente las primas cuando el contrato del seguro lo permite.

[5] Es un hecho contrastado, tal como señalan Braun y Xu (2019), que la incertidumbre sobre el valor total de las primas que realmente deberá satisfacer el inversor es una de las variables más relevantes para determinar la prima de riesgo que se aplica al interés de actualización. En el caso en que haya una mayor carga de prima pendientes, el riesgo de que el asegurado sobreviva por encima de lo previsto no sólo implica que el capital asegurado se cobre más tarde, sino que además el comprador debe seguir satisfaciendo las primas periódicas previstas. Por tanto, en la práctica, el seguro sin primas pendientes se hubiera valorado con una prima de riesgo significativamente inferior.

Los *LSs* presentan un notable *riesgo de liquidez*. Sin duda se trata de activos mucho más ilíquidos que los negociados en los mercados financieros convencionales, como acciones, bonos, etc., ya que son activos no estandarizados y se negocian en mercados OTC, donde la concertación de transacciones es más costosa y su transparencia es notablemente inferior (Rosenfeld 2009). ELSA (2019) señala, como más relevantes, dos fuentes de iliquidez. La primera es el retraso en la recepción de las prestaciones por fallecimiento imputable a factores como errores en el seguimiento de la vida del asegurado o por sospechas de la compañía de seguros de la naturaleza ilícita de la póliza. Si la inversión en *LSs* se realiza a través de fondos abiertos, aparece un segundo problema: el que las solicitudes de reembolso sean más altas de lo esperado y no puedan ser satisfechas mediante una venta ordenada de pólizas. En los fondos abiertos, aún en el caso en que no haya un exceso de demanda de solicitudes de reembolso, la liquidación de las participaciones de los partícipes no es especialmente ágil, ya que sólo es permitida en fechas determinadas de periodicidad mensual o trimestral (Braun *et al.* 2012).

2.4. *Implicaciones de los* life settlements *en los actuantes en los mercados*

La aparición de los *LSs* afecta de diferente manera a los implicados en este tipo de operaciones: tomadores de seguros de vida, inversores y aseguradores. Para los tomadores de los seguros de vida, la posibilidad de acceder a un mercado secundario de pólizas supone dotarlas de mayor liquidez y, por tanto, mayor atractivo pues el tomador puede optar entre ejercitar el valor de rescate o el valor de venta mediante un *LS*. Doherty y Singer (2003) indican que desaparece el monopsonio de los aseguradores para la recompra de pólizas de vida y aumenta la eficiencia en su valoración. Dada la naturaleza de las pólizas destinadas al negocio de *LSs*, cuyo asegurado normalmente es una persona jubilada, este mercado secundario redunda en una mejora del atractivo del seguro de vida como producto de previsión. Así, es lógico suponer que la existencia de un mercado secundario de pólizas de seguro conllevará un aumento de su demanda en el mercado primario (Doherty y Singer 2003; Gatzert 2010).

Desde el punto de vista de los inversores, nos encontramos con un producto que, tal como señalan los trabajos de Braun *et al.* (2012), Giaccotto *et al.* (2015) o de The McGriff Alliance (2018), presenta una rentabilidad que en muchos periodos puede ser superior a la correspondiente a los mercados de renta fija y acciones. No obstante, la opinión sobre su riesgo no es coincidente. Así, según Braun *et al.* (2012) su volatilidad no es superior a la de las acciones mientras que Giaccotto *et al.* (2015) detectan mucha más volatilidad. Un aspecto positivo para los gestores de carteras de *LSs* es que, dada la naturaleza de los riesgos que afectan a este tipo de activos, básicamente el de longevidad, su rentabilidad no está relacionada con los ciclos económicos, noticias políticas, desastres naturales, etc. y, por tanto, tienen una baja correlación con los activos financieros convencionales. Bajo *et al.* (2013) muestran empíricamente, dentro del marco analítico del modelo de carteras de Markowitz, que la inclusión de *LSs* en carteras compuestas por activos convencionales mejora su eficiencia en términos de rentabilidad-riesgo. Esto les hace un activo muy interesante dentro de los considerados como «alternativos». La otra cara de la moneda, negativa, es que normalmente las estrategias inversoras son casi siempre consistentes en comprar y mantener (The McGriff Alliance 2018), debido a la dificultad para encontrar contrapartidas en los mercados secundarios y terciarios de *LS* apuntada en Rosenfeld (2009). Otro aspecto relacionado con los *LSs* es la duda ética que plantea su adquisición, que puede interpretarse como una apuesta sobre la fecha de muerte de las personas (Braun *et al.* 2019).

La inversión en *LSs* suele cubrirse con contratos q-*forward*, bonos y *swaps* de longevidad. De hecho, las noticias que más influyen sobre los precios de los *LSs* son aquellas relacionadas con avances médicos e investigación biotecnológica en el tratamiento de enfermedades. Así, la toma de posiciones inversoras en productos financieros más relacionados con estos hechos, como los bonos de titulización emitidos por empresas de biotecnología, son más eficaces que los derivados sobre longevidad estándar (MacMinn y Zhu 2017).

En el caso de las compañías aseguradoras, el impacto de un mercado secundario ajeno a ellas supone la pérdida de su monopsonio en el proceso de recompra de pólizas (Doherty y Singer 2003). El mercado de rescate de pólizas no es un mercado eficiente, ya que en el cálculo del valor de rescate se utilizan las probabilidades estándares. Esto genera, según Braun *et al.* (2018), un mecanismo en cierto modo «perverso» según el cual las pérdidas que pueden tener los aseguradores cuando dicho rescate lo realizan personas jóvenes y con una salud por encima del estándar (se les supone una EV por debajo de la que realmente tienen), queda financiado por el valor de rescate que obtienen asegurados senior con un estado de salud delicado, inferior a su valor económico. Para éstos últimos, las pólizas son valoradas con la consideración de una EV estándar y, por tanto, superior a su EV real. Así, paradójicamente, los colectivos más necesitados de protección acaban financiando los valores de rescate de pólizas que tienen un valor económico muy inferior al de rescate. El mercado de *LSs* desvía del mercado de rescate asegurador las pólizas con un valor económico superior al de rescate, pero se siguen rescatando pólizas con un valor económico menor al de rescate. Así, los márgenes de las compañías de vida se reducen por la antiselección que se produce en los rescates de las pólizas. Gatzert *et al.* (2009) matizan, no obstante, que el desplazamiento de pólizas potencialmente rescatables a potencialmente vendidas depende del tipo de prima pactada, si es única o periódica y del tiempo de permanencia de la póliza en la cartera.

El mercado de *LSs* puede provocar problemas de antiselección, riesgo moral y fraude que lleve a producir en el mercado primario un aumento de asegurados con salud por debajo del promedio cuyo objetivo es revender la póliza en el mercado de *LS*. Este impacto supuestamente negativo sobre el negocio asegurador ha propiciado comportamientos obstruccionistas y de boicot contra el mercado de *LSs* (Doherty y Singer 2003) y, según Braun *et al.* (2019), advertencias sobre la posibilidad de que los tomadores con menores recursos se vean desplazados del mercado primario por el consecuente aumento de precios.

En cualquier caso, en opinión de Doherty y Singer (2003), la existencia de un mercado secundario de cierta magnitud acaba siempre beneficiando a todos los participantes del mercado primario, tanto por el aumento de la transparencia en la formación de precios, como por el incremento de la demanda. La literatura

remarca diversos efectos positivos para los aseguradores imputables a la presencia del mercado de *LSs*. Gatzert *et al.* (2009) indican que un aumento de los volúmenes en el mercado primario supone, per se, una gran posibilidad de ampliar la penetración del negocio asegurador. Rosenfeld (2009) detecta a partir de mediados de la década de los 2000 que muchas compañías de vida se implican en el mercado de *LSs* ya que entienden que proporcionan valor a sus clientes y, asimismo, la inversión en pólizas suscritas por otros aseguradores permite cubrir, vía diversificación, sus propios riesgos. En su trabajo también señala que las compañías de seguros, debido a su experiencia, tienen una ventaja competitiva en la inversión en *LSs*. De hecho, tal como indica The McGriff Alliance (2018), las compañías de seguros son actualmente unos de los mayores compradores de *LSs* lo que, aparte de poder entenderse como una inversión, puede formar parte de una política de cobertura de sus pólizas emitidas (Wang *et al.* 2011). Gatzert (2010) remarca que el hecho de que una póliza sea transferida al mercado de *LSs* asegura a la compañía de seguros que ésta no será rescatada antes de su vencimiento, disminuyendo así su riesgo de liquidez. En cualquier caso, la existencia de un mercado secundario de pólizas de seguros obliga a las compañías de seguros a innovaciones en la gestión y creación de coberturas. Braun *et al.* (2018) proponen medidas encaminadas al acercamiento del valor de rescate y el económico de las pólizas, tanto en aquéllas con un valor económico superior como en las que lo tienen inferior. También proponen en aquellas pólizas que contemplan el incremento en las primas pendientes su limitación, ya que en muchas ocasiones estos incrementos provocan que el tomador, ante la imposibilidad de continuar con la póliza, acabe vendiéndola. Rosenfeld (2009) sostiene que la capacidad de realizar predicciones de longevidad ajustadas a la situación individual del asegurado, las posibilidades inherentes a las inversiones de las primas en un contexto de gran desarrollo de los mercados financieros y la aplicación de la tecnología, ofrecen una oportunidad a la industria de seguros de vida para crear nuevos productos financieros basados en la longevidad que estén estrechamente adaptados a las necesidades del consumidor. Por su parte, Gatzert (2010) sugiere algunas alternativas como ofrecer la posibilidad de avanzar parcialmente las prestaciones de fallecimiento en casos como una enfermedad grave o la opción de obtención de rentas de supervivencia ajustadas a la salud real del asegurado contra el valor económico de la póliza de vida.

3. ASPECTOS CUANTITATIVOS EN LA VALORACIÓN DE *LIFE SETTLEMENTS*

3.1. Ajuste de la esperanza de vida del asegurado y de la TIR

La ecuación de valoración (1) muestra que los dos parámetros claves en la obtención del valor de un seguro de vida para su venta en *LS* son la mortalidad específica del asegurado candidato a vender su póliza, que se plasma en una EV o unas tasas de mortalidad no estándares; y el tipo de interés de valoración (TIR o rentabilidad esperada) utilizado.

Referente a la estimación de la EV, el tomador que quiere liquidar su póliza en el mercado de *LSs* debe obtener un certificado de un *MU* con la EV del asegurado de dicha póliza y la tabla de mortalidad aplicable a su caso. En el Gráfico 2 se muestra el proceso que siguen dos de los principales *MUs* de EE.UU. (ITM TwentyFirst, LLC y AVS Underwriting, LLC) para emitir un certificado de EV. El *MU* usa el historial médico del asegurado, que se plasma en un formulario de salud, y adicionalmente puede requerir determinados análisis e informes clínicos que completen la declaración realizada. Con estos inputs, el *MU* debe cuantificar hasta qué punto la mortalidad del candidato es diferente a la estándar. Así, el *MU* finalmente obtiene, a partir de una tabla de mortalidad estándar, otra modificada que se adapta a la situación personal de salud y estilo de vida del asegurado y, de esta nueva tabla, su EV asociada. Olivieri (2006) muestra diferentes alternativas que la literatura ha propuesto para modificar las tablas de mortalidad estándar en la tarificación de los seguros de vida. Así, si denominamos q_x la probabilidad de que un asegurado de edad x fallezca antes de alcanzar la edad $x + 1$ y $q_x^\star$ su homóloga modificada para el individuo cuya situación le hace susceptible de presentar una EV diferente a la estándar:

$$q_x^\star = \alpha + \beta q_x \tag{3}$$

$$q_x^\star = q_{x+k} \tag{4}$$

Obsérvese que en (3) $q_x^\star$ es una función lineal de la probabilidad estándar q_x. Asimismo, la probabilidad modificada de fallecimiento $q_x^\star$ en (4) se obtiene aumentado la edad actual del asegurado k años, como resultado de estimar que su EV reducida se corresponde con la de una persona de edad $x + k$.

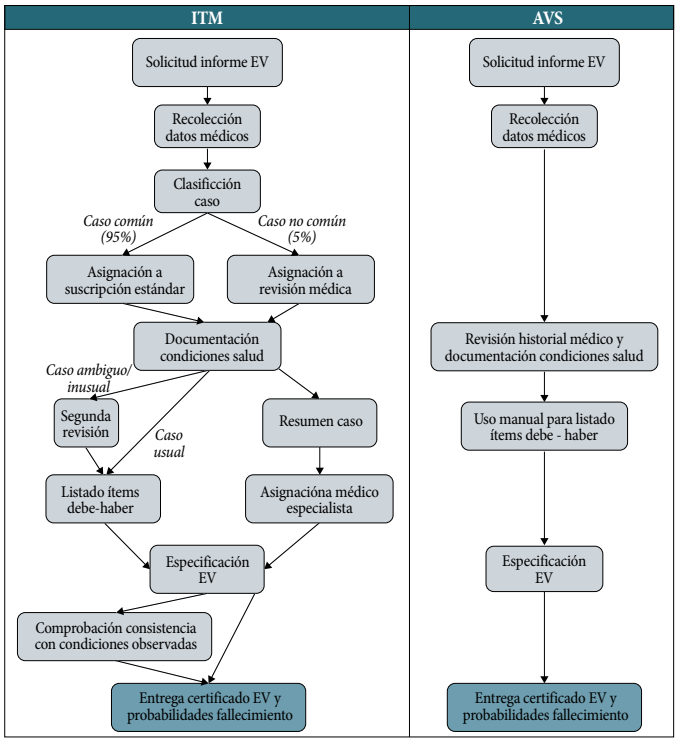

Gráfico 2
Proceso que siguen dos *MUs* (ITM TwentyFirst, LLC y AVS Underwriting, LLC) en la elaboración de certificados de EV
Fuente: Elaboración propia a partir de Xu (2019).

En el campo de los *LSs*, (3) es especialmente relevante. Siguiendo a Brockett *et al.* (2013), Dolan (2019) o Xu (2019) lo más común por los *MUs* es adoptar (3) con $\alpha = 0$ y $\beta = 1 + \gamma$, recogiendo γ el incremento de mortalidad debido a la situación personal del asegurado. En la literatura, β se denomina comúnmente *multiplicador de mortalidad*. Así, γ, tal como explican Dolan (2019) y Xu (2019) se ajusta mediante un método de debe (ante factores negativos para la vida del asegurado) y haber (cuando en la evaluación médica se detectan factores positivos). Se incrementa γ ante circunstancias tales como, por ejemplo, hipertensión, consumo habitual de alcohol, etc. Análogamente, se disminuye γ ante factores como un estilo de vida activo, ausencia de antecedentes de tumores malignos en la familia, etc. En el desarrollo de esta evaluación, tal como señala Dolan (2019), se utiliza la propia experiencia del *MU* recogida en un manual de operaciones, pero también cobra gran importancia la revisión bibliográfica de estudios médicos y demográficos en revistas científicas y la consulta de bases de datos. Una implementación muy habitual e intuitiva, según Pitacco (2019), es el denominado como *numerical rating system*. Dados m factores se cuantifica como $\gamma = \sum_{j=1}^{m} \rho_j$ donde ρ_j supone un débito o un crédito en la mortalidad debida a la valoración realizada sobre el ítem j. Así, (3), queda expresado como:

$$q_x^{\star} = \beta q_x = \left(1 + \sum_{j=1}^{m} \rho_j\right) q_x \tag{5}$$

Y dado que $0 \le q^{\star}_x \le 1$, debe cumplirse que $-1 < \sum_{j=1}^{m} \rho_j < \frac{1}{q_x} - 1$.

No obstante, como es posible que esta desigualdad no se cumpla en todas las edades que puede tomar el asegurado en la tabla de mortalidad estándar que sirve de base, Xu (2019) propone:

$$q_{x+t}^{\star} = \min\left\{1, \left(1 + \sum_{j=1}^{m} \rho_j\right) q_{x+t}\right\}, t = 1,2,\ldots,\omega - x \tag{6}$$

A partir de las probabilidades de fallecimiento $q^{\star}_{x+t}$, $t = 1,2,\ldots,\omega - x$, podemos hallar la probabilidad no estándar de que el asegurado de edad x sobreviva k años como:

$${}_k p_x^{\star} = \prod_{t=0}^{k-1} \left(1 - q_{x+t}^{\star}\right) \tag{7}$$

y así, la EV del asegurado es:

$$e_x^{\star} = \sum_{k=1}^{\omega - x} {}_k p_x^{\star} = \sum_{k=1}^{\omega - x} \prod_{t=0}^{k-1} \left(1 - q_{x+t}^{\star}\right) \tag{8}$$

En el Gráfico 3, partiendo de la tabla de mortalidad base PASEM 2010, se muestra la distribución estándar y la modificada del número de años enteros de vida restantes para un hombre de edad 65 años para el que se suponen dos factores de riesgo. El primero es un cáncer hipofaríngeo localizado que, según la American Cancer Society (2019), tiene una tasa relativa de supervivencia a 5 años del 52%; es decir, la probabilidad de supervivencia del afectado es un 52% de la que le correspondería en una tabla estándar. Dado que en la PASEM 2010 ${}_5p_{65} = 0{,}9227$, el aumento de la tasa de mortalidad a 1 año por este factor, ρ_1, se halla despejando de $\prod_{t=0}^{4}\left[1-(1+\rho_1)q_{65+t}\right] = 0{,}52 \cdot 0{,}9227$, de donde $\rho_1 = 7{,}54$. El segundo factor es su afición al salto base que supone[6] una probabilidad de fallecimiento de 1/60 = 0,0167. Dado que según las tablas estándar $q_{65} = 0{,}012703$, el incremento de la probabilidad de fallecimiento debido a la afición a dicho deporte es $\rho_2 = (0{,}0167 - 0{,}012703)/0{,}012703 = 0{,}31$. Así, una estimación intuitiva del multiplicador β en (5) sería $\beta = 1 + 7{,}54 + 0{,}31 = 8{,}85$.

Referente al tipo de actualización de los *LSs* (TIR), siguiendo a Januário y Naik (2013) y Braun y Xu (2019), podemos separar el tipo de interés libre de riesgo, que es asimilable al interés técnico legal y se calcula a partir del rendimiento de la deuda pública; de la prima de riesgo (PR). La parte fundamental de la TIR de los *LSs* es imputable a este último componente en unas proporciones respecto al tipo libre de riesgo positivo que oscilan entre el 10 a 1 y 20 a 1.

Braun y Xu (2019) identifican los determinantes en la PR que recoge la Tabla 3.

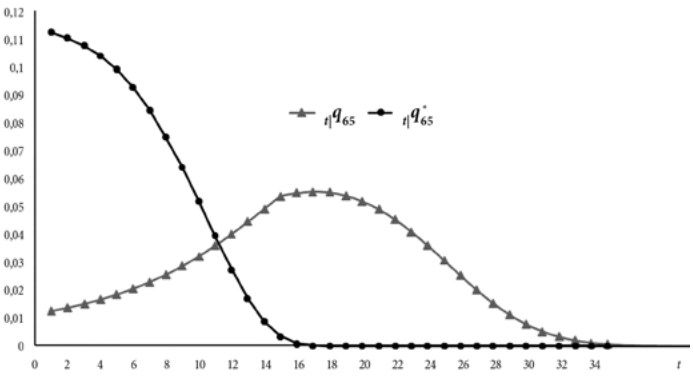

Gráfico 3

Número de años de vida pendientes para un hombre de edad 65 años con la tabla PASEM 2010 estándar y la modificada por un multiplicador β = 8,85.

Nota: La EV estándar es e_{65}=15,41 años y la modificada e^{*}_{65} = 4,60 años.

Fuente: Elaboración propia.

[6] Extraído del artículo de prensa Bermejo, D., 2018. Éstas son las probabilidades que tienes de morir haciendo deporte o jugando a videojuegos…y no son las que esperas. *El Mundo*, 5 de noviembre de 2018.

Tabla 3
Determinantes de la prima de riesgo en los *LSs*

Variable	Relación respecto a la variable	Comentarios
EV	Decreciente respecto a la EV (y creciente con el riesgo de longevidad)	Una menor EV supone un mayor riesgo de que el contrato se extienda por encima de dicha EV
Capital de fallecimiento	Creciente	Un mayor capital asegurado se asocia a personas con mayor poder adquisitivo y mayor cultura, lo que supone una capacidad superior para acceder a asistencia sanitaria y una mayor concienciación respecto a hábitos saludables
Dispersión entre las estimaciones de los *MU*s sobre la EV	Creciente	En los *LSs* la práctica habitual es demandar al menos dos evaluaciones independientes sobre la EV del asegurado. Una mayor diferencia de criterio implica una mayor incertidumbre sobre la finalización del seguro
Fase de negociación (secundario vs. terciario)	Decreciente	La PR es superior en el mercado secundario que en el terciario debido a que es en el primero donde se materializa el problema de la selección adversa
Edad del asegurado	Creciente	En los asegurados de mayor edad es más difícil realizar predicciones precisas sobre la mortalidad debido a la mayor escasez de datos
Volumen de primas pendientes de pagar	Creciente	La PR es superior en los seguros pactados a prima nivelada que los pactados a prima única; y menor en aquéllos que en los pactados a primas naturales o crecientes
Calificación crediticia del asegurador	Decreciente	La PR disminuye con la mejora de la calificación crediticia del asegurador, pues existe un menor riesgo de crédito
Antigüedad de la póliza	Decreciente	Una menor antigüedad de la póliza supone una mayor probabilidad de que ésta no haya sido contratada con un interés asegurable (sea una *STOLI*) o una póliza contratada fraudulentamente y, por tanto, rescindible por la compañía de seguros
Riesgo de liquidez	Creciente	Los mercados secundarios y terciarios de seguros son notablemente ilíquidos

Fuente: Elaboración propia a partir de Braun y Xu (2019).

3.2. *Determinación del precio de un* life settlement

Siguiendo a Zollars *et al.* (2003), Lubovich *et al.* (2008) y Brockett *et al.* (2013), diferenciamos tres metodologías de determinación del valor (o precio) de un *LS*: determinista, probabilística y estocástica. La valoración determinista conceptualiza el seguro como una operación financiera cierta cuya finalización se ubica en la EV, (8). Así, el valor económico determinista para el seguro asociado a una persona de edad x, VED_x, suponiendo una EV e_x^* y para una TIR dada, es:

$$VED_x = \frac{C_{x+e_x^*}}{(1+TIR)^{e_x^*}} - \sum_{k=1}^{e_x^*} \frac{P_{x+t}}{(1+TIR)^k} \tag{9}$$

Por tanto, para aplicar (9) nos basta, una vez se ha fijado el tipo de interés de valoración, conocer la EV indicada en el informe del *MU*. Esta metodología se empleó sobre todo al inicio del mercado de *VSs*, que tienen una duración esperada más baja que los *LS* y para los que la determinación de la EV se podía hacer de forma bastante precisa. No obstante, siguiendo a Lubovich *et al.* (2008), (9) presenta como principal problema que la estructura de primas/prestaciones contempladas a partir de la EV queda sin ser valorada cuando, realmente, son cantidades que el comprador de *LS* finalmente puede llegar a pagar/cobrar. Brockett *et al.* (2013) indican que, merced a la desigualdad de Jensen, esta metodología minusvalora el valor económico del contrato.

El segundo método valorativo es el que la literatura denomina como probabilístico. En este caso, todos los flujos de caja que pueden llegar a ser cobrados y pagados quedan contemplados siendo ponderados por la probabilidad de su ocurrencia. La ecuación (1) se ha formulado siguiendo este principio. Así, el valor económico probabilístico para un asegurado de edad x, VEP_x, es:

$$VEP_x = \sum_{k=1}^{\omega-x} \frac{C_{t+k}}{(1+TIR)^k} {}_{k-1|}q_x^* - \sum_{k=1}^{\omega-x} \frac{P_{t+k}}{(1+TIR)^k} {}_k p_x^* \tag{10}$$

Se trata de la fórmula de valoración más aceptada del mercado y la que viene en manuales operativos de empresas del sector (ver, por ejemplo, AA-Partners Ltd. 2017).

El tercer método valorativo es el denominado como estocástico. En este caso, se parte de la variable aleatoria *Años de vida enteros para el asegurado de edad actual x*, T_x^*, que puede obtenerse a partir de la tabla de mortalidad modificada que corresponde al asegurado. Los posibles resultados de T_x^* son $\{0,1,2,\ldots, \omega - x - 1\}$ con probabilidades respectivas $\{q_x^*, {}_{1|}q_x^*, {}_{2|}q_x^*, \ldots, {}_{\omega-x-1|}q_x^*\}$. Así, T_x^* induce la variable aleatoria valor económico estocástico, VEE_x:

$$VEE_x = \frac{C_{t+T_x^*+1}}{(1+TIR)^{T_x^*+1}} - \sum_{k=1}^{T_x^*} \frac{P_{t+k}}{(1+TIR)^k} \tag{11}$$

En cualquier tratado de matemática actuarial, como Gerber (1995), se comprueba que la esperanza matemática de la variable aleatoria VEE_x coincide con el valor económico probabilístico, VEP_x. No obstante, el enfoque estocástico permite, además, obtener indicadores relacionados con el riesgo de longevidad, realizar análisis de riesgos para carteras de *LSs* mediante simulación de Montecarlo (por ejemplo, con la determinación de percentiles), etc.

Tabla 4
Expresiones del valor económico de un *LS* para estructuras comunes de seguros de vida entera

Enfoque	Prima nivelada	Prima única
Determinista	$VED_x = \frac{C}{(1+TIR)^{e^*_x}} - \sum_{k=1}^{e^*_x} \frac{P}{(1+TIR)^k} = \frac{C}{(1+TIR)^{e^*_x}} - Pa_{\overline{e^*_x}\vert TIR}$	$VED_x = \frac{C}{(1+TIR)^{e^*_x}}$
Probabilístico	$VEP_x = \sum_{k=1}^{\omega-x} \frac{C}{(1+TIR)^k} {}_{k-1\vert}q^*_x - \sum_{k=1}^{\omega-x} \frac{P}{(1+TIR)^k} {}_k p^*_x = CA^*_x - Pa^*_x$	$VEP_x = CA^*_x$
Estocástico	$VE_x = \frac{C}{(1+TIR)^{T^*_x+1}} - Pa_{\overline{T^*_x}\vert TIR}$	$VE_x = \frac{C}{(1+TIR)^{T^*_x+1}}$

Nota: A^*_x y a^*_x representan que las estructuras actuariales han sido evaluadas con las probabilidades modificadas y la TIR.
Fuente: Elaboración propia.

En la Tabla 4 se ofrecen las expresiones particulares del valor económico de un *LS* correspondiente a un seguro de vida entera que se obtienen con los tres enfoques, en el caso de primas anuales niveladas pagaderas de forma vencida mientras viva el asegurado, *P*, y prima única, siendo la prestación por muerte constante y de importe *C*.

3.3. *Evaluación de la sensibilidad del valor de los* life settlements *ante variaciones de la esperanza de vida*

A continuación, desarrollamos dos medidas que permiten evaluar la sensibilidad del valor de *LSs* ante modificaciones del valor inicial del multiplicador de mortalidad que determina la EV. Como se comentó, dicho multiplicador puede interpretarse como un sumatorio de factores de riesgo. Por tanto, su variación puede ser debida tanto a factores imputables a circunstancias sobrevenidas desde el inicio del *LS* (por ejemplo, una mejora en el tratamiento de las enfermedades a las que está sujeto el asegurado o un cambio en sus hábitos), como a aspectos imputables a una incorrecta valoración del multiplicador. En efecto, ya se vieron diferentes factores que pueden provocar una incorrecta valoración de la EV, por parte de los *MU*s, con un sesgo a la baja. Las medidas propuestas son análogas a la duración y la convexidad respecto al tipo de interés.

Stone y Zissu (2008) y Jori *et al.* (2010) exponen el concepto de duración y convexidad respecto a la EV partiendo de una modelización del precio del *LS* determinista. Basándose en estos resultados, Ortiz *et al.* (2008) construyen una medida que permite sopesar la influencia de los cambios de la EV sobre la duración respecto al tipo de interés. No obstante, ya comentamos que, si bien, el enfoque de valoración determinista fue ampliamente utilizado en el mercado de *VSs*, con pólizas de muy corta maduración, el estándar en el mercado para los *LSs* es utilizar el enfoque de valoración probabilístico. Por ello, el resto del presente trabajo únicamente considerará este enfoque hablando, por simplicidad, de valor económico (en lugar de valor económico probabilístico). Se ha de indicar que el planteamiento que se va a exponer es, en cierto modo, cercano al expuesto en los trabajos de Wang *et al.* (2010) y Li y Luo (2011). En efecto, en el primer trabajo, los autores conceptualizan la duración y convexidad frente a cambios de los tantos de mortalidad instantáneos Por su parte, Li y Luo (2012) extienden el concepto de duración direccional de Ho (1992) a las variaciones de las probabilidades de fallecimiento.

Así, definimos la medida de duración asociada a cambios en el multiplicador de las tasas de mortalidad, DM_x, como:

$$DM_x = \frac{\frac{\partial VEP_x}{\partial \beta}}{VEP_x} \tag{12}$$

Para determinar $\frac{\partial VEP_x}{\partial \beta}$ partimos de que, según (5) y (7):

$${}_k p^*_x = \prod_{t=0}^{k-1} \left(1 - q^*_{x+t}\right) = \prod_{t=0}^{k-1} \left(1 - \beta q_{x+t}\right) \tag{13}$$

luego:

$$\frac{d\, {}_k p^*_x}{d\beta} = -\sum_{t=0}^{k-1} q_{x+t} \prod_{j=0, j\neq t}^{k-1} \left(1 - \beta q_{x+j}\right) = -\sum_{t=0}^{k-1} q_{x+t} \frac{{}_k p^*_x}{p^*_{x+t}} = -{}_k p^*_x \sum_{t=0}^{k-1} \frac{q_{x+t}}{p^*_{x+t}} \tag{14}$$

donde:

$${}_k p^{*\prime}_x = {}_k p^*_x \sum_{t=0}^{k-1} \frac{q_{x+t}}{p^*_{x+t}} \tag{15}$$

puede interpretarse como la corrección de la probabilidad de supervivencia modificada ${}_k p^*_x$ con el coeficiente $\sum_{t=0}^{k-1} \frac{q_{x+t}}{p^*_{x+t}}$.

Por otra parte, como la probabilidad de fallecimiento ${}_{k-1|}q_x^*$ puede escribirse como ${}_{k-1|}q_x^* = q_{x+k-1}^* \cdot {}_{k-1}p_x^*$ y ${}_{k-1|}p_x^* = \prod_{t=0}^{k-2}(1-\beta q_{x+t})$, observamos:

$$\frac{d_{k-1|}q_x^*}{d\beta} = q_{x+k-1}\prod_{t=0}^{k-2}(1-\beta q_{x+t}) - \beta q_{x+k-1}\sum_{t=0}^{k-2} q_{x+t}\prod_{j=0,j\neq t}^{k-2}(1-\beta q_{x+j}) =$$

$$= q_{x+k-1}\cdot {}_{k-1}p_x^* - \beta q_{x+k-1}\cdot {}_{k-1}p_x^*\sum_{t=0}^{k-2}\frac{q_{x+t}}{p_{x+t}^*} = q_{x+k-1}\cdot {}_{k-1}p_x^*\left[1-\beta\sum_{t=0}^{k-2}\frac{q_{x+t}}{p_{x+t}^*}\right]$$

Luego:

$$\frac{d_{k-1|}q_x^*}{d\beta} = \frac{{}_{k-1|}q_x^*}{\beta}\left[1-\beta\sum_{t=0}^{k-2}\frac{q_{x+t}}{p_{x+t}^*}\right] = {}_{k-1|}q_x^*\left[\frac{1}{\beta}-\sum_{t=0}^{k-2}\frac{q_{x+t}}{p_{x+t}^*}\right] \tag{16}$$

Así:

$${}_{k-1|}q_x^{*\prime} = {}_{k-1|}q_x^*\left[\frac{1}{\beta}-\sum_{t=0}^{k-2}\frac{q_{x+t}}{p_{x+t}^*}\right] \tag{17}$$

puede también interpretarse como una corrección de la probabilidad de fallecimiento modificada ${}_{k-1|}q_x^*$.

Por tanto, $\frac{\partial VEP_x}{\partial\beta}$ se halla aplicando los valores asimilables a probabilidades ${}_kp_x^{*\prime}$ y ${}_{k-1|}q_x^{*\prime}$ como:

$$\frac{\partial VEP_x}{\partial\beta} = \sum_{k=1}^{\omega-x}\frac{C_{t+k}}{(1+TIR)^k}\,{}_{k-1|}q_x^{*\prime} + \sum_{k=1}^{\omega-x}\frac{P_{t+k}}{(1+TIR)^k}\,{}_kp_x^{*\prime} \tag{18}$$

Y, finalmente, sustituyendo (18) en (12) obtenemos DM_x:

$$DM_x = \frac{\sum_{k=1}^{\omega-x}\frac{C_{t+k}}{(1+TIR)^k}\,{}_{k-1|}q_x^{*\prime} + \sum_{k=1}^{\omega-x}\frac{P_{t+k}}{(1+TIR)^k}\,{}_kp_x^{*\prime}}{\sum_{k=1}^{\omega-x}\frac{C_{t+k}}{(1+TIR)^k}\,{}_{k-1|}q_x^* - \sum_{k=1}^{\omega-x}\frac{P_{t+k}}{(1+TIR)^k}\,{}_kp_x^*} \tag{19}$$

A partir de (12) podemos aproximar las variaciones del valor económico del *LS*, VEP_x, ante variaciones del multiplicador β, como:

$$\Delta VEP_x \approx VEP_x \cdot DM_x \cdot \Delta\beta \tag{20}$$

Si se desea tener una aproximación más precisa que la obtenida con (20) se debe utilizar la segunda derivada del valor económico respecto a β obteniéndose, así, una medida de tipo convexidad. En este trabajo introducimos una medida de convexidad asociada a cambios en el multiplicador de las tasas de mortalidad que se basa en la convexidad respecto a la de la EV de Stone y Zissu (2008), CM_x:

$$CM_x = \frac{\frac{\partial^2 VEP_x}{\partial\beta^2}}{VEP_x} \tag{21}$$

Para determinar $\frac{\partial^2 VEP_x}{\partial\beta^2}$ consideramos (14) y (16), obteniéndose:

$$\frac{d^2\,{}_kp_x^*}{d\beta^2} = {}_kp_x^{*\prime\prime} = {}_kp_x^*\left(\sum_{t=0}^{k-1}\frac{q_{x+t}}{p_{x+t}^*}\right)^2 - {}_kp_x^*\sum_{t=0}^{k-1}\frac{(q_{x+t})^2}{(p_{x+t}^*)^2} =$$

$$= {}_kp_x^*\left[\left(\sum_{t=0}^{k-1}\frac{q_{x+t}}{p_{x+t}^*}\right)^2 - \sum_{t=0}^{k-1}\frac{(q_{x+t})^2}{(p_{x+t}^*)^2}\right] \tag{22}$$

$$\frac{d^2\,{}_{k-1|}q_x^*}{d\beta^2} = {}_{k-1|}q_x^{*\prime\prime} = {}_{k-1|}q_x^*\left[\frac{1}{\beta}-\sum_{t=0}^{k-2}\frac{q_{x+t}}{p_{x+t}^*}\right]^2 - {}_{k-1|}q_x^*\left[\frac{1}{\beta^2}+\sum_{t=0}^{k-2}\frac{(q_{x+t})^2}{(p_{x+t}^*)^2}\right] =$$

$$= {}_{k-1|}q_x^*\left[\left(\sum_{t=0}^{k-2}\frac{q_{x+t}}{p_{x+t}^*}\right)^2 - \frac{2}{\beta}\sum_{t=0}^{k-2}\frac{q_{x+t}}{p_{x+t}^*} - \sum_{t=0}^{k-2}\frac{(q_{x+t})^2}{(p_{x+t}^*)^2}\right] \tag{23}$$

Así, $\frac{\partial^2 VEP_x}{\partial\beta^2}$ puede valorarse con una expresión similar a (18) considerando los valores asimilables a probabilidades ${}_kp_x^{*\prime\prime}$ y ${}_{k-1|}q_x^{*\prime\prime}$:

$$\frac{\partial^2 VEP_x}{\partial\beta^2} = \sum_{k=1}^{\omega-x}\frac{C_{t+k}}{(1+TIR)^k}\,{}_{k-1|}q_x^{*\prime\prime} + \sum_{k=1}^{\omega-x}\frac{P_{t+k}}{(1+TIR)^k}\,{}_kp_x^{*\prime\prime} \tag{24}$$

Entonces:

$$CM_x = \frac{\sum_{k=1}^{\omega-x}\frac{C_{t+k}}{(1+TIR)^k}\,{}_{k-1|}q_x^{*\prime\prime} + \sum_{k=1}^{\omega-x}\frac{P_{t+k}}{(1+TIR)^k}\,{}_kp_x^{*\prime\prime}}{\sum_{k=1}^{\omega-x}\frac{C_{t+k}}{(1+TIR)^k}\,{}_{k-1|}q_x^* - \sum_{k=1}^{\omega-x}\frac{P_{t+k}}{(1+TIR)^k}\,{}_kp_x^*} \tag{25}$$

Por tanto, la aproximación (20), al añadir el término asociado a la medida de convexidad, se convierte en:

$$\Delta VEP_x \approx VEP_x\cdot\left[DM_x\cdot\Delta\beta + \frac{1}{2}CM_x(\Delta\beta)^2\right] \tag{26}$$

Para los casos comunes de seguros pactados a prima nivelada, *P*, y a prima única, con prestación por muerte constante y de importe *C*, las expresiones de los indicadores de sensibilidad vienen dados por las expresiones recogidas en la Tabla 5.

Tabla 5
Expresiones particulares de las medidas de sensibilidad del valor económico de un *LS* para estructuras comunes de seguros de vida entera

	Prima nivelada	Prima única
DM_x	$\frac{CA_x^{*\prime} + Pa_x^{*\prime}}{CA_x^{*} - Pa_x^{*}}$	$\frac{A_x^{*\prime}}{A_x^{*}}$
CM_x	$\frac{CA_x^{*\prime\prime} + Pa_x^{*\prime\prime}}{CA_x^{*} - Pa_x^{*}}$	$\frac{A_x^{*\prime\prime}}{A_x^{*}}$

Notas: (a) * representa que las estructuras actuariales se han calculado con las probabilidades modificadas y la TIR. (b) (′) y (′′) denotan que dichas estructuras han sido evaluadas con los valores asimilables a probabilidades de vida y fallecimiento ${}_kp_x^{*\prime}$, ${}_{k-1|}q_x^{*\prime}$ y ${}_kp_x^{*\prime\prime}$, ${}_{k-1|}q_x^{*\prime\prime}$, respectivamente.

Fuente: Elaboración propia.

Caso práctico. Las Tablas 6 y 7 permiten sopesar la precisión de la aplicación de los conceptos de duración y convexidad respecto al multiplicador de mortalidad β en la variación del valor económico del *LS* para el seguro suscrito a primas niveladas del caso práctico de la Sección 2.2.

Tabla 6
Características del seguro analizado, valor económico según la edad a la venta y sensibilidad de dicho valor respecto a cambios en el multiplicador β

Seguro de vida entera				
Edad del asegurado en la suscripción: 45 años				
Interés técnico: 1,5%				
Tablas de mortalidad: PASEM 2010				
Capital de fallecimiento: 1.000€				
Prima anual: 23,84€				
Edad a la venta en *LS*	60	65	70	75
VEP_x inicial (β =8,85 y TIR=12%)	421,29	528,71	674,77	818,48
DM_x	0,0689	0,0513	0,0360	0,0234
CM_x	−0,0068	−0,0058	−0,0048	−0,0036

Fuente: Elaboración propia.

Tabla 7
Variación del valor económico de los *LSs* ante variaciones del multiplicador β

	Nueva EV ante variaciones del multiplicador						
$x\backslash\Delta\beta$	−2	−1	−0,5	0	0,5	1	2
60	8,59	7,11	6,81	6,53	6,28	6,04	5,23
65	5,55	5,03	4,81	4,60	4,41	4,23	3,91
70	3,33	2,96	2,79	2,64	2,51	2,38	2,15
75	1,57	1,32	1,21	1,11	1,02	0,94	0,80
	Nuevo valor de los *LSs* ante variaciones del multiplicador						
$x\backslash\Delta\beta$	−2	−1	−0,5	0	0,5	1	2
60	356,28	390,55	406,32	421,29	435,53	449,10	474,42
65	466,94	499,77	514,68	528,71	541,96	554,50	577,67
70	618,13	648,54	662,12	674,77	686,60	697,69	717,94
75	772,47	797,49	808,42	818,48	827,77	836,39	851,88
	Nuevo valor de los *LSs* ante variaciones del multiplicador con (20)						
$x\backslash\Delta\beta$	−2	−1	−0,5	0	0,5	1	2
60	363,20	392,25	406,77	421,29	435,81	450,33	479,38
65	474,51	501,61	515,16	528,71	542,27	555,82	582,92
70	626,20	650,49	662,63	674,77	686,92	699,06	723,35
75	780,14	799,31	808,90	818,48	828,06	837,65	856,82
	Error en la aproximación de la variación del valor con (20)						
$x\backslash\Delta\beta$	−2	−1	−0,5	0	0,5	1	2
60	10,65%	5,52%	3,00%	0,00%	1,98%	4,45%	9,33%
65	12,25%	6,35%	3,45%	0,00%	2,28%	5,11%	10,72%
70	14,25%	7,40%	4,02%	0,00%	2,66%	5,97%	12,54%
75	16,67%	8,67%	−4,71%	0,00%	3,13%	7,03%	14,76%
	Nuevo valor de los *LSs* ante variaciones del multiplicador con (26)						
$x\backslash\Delta\beta$	−2	−1	−0,5	0	0,5	1	2
60	357,46	390,81	406,41	421,29	435,45	448,90	473,63
65	468,35	500,07	514,78	528,71	541,88	554,28	576,76
70	619,76	648,88	662,23	674,77	686,52	697,45	716,91
75	774,19	797,82	808,52	818,48	827,69	836,16	850,86
	Error en la aproximación de la variación del valor con (26)						
$x\backslash\Delta\beta$	−2	−1	−0,5	0	0,5	1	2
60	1,81%	0,85%	0,60%	0,00%	0,54%	0,72%	1,49%
65	2,27%	1,03%	0,71%	0,00%	0,63%	0,86%	1,86%
70	2,88%	1,26%	0,84%	0,00%	0,74%	1,05%	2,37%
75	3,72%	1,58%	1,01%	0,00%	0,87%	1,29%	3,07%

Nota: El error se calcula como

$$\left|\frac{\text{Variación aproximada del valor} - \text{Variación real del valor}}{\text{Variación real del valor}}\right| \cdot 100$$

Fuente: Elaboración propia.

Los resultados de las Tablas 6 y 7 permiten realizar las siguientes apreciaciones, generalizables a otras edades y otros valores de la TIR:

1. La Tabla 6 indica que a medida que aumenta la edad del asegurado en el momento de la venta del seguro en *LS*, disminuye la sensibilidad del precio o valor económico del *LS* respecto a cambios en el multiplicador de la mortalidad. También muestra que el precio de un *LS* es una función creciente y cóncava respecto al multiplicador de la mortalidad.
2. La Tabla 7 muestra que una mayor variación del multiplicador de la mortalidad redunda en un mayor error de la aproximación (20). Así, para fluctuaciones extremas del multiplicador es necesario complementar la aproximación lineal proporcionada por DM_x con medidas relacionadas con la curvatura de la función valor económico del *LS* respecto al multiplicador. La medida de convexidad basada en la segunda derivada de dicho valor respecto a β, recogida en (26), mejora notablemente la precisión de la aproximación a la variación del valor económico de la póliza.
3. Es conocido que la utilización exclusiva de la duración respecto a tipo de interés implica minusvalorar el precio final de un *LS* cuando hay un cambio en el tipo de interés. En cambio, la utilización exclusiva de DM_x sobrevalora el precio final del *LS* cuando el multiplicador varía. La introducción de la medida de convexidad respecto a β supone una aproximación al nuevo valor económico del *LS* notablemente más precisa. Con la convexidad se minusvalora el precio cuando aumenta el multiplicador y se sobrevalora cuando dicho multiplicador disminuye.
4. Los errores derivados de utilizar las aproximaciones (20) y (26) ante disminuciones del multiplicador son mayores que los asociados a aumentos de éstos de la misma magnitud. Asimismo, observamos que el error que producen las aproximaciones propuestas es mayor a medida que la edad del asegurado es mayor y, por tanto, la EV es menor.

3.4. Aplicaciones de las medidas de duración y convexidad respecto al multiplicador en la gestión de riesgos

Las medidas de sensibilidad propuestas, una vez se han calculado, permiten valorar un *LS* para distintos valores del multiplicador de mortalidad con un reducido coste calculatorio adicional. Esto es de gran utilidad para realizar valoraciones ante múltiples escenarios como, por ejemplo, los resultantes de una simulación de Montecarlo. Así, en la elaboración de la Tabla 7, en la que para una edad dada se evalúan seis escenarios de la variación del multiplicador, la determinación del nuevo valor económico «exacto» del *LS* requiere, en cada caso, calcular seis nuevas trayectorias para las probabilidades de fallecimiento y supervivencia con (6) y (7). Posteriormente, con (10), calcular seis veces el valor actual esperado de un capital de fallecimiento y el de la renta contingente que suponen las primas. Sin embargo, la utilización de la duración reduce el cálculo de los nuevos valores económicos del *LS* a sólo una expresión, la (20), o a dos, también la (26), si para mayor precisión se complementa la medida de duración con la de convexidad.

La duración y convexidad propuestas también pueden aplicarse para evaluar el impacto en la provisión matemática de los seguros de vida en la cartera del asegurador ante *shocks* multiplicativos en las probabilidades de mortalidad aplicadas. En este caso, el asegurador partiría de una evaluación de las pólizas para asegurados con una EV estándar ($\beta = 1$) y el tipo de interés técnico aplicable.

Según (5), las variaciones del multiplicador son porcentuales, por lo que se puede definir una variación de 1 punto básico en el multiplicador como $\Delta\beta = 0{,}01\%$. Así, utilizando una medida análoga al valor del punto básico de los instrumentos de renta fija ante cambios del tipo de interés, el valor del punto básico respecto al multiplicador de un contrato de *LS* sería $\Delta VEP_x = VEP_x \cdot DM_x \cdot 0{,}0001$.

Por otra parte, la duración obtenida permite aproximar linealmente el riesgo de variaciones del valor económico del *LS* mediante su desviación estándar, $\sigma_{\Delta VEP_x}$, a partir de la desviación estándar de las variaciones del multiplicador, $\sigma_{\Delta\beta}$, de forma análoga a la aproximación que Dowd (2007, p.21) indica para el riesgo de precio de los títulos de renta fija a partir de la duración:

$$\sigma_{\Delta VEP_x} \approx VEP_x \cdot DM_x \cdot \sigma_{\Delta\beta} \tag{27}$$

La ecuación (27) es fácilmente aplicable para gestionar y medir el riesgo de longevidad de los *LSs*. Sin ánimo de ser exhaustivos mencionamos las siguientes aplicaciones:

a) Determinar el valor en riesgo de un *LS* o de una cartera de *LSs*, siendo uno de los factores de riesgo considerados la disminución del multiplicador, por los métodos delta-normal y delta-gamma normal.
b) Li y Lou (2012) analizan cómo cubrir el riesgo de longevidad en rentas de supervivencia vendiendo contratos q-*forward*; esto es, pagando una probabilidad de mortalidad *forward* sobre un nocional y cobrando sobre dicha cantidad una tasa de mortalidad efectiva. El cobro neto que proporciona la venta del q-*forward* es denotado como $N \cdot \Delta q$, siendo Δq la diferencia entre la mortalidad realmente registrada en el colectivo de referencia y la mortalidad *forward* y N el valor nocional. Describimos, brevemente, cómo diseñar una estrategia de cobertura de *LSs* con contratos q-*forward* usando nuestro concepto de duración respecto al multiplicador. Denotamos por $\sigma_{\Delta q}$ a la desviación estándar de la diferencia de probabilidades de mortalidad y por $\rho(\Delta\beta,\Delta q)$ a la correlación entre $\Delta\beta$ y Δq. Entonces, la desviación estándar del valor de la venta de un q-*forward* es $\sigma_{q\text{-}forward} = N \cdot \sigma_{\Delta q}$. Por tanto, el número de contratos a vender bajo el criterio de minimizar la varianza de la cobertura sería $n = \rho(\Delta\beta,\Delta q)\dfrac{\sigma_{\Delta VEP_x}}{\sigma_{q-forward}}$.
c) Wang *et al.* (2011), partiendo de los resultados de Wang *et al.* (2010), proponen mitigar el riesgo de mortalidad de la cartera pasiva de seguros de vida invirtiendo parte de la cartera activa en *LSs*. Así, si se produce un aumento de la mortalidad que suponga un sobrecoste de la cartera pasiva, éste puede quedar compensado, al menos parcialmente, por los cobros anticipados que proporcionaría la cartera de *LSs* imputables a dicho aumento de mortalidad. El uso de las medidas de

sensibilidad respecto al multiplicador de mortalidad permite determinar el riesgo asociado a una posición conjunta de una cartera de seguros con una proporción de la cartera activa vinculada invertida en *LSs*. Una vez cuantificado el riesgo, el asegurador puede plantearse su posterior cobertura.

4. CONCLUSIONES

La actual situación demográfica, en países como España, supone un desafío, pero a la vez una gran oportunidad, para el asegurador de vida. Como se ha expuesto en la introducción, esta circunstancia debe impulsar al sector asegurador a introducir innovaciones en sus productos con el fin de aumentar su atractivo para el ahorro enfocado a la previsión. En este sentido, describimos el funcionamiento de una figura ampliamente arraigada en otros países como son los *LSs*. Su implantación y desarrollo en España enriquecería y dinamizaría, sin duda, la actividad aseguradora de vida aumentando la liquidez de los seguros de vida.

La descripción de los *LSs* muestra que su operativa es compleja, por lo que llevan asociados un volumen de comisiones relativamente elevado. Asimismo, el inversor en *LSs* está sujeto a una multiplicidad de riesgos, entre los que destaca el de longevidad y el de la subestimación de la EV, siendo la consecuencia que el tipo de interés aplicado para calcular su precio deba contener una elevada PR. Así, la póliza de un asegurado con una EV por debajo de la media no necesariamente tendrá un precio de venta más atractivo en el mercado de *LSs* que su valor de rescate; dependerá de factores como la estructura de las primas o la calificación crediticia del asegurador. Por otra parte, los *LSs* complementan perfectamente la inversión en activos financieros convencionales o incluso activos reales como los inmobiliarios, debido a la poca correlación de los riesgos a los que están sometidos estos últimos con el riesgo de longevidad.

La principal aportación de este trabajo se centra en el desarrollo de medidas asociadas al riesgo de variación sobre la EV asimilables a la duración y la convexidad respecto al tipo de interés. Así, extendemos los resultados presentados en Stone y Zissu (2008) y Jori *et al.* (2010), basados en el enfoque determinista en la valoración de *LSs*, al análisis de la sensibilidad del valor de estos acuerdos bajo el marco valorativo que proporciona el enfoque probabilístico, que es el comúnmente aceptado en lugar del determinista. Sin embargo, en lugar de considerar que el parámetro cuantificador de la sobremortalidad susceptible de variación es la EV, suponemos que es el multiplicador de la mortalidad que los *MUs* calculan y que está asociado a dicha EV. La utilización exclusiva de medidas de duración respecto al multiplicador de mortalidad proporciona una buena aproximación ante fluctuaciones moderadas del multiplicador. No obstante, en el caso de mayores variaciones de este parámetro, cuya evaluación es de gran interés en la gestión de carteras, esta medida debe ser complementada con la medida de convexidad del valor económico de la póliza respecto a dicho multiplicador.

Finalmente, el enfoque propuesto puede ser aplicado al caso en que, en lugar de considerar como tabla base la correspondiente a una población estándar, se utiliza una tabla de mortalidad específica para ciertos factores de riesgo (código postal, diabetes, cáncer de mama, etc.). En este caso, el multiplicador de mortalidad adaptaría las probabilidades de fallecimiento de dicha tabla a las condiciones específicas del asegurado.

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The impact of social media and e-WOM on the success of reward-based crowdfunding campaigns

El impacto de los medios sociales y del e-WOM en el éxito de las campañas de crowdfunding *basadas en recompensas*

Susana Bernardino*, J. Freitas Santos[a], Sílvie Oliveira[b]

[a] *Polytechnic Institute of Oporto/ISCAP/ CEOS.PP – Centre for Organisational and Social Studies of P.Porto, Portugal, Rua Jaime Lopes Amorim, S. Mamede de Infesta,4465-004, Portugal. – jfsantos@iscap.ipp.pt – https://orcid.org/0000-0001-8233-5039*

[b] *Polytechnic Institute of Oporto/ISCAP, Rua Jaime Lopes Amorim, S. Mamede de Infesta,4465-004, Portugal. – SilvieTavOliveira@hotmail.com – https://orcid.org/0000-0003-3400-351X*

* ***Corresponding author**: Polytechnic Institute of Oporto/ISCAP/ CEOS.PP – Centre for Organisational and Social Studies of P.Porto, Rua Jaime Lopes Amorim, S. Mamede de Infesta,4465-004, Portugal.– susanab@iscap.ipp.pt – https://orcid.org/0000-0002-1639-3553*

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ABSTRACT

Crowdfunding (CF) is a financial tool that has faced an impressive growth over the past few years, and provides an alternative form of fundraising entrepreneurial projects. However, not all CF campaigns are successful in attracting the investors' interest and obtaining the pledging goal. As CF is built over internet platforms, digital marketing strategies have been used to improve awareness and engage people to contribute with small amounts of money for a given CF campaign.

Hence, this paper intends to study the effect of social media and electronic word of mouth (e-WOM) on the CF campaigns' outcomes and whether these digital marketing strategies might influence the small investors' decision to support or not a reward-based CF campaign.

Using a sample of data from the second largest American reward-based CF platform (Indiegogo), we have applied the multiple OLS regression analysis, to assess the causal effect of various sets of variables in the success rate of a CF campaign.

The findings show that social media and e-WOM strategies play a critical role and have a positive significant impact on a CF campaign.

Keywords: Crowdfunding; Reward-Based Crowdfunding; Social Media; Electronic Word of Mouth (e-WOM); IndieGoGo.

RESUMEN

El Crowdfunding (CF) es un instrumento financiero que ha experimentado un crecimiento impresionante en los últimos años y ofrece una forma alternativa de captación de fondos para proyectos empresariales. Sin embargo, no todas las campañas de CF logran atraer la atención de los inversores y obtener el objetivo inicial de la campaña. Dado que las campañas de CF se construyen sobre plataformas de Internet, se han utilizado estrategias de comercialización digital para mejorar la concienciación y lograr que las personas contribuyan con pequeñas cantidades de dinero a una determinada campaña de CF.

Por lo tanto, este documento tiene por objeto estudiar el efecto de los medios sociales y del boca a boca electrónico (e-WOM) en los resultados de las campañas de CF y si estas estrategias de comercialización digital podrían influir en la decisión de los pequeños inversores de apoyar o no una campaña de CF basada en la recompensa.

Utilizando una muestra de datos de la segunda mayor plataforma americana de CF basada en la recompensa (Indiegogo), hemos aplicado el análisis de regresión de mínimos cuadrados ordinarios múltiples, para evaluar el efecto causal de varios conjuntos de variables en la tasa de éxito de una campaña de CF.

Los resultados muestran que los medios sociales y las estrategias de e-WOM desempeñan un papel fundamental y tienen un impacto significativo positivo en una campaña de CF.

Palabras clave: Crowdfunding; Crowdfunding basado en la recompensa; medios sociales; boca a boca electrónico (e-WOM); IndieGoGo.

1. INTRODUCTION

The definitions of crowdfunding (CF) emphasise the role of the "crowd" as the main contributor for funding a new entrepreneurial venture (Belleflamme *et al.* 2015; Moritz and Block 2016). For Lehner (2013), the meaning of CF is targeting a large dispersed audience, dubbed as the "crowd", open to provide small sums of money to fund a project or a venture. Mollick (2014) refers to the efforts made by entrepreneurial individuals and groups – cultural, social, and for-profit – to fund their ventures by drawing on a relatively large number of individuals (the crowd) using the internet, without the intervention of traditional financial brokers. Kuppuswamy and Bayus (2018), considered CF a modern mechanism for financing informal ventures that enables entrepreneurs to directly call for financial assistance of the general public (i.e., the "crowd") to get their innovative ideas off the ground. Other scholars (e.g. Ahlers *et al.* 2015) used an umbrella term to describe an increasingly widespread form of fundraising via the internet, whereby groups of people (crowd) pool money, usually through (very) small individual contributions to support a specific venture. As stated by different authors (Gajda and Mason 2013; Agrawal *et al.* 2015; Baumgardner *et al.* 2017), there is no doubt that the development of internet and the spread of Information and Communication Technologies (ICT) increased the awareness and the participation of the "crowd" in financing entrepreneurial projects.

Regardless of CF business models that might be considered, the role of the crowd is critical (Mollick 2014). For instance, in the donation or patronage model of CF usually used in philanthropy, the donations are given by the crowd without any expected direct reward. In the lending model, the concession of small loans was made available by the "crowd" that has the expectation of being repaid by the founder plus an interest rate. In the reward-based model, the crowd is seen as early customers that buy products previously to be launched in the mass-market (André *et al.* 2017). In the equity model, the crowd acquire equity stakes if they support a project, and the persons are treated as equity investors.

The success of a CF campaign occurs when the projects to be financed match with what is valued by the crowd (Belleflamme *et al.* 2014). In other words, to be considered successful, a CF campaign has to be able to collect all the resources requested by the entrepreneur. To attain this objective the promoter needs to persuade the maximum number of people possible to complete the pledging goal.

The existing statistics indicate that in 2019 the success rate of the Kickstarter CF platform is just about 37.4% (Statista 2020). To increase the probability of success of the projects posted on the CF platforms the promoters develop digital marketing strategies in order to influence potential investors. In this context, the research aims to analyse if social media and eWOW are important drivers of the investors' decision to participate in a CF campaign.

Although social media and e-WOM has been a subject of interest for several researchers in digital marketing, previous research about the influence of social media and e-WOM on the success of a CF campaign has been scarce (Kaur and Gera 2017). Further, Thies, Wessel and Benlian (2014) claimed for additional research on the dynamic interaction of e-WOM and the campaign contribution behavior of backers in CF, and the consequences of these interactions for other CF platforms.

Therefore, the objective of this article is to investigate the influence of social media (Facebook shares) and e-WOM (online comments) on a reward-based CF campaign, and its relative importance when project's characteristics and founder's profile are considered. The intention is to understand if participation in online communities and the consequent generation of social buzz increase the probability of the success rate of a reward-based CF campaign. Moreover, most of the available studies does not take account of other variables related with the project (e.g. whether the project is technology based vs. culture and arts based), nor does it assess its influence on differentiating the behavior of promoters (e.g. experienced vs. non-experienced entrepreneurs). The analysis of the role of social media and e-WOM within a reward-based CF setting will provide practical recommendations for crowdfundees and platform operators, helping them raise the attention of current and prospective crowdfunders.

The paper is organised as follows. First, we provide the concept and business models of CF, explaining in more detail the reward-based model. In the second section, we analyse the role of social media and e-WOM on CF. Additionally, the next section examines the influence of the characteristics of the project and the founders' attributes on the success rate of a CF campaign. Then, we present the methodology and the model used in the investigation. Following this, we examine the data, ascertain relevant factors and discuss the results. The paper closes with the main conclusions, limitations and future research directions.

2. THE REWARD-BASED MODEL OF CROWDFUNDING

Reward-based model is the most popular and widely known type of CF (Cho and Kim 2017; Yu *et al.* 2017). The reward-based model allows fundraisers to attract a group of funders who essentially receive a reward for backing a project. Contributors receive a "reward" in exchange for the money they offered to the project (André *et al.* 2017). The reward delivered consists of an incentive system to funders and is also a mean by which entrepreneurs show their gratitude to the investors by supporting a given project asking for funds (Joshi 2008; Paschen 2017). For Cruz (2018, p. 374) "reward-based crowdfunding consists of a financing mode where entrepreneurs pitch for monetary contributions to an idea in exchange for special prizes, appreciation tokens or early editions of products". The reward embedded in a CF campaign could range according to the amount of the contributions offered. The reward often contains a beta-version of a product, the final product (e.g. a book or a game), which may be personalised (signed, a thank you note, etc.), a publicly available mention, or a chance to meet the creators of a project (Mollick and Kuppuswamy 2014). Alternately, the funders could be treated as early customers giving them priority and preference in the access of a new product never launched in the market at a lower price, or with some additional attributes. The pre-purchasing

of products by early customers, such as software, hardware, or consumer products, is a pattern in this kind of projects (Mollick and Kuppuswamy 2014). This scheme reduces the risks for crowdfundees as the potential losses are minimal, while the main question to crowdfunders is whether the product will satisfy his/her tastes.

Reward-based CF proposals cannot be measured in monetary terms as funders receive tangible but non-financial benefits for their contributions (Belleflamme *et al.* 2015). Gerber *et al.* (2012) provide some examples of the relevance of rewards for funders and its role in increasing the participation in CF communities. Also, taste heterogeneity among crowdfunders seems to play a prominent role as a specific creative project may appear to be extremely important for some funders while completely irrelevant to others (Belleflamme *et al.* 2015). Herein, the design of the rewards strategy is critical for the CF campaign. As argued by André *et al.* (2017, p. 325), "rewards must be based on multiple logics including the capacity to generate connections and interactions between backers and the entrepreneurs".

Reward-based CF could be a very promising financial mechanism, that allows entrepreneurs to fundraise money for their projects, without incurring in debt or sacrificing equity (Yu *et al.* 2017). Besides the easy and costless access to finance, reward-based CF also offers other benefits to potential entrepreneurs. From a market research point of view, the amount of funding and backers could be seen as a predictor of future demand for the product. On the other hand, the success of the campaign may serve as a signal for future funding rounds, possibly through more traditional funding channels (e.g., venture capital or bank loans).

Crowdfunding campaigns are designed for a specific amount (the pledging goal) and held during a given period of time (the campaign duration). If within the time horizon defined the campaign was able to collect the resources asked to reach the funding amount (pledging goal) they will succeed; otherwise, they will not be considered successful. Therefore, the ability to attain the funding goal proposed is traditionally the most common measure of success of a CF campaign (Sahaym, Datta and Brooks 2019), although other approaches could either be considered, even though they are not as common in the literature.

Some of the literature has also focused on the motivations that led individuals to support a certain CF campaign. Choy and Schlagwein (2016) proposed four categories of motivational orientation based on the bifurcation into intrinsic and extrinsic components, and individual and social elements. Intrinsic motivation consists of performing an activity for its own sake, by the pleasure and enjoyment of the task. In contrast, extrinsic motivation refers to people doing something for some external goal outside the task itself (Ryan and Deci 2000). Individual motivation is the willingness to exert high levels of effort toward a goal without regard to the social influence of a community, while social motivation is the willingness to exert a task due to the social influence of a community in order to be accepted by that community (Forgas *et al.* 2005). According to the results of the qualitative study, Choy and Schlagwein (2016, p. 237) found a first type of motivation called intrinsic-individual that "relate to donors" self-enjoyment or personal satisfaction in supporting the campaign', the second motivation is coined social-intrinsic and "relates to donors" self-enjoyment or personal satisfaction in supporting the campaign in the presence of an online crowd/community', the third is the individual-extrinsic motivation that "relate to donors" desire to realise a particular outcome as a result of supporting the campaign', and the fourth is the social-extrinsic motivation that "relate to donors" desire to realise a particular outcome as a result of supporting the campaign in the presence of an online crowd/community'. The same four categories are proposed by Ryu and Kim (2016) that classified the crowdfunders into: angelic backers (similar to traditional charitable donors), reward hunters (analogous to market investors), avid fans (most passionate sponsor group, similar to members of a brand community), tasteful hermit (active in supporting the project as avid fans, but with lower extrinsic and others-oriented motivations). We can also classify the motives of the crowd based on the type of business model of CF that was used to attract contributions. For instance, in reward-based CF, receiving new products/services from entrepreneurs is an important motivation for backers. Also, helping others and being part of a community that support the development of new products might also encourage more backers to invest in crowdfunding projects (Gerber *et al.* 2012; Gerber and Hui 2013). In a review of literature, Kaartemo (2017) found that people are driven to participate in CF projects by the attempt to collect rewards and financial returns, help other people in need and support a cause, and to form relationships and be part of a community.

The reasons that could deter crowdfunders (investor) from funding are associated with lack of trust in the crowdfundee (entrepreneur), specifically in platforms where the fund-seeker is allowed to keep the money even when the target is not met (Gerber and Hui 2013). Another problem is time, as online fundraising campaigns require performing a set of managerial tasks that could be a very time-consuming venture that represents a "full-time job" (Cruz 2017). Other major concern is related to the need of display publicly detailed information about the project that increases the risk of copying, especially for projects in the business domain that once imitated might reduce or eliminate the competitive advantage (Hommeravá 2020). Another problem is the disadvantageous position that the crowdfunder has about the crowdfundee that could lead to the risk of moral hazard (such as fraud) and deter some people from putting their money into a given project (André *et al.* 2017). This is called information asymmetry that refers to "investors lacking information about the risks and/or expected returns of their investments" resulting from the fact that "investors are likely to be less informed than entrepreneurs or borrowers about the quality of the project" (European Commission 2015, p. 25).

In a context of information asymmetry and uncertainty, the investors have to collect the maximum of information possible to reduce risk. Besides the information about the founder of the project, it will be helpful to obtain specific information about the project that could help current and prospective investors (backers) make an informed investment decision.

3. THE ROLE OF SOCIAL MEDIA AND E-WOM ON CF CAMPAIGNS

There is a growing number of academic researchers that have started to study the role of digital marketing strategies in CF, although it is still an under-exploited topic in the empirical literature (Laurell *et al.* 2019). Specifically, the study of social media and e-WOM strategies within the scope of CF are important issues to analyze.

3.1. Social media

Social media has become widely used by firms to create awareness for its products and projects (Sahaym *et al.* 2019). Social media has further been recognised as very helpful for diffusing information, increasing exposure, improving the site traffic and also promoting engagement with its audience (Sahaym *et al.* 2019).

In CF, social media is often used to enable entrepreneurs and investors to disseminate information about the campaign after its launch, claim for support and resources, and share project updates with the crowd (Hui *et al.* 2014). Thus, social media helps entrepreneurs to build ties and reinforce tie strength with existing and potential backers. Besides the improved transparency allowed by social media, the creation of trust is key to engage with prospective investors (Sahaym *et al.* 2019).

Thus, CF campaigns, especially for new projects in the early stages of development, strongly benefit from the creation of a virtual word of mouth marketing strategy as well as buzz, that positively impacts the collection of funds.

Previous studies have confirmed the relevance of social media on CF success in multiple social platforms (e.g. Beier and Wagner 2015; Borst *et al.* 2017; Lu *et al.* 2014). At the same time, existing literature recognise that the vast majority of highly-funded CF projects have used social media to spread awareness among potential supporters and have used multiple advertisements and messages across different platforms (Borst *et al.* 2017).

To increase the likelihood of collecting funds to attain or surpass the pledging goal of a CF campaign, it is necessary to reach a larger number of potential funders, for which the use of online CF communities on social media is critical (Borst *et al.* 2017). Social media facilitates the creation and maintenance of social networks (Laurell *et al.* 2019). Also, the use of social media allows entrepreneurs to obtain, via digital communication means, other connections that are technically available but are not yet activated (latent ties) (Borst *et al.* 2017). Thus, through social media it is possible to attract more distant people that otherwise would not be possible.

The number of contacts in social media (number of "friends") has also been recognised as having a positive impact on CF success (Mollick 2014; Zheng *et al.* 2014). However, Borst *et al.* (2017) findings indicate that weak and latent ties are more important for campaign success than strong ties, that are closer to the entrepreneur and composed mainly of family and friends.

Therefore, social media could be key to atract the "crowd" and establish communication with a broader audience, necessary to support the project, especially in the context of digital interactions where CF is strongly embedded.

Social media could either perform an important role in stimulating the herd behaviour and to increase the number of supporters of a given project/campaign. The empirical work carried out by Borst *et al.* (2017) confirms the presence of herd behaviour, that results from the influence made by peers in social networks. This herding bahevior contributes positively to the campaigns' success, even though that could be somewhat blurred by the contrary influence of the bystander effect. According to this latter effect, a higher network reduces the likelihood of its members acting and giving support to a campaign, since they are more prone to act as "spectators" (Borst *et al.* 2017).

In a different way, the investigation of Sahaym *et al.* (2019) found that entrepreneurial orientation is positively related to the CF campaign success, and this relationship is also mediated by the perceived contributions of social media. The investigation found that innovativeness and proactiveness stimulate companies to recognise the benefits derived from the use of social media platforms to the CF campaign (Sahaym *et al.* 2019).

From a marketing point of view, the backers can be converted into ambassadors by helping to promote the product in social media (e.g. Facebook, Instagram). As CF is mostly based on social media and digital communication, it is very simple to exchange information about a project with people across country borders. Viral marketing strategies can be used by backers to promote projects as sending information to friends, and other people is easier and faster than using traditional offline technologies. Also, due to the financial involvement of backers in the supported projects, there is an additional motivation to apply the most recent digital communication tools to enhance the awareness of the projects among the social media community (Gierczak *et al.* 2015).

Facebook is one of the most prominent social media platforms that could be used to promote the projects allowing people to share, discuss, and communicate with others. Most of the reward-based platforms have many accounts linked to Facebook which means that it is easy to determine how many Facebook connections each founder has, thus providing control over the extent of a founder's social network. Large numbers of friends on online social networks have long been associated with the success of crowdfunding campaigns (Mollick and Kuppuswamy 2014). Mollick (2014) drawing on a dataset of over 48,526 projects on Kickstarter concludes that the size of a fundraiser's personal network (number of Facebook connections) is associated with the success of crowdfunding efforts. Similarly, Thies, Wessel and Benlian (2014) examine the effects of social networks on the likelihood of success of 6,000 crowdfunded campaigns on Indiegogo to conclude that social buzz (especially Facebook shares) positively influences project backing. Hong, Hu and Burtch (2015) examine panel data from Indiegogo to conclude that social media activities matter in general but have a slightly different impact. In the case of Facebook, the messages shared are more influential for public goods campaigns, while on Twitter the impact is more on private products campaigns. Further, Lu *et al.* (2014) based on empirical evidence stress that social networking, especially in the early stage of the project, can significantly increase the probability of attracting funds for a project.

Despite the huge benefits that the use of social media can provide, there is also some risks to be considered, such as those related with privacy issues or loss of control over information overspread through conversations. Since social media platforms are active all the time and conversations can occur even without the presence of the responsible for the project, part of those con-

trol is transferred to the community as a whole (Sahaym *et al.* 2019; Summers *et al.* 2016).

A synthesis of the main impacts of social media in CF campaigns is presented in Table 1.

Table 1
Social media and the impact on reward-based CF campaigns

Factors	Authors	Impact
Social Media	Beier and Wagner (2015) Borst *et al.* (2017) Lu *et al.* (2014) Mollick (2014) Mollick and Kuppuswamy (2014) Thies *et al.* (2014) Zheng *et al.* (2014)	— Use of social media increases the likelihood to attract funds — Social media extends the social network of the entrepreneur and the reach of the campaign — Social media facilitates the communication with a broader and more diverse audience — Social media can spread the herd effect

Source: Authors' own elaboration.

The assessment of the relevance of social media for the success of a reward-based CF campaign lead to our first hypothesis:

H1) The presence of a project in social media has a positive impact on the success of a reward-based CF campaign.

3.2. Eletronic word of mouth (e-WOM)

Electronic word-of-mouth represents statements made about a product or service made available through social networks to a multitude of people and institutions via the Internet (Kietzmann and Canhoto 2013). Hennig-Thurau *et al.* (2004 p. 39) define eWOM communication as "any positive or negative statement made by potential, actual, or former customers about a product or company, which is made available to a multitude of people and institutions via the internet'.

Several studies performed in different industries conclude that on-line reccomendations or reviews made by consumers have a positive impact on other consumer purchasing behaviour (e.g. Senecal and Nantel 2004; Chevalier and Mayzlin 2006; Xia and Bechwati, 2008; Xiaofen and Yiling 2009). Analysing specifically the WOM referrals, Trusov *et al.* (2009) detected a twofold positive impact: in the short term, a very strong direct effect on new customer acquisition; and, a larger and enduring effect of WOM in the mind of the consumer.

The increasing relevance of eWOM is part of a general process of social transformation, where customers are becoming active participants in the business processes. Wherein, they share their ideas and experiences in different platforms (e.g. social networks, blogs, review sites, among others), rather than just having a passive attitude (Summers *et al.* 2016). Leveraging online word of mouth is important either to spread brand-related information and also to get some feedback from potential supporters and consumers. Also, e-WOM enables consumers (or other relevant stakeholders) to improve communication and increase the brand popularity of a company or project (Hennig-Thurau *et al.* 2004). For instance, the comments about the project included in the CF platform allow backers to interact with the founder of the project and other prospective investors generating e-WOM via the Internet.

Empirical evidence shows that lack of information directly related with the quality of the project may lead prospective backers to rely on e-WOM generated by the friends of the fundraiser to clarify some aspects of the project (Belleflamme *et al.* 2015). The e-WOM has been found to be influential in driving opinions in CF context. Kaminski, Hopp and Lukas (2018) provide empirical evidence that a higher quality campaign in Kickstarter benefits from user-generated e-WOM (online comments) and mass personal e-WOM (Facebook shares) although the social media activity follows the success of the campaign but does not affect the probability of success. Therefore, they recommend that CF campaigns approach their social media activities with caution to attain their campaign goal (Kaminski *et al.* 2018). Kaur and Gera (2017) confirm the results of previous research stressing that social interaction and connectivity have a positive impact on attracting funds for a CF project. Aggarwal *et al.* (2012), based on the volume of conversation generated through social media, also find that eWOM has a positive impact on venturing's financing.

Differently, the investigation performed by Summers *et al.* (2016) indicates that social media buzz has no direct effects on funding, although significant moderating effects were found on the relationship between project signals and funding outcomes. The research also reveals that the influence of social media in CF is a very complex process. Herein, nor all social media buzz has exactly the same contribution, since some buzz is just "noise" and others are "buzzworthy" and influence fundraising. According to Summers *et al.* (2016), the differential effect of "buzz", depends mainly on the social platform used and the kind of signal embedded, where the broadly diffused and hybrid varieties of buzz leverage the commitments signals. The authors identify a positive impact of "tweets" and Google+ "shares", that is not significantly reached through Facebook "shares".

A summary of the main impacts of e-WOM in CF campaigns could be seen in Table 2.

Table 2
E-WOM and the impact on reward-based CF campaigns

Factors	Authors	Impact
e-WOM	Hennig-Thurau *et al.* (2004) Belleflame *et al.* (2015) Kaminski *et al.* (2018) Summers *et al.* (2016)	— The e-WOM effect improves project popularity and recognition — The e-WOM expands the "wisdom of the crowd" — The e-WOM positively influences the attainment of funding goals — The e-WOM positively influences the commitment signalisation

Source: Authors' own elaboration.

The assessment of the importance of e-WOM for the success of a reward-based CF campaign lead to our second hypothesis:

H2) The extent of eWOM generated to a project has a positive impact on the success of a reward-based CF campaign.

4. VARIABLES RELATED TO PROJECT'S CHARACTERISTICS AND FOUNDER'S PROFILE

The content of a CF campaign includes the pitch, the funding goal, the time frame, the reward-tiers and the communication (Young 2013). The pitch is the first contact point to the audience and contains the project introduction to the project that could be displayed in written and/or video format. The funding goal is the total amount of money that is needed to make the project work. The time frame begins when the campaign is launched and ends when it finishes independently of the required funding goal is attained or not. The reward-tiers are defined according to the strategy of the founder with multiple options in varying price ranges attracting more people. Several researchers (e.g. Koch and Siering 2015; Kraus *et al.* 2016; Giudici *et al.* 2017) identified the main influential factors that determine the success of a CF campaign. They could be grouped in two components: the project related factors include the length of the video pitch, the depth of the project's description, project's updates availability, the typology of the project, and the pledging goal target. The promoter related factors encompass the way promoters present themselves on the website of the project, the number of backers, the team and the previous experience of projects on the CF platform.

4.1. Variables related to project's charateristics

These variables refer to the project's characteristics that includes the existence and length of the video pitch, the detailed description of the project, the number of updates to the project that are posted on the platform, the technological nature of the project, and the amount of the pledging goal. The empirical evidence provided by Table 3 shows that these variables significantly influence the investment choices of the prospective investors.

Therefore, we hypothesise:

H3) The variables related to the characteristics of the project have a positive impact on the success rate of a CF campaign.

Table 3
Project's related variables and the impact on reward-based CF campaigns

Factors	Authors	Impact
Length of the video pitch	Park and Hopkins (1993) Jiang and Benbasat (2007) Young (2013) Mollick (2014) Colombo *et al.* (2015) Kraus *et al.* (2016) Hobbs *et al.* (2016) Kaartemo (2017) Bi *et al.* (2017) Courtney *et al.* (2017) Zhou *et al.* (2018) Koch and Siering (2015; 2019)	— Visual display of information is more effective if it is dynamic rather than static; — Visitors perceived websites with video content as more useful than static-picture formats only; — Absence of a video was negatively associated with CF success; — Videos are 100% more successful than the ones that don't have a video; — Videos, pictures, and other digital marketing activities are relevant in a CF campaign; — Videos may increase project acceptance.
Depth of the project description	Koch and Siering (2015; 2019) Hobbs *et al.* (2016) Kaartemo (2017) Hossain and Oparaocha (2017)	— Level of the description of the project has a positive effect on a CF campaign.
Availability of project updates	Xu *et al.* (2014) Mollick (2014) Block *et al.* (2018) Kuppuswamy and Bayus (2018) Shahab *et al.* (2019)	— Updating information about a project with pertinent posts has a significant positive contribution to the success of a CF campaign; — Number of updates is a key motivating factor in investment decision; — Updating frequently the information about the projects can almost double the probability of funding.
Typology of the project	Mollick (2014) Hörisch (2015) Chan *et al.* (2018) Zhang and Chen (2019)	— Majority of technology projects that failed to reach their funding goals; — Different product categories show systematic variations in the attraction of funds.
Amount of pledging goal	Mollick (2014) Frydrych *et al.* (2014) Colombo *et al.* (2015) Kaartemo (2017) Gangi and Daniele (2017) Zhou *et al.* (2018) Janku and Kucerova (2018) Koch and Siering (2015; 2019).	— Lower pledging goals are more likely to be successful

Source: Authors' own elaboration.

4.2. Variables related to founders's profile

The profile of the promoter of the project can play an important role in influencing prospective investors. Evidence in previous studies (Table 4) shows that the way founder presents himself, the number of backers that attracts to the project, the nature of the team, and the previous experience of the founder act as driving forces to attract investments.

Therefore, we hypothesise:

H4) The variables related to the founder's profile have a positive impact on the success rate of a CF campaign.

Table 4
Founder's related variables and the impact on reward-based CF campaign

Factors	Authors	Impact
Founder's presentation	Egger (2001) Fogg *et al.* (2001) Boeuf *et al.* (2014) Colombo *et al.* (2015) Koch and Siering (2015) Gafni *et al.* (2018)	— Picture of the project owner boosts the probability of obtaining success; — Name of entrepreneurs on the pages of projects are positively and significantly related to CF success; — Presenting authentic people from a company in a campaign gives a "real-world feeling" and enhances credibility.
Number of backers	Bikhchandani *et al.* (1992) Shen *et al.* (2010) Herzenstein *et al.* (2011) Lee *et al.* (2011) Lee and Lee (2012) Zhang and Liu (2012) Colombo *et al.* (2015) Agrawal *et al.* (2015) Hobbs *et al.* (2016) Wang and Tu (2016) Gangi and Daniele (2017) Kuppuswamy and Bayus (2018) Mezei (2018)	— Evidence of a strong herding behaviour; — Higher participation rate attracts more bids; — The number of backers is a positive predictor of the probability of success of a CF campaign; — Strong community support for a venture signals that the project is perceived as having high quality; — Funders' propensity to invest in a given artist increases as capital on the platform accumulates; — The success of a CF campaign depends highly on the early support given by backers; — Past investments made by other backers may increase the propensity to fund; — The dynamic pattern of backer support over the project funding cycle is U-shaped.
Founder's team	Lagazio and Querci (2018)	— Projects that present a large number of team members had a higher probability of succeeding in fundraising
Previous experience of the founder	Courtney *et al.* (2017) Zhou *et al.* (2018) Janku and Kucerova (2018) Koch and Siering (2015; 2019)	— Founders that have a higher number of previous projects funded might increase the probability of having more success in the subsequent projects' campaigns

Source: Authors' own elaboration.

5. METHODOLOGY

This study focuses on the projects launched by entrepreneurs to raise money from backers to start their new venture within a limited time window, providing prospective investors with different reward schemes. The backers interested in a certain project choose an appropriate reward scheme and pay the backing prices to support the project. A project will be funded if the total money of committed purchases from backers exceeds a specified goal within a predetermined time window.

The purpose of the investigation is to empirically examine the influence of social media and e-WOM on the success of a CF campaign. To that purpose, we extracted a unique dataset from the Indiegogo platform. Indiegogo was created, in 2008, in the United States (San Francisco) and according to the information displayed on their website since the beginning of the operations the platform has helped more than 800,000 innovative ideas come to life. The number of people that visit the platform is impressive (ten million each month), geographically diversified (235 countries and territories) with around 19,000 campaigns launched by month (www.indiegogo.com). Projects fall into three main groups: i) Tech and Innovation; ii) Creative Works; iii) Community Projects. The first group includes audio, camera gear, education, energy & green tech, fashion & wearables, food & beverages, health & fitness, home, phones & accessories, productivity, transportation, and travel & outdoors. The second group encompasses art, comics, dance & theatre, film, music, photography, podcasts, blogs & vlogs, tabletop games, videogames, web series & TV shows, and writing & publishing. The last group includes culture, environment, human rights, local businesses, and wellness. For empirical analysis we have excluded the last group as the projects are mainly related to social causes and social CF, that is led by different motivations.

To perform the study, secondary data about different characteristics of the founder and the project were collected from the platform IndieGoGo (www.IndieGoGo.com). Then, we proceed to the process of content analysis by analysing a random strat-

ified sample of the projects displayed on the platform between March and September of 2019. The sample includes both successful and unsuccessful projects and is limited to two strata – technology, and arts and culture. The final sample was composed of 125 technological and 125 arts and culture projects, that were conjointly analysed, given the research aims.

The data were codified and examined using several statistical techniques from the software package IBM SPSS, version 24. Specifically, firstly, we have employed descriptive statistics, that were followed by correlation analysis to detect problems of multicollinearity. After some tests, we proceed to the OLS multiple regression analysis to assess the causal effect of the different variables in the success rate of the project. The model to be used is presented in the next section.

6. MODEL

To estimate a response model, we use a multiple regression analysis (OLS). This is a statistical technique that allows a researcher to analyse the impact of each independent variable in an output. In this case, the formula assumes that the outcome (dependent variable), the success rate of a project, is a function of the factors (independent variables). The variables regarding the rate of success (SUC), the total amount of the pledging goal (AMOU) the number of likes on Facebook's page (LIKE) and the number of online comments (COMM) used in the analysis were logarithmised to render the distribution nearly normal.

The generic equation is the following:

$$\text{Log (SUC)} = a + \beta 1\text{LogLIKE} + \beta 2\text{LogCOMM} + \beta 3\text{VIDD} + \beta 4\text{PROT} + \beta 5\text{UPD} + \beta 6\text{NAT} + \beta 7\text{LogAMOU} + \beta 8\text{PRES} + \beta 9\text{LogBACK} + \beta 10\text{TEAM} + \beta 11\text{PREV} + e$$

In this model, the dependent variable is the Success of a CF project (SUC). This variable takes the value given by the percentage of the pledging goal that could be above or below 100%. The projects that attain values above 100% (attain the pledging goal) are considered successful, while projects with values below 100% are considered a failure. The higher the value above 100%, the more successful is the project.

The key independent variables related to social media and e-WOM are:

— The logarithm of the number of Facebook friends (LogLIKE) is the number of likes that the Facebook page of the campaign displays;
— The logarithm of the number of comments (LogCOMM) is the number of comments posted by the followers of the project in the project feed of the CF platform, in a logarithmised form.

The key independent variables related to the project are:

— Length of the video pitch (VIDD), measured in minutes;
— Depth of the project description (PROT) is a dummy variable that takes the value of 1 when there is a detailed description that allows deriving a prototype of the project (such as images, an explanation of the evolution of the product/idea); and 0 otherwise;
— Availability of project updates (UPD) is a dummy variable that takes the value of 1 when have been registered updates for the project and 0 otherwise;
— Typology of the project (NAT) is a dummy variable and takes value 1 for technology projects and 0 for arts and culture projects;
— The logarithm of the amount of pledging goal (LogAMOU) is the total amount of the pledging goal, in US dollars, in a logarithmised form.

The key independent variables related to the founder are:

— Presentation of the project's promoter (PRES) is a dummy variable that takes the value of 1 when the founder of the project appear (name and photo) and 0 otherwise;
— The logarithm of the number of backers (LogBACK) includes the number of backers registered on the platform for a given project, in a logarithmised form;
— Nature of the founders (TEAM) is a dummy variable with 1 for a campaign developed by a team and 0 by an individual;
— Previous experience of the entrepreneur (PREV): it is a dummy variable that when the promoter has previous experience on a CF campaign the value is 1 and 0 otherwise.

7. RESULTS

The analysis of Table 5 shows that the dependent variable that measures the success of each CF campaign in the Indiegogo platform has a minimum value of 4 and a maximum value of 20600. Overall, of the 250 campaigns inspected we can see that at least one of them was exceptionally successful surpassing the pledging goal by far (20600%), while on the other extreme one campaign has failed to obtain only 4% of the pledging goal. To avoid problems of skewness of the data, the variable LogSUC presents the values in a logarithmised form.

Table 5
Descriptive Statistics

Variables	Mean	Standard Deviation	Minimum	Maximum
SUC	846.34	2051.668	4	20600
LogSUC	5.43	1.55	1.39	9.93
LIKE	24068.23	124743.47	2	1315968
Log LIKE	7.0294	2.25665	0.69	14.09
COMM	364.61	1704.85	0	20647
Log COMM	2.0731	2.58394	0	9.94
VIDD	2.09	1.64	0	11
PROT	0.78	0.418	0	1
UPD	0.76	0.425	0	1
NAT	0.52	0.500	0	1
AMOU	35598.53	81306.02	500	669086
Log AMOU	9.2821	1.63452	6.21	17.17
PRES	0.63	0.484	0	1
BACK	2400.57	6712.49	3	46285
Log BACK	5.4616	2.16049	1.10	10.74
TEAM	0.58	0.494	0	1
PREV	0.32	0.467	0	1

Note: N=250.

Source: Authors' own elaboration.

The CF campaign facebook page got on average 24,068 Likes; some projects have only 2 likes on Facebook, whether others obtained an impressive number of 1,315,968 (*M*= 24,000). The number of comments on the project feed also has a high variability between projects, ranging from the absence of comments at all observed in some projects to a maximum of 20,647 comments (*M*=364.61).

The independent variables VIDD (video duration) has a maximum of 11 minutes and a mean of 2 minutes. The pledging goal for the projects is positioned between 500 and 669,086 US dollars (*M*=36,000USD). The number of backers varies between 3 and 46,285 (*M*=2,400).

The correlation matrix for the variables used in the study is provided in Table 6. An inspection of the different correlations shows low coefficients in most of the variables, although some values merit our attention as some of them are higher than 0.50. Consequently, we determine if there were multicollinearity problems with the independent variables by applying the methods recommended by Hair *et al.* (1995) and O'Brien (2007). The variance inflation factors (VIF) found for the different variables are all well below the threshold value of 10, and most of them below 2. Therefore, we proceed with our analysis as multicollinearity was not a problem.

Table 6
Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
LogSUC (1)	1	0.462 (**)	0.692 (**)	0.049	0.313 (**)	0.299 (**)	0.47 (**)	0.236 (**)	0.03	0.723 (**)	0.36 (**)	0.244 (**)
LogLIKE (2)	0.462 (**)	1	0.574 (**)	0.207 (**)	0.128 (*)	0.311 (**)	0.153 (*)	0.479 (**)	0.006	0.616*(*)	0.256 (**)	0.155 (*)
LogCOMM (3)	0.692 (**)	0.574 (**)	1	0.247 (**)	0.222 (**)	0.374 (**)	0.374 (**)	0.627 (**)	0.049	0.863 (**)	0.393 (**)	0.20 (**)
VIDD (4)	0.049	0.207 (**)	0.247 (**)	1	0.075	0.30 (**)	0.012	0.44 (**)	0.153 (*)	0.296 (**)	0.069	-0.02
PROT (5)	0.313 (**)	0.128 (*)	0.222 (**)	0.075	1	0.085	0.237 (**)	0.156 (*)	-0.235 (**)	0.265 (**)	0.268 (**)	0.101
UPD (6)	0.299 (**)	0.311 (**)	0.374 (**)	0.30 (**)	0.085	1	0.093	0.36 (**)	0.118	0.399 (**)	0.104	0.038
NAT (7)	0.47 (**)	0.153 (*)	0.281 (**)	0.012	0.237 (**)	0.093	1	0.241 (**)	-0.154 (*)	0.326 (**)	0.398 (**)	0.07
LogAMOU (8)	0.236 (**)	0.479 (**)	0.627 (**)	0.44 (**)	0.156 (*)	0.36 (**)	0.241 (**)	1	0.085	0.678 (**)	0.269 (**)	-0.005
PRES (9)	0.03	0.006	0.049	0.153 (*)	-0.235 (**)	0.118	-0.154 (**)	0.085	1	0.10	-0.012	-0.04
LogBACK (10)	0.723 (**)	0.616 (**)	0.863 (**)	0.296 (**)	0.265 (**)	0.399 (**)	0.326 (**)	0.678 (**)	0.10	1	0.418 (**)	0.139 (*)
TEAM (11)	0.36 (**)	0.256 (**)	0.393 (**)	0.069	0.286 (**)	0.104	0.398 (**)	0.269 (**)	-0.12	0.418 (**)	1	0.092
PREV (12)	0.244 (**)	0.155 (*)	0.20 (**)	-0.022	0.101	0.038	0.07	-0.005	-0.04	0.139 (**)	0.092	1

Note: N = 250. Significance: (**)p<0.01;(*) p<0.05.

Source: Authors' own elaboration.

To assess the impact of each of the independent variables on the success rate of a CF campaign, we conducted multiple OLS regression analysis according to the general model presented before. To evaluate the impacts separately, we create four models: a full model contemplates all the variables, and three restricted models grouped the independent variables related with social media and e-WOM, the project and the founder. A global analysis of all the models shows that the coefficient of the adjusted R^2 is high (between 0.736 and 0.314) and the values of Snedecor's F statistically significant (p<0.01).

The empirical results for CF campaign success are presented in Table 7. The full model explains 73.6% of the variance that could be considered very effective at predicting the success of a CF campaign. Even if this model represents only a general exploratory investigation of the variables, it confirms their influence on the dependent variable. The results of Model 1 indicate that of the 11 variables under consideration, only VIDD, PRES and TEAM have no significant effects on CF success. The variables regarding the social media (LIKE) and the e-WOM

(COMM) are statistically significant (p<0.10; p<0.05, respectively) indicating that gaining comments and likes to the project increases the probability of success of the campaign.

Table 7
Results of the OLS multiple regression (dependent variable Log (SUC)

Variables	Model 1 (All variables)	Model 2 (Digital marketing related variables)	Model 3 (Project related variables)	Model 4 (Founder related variables)
Intercept	5.252***	4.169***	0.3211***	2.751***
LIKE	0.078*	0.097*		
COMM	0.218**	0.637**		
VIDD	-0.05		-0.068	
PROT	0.103**		0.196***	
UPD	0.067*		0.247***	
NAT	0.257***		0.405***	
AMOU	-0.482**		0.053	
PRES	0.055			-0.032
BACK	0.696***			0.681***
TEAM	0.048			-0.062
PREV	0.064*			0.143**
Adjusted R2	0.736	0.481	0.314	0.541
F	64.048***	116.512**	23.743***	74.401***

Note: (***) p<0.01; (**) p<0.05; (*) p<0.10.
Source: Authors' own elaboration.

The length of the video, although with the correct signal has no statistical significance, meaning that excessive duration of the video pitch could be more harmful than positive to the campaign. The non-significance of the variable TEAM implies that a project conducted by a single or a team of entrepreneurs do not enhance or reduce the rate of success of the campaign. The same applies to PRES regarding the founder's presentation. Additionally, the full model shows that when all variables are included the critical factors for a successful campaign of CF are the existence of an extensive description of the project (p<0.05), the appropriate updates that are added to the project (p<0.10), the technological nature of the project (p<0.01), the number of funders that already invested in the project (backers) (p<0.01), the previous experience of the founder on the platform (p<0.10). The amount of the project is inversely related to the success of the campaign, meaning that the higher the pledging goal for a project, the lower is the probability of success (p<0.05).

The partial Model 2 consists of just the variables related to social media and eWOM, show consistency with the full model. The decrease in the adjusted R^2 over Model 1 (0.255) is also significant (p<0.01) but acceptable as the partial model maintain the predictive power (48.1% of the variance explained). According to the results, the likes shared on Facebook's page (LIKE) and the comments posted on the platform about the project (COMM) seems to be relevant (p<0.05; p<0.01, respectively) to attract more funders to the project. This evidence strongly supports hypothesis H1 and H2.

Model 3 evaluate the sole impact of the characteristics of the project on the success of the campaign. The decrease in the adjusted R^2 over Model 1 (0.422) is also significant (p<0.01), but acceptable as 31.4% of the variance is explained by the model. As in the full model, the existence of a detailed description of the project (PROT) increases the chance of funding (p<0.01). The same occurs with the posting of updates to the project (UPD) and the technological nature of the project (NAT) that are both statistically significant (p<0.01). On the contrary, none of the variables related to the pledging goal fixed for a project (AMOU) and the length of the video pitch (VIDD) was statistically significant. These results show that only variables PROT, UPD and NAT contribute significantly to the success rate of the campaign and thus partially supporting H3.

Model 4 drops the variables related to the project and the social media and e-WOM to evaluate the impact of founder related factors on the success of the campaign. The decrease in the adjusted R^2 over Model 1 (0.195) is also significant (p<0.01) and effective at predicting the success of a CF' campaign as the variance explained is 54.1%. To attract more funds to their projects, founders have to rely on the backers (BACK) and the herding effect (p<0.01) and in the previous experience (PREV) on the platform with other ventures. The variables PRES and TEAM show no statistical significance. Therefore, as only variables BACK and PREV significantly contribute to the success rate of the campaign, the hypothesis H4 is only partially confirmed.

8. DISCUSSION AND PRACTICAL IMPLICATIONS

Several interesting results were found regarding the factors that might increase the rate of success of a CF campaign. Perhaps the most noteworthy finding in this study is that the participation in online communities (Facebook) and the e-WOM generated by the comments posted on the website of the project are important to be successful. This corroborates with the basic conclusions of the studies which found that that a campaign benefits from user-generated e-WOM (online comments) and social media (Facebook shares) (e.g. Beier and Wagner 2015; Borst *et al.* 2017; Kaminski *et al.* 2018; Lu *et al.* 2014). However, the intensity of the impact of e-WOM is higher than the social media effect. Clearly, the relative importance of the e-WOM suggests that lack of information directly related to the quality of the project may lead prospective backers to rely on e-WOM (Belleflamme *et al.* 2015). Within this perspective, the comments made about a project through social networks can enhance social interaction and connectivity generating a positive e-WOM (Kaur and Gera 2017) and therefore attracting more supporters to the campaign.

The effect of social media on the success rate of the campaign seems to be more limited than anticipated by other studies. Even though a large numbers of friends on online social networks (Mollick and Kuppuswamy 2014) or the size of a fundraiser's personal network (number of Facebook connections) (Mollick 2014) have long been associated with the success of CF campaigns. However, it should be noted that as mentioned by Summers *et al.* (2016) and Borst *et al.* (2017), the influence of social media on the investors decision-making process could be shaped by the type of platforms used.

Also, social buzz (especially Facebook shares) and social media activities positively influence project backing (Thies *et al.* 2014;

Lu *et al.* 2014; Hong *et al.* 2015). Therefore, social media should be frequently used by the promoters of the project to spread information, ask for support and resources, and share project updates (Hui *et al.* 2014). Facebook, as the main social network, is particularly important to promote the project by sharing, discuss, and communicate with prospective backers.

The positive contribution of social media and eWOM on the campaign success could either derive from the massive communication that is established with a broader audience, only made possible through the use of multiple digital communication platforms.

Even so, the specific impact of eWOM on the ability to obtain financial support to the project could be justified by the "independent messages", that are produced by others and not by the promoter. As the comments generated by eWOM are not controlled by the founder, apparently create a very positive impact on crowdfunders' behavior and decision-making process.

Further, the use of social media and eWOM could signal some additional transparency to potential investors (Sahaym *et al.* 2019), since the founder is willing to display more information to people and accept to be exposed to higher public scrutiny, to those who participate in social platforms. In a scenario of information asymmetry that CF involves, this signalling effect could be especially important to convince investors to give support to a specific campaign, over many others for which very little information is available.

The findings suggest some herd behavior of the investors that is triggered by the buzz caused by a higher number of comments on social media, as stated by Borst *et al.* (2017). Further, the study highlights the importance of social media and eWOM as predictors of a campaign success rate. As mentioned before, the partial model used (Model 1), explains 48.1% of all data variance, while the full model that comprised eleven (11) independent variable has an explanatory power of 73.6%. Thus, the investigation suggests that to be successful in the CF campaign it is imperative to pay a careful attention to the formulation of the fundraising operation (project-related attributes and founders profile), as well as to the design of the digital communication strategy.

The results regarding the project related variables and the positive impact on the rate of success of a CF campaign are in line for the importance of displaying detailed information about the product (prototype, pictures, photos, schemes) (Koch and Siering 2015, 2019; Hobbs *et al.* 2016; Hossain and Oparaocha 2017). Also, the importance of posting updates about the project has been confirmed as generating a positive effect on the success of the CF campaign (Mollick 2014; Cho and Kim 2017; Kuppuswamy and Bayus 2018; Shahab *et al.* 2019). The same happens with the technological nature of the projects that are more valued by crowdfunders that seem to feel more comfortable in supporting technological projects rather than cultural ones (Hörisch 2015; Chan *et al.* 2018). The variables amount of pledging goal and length of the video pitch are negligible (non-statistical significance). Conversely, the empirical literature reports a negative impact for higher pledging goals (Mollick 2014; Frydrych *et al.* 2014; Colombo *et al.* 2015; Kaartemo 2017) that is validated in the full model but not in the second, thus meaning that no definitive conclusion can be obtained. On the other hand, a positive effect for the video pitch was expected (Jiang and Benbasat 2007; Mollick 2014; Koch and Siering 2019) but not confirmed. A possible explanation is that the variable measures the duration of the video pitch instead of its availability on the platform, and therefore the negative effect is for longer rather than shorter videos that might be effective in attracting potential funders.

Concerning the founders' profile, the results indicate a positive effect of backers' support and previous experience. These two predictive impacts are in line with the literature. Firstly, the positive impact of the number of backers suggests that each investor is not completely independent, but is influenced by the behaviour of other crowdfunders (Lee *et al.* 2011). Secondly, the previous experience of the founder is recognised by the empirical literature as significant for the success of the CF campaign (Courtney *et al.* 2017; Zou *et al.* 2018; Janku and Kucerova 2018; Koch and Siering 2015, 2019). The presentation of the founder and the single or collective nature of the founder is not supported by the data. The first finding is surprising as most of the literature argues that founders should present themselves to reduce uncertainty, increase transparency (Koch and Siering 2015) and credibility (Egger 2001; Fogg *et al.* 2001). One possible explanation is that prospective investors put more emphasis on the number of backers (herding effect) and the previous experience of the founder than on the way the founder presents himself to the audience or the elements of the team.

From the findings it is possible to derive some important practical implications to people who are thinking about launching a CF campaign. First of all, to be successful in getting funds through CF platforms requires a constant presence in social media to generate social buzz and engage with prospective investors. Herein, it is highly recommended the definition of an integrated digital marketing strategy conducted by professionals or people technically prepared. The results pointed out that crowdfunding campaigner creators should make use of direct pieces of communication, since people (the crowd) positively values the provision of regular but also brief information in order to generate user content word of mouth. Also, entrepreneurs' commitment to potential investors, made through regular interaction and information provision, is a strategic asset that entrepreneurs should bear in mind once they had decided to use crowdfunding as a vehicle for funding their projects.

Another practical implication is the critical role that communication plays on CF success. The communications should be held internally, trough the elaboration of communication material, and the constant interaction through the provision of regular updates. However, to be able to attract more funds entrepreneurs have to stimulate "an external communication", through the generation of comments by supporters, that have a more powerful impact on the "crowd behavior", than the formal information prepared and controlled by the founder. Being able to create a digital debate around the campaign and an emotional commitment to the project will be critical to the success of the campaign.

Another practical implication that could be derived is that for taking advantage of all the social media potential it is important to get an in-depth knowledge of the audience the campaign intents to engage, that could be more sensitive to the work developed in some social platforms than others.

9. CONCLUSIONS

Crowdfunding has been recognised as a very promising fundraising tool for new ventures. However, not all campaigns have the same potential in terms of resource mobilisation, since some of them are successful in terms of funds collected and others not. In this scenario, it is critical to have a deeper understanding of the factors that are able to drive the success of a given campaign, specifically social media and e-WOM.

The results indicate that it is possible to find an explanation for the different levels of success of reward CF campaigns based on the analysis of network factors, the characteristics of the project and its founder. The results show that social media and, especially, e-WOM have a positive impact on the success rate of a campaign. Also, factors related to the project (detailed information of the future product, project updates, and the nature of the project, specifically if it has a technological orientation) have demonstrated a positive impact. By contrast, the length of the video pitch and a higher pledging goal affects negatively the campaign success. In the founder's profile, the most important factors were the number of backers supporting the project and the existence of a previous campaign on the platform, while the presentation of the founder and his team have been devaluated.

As can be seen by the results, the success of a CF campaign is based on multiple criteria that include the presence in social platforms, the digital networking of the founder with its followers and backers , the characteristics of the project as well as the founder profile. Thus, a deeper understanding of the critical success factors of a campaign should include and not isolate all the elements that have been studied.

The results obtained suggest that in the investor's decision-making process, potential funders (crowdfunders) highlight the importance of the attributes that signal the quality of the project for which funds are called, and thus mitigate some of the risks arising from information asymmetry. The research carried out indicate that the fears about information are major constrain of CF although the reward-based CF was a non-investment model.

The investigation assessed the contribution of social media and eWOM on a CF campaign success, regardless of the content of the messages shared. In the future, it would be positive to separate the effect of different types of buzz (positive or negative comments), as well as evaluating the impact of different kind of traffic (such as organic and paid). In the study of social media, we have considered the use of Facebook, as it is one of the most important and researched social platforms. Even so, the use of a unique social platform is a limitation of the study. In the future, it would be interesting to extend the research model to other social platforms.

The investigation unfolds some important issues that are worthy of being further studied. One example of that is the role played by entrepreneurs' previous experience on the success of CF campaigns and how this past experience can leverage the fundraising outcomes. Some qualitative research (in-depth interviews) would probably bring new insights into this issue.

In the future, it would be worthy of extending the investigation to other platforms and countries, since most of the empirical studies have been performed under the most well-known American platforms, such as Kickstarter or Indiegogo. It would be interesting to study the success factors of CF campaigns in other platforms of more peripheral countries and with different economic development levels. It would also be quite interesting to understand if the major factors that influence CF success are the same in different business models of CF. As the research suggests that investors are highly concerned with asymmetry information risks, it would be worthy of performing additional research on the topic, and study in-depth the main fears affecting potential investors.

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An Empirical Analysis of the Factors Influencing Social Entrepreneurship: A Gendered Approach

Un análisis empírico de los factores que influyen en el emprendimiento social: un enfoque de género

Ambreen Khursheed*, Maham Fatima[a], Dr. Faisal Mustafa[b], Dr. Rab Nawaz Lodhi[c], Ayesha Akhtar[d]

[a] *Research Associate, UCP Business School, University of Central Punjab, Pakistan –maham.fatima@ucp.edu.pk – https://orcid.org/0000-0002-8407-6162*

[b] *Professor, Dean UCP Business School, University of Central Punjab, Pakistan– faisal.mustafa@ucp.edu.pk – http://orcid.org/0000-0003-4689-5711*

[c] *Associate Professor, UCP Business School, University of Central Punjab, Pakistan– rabnawaz.lodhi@ucp.edu.pk – https://orcid.org/0000-0003-2120-358X*

[d] *Research Associate, UCP Business School, University of Central Punjab, Pakistan– ayeshaakhtar@ucp.edu.pk – http://orcid.org/0000-0001-8373-5958*

* ***Corresponding author**: Senior Lecturer, PhD Scholar, UCP Business School, University of Central Punjab, Pakistan –ambreen.khursheed@ucp.edu.pk – http://orcid.org/0000-0003-1497-5848*

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ABSTRACT

Purpose: This study examines how entrepreneurial ecosystem factors (entrepreneurial finance, entrepreneurial education, physical and commercial infrastructure, culture, and R&D transfer activities) shape social entrepreneurial activities (SEA) of men and women.
Design/methodology/approach: Panel data from 35 countries are examined through General Methods of Moments (GMM) with Arellano Bond tests for the period of ten years (2005-2014).
Findings: Our results indicate that women are more likely to get involved in creation of social ventures. Further, the selected six entrepreneurial factors modify SEA in a significantly different manner for both genders.
Originality/value: Based on this analysis, this study is the first to provide deeper insights for improving the assessment of social entrepreneurial activities in efficiency and innovation driven economies within the entrepreneurial ecosystem.

Keywords: Social entrepreneurship; Entrepreneurial Ecosystem; Culture, Social ventures; Gender; Arellano Bond test.

RESUMEN

Finalidad: Este estudio examina el modo en que los factores del ecosistema empresarial (financiación empresarial, educación empresarial, infraestructura física y comercial, cultura y actividades de transferencia de I+D) dan forma a las actividades empresariales sociales (AES) de hombres y mujeres.
Diseño/metodología/enfoque: Para un periodo de diez años (2005-2014) se examinan datos de panel de 35 países mediante los Métodos Generales de Momentos (GMM), empleando el test de Arellano Bond.
Hallazgos: Nuestros resultados indican que las mujeres son más propensas a involucrarse en la creación de empresas sociales. Además, los seis factores empresariales seleccionados modifican las AES de una manera significativamente diferente para ambos géneros.
Originalidad/valor: Sobre la base de este análisis, el presente estudio es el primero en ofrecer una visión más profunda para mejorar la evaluación de las actividades empresariales sociales en economías impulsadas por la eficiencia y la innovación dentro del ecosistema empresarial.

Palabras clave: Emprendimiento social; Ecosistema empresarial; Cultura; Social ventures; Género; Test de Arellano Bond.

1. INTRODUCTION

The current literature on social entrepreneurship (SE) indicates that attaining sustainable social gains is one of the main objectives for social entrepreneurship, which comprises various elements, processes, and results (Lumpkin *et al.* 2013; Omorede 2014). The societies are more interested to figure out more cost-effective and innovative ways for addressing social issues, "social ventures" —mainly initiated by motivated people known as "social entrepreneurs"— have received growing attention (Bhushan 2020). These people combine a business mindset with social aims for addressing largely discontented needs in their societies (Ashrafi *et al.* 2020).

The growing consideration of SE's significance in the field of social and economic wellbeing is raising academicians' interests in social venture creation process and its impacts on society (Dwivedi and Weerawardena 2018). Recent literature reveals a huge amount of research has precisely considered debating what is involved and not involved in the concept of SE. Because defining SE is not an easy task, mainly due to the lack of consistency in the existing definitions of SE along with the divergent viewpoints focused to understand the phenomenon (Shaw and Carter 2007; Perrini, Vurro and Costanzo 2010; De Bruin and Ferrante 2011). Moreover, SE is complex in detail due to its complicated nature as it comprises of two essential concepts; first is entrepreneurship and second is social outreach (Rey-Martí *et al.* 2016). Consequently, Dacin *et al.* (2010) narrated 37 definitions of the social entrepreneurship concept. Austin, Stevenson and Wei-Skillern (2006) defined social entrepreneurship (SE) as an activity possessing innovative and value-creating features and can be found everywhere such as in business, non-profit organizations or the public sector. Similarly, social entrepreneurship is considered an activity that brings innovative solutions required for the resolving of societal issues and plays a significant role in assembling concepts, ideologies, resources, capabilities, and social setups necessary for consistent social revolutions (Alvord, Brown and Letts 2004).

In recent years, the concept of social entrepreneurship has gained the consideration of both practitioners and academics, as revealed by an emerging body of theoretical studies and empirical communities (Wakkee *et al.* 2019; Ashrafi *et al.* 2020). Accordingly, there are signs of inclining interest in the discipline of social entrepreneurship, but still, it is revolving in the emergent phase of its lifecycle (Cohen and Winn 2007) with an in-process development of institutional legitimacy (Hall *et al.* 2010). Apart from the recent social entrepreneurial work, the existence of some studies with an ability to test the scope and simplification of propositions have been seen (Ferreira *et al.* 2017; Doherty 2018). Nevertheless, majority of the studies does not completely assess the influence of entrepreneurial ecosystem factors on SE; thus, the factors promoting or hindering social enterprises remain undiscovered (Kedmenec and Strašek 2017; Capella-Peris *et al.* 2020) and SE intentions undertheorized (Sharir and Lerner 2006; Van Slyke and Newman 2006). Further, research contributions that highlight contextual differences among countries open new avenues for further research due to a lack of generalizability in the findings of studies. Therefore, this study fills the existing gap, as it determines how global entrepreneurial ecosystem factors (access to finance, education, culture and norms, physical infrastructure, commercial infrastructure and R&D transfer) shape social entrepreneurial activities of men and women.

For getting deeper insights into the role of gender in the creation of social enterprises, it is crucial to understand the entrepreneurial ecosystem factors. These factors are dynamically involved in the complex interlinkage creation among social entrepreneurs who ultimately shape the growth of an entrepreneurial society. Additionally, the conceptual perspective and scope of social entrepreneurship have been positively evolved, however, a huge research gap exists with evident challenges for women as social entrepreneurs (Goyal and Parkash 2011). Therefore, accessing the perception of Levie and Autio (2008), we present a cultural and social experiment-based investigation of social entrepreneurship integrated with entrepreneurial framework coupled with time. We investigated a panel data of ten years (2005-2014) collected from global entrepreneurship monitor (GEM) for examining the influence of entrepreneurial ecosystem factors on social venturing rates in 35 countries for both genders. We examined the data through a rigorous statistical method "General Method of Moments" GMM and robustness checks (Arellano and Bond 1991). Precisely, this study examines how entrepreneurial ecosystem factors differently affect male and female involvement in social entrepreneurial activities.

This study provides three valuable contributions to the existing field of social entrepreneurship. First, this study makes a primary effort in examining social entrepreneurship; entrepreneurial education, research and development (R&D) transfer, access to finance, physical infrastructure, commercial infrastructure and culture. Our outcome reveals that three out of six selected factors shape social entrepreneurial activities in a considerably different manner. Second, this study expands our understanding of male and female social entrepreneurial activities as we affirm that some factors influence male and female enterprises equally, some negatively and others have no significant impact. Third, by examining large scale data, this paper contributes to the present scarce empirical studies on social entrepreneurship and improves the generalizability of results on factors that influences social entrepreneurial activities in an entrepreneurial ecosystem (Urban and Kujinga 2017; Clark, Newbert and Quigley 2018; Hsu and Wang 2019; Capella-Peris *et al.* 2020).

The first section of this study provides the background of the social entrepreneurship then in the second section the literature is discussed. The third section presents the methodology and fourth section presents the results of the analyzed data. The fifth section shows the discussion and conclusion. The sixth section presents the implications with future directions.

2. LITERATURE REVIEW

2.1. GEM and Social Entrepreneurial Activities

The global entrepreneurship monitor (GEM) Social Entrepreneurship survey approach sees social entrepreneurs

as those people who show positive response whether alone or with others to the involvement in commencing or owing to any kind of entrepreneurial activity with a clear purpose in social, societal and environmental perspective (Reynolds *et al.* 2005). To reach the likelihood of individuals engaging with social entrepreneurial activities, we completely consider identified nascent entrepreneurs for this aim. But these individual entrepreneurs are more likely to positively answer one question according to GEM methodology i.e. Do they have any type of involvement in any project, business start-up or entrepreneurial activity by showing some relative environmental, societal, social or cultural purpose? (Mair and Marti 2006; Zahra *et al.* 2009). The dependent variable is concerned with value 1 in case of a positive individual response, otherwise with 0 value.

Entrepreneurial ecosystems are a set of interdependent factors that are precisely coordinated for empowering productive entrepreneurship within a specific boundary (Feld 2012). The functional aspects of the entrepreneurial ecosystem show relative association with entrepreneurship and welfare outcomes (Feld 2012). Entrepreneurial ecosystems possess certain characteristics such as a foundation of large established business; entrepreneurial recycling- a process in which people reinvest their money, time and especially expertise for the initiation of new endeavors and informational setups that provide accessibility of information to everyone (Acs, Stam, Audretsch and O'Connor 2017). We remained focused on the GEM conceptual approach of Reynolds *et al.* (2005) and the entrepreneurial framework conditions (EFC) module of the GEM model. This module is effective in highlighting conditions that empower productive social entrepreneurship (Bhushan 2020). It measures incentive structures necessary for social entrepreneurship development. The global entrepreneurship model is a multi-level model, in this model EFCs are presented at national level. While entrepreneurial capacity, opportunity and activity are considered at the individual level and are totaled to the national level. Thus, the conceptualized model implies that social entrepreneurial activity at the national and individual levels is subject to various environmental parameters. The GEM model mainly considers structural conditions that regulate the effort allocation into social entrepreneurship at population level. A comprehensive social-economic phenomenon such as country-level social entrepreneurial activities involves individual capabilities as well as actions visualized by the system's incentives (Welter 2011; Sahasranamam and Nandakuma 2020). Consequently, the EFCs deals with country-level entrepreneurship to determine the percentage of entrepreneurial activities uniquely done by both genders. The reason behind this research is to favor the fact that the set-up of social structure and incentive procedures apply some discrimination in genders in the social venture creation process. Given existing literature, we formulated the following research question that how entrepreneurial ecosystem factors affect the social entrepreneurial activities of men and women? We have selected six entrepreneurial factors (entrepreneurial education, R&D transfer, access to finance, physical infrastructure, commercial infrastructure and culture) due to their importance in examining social entrepreneurial activities (Desa 2012; Beckmann *et al.* 2014; Mustafa *et al.* 2018; Hakberstadt *et al.* 2019; Canestrino *et al.* 2020) Following sub-questions of the study are developed.

1. Does entrepreneurial education influence social entrepreneurial activities and is it more beneficial for men than women?
2. How R&D activities influence social entrepreneurship at the national level and are such activities more favourable for establishing social entrepreneurial ventures by women than men?
3. What role does financial support play in enhancing social entrepreneurial activities and is it more easily available to men than women?
4. What is the role of physical infrastructure in boosting social entrepreneurship at the national level and is it more accessible to men than women?
5. What is the role of commercial infrastructure in boosting social entrepreneurship at the national level and is it equally supporting both men and women?
6. Do social and cultural norms influences social entrepreneurial activities and are these activities more favourable for men than women?

2.2. Research hypotheses

Entrepreneurial education is defined in the context of innovation and creativity applied to a wide range of areas such as business, societal or public sector (Ahmed *et al.* 2010). Past research highlighted that education promotes an increase in the supply of entrepreneurs by ensuring exceptional skills in individuals to go beyond the territories of routine businesses and initiates thinking more broadly on entrepreneurial activities (Deb and Bhatt 2020). It plays important role in exploring cognitive abilities to properly accomplish the process of recognition of opportunities along with a fine assessment and manipulation (DeTienni and Chandler 2004). Research indicates the existence of a positive relationship between entrepreneurial education and entrepreneurial activities (Delmar and Davidsson 2000). However, several studies found that women face more hurdles in their entrepreneurial careers due to a lack of access to education specifically focused on women-led business startups (Hashmi 2019). Hence, we propose that countries enriched with a diverse and prominent transparent educational system favoring entrepreneurship are more likely to evolve social entrepreneurial activities and this factor is more influential on men than women.

$H1_a$: Entrepreneurial education is directly associated with social entrepreneurial activities.

$H1_b$: Entrepreneurial education is more favorable for men than women.

Research and development (R&D) transfer is the capacity of the national research and development process to direct new business projects and commercial opportunities along with the availability to SMEs (Amorós *et al.* 2019). By keeping in view this concept, the knowledge spillover theory of entrepreneurship states that seeking an optimistic interest in different companies' knowledge that still needs to be explored by markets and

needs to be commercial facilitates to grow as an entrepreneur (Acs *et al.* 2008). Entrepreneurship exploits new knowledge due to the multifaceted portfolio of knowledge which shows a combination of a higher level of information along with uncertainty and asymmetry (Kong *et al.* 2019). Consequently, entrepreneurship is actively high in those countries in which quick and cheap transference of knowledge by incumbents to entrepreneurs is available in contrast to those countries where this transference is time-consuming and expensive. Markman *et al.* (2004) stated the positive relationship between entrepreneurship and incentive methodology in the case of university expertise transfer workplace personnel. While incentive methodology showed a negative relation to scientists' involvement in entrepreneurial activities. Therefore, we propose that at the national entrepreneurship stage, the impact of sharing knowledge influences both men and women but shows preference in its influence mainly on women. Thus, the following hypotheses are proposed.

$H2_a$: R&D activities are positively associated with social entrepreneurship at the national level.

$H2_b$: R&D transfer is more favorable for women than men.

Blanchflower *et al.* (2003) defined entrepreneurial finance in terms of availability of financial funds i.e. debt and equity for small and moderate level businesses. Similarly, Shane (1996) documented that the exploitation of new opportunities is more usual where access to finance is easier. In this aspect, the consideration of gender is also very important as it involves both supply and demand-side debates for understanding the impact of financial support on SEA rates of men and women (Ahl 2004). On one hand, the demand debate reveals risk of declined access of women entrepreneurs to outdoor investments (Mittal and Vyas 2011). Whereas, Marlow and Patton (2005) discuss that females require more investment and credit when stepping forward to initiate any business activity.

On the other hand, supply-side debate considers the risk of discrimination of the female gender by financial institutions (Alibhai *et al.* 2019). Research witnessed that the female gender faces more difficulties in getting loans from official financial institutions, believed by business owners as well (Pergelova *et al.* 2019). Thus, the female gender is more exposed to finance and credit hurdles in initiating business setups rather than men. Because of the above discussion, we propose the following hypotheses.

$H3_a$: Social entrepreneurship exhibits direct association with financial support.

$H3_b$: Financial support is more easily available for men than women.

Physical infrastructure is the convenience in accessing different physical resources including transportation, communication, land, building and utilities at a cost that favors SMEs (Amorós and Bosma 2014). Specific infrastructure programs matching with relative industry can be supportive for new endeavors and also speed up new projects in the relevant industry (Audretsch *et al.* 2015). This factor has such a vital role that it can act as a huge barrier in launching a new business (Ghani *et al.* 2014). A few studies that determined the role of physical infrastructure in enhancing social entrepreneurship have been subject to noticeable subsequent limitations. Thus, we come up with the belief that physical infrastructure influences SEA rates and it exhibits a stronger impact on men as compared to women.

$H4_a$: At the national level, social entrepreneurship is positively associated with physical infrastructure.

$H4_b$: Physical infrastructure is more accessible to men as compared to women.

Commercial infrastructure is associated with business and litigation activities that are necessary for all businesses. It shows concern for certain activities in the background linked with firm creation including subcontractors, customers, suppliers, advertising, marketing, financial attractiveness, consultants and legal services (Harrington *et al.* 2019). An alert focus on the availability of commercial and legal infrastructure facilitates business in having an exceptional competitive advantage. Whereas, any negligence in these services leads to declined social entrepreneurial effort (Kruse *et al.* 2019). Therefore, we propose to investigate this key relationship by examining the influence of commercial infrastructure on both genders.

$H5_a$: Social entrepreneurship is positively associated with commercial infrastructure.

$H5_b$: Commercial infrastructure significantly influences the social entrepreneurial actives of men and women.

Amorós and Bosma (2014) states that the scope of social and cultural norms motivates actions required for new endeavors to positively contribute to the maximization of personal wealth. In the debate of social and cultural norms, the first thing to be considered is the distinction among parameters of national culture (Hofstede 1980; Schwartz 1994; Inglehart 1997; House 1998) compared with particular beliefs or attitudes regarding social entrepreneurship (Levie and Autio 2008). Considerable change has been seen in national as well as social values, beliefs and attitudes regarding entrepreneurship (Etzioni 1987; Lounsbury *et al.* 2019) unlikely universal values (Inglehart 1997). Constructive publicity, media perspective and societal admiration for entrepreneurship (viewed in the parameters of attitude towards those who have earned personal wealth under the scope of entrepreneurship) show influence on desirability and engagement of social entrepreneurship at the individual level (Doherty 2018). Research witnessed less engagement of women toward social entrepreneurial activities in those countries which are enriched in aggressive institutional setup (Digan *et al.* 2019). Also, female entrepreneurial movements are comparatively at higher risk to be impacted by cultural environment in contrast to men (Brush *et al.* 2019). The more is the probability of women's entrepreneurial activities to be susceptible by cultural values and beliefs, the more likely women are influenced by the norms regarding entrepreneurship. Thus, we propose the following hypotheses.

$H6_a$: Social and cultural norms are directly associated with social entrepreneurial activities.

$H6_b$: Social and cultural norms are more favorable for men than women.

We categorized control variables in the light of economic and social outlook. We selected the world bank (WB) database for the determination of country's GDP per capita for every corre-

sponding year and calculated it as recent US dollars (Van Stel *et al.* 2007; Acs *et al.* 2008). The size of any country is a crucial factor as it reveals the supply of individuals in the active labor force sector, ultimately affecting social entrepreneurial ventures. Hence, we screened the size of population by attaining it from the WB database and mentioned population in our research. We used yearly-based dummies in the applied models of research patterns as instruments. The conceptual model of the study is presented in Figure 1.

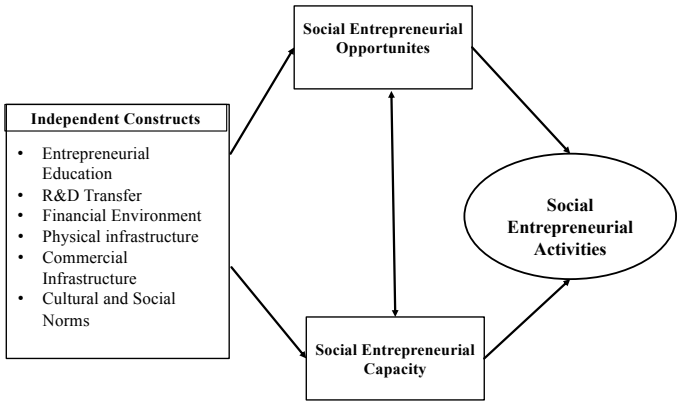

Figure 1
GEM Conceptual Model of the Study
Source: Own elaboration.

The definition of social entrepreneurship revolves around a variety of concepts. Each concept depicts a different meaning of the same unified term. This variation comes as the first significant barrier in the evolutional study of social entrepreneurship by scholars. The diversification in the perspective of defining social entrepreneurship comes from relating its meaning in the context of various disciplines such as economics, accounting, political sciences and entrepreneurship (Alter, 2007; Short *et al.* 2009). Despite the varied scope of defining social entrepreneurship, some other dominating factors give it a unique recognition from conventional entrepreneurship and usual charities. In the light of previous literature, three factors are listed as impacting ones: the emphasis on innovation, the role of earnings and the superiority of social mission (Dawson and Daniel 2010; Lehner and Kansikas 2012). The consideration of social innovation makes social mission achievable as revealed by the past studies in the aspect of social entrepreneurship (Shaw and Carter 2007; Perrini Vurro and Costanzo 2010; De Bruin and Ferrante 2011). The literature further adds that social entrepreneurship and social innovation are interlinked as both follow opportunity appreciation and social mission (Korsgaard 2011). Moreover, Ruvio and Shoham (2011) explained that for attaining success in social entrepreneurship, a requirement of launching innovative products and services to the market must be assured.

For understanding the influence of entrepreneurial factors on SEA rates we have used two theories. As our society is dealing with several economic and social challenges, while government efforts are unsatisfactory in managing such challenges. Therefore, this failure leads to the establishment of social entrepreneurial ventures that focuses to resolve issues by implementing innovative tools (Santos 2012). Prior studies claimed that all social enterprises have social underpinnings and their long-term success is dependent on their ability to achieve certain human goals that meet the potential, creativity and dignity of a freeman (Friedman 1970; Davis 1973; Dees and Elias 1998; Thompson 2002). Santos (2012) introduced a social entrepreneurship theory that explicates the role of social entrepreneurs in the economic system. This theory explains that the central goal of social entrepreneurial ventures is value creation (producing a significant impact for society) or value capture (generating maximum value creation along with profit generation) and the failure of governmental efforts in resolving social issues leads to increase social entrepreneurial activities (SEA). Therefore, we have used this theoretical concept, as it is quite relevant for determining that whether prevalence of SEA rates of men and women are influenced by entrepreneurial ecosystem factors or these rates are independent of such factors.

However, for getting a deeper understanding of the impact of R&D transfer activities on SEA rates, we have used the 'knowledge spillover theory of entrepreneurship' introduced by Acs (2006). This theory presents the extension and merger of Schumpeterian and Romanian economic growth models (Acs 2009; Acs *et al.* 2013). This theory claims that knowledge by itself is essential but it is not enough condition for enhancing economic growth. As all inventions may not automatically transform into innovations and similarly all types of research knowledge are not capable to provide commercialized useful knowledge. Therefore, to contribute to the development of an economy a research knowledge needs to be transformed into economically beneficial knowledge and discoveries need to be transformed into innovations. In the accordance with this theory:

> "Entrepreneurship plays a vital role in boosting the economic growth by serving as a channel although it is not the only channel by which the knowledge produced by incumbent organization spills over to the agents who endogenously produce a new organization."

Thus, in line with knowledge spillover theory, this study examines that countries in which knowledge transfer generated through R&D activities is relatively fast and inexpensive should create more social startups or enhance social entrepreneurial activities than those in which these activities are expensive and slow. Despite existing research on individual and contextual antecedents of social entrepreneurship, little research has investigated the impact of entrepreneurial ecosystem factors on SEA. For getting deeper insights past researchers have mostly applied theory of planned behavior and effectuation theory (Prieto *et al.* 2012; Servantie and Rispal 2018; Chandra and Paras 2020) but in this study, we have incorporated two crucial theories to better understand the potential impact of entrepreneurial ecosystem factors on SEA.

3. METHODOLOGY

The structure of our final sample covers 35 countries selected based on data availability of SEA prevalence rates from 2005 to 2014. Although the formation of our data seems as an unstable dynamical longitudinal panel, we used the General Method of Moments (GMM) estimator to deal with probable endogeneity and unanalyzed heterogeneity (Arellano 2003). To test the

research objectives of the study, first, we checked the descriptive statistics, then the diagnostic checks of GMM are applied, which includes Hansen and Wald chi-square test. After diagnostic checks, the GMM test with the Arellano Bond test is applied for checking first-order (AR1) and second-order (AR2) serial correlation. This facilitated our study to observe auto aggressive distributed lagged models from unstable panels with various elements measured on cross-sectional period kept for comparatively limited periods.

Our study unlocks three data sources in the model analysis of secondary data. Our sample comprises of country-level sources: Adult Population Survey (APS), National Expert Survey (NES) and Global Entrepreneurship Monitor (GEM) (Reynolds *et al.* 2005). The percentage representation of social entrepreneurship involvement at the initial level is taken as a dependent variable, which comes from GEM 2015 data (Bosma *et al.* 2016). GEM has earned a reputation for providing the largest dataset for social entrepreneurial activities done worldwide by interacting with 103,593 persons from 35 countries. GEM declares the meaning of social entrepreneurship in terms of individual involvement in entrepreneurial activity by concerning any kind of social, legal, commercial and environmental aspect.

4. RESULTS

The bivariate and descriptive statistics are presented in Table 1. Variance inflation factor (VIF) is used for calculating separate regression models. The mean VIF for the whole data of social entrepreneurial activity (SEA) is 3.09 for male SEA, and 3.14 for female SEA, as VIF is below 10 so it is considered suitable (Craney *et al.* 2002). The results presented by General Methods of Moments (GMM) are depicted in Table 3. According to our results entrepreneurial education showed a positive effect on male SEA rates ($\beta = 2.109$; $p = 0.012$) and female SEA rates ($\beta = 5.118$; $p = 0.004$). This shows that entrepreneurial education positively influences social entrepreneurial activities. Thus, proving $H1_a$, however, $H1_b$ is not supported by our results as the impact of entrepreneurial education is found higher for women as compared to men.

In case of R & D transfer the male SEA rates ($\beta = -2.402$; $p = 0.009$) and female SEA rates ($\beta = -4.134$, $p = 0.003$). This shows that the countries having research and development activities will have lesser social entrepreneurial activities. Hence, $H2_a$ is not supported by results, but $H2_b$ is supported as the result reveals the impact of R&D transfer is stronger for women compared to men.

Overall access to finance positively influences male SEA rates ($\beta = 3.069$; $p = 0.018$) and female SEA rates ($\beta = 2.492$; $p = 0.039$). Thus, our results support $H3_a$ and $H3_b$. Thus, confirming the past studies that the availability of entrepreneurial finance for conducting social entrepreneurial activities plays a significant role, particularly for men.

Physical infrastructure and services found to positively and significantly influence female SEA rates ($\beta = 1.198$; $p = 0.008$) and male SEA rates ($\beta = 3.017$, $p = 0.001$) with stronger impact on male SEA rates. The results reveal that $H4_a$ and $H4_b$ are supported. Further, we found that commercial infrastructure accessibility shares a significant and positive relationship with SEA rates for only females ($\beta = 2.424$, $p = 0.007$). Our results partially supported $H5_a$ and $H5_b$ as only female SEA rates are found to be significant and positively related to commercial infrastructure. Cultural and social norms also found to significantly and positively influence social entrepreneurial activities, as the male SEA rates is ($\beta = 3.514$, $p = 0.004$) and female SEA rates ($\beta = 2.405$; $p = 0.003$). Further, cultural impact is found to be more favorable for men. Thus, the results support $H6_a$ and $H6_b$.

4.1. Robustness Checks

For robustness checks, we classified our sampled 35 countries by their competitiveness across two phases of economic advancement; Efficiency driven economies (having scale intensity) and Innovation-driven economies (preferring the latest production methods for introducing innovative products and services). We have used these two classifications of countries for determining exclusive differences in ecosystem effects. In the perspective of innovation-driven economies, education shares a significant and positive effect on the social entrepreneurial activities of men and women. The male SEA rates are ($\beta = 2.752$; $p = 0.013$) and female SEA rates are ($\beta = 2.113$; $p = 0.004$). Likewise, access to finance also shares a positive and significant effects on SEA rates, for male SEA rates ($\beta = 3.101$; $p = 0.012$) for female SEA rates ($\beta = 2.341$; $p = 0.011$), while the commercial and legal infrastructure shares a significant and positive effect on both male and female SEA rates, for male ($\beta = 0.314$; $p = 0.003$) for female ($\beta = 0.252$; $p = 0.041$). While physical infrastructure reveals an insignificant relationship with SEA in innovation-driven economies.

In case of efficiency driven economies access to finance positively effects males SEA rates ($\beta = 3.882$; $p = 0.024$) and female SEA ($\beta = 4.554$; $p = 0.006$). Similarly, physical infrastructure positively influences both male SEA rates ($\beta = 2.112$; $p = 0.003$) and female SEA rates ($\beta = 0.314$; $p = 0.009$).

Table 1
Descriptive and bivariate statistics

Variable	Mean	S.D.	1	2	3	4	5	6	7	8	9	10
Male SEA	11.24	6.45	1									
Female SEA	7.51	6.81	0.875**	1								
GDP per capita PPP	24,073.39	22,626.52	−0.397**	−0.495**	1							
% GDP growth	3.86	4.79	0.008*	0.243**	−0.1.65**	1						
Population	71,357,356.71	399,675,056.88	0.077	0.061	−0.041	0.181**	1					
Access to finance	3.41	0.32	−0.413**	−0.613**	0.437**	0.079	−0.076*	1				
Entrepreneurial education	3.98	0.21	−0.123**	−0.129**	0.367**	0.198**	0.011	0.121*	1			
R&D transfer	3.98	0.41	−0.398**	−0.389**	0.701**	−0.041	−0.059	0.071	−0.051	1		
Commercial and legal infrastructure access	4.01	0.09	−0.411**	−0.431**	0.561**	−0.039	−0.069	0.071	−0.049	−0.142**	1	
Physical infrastructure and services	3.82	0.52	−0.301**	−0.209**	0.543**	−0.098*	0.045	0.151**	0.008	−0.310**	−0.192**	1
Cultural, social norms supportive	3.01	1.23	0.098**	0.172**	0.187**	0.165	0.257**	0.211**	0.255**	−0.303**	−0.321**	−0.328**

* significant at p≤ 0.05
** significant at p≤ 0.01
Source: Own elaboration.

Table 2
Regression models entrepreneurship rates of men and women

	Male SEA rate (Control)			Male SEA rate (Actual Effects)			Female SEA rate (Control)			Female SEA rate (Actual Effects)		
	Beta value	Standard error	Significance value	Beta value	Standard error	Significance value	Beta value	Standard error	Significance value	Beta value	Standard error	Significance value
Entrepreneurship rate 1-year lag	0.697	0.089	0	0.382	0.561	0	0.697	0.14	0	0.732	0.213	0
Population	0.01E+00	0.01E+00	0.592	0.000	0.000	0.019	0.01E+00	0.00E+00	0.513	0.01E+00	0.01E+00	0.011
GDP	0.00E+00	0.00E+00	0.231	0.000	0.000	0.613	0.01E+00	0.01E+00	0.087	0.01E+00	0.01E+00	0.199
GDP growth	−0.031	0.069	0.811	−0.015	0.062	0.793	−0.056	0.063	0.379	−0.042	0.049	0.451
Access to finance				3.069	1.549	0.018				2.492	1.721	0.039
Entrepreneurial education				2.109	1.872	0.012				5.118	1.641	0.004
R&D transfer				−2.402	1.532	0.009				−4.134	1.912	0.003
Commercial infrastructure access				−1.391	1.783	0.452				2.424	1.367	0.007
Physical infrastructure				3.017	1.691	0.001				1.198	1.231	0.008
Cultural and social norms				3.514	1.523	0.004				2.405	1.421	0.003
2005	3.623	1.642	0.679	−3.125	2.541	0.254	1.093	0.042	0.652	1.254	1.651	0.321
2006	−1.945	1.498	0.216	2.541	0.253	2.1254	0.169	0.721	0.721	1.586	1.321	0.136
2007	−2.106	1.523	0.154	3.561	3.214	2.367	−0.459	1.052	0.649	4.258	1.481	0.431
2008	2.194	1.983	0.875	−4.258	5.487	1.354	0.956	0.632	0.681	−3.214	1.602	0.821
2009	2.156	1.109	0.056	1.256	1.256	1.658	−0.842	0.921	0.061	3.658	0.521	0.261
2010	2.984	1.015	0.135	−3.886	2.365	1.698	0.732	0.591	0.187	3.457	0.521	0.682
2011	0.432	0.965	0.166	−3.956	3.587	1.546	1.183	0.631	0.019	−2.235	0.639	0.241
2012	−1.145	0.832	0.194	2.147	3.574	1.358	1.001	0.645	0.563	2.147	0.641	0.321
2013	0.462	1.193	0.421	0.421	0.541	0.072	0.521	0.318	0.369	1.932	1.621	0.213
2014	0.531	0.111	0.701	−0.431	0.921	0.675	0.832	0.731	0.265	0.421	0.532	0.758
Intercept	−9.359	8.932	0.732	−0.417	9.547	0.672	−0.721	2.746	0.831	3.451	5.671	0.537
Countries	35			31			35			31		

	Male SEA rate (Control)			Male SEA rate (Actual Effects)			Female SEA rate (Control)			Female SEA rate (Actual Effects)		
	Beta value	Standard error	Significance value	Beta value	Standard error	Significance value	Beta value	Standard error	Significance value	Beta value	Standard error	Significance value
N	382			304			382			304		
Hansen	32.710		0.19	68.92		0.11	43.64		0.085	42.14		0.191
Wald X^{2c}	6.235	0.51	0.004	5.871	1.61	0.001	5.786	0.014	0.003	5.772	0.119	0.000
AR(1)	2.890		0.003	3.13		0.005	2.89		0.001	3.24		0.004
AR(2)	2.230		0.345	1.67		0.538	1.18		0.419	1.19		0.287
R^2	0.649			0.811			0.745			0.779		

Source: Own elaboration.

Table 3
Sub-set regression models of innovation-driven economies

	Male SEA rate (Control)			Male SEA rate (Actual Effects)			Female SEA rate (Control)			Female SEA rate (Actual Effects)		
	Beta value	Standard error	Significance value	Beta value	Standard error	Significance value	Beta value	Standard error	Significance value	Beta value	Standard error	Significance value
Entrepreneurship rate 1-year lag	0.841	0.042	0.002	1.735	0.426	0.101	0.718	0.027	0.012	2.067	1.16	0.003
Population	−1.2167	1.4612	0.405	3.0931	1.8098	0.297	1.5892	1.3561	0.314	−1.7641	6.9632	0.003
GDP	0.001	0.001	0.014	0.011	0.010	0.581	0.009	0.001	0.051	0.001	0.001	0.254
GDP growth	0.010	0.031	0.716	0.114	0.140	0.645	0.012	0.021	0.278	−0.076	0.338	0.541
Access to finance				3.101	3.014	0.012				2.341	0.545	0.011
Entrepreneurial education				2.752	4.050	0.013				2.113	0.655	0.004
R&D transfer				−1.771	4.476	0.624				1.217	0.842	0.412
Commercial infrastructure access				0.314	6.013	0.113				0.252	1.025	0.441
Physical infrastructure				2.762	2.166	0.912				−0.165	0.625	0.541
Cultural norms				−2.142	3.551	0.831				0.103	0.446	0.281
2005	2.541	1.054	0.003	2.314	1.054	0.115	0.542	0.326	0.242	1.825	1.171	0.321
2006	2.562	1.678	0.070	2.562	1.420	0.060	0.221	0.321	0.457	1.761	1.132	0.121
2007	0.508	0.951	0.732	1.010	2.330	0.510	0.231	0.177	0.765	1.082	1.321	0.132
2008	1.496	0.624	0.030	1.128	2.047	0.455	0.077	0.208	0.666	0.014	1.528	0.05
2009	0.157	0.756	0.646	0.556	0.783	0.351	0.102	0.142	0.181	1.049	0.851	0.012
2010	0.102	0.624	0.875	1.810	1.082	0.070	1.418	0.233	0.231	0.018	0.821	0.012
2011	2.525	0.625	0.010	2.213	1.657	0.147	0.432	0.210	0.002	0.618	0.512	0.061
2012	1.080	0.651	0.041	2.713	1.561	0.081	1.421	0.221	0.019	0.671	0.523	0.052
2013	1.270	0.625	0.050	1.741	1.721	0.231	0.721	0.119	0.061	0.051	0.031	0.042
2014	0.737	0.637	0.146	2.846	1.231	0.074	1.221	0.302	0.141	0.472	0.64	0.271
N	195			168			195			168		
Intercept	4.010	2.135	0.050	−1.900	0.021	0.082	−0.422	0.820	0.062	−0.19	2.715	0.662
Countries	17			17			17			17		
Wald X^{2c}	1.254		0.011	3.651		0.041	3.143		0.021	2.951		0.013
Hansen	34.300		0.361	17.810		0.376	11.420		0.391	9.610		0.380
AR(1)	0.989		0.003	0.721		0.007	4.821		0.041	0.861		0.091
AR(2)	0.731		0.538	0.555		0.612	0.751		0.712	0.741		0.915
R^2	0.712			0.769			0.861			0.778		

Source: Own elaboration.

Table 4
Sub-set regression models for efficiency-driven economies

	Male SEA rate (Control)			Male SEA rate (Actual Effects)			Female SEA rate (Control)			Female SEA rate (Actual Effects)		
	Beta value	**Standard error**	**Significance value**	**Beta value**	**Standard error**	**Significance value**	**Beta value**	**Standard error**	**Significance value**	**Beta value**	**Standard error**	**Significance value**
Entrepreneurship rate 1-year lag	0.738	0.011	0.001	1.724	0.321	0.004	0.607	0.036	0.007	2.051	1.110	0.002
Population	0.4326	1.3211	0.001	1.0831	1.7311	0.014	1.4732	1.2451	0.018	–1.6321	6.8521	0.019
GDP	0.009	0.007	0.041	0.003	0.001	0.156	0.007	0.008	0.051	0.006	0.005	0.097
GDP growth	0.018	0.021	0.612	0.013	0.131	0.024	0.001	0.031	0.012	–0.061	0.327	0.006
Access to finance				3.882	3.011	0.024				4.554	0.434	0.006
Entrepreneurial education				2.641	4.141	0.623				2.002	0.544	0.125
R&D transfer				–1.665	4.364	0.932				1.106	0.731	0.158
Commercial infrastructure access				0.203	6.031	0.671				0.141	1.014	0.942
Physical infrastructure				2.112	1.117	0.003				0.314	0.012	0.009
Cultural, social norms supportive				–2.114	1.165	0.217				–6.119	0.446	0.312
2005	2.431	1.143	0.103	2.203	1.041	0.614	0.431	0.235	0.023	1.714	1.161	0.023
2006	2.439	1.567	0.256	2.451	1.311	0.508	0.111	0.211	0.014	1.651	1.121	0.008
2007	0.417	0.840	0.004	0.110	2.221	0.917	0.121	0.161	0.078	1.071	1.211	0.019
2008	1.385	0.513	0.061	1.017	2.036	0.082	0.065	0.107	0.129	0.025	1.417	0.026
2009	0.349	0.645	0.012	0.445	0.651	0.689	0.103	0.031	0.176	1.058	0.741	0.001
2010	0.013	0.513	0.024	1.701	1.432	0.019	1.317	0.122	0.154	0.027	0.711	0.034
2011	2.414	0.514	0.007	2.102	1.546	0.078	0.321	0.129	0.289	0.507	0.401	0.058
2012	1.190	0.541	0.009	2.602	1.432	0.053	1.311	0.119	0.728	0.561	0.412	0.039
2013	1.380	0.514	0.041	1.630	1.611	0.069	0.611	0.228	0.329	0.041	0.021	0.124
2014	0.626	0.526	0.058	2.735	1.221	0.084	1.119	0.201	0.196	0.361	0.531	0.319
N	145			117			145			117		
Intercept	3.134	2.026	0.031	–1.011	0.011	0.078	–0.311	0.710	0.008	–0.170	2.604	0.468
Countries	16			16			16			16		
Wald X^{2c}	1.457		0.001	4.568		0.003	3.256		0.004	2.354		0.011
Hansen	14.3		0.258	16.17		0.381	10.31		0.379	7.520		0.361
AR(1)	0.731		0.077	0.831		0.041	0.759		0.021	0.901		0.018
AR(2)	0.901		0.211	0.771		0.832	0.777		0.921	0.891		0.671
R^2	0.729			0.841			0.711			0.731		

Source: Own elaboration.

Table 5
Summary of results

Hypothesis	Complete Sample		Efficiency-driven Sample		Innovation-driven Sample	
	Male SEA	Female SEA	Male SEA	Female SEA	Male SEA	Female SEA
H1a: Entrepreneurial education is directly associated with social entrepreneurial activities.	Accepted	Accepted	Not Accepted	Not Accepted	Accepted	Accepted
H1b: The effect remains prominent mainly for men as compared to women.	Accepted	Accepted	Not Accepted	Not Accepted	Accepted	Accepted
H2a: R&D activities are positively associated with social entrepreneurship at national level.	Not Accepted	Not Accepted	Not Accepted	Not Accepted	Not Accepted	Not Accepted
H2b: The effect remains prominent mainly for women as compared to men.	Accepted	Accepted	Not Accepted	Not Accepted	Not Accepted	Not Accepted
H3a: Social entrepreneurship is positively associated with financial support.	Accepted	Accepted	Accepted	Accepted	Accepted	Accepted
H3b: Financial support is more easily available for men than women.	Accepted	Accepted	Not Accepted	Not Accepted	Not Accepted	Not Accepted
H4a: At the national level, social entrepreneurship is positively associated with physical infrastructure.	Not Accepted	Accepted	Accepted	Accepted	Not Accepted	Not Accepted
H4b: Physical infrastructure is more accessible to men than women.	Accepted	Accepted	Accepted	Accepted	Not Accepted	Not Accepted
H5a: Social entrepreneurship is positively associated with commercial infrastructure.	Accepted	Accepted	Not Accepted	Not Accepted	Accepted	Accepted
H5b: Commercial infrastructure significantly influences the social entrepreneurial actives of men and women.	Not Accepted	Accepted	Not Accepted	Not Accepted	Accepted	Accepted
H6a: Social and cultural norms are directly associated with social entrepreneurial activities.	Accepted	Accepted	Not Accepted	Not Accepted	Not Accepted	Not Accepted
H6b: Social and cultural norms are more favorable for men than women.	Accepted	Accepted	Not Accepted	Not Accepted	Not Accepted	Not Accepted

Source: Own elaboration.

5. DISCUSSION AND CONCLUSION

This study examines the influence of entrepreneurial ecosystem factors on the social entrepreneurial activities for both genders. We test our hypotheses using data from GEM 2015 by covering 35 countries for ten years (2004-2014). We also performed robustness checks by dividing our sample into two subsets; innovation and efficiency-driven economies. The results indicated that some factors of entrepreneurial ecosystem significantly influence social entrepreneurial activities. Our research confirms previous research findings that the entrepreneurial ecosystem plays a significant role in boosting social entrepreneurial activities (Doherty *et al.* 2018; Lounsbury *et al.* 2019). Findings reveal three entrepreneurial factors (access to finance, commercial infrastructure, and physical infrastructure) significantly influences SEA rates of both genders. Among selected six factors, our result supported H1a as we found a significant impact of entrepreneurial education on SEA and this result is in line with past studies (Jensen 2014; Mueller Brahm and Neck, 2015). H1b is not supported by the results and the reason would be that women are less likely to start an entrepreneurial venture without having appropriate education while men prefer learning from experience more than education (Kumar and Kalyani 2011; Schneider 2017).Further, this finding presents that the contemporary environment is promoting entrepreneurial education more for young women entrepreneurs over men entrepreneurs and eventually supporting social start-ups launched by women entrepreneurs. Thus, this finding suggests that entrepreneurial education can prepare young female entrepreneurs more effective for dealing with the practical challenges in the field of social entrepreneurship (Peterman and Kennedy 2003; Souitaris, Zerbinati and Al-Laham 2007).

Further, H2a is not supported by the results. While H2b is supported by the results of whole sample but not supported in the results of innovation and efficiency driven economies. The reason could be that as R&D transfer is inconsistent with the knowledge spill-over theory of entrepreneurship as it reveals that countries having cheap and fast R&D activities have lower rates of SEA by depicting a negative and significant relationship between R&D transfer and SEA rates for both genders. This result is in contrast to previous studies that claimed that R&D activities promote the transfer of knowledge and increases social entrepreneurial activates (Audretsch and Lehmann 2005; Acs *et al.* 2008). However, our result supports the outcomes of Markman *et al.* (2004) who found that R&D incentive systems negatively influence entrepreneurial activities. Also, Morimoto (2018) found an inverted U-shaped linkage between R&D and entrepreneurial rates. The reason behind this negative relationship may lie in the fact that individuals processes heterogeneous capabilities and R&D subsidies reduces their intergenerational inequalities and thus reduces the number of entrepreneurs. As certainly, sponsorships promote R&D activities and encourage labor demand for the activities. This increase of labor demand, in turn, upsurges workers' income, creating it unattractive to be an entrepreneur.

In this way subsidies of R&D promote R&D activities but also at the same time discourage entrepreneurs. Hence, our results suggest that sometimes a policy developed to promote research and development activities can have a negative influence on social entrepreneurial activities.

H3a is supported by the results and H3b is only proved by whole sample results while not proved in innovation driven and efficiency driven economies. The findings suggest that having access to finance strongly enhances the spirit of social entrepreneurship among male and female entrepreneurs and this finding provides evidence to the previous research findings (Black and Satrahan 2002; Blanchflower *et al.* 2003). This outcome also finds its evidence in the results of innovation and efficiency-driven economies.

In case of H4a our results of complete sample proved that physical infrastructure supports women than men. While in efficiency driven sample H4a is proved but in innovation driven sample it is not supported by the results. Overall, the results revealed that the physical infrastructure and services shared a positive and significant relationship with SEA rates of both genders and this finding provides evidence for the past studies that claimed the necessity of physical infrastructure for enhancing the social entrepreneurial activities (Amorós and Bosma 2014; Amorós *et al.* 2019). In case of H4b, as proposed its impact is found to be stronger for men than women in complete sample and efficiency driven sample results. The reason behind this result may lie in the fact that the physical infrastructure such as operating space, communication facilities and transportation is more assessable to men as compared to women. Because women prefer to work from home thus assessing physical infrastructure shares a stronger relationship with men as compared to women (Bitzenis and Nito 2005).

In view of results H5a is found to be accepted for complete and innovation driven sample. While, H5b finds partial support from results as the commercial infrastructure reflected a positive and significant relationship with social entrepreneurial activities in the case of only female respondents of complete sample. Surprisingly commercial infrastructure showed an insignificant relationship with SEA rates in the case of male respondents, maybe since the current feminist economic arguments are enhancing the awareness regarding the importance of women entrepreneurs and commercial infrastructure becomes more favorable for women than men in establishing new social start-ups (Karadeniz and Ozdemir 2009). Further, the influence of commercial infrastructure on SEA rates for both males and females is also found to be positively and significantly related to the results of innovation-driven economies.

In the perspective of cultural and social norms, the results of H6a and H6b indicated a positive and significant relationship between culture and SEA rates for both genders and culture seems to be more favorable for social entrepreneurial activities of men. This result also finds support from the past studies (Hofstede 1980; Khursheed *et al.*, 2018; Khursheed *et al.* 2019).

Regarding social entrepreneurship theory, we found that global entrepreneurial factors have a considerable impact on prevalence rates of social business ventures and the goal of starting a social business venture is not independent of the entrepreneurial ecosystem and its factors.

This study made an effort to explore how different aspects of an entrepreneurial ecosystem influences social entrepreneurial activities for both men and women at the national level. We found that considerably three factors of an entrepreneurial ecosystem influence social entrepreneurship rates for men and women. This study provides valuable information for policymakers about the factors that drive social entrepreneurial activities. Further, the finding provides researchers and social entrepreneurs a deeper insight regarding the key factors leading to social business venture success. Further, the model analyzed in this study provides the key context to comprehend the relationship between social entrepreneurship and its factors. The results may also facilitate the researchers and academicians to explore new ways for understanding social entrepreneurship from the perspective of entrepreneurial ecosystem.

6. IMPLICATIONS AND FUTURE DIRECTIONS

The implications of this study are both theoretical and practical. From the theoretical perspective, its contribution is to improve the existing studies on SE by introducing a framework based on entrepreneurial factors to explore the un-examined areas. This study is capable to fill the gap in the literature by analyzing the relationship between entrepreneurial factors and SE in various countries by drawing on empirical data from Global Entrepreneurship Monitor (GEM). Hence, the findings of this study facilitate scholars and analysts with the latest empirical advancements in the field of SE, specifically by considering 35 different countries in this regard. Furthermore, this study enlightens the major differences between commercial entrepreneurship and social entrepreneurship. From a practical perspective, this study reveals that entrepreneurial factors are recognized as the significant drivers of SE. Particularly, this study gives future directions to academicians that how culture, gender and entrepreneurial factors can be examined to improve the effectiveness of an organizations' practices and behavior, especially those who work for the uplift of society. The study provides practical implications for future social entrepreneurs particularly in innovation and efficiency driven economies. Further, the study expands future research avenues on social entrepreneurship in diverse contexts. The findings highlights that social entrepreneurship is the key source for social value creation in an economy. Thus, by focusing on the key constructs analyzed in this study social entrepreneurial activities of men and women can be boosted.

This study provides two limitations. First, the GEM database contains data from 75 countries for entrepreneurial intentions. While data on SEA and all six entrepreneurial factors were accessible only for 35 countries. After merging data from three databases depicted that 35 countries have attained values common in GEM SEA, NES and APS. Owing to constraints in the availability of GEM data, the second limitation is the data range covering the period of ten years (2005 -2014) in this study.

Despite these limitations, this study recommends new trends for academicians and researchers. As discussed earlier in the literature, SE has been generally investigated with the help of two components (Austin, Stevenson and Wei-Skillern 2006; Dacin *et al.* 2010), which means that by concentrating on the relative

balance between self-satisfaction and other's interests in the formation of an entrepreneurial process. Therefore, future research is required to investigate the influence of entrepreneurial factors on both components of SE as well as on the relative balance. Questions that may contribute invaluable research include:

— What combination of entrepreneurial factors is required to sustain the pace and growth of social entrepreneurial activities?
— How do different entrepreneurial factors affect social and entrepreneurial orientation?
— How culture and gender mediate the relationship between entrepreneurial factors and the social venture creation process?

The development of these research questions highlights the presence of a still undiscovered field of examination, within which academicians may take benefit of these outcomes. Particularly, social identity theory, resource dependency theory and institutional theory may be utilized to join gendered based approaches in social entrepreneurship study.

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Explanatory and predictive drivers of entrepreneurial orientation and innovation capacity: Evidence from family enterprises

Variables explicativas y predictivas de la capacidad de emprendimiento e innovación: evidencia en las empresas familiares

Alfredo Martínez-Bobillo*, Juan Antonio Rodríguez-Sanz[a], Fernando Tejerina-Gaite[b]

[a] *Catedrático de Economía Financiera. Universidad de Valladolid. Facultad de CC. Económicas y Empresariales. Avenida Valle de Esgueva. 6. 47011-Valladolid (España) –juanantonio.rodriguez@uva.es – https://orcid.org/0000-0001-7228-4020*

[b] *Profesor Titular Universidad de Economía Financiera. Universidad de Valladolid. Escuela Ingeniería Informática. Campus Miguel Delibes. 47011-Valladolid (España)– ftejerina@efc.uva.es – http://orcid.org/0000-0001-6301-0757*

* ***Corresponding author****: Catedrático de Economía Financiera. Universidad de Valladolid. Facultad de CC. Económicas y Empresariales. Campus Esgueva. 47011-Valladolid (España) –alfredo.martinez@uva.es – http://orcid.org/0000-0003-2488-8174*

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ABSTRACT

This paper aims to identify potential explanatory variables of the entrepreneurial orientation and innovation capacity (EO-IC) of family enterprises (FEs) through a comparative study of family businesses in Spain and Latin America. The innovation literature reports a paradigm shift whereby the dynamic boost provided by corporate governance and productivity is playing an increasing role as a driver of EO-IC and sustainable competitive advantage. This issue acquires particular relevance in the case of family firms, where entrepreneurial and innovation capacities are characteristically hampered by socio-emotional and risk-aversion factors. We construct a panel of data on 182 large family enterprises (1,820 observations) domiciled in Argentina, Brazil, Chile, Colombia, Mexico, Peru, Uruguay and Spain, drawing on the Thomson Onebanker and ORBIS databases for the period 2008-2018. The results reveal the emergence of new explanatory variables for the structure of the family-firm EO-IC framework, some related to productivity; others more basically to corporate governance. They also show that, in Latin America, the use of business efficiency (productivity) factors in the planning and potentiation of EO-IC by family firms is hampered by the institutional (legal, regulatory, labour and educational) environment, where traditional factors such as firm size and ownership concentration are more relevant. In the Spanish case, however, the evidence points to a transition from traditional inputs towards business efficiency and productivity-related factors.

Keywords: family firm, entrepreneurial orientation, innovation capacity, corporate governance, productivity, Latin America vs. Spain.

RESUMEN

El presente trabajo pretende analizar las variables explicativas de la orientación emprendedora y la capacidad de innovación de la empresa familiar (EO-IC) en un estudio comparativo de las empresas familiares españolas y latinoamericanas. A este respecto, se constata un cambio de paradigma en la literatura sobre innovación en el que las capacidades dinámicas derivadas del gobierno corporativo y de la productividad han ido cobrando progresiva importancia en la conformación de la (EO-IC) y en la consecución de una ventaja competitiva sostenible. Esta problemática cobra especial interés en el caso de la empresa familiar, donde las implicaciones socioemocionales y la aversión al riesgo, características de este tipo de empresa, ponen habitualmente en tela de juicio su capacidad para innovar y emprender. Construimos un panel con 182 grandes empresas familiares (1.820 observaciones) pertenecientes a Argentina, Brasil, Chile, Colombia, México, Perú, Uruguay y España, utilizando las bases de datos Thomson Onebanker y ORBIS para el período 2008-2018. Los resultados obtenidos evidencian la aparición de nuevas variables explicativas en la configuración de la (EO-IC) de la empresa familiar, basadas en la productividad y fundamentalmente en el gobierno corporativo. De la misma manera, en la empresa familiar latinoamericana, se constata cómo el entorno institucional (legal, regulatorio, laboral y educativo) frena la utilización de variables de eficiencia (productividad), en favor de otras variables más tradicionales como tamaño y concentración de la propiedad en el diseño y fortalecimiento de la OE CI. En el caso español, sin embargo, se evidencia la transición de variables tradicionales hacia factores relacionados con la eficiencia y productividad empresarial.

Palabras clave: empresa familiar, capacidad emprendedora, capacidad de innovación, gobierno corporativo, productividad, Latinoamérica vs. España.

1. INTRODUCTION

The globalization of the economy carries both risks and opportunities for today's society. Within this context, the transformation of its component units, such as businesses, faces the global market with the challenge of constant adaptation (Craft 2000). Automation, standardization and distribution formed the bulwark of firm modernization in the last century, whereas the identity of the twenty-first century is based on the use of information technologies (ICTs) grounded in the automation and digitalization of the economy (Pavitt 2005). These dynamics are driving the transformation towards higher industrial specialization, featuring small businesses equipped with the latest-generation technology. Thus, in an environment as volatile, uncertain, complex and ambiguous as the current one, the key to firm survival and sustainable competitive advantage across all sectors will be to invest in innovation.

Against this background, analysis of the possible repercussions of entrepreneurial orientation and innovation capacity (EO-IC) in all firms, particularly family enterprises (FEs), gains special relevance. Given an endowment of resources and specific capabilities that could either stimulate or hinder EO-IC activities, FEs provide an exceptional context for a case-study of EO-IC development (Habbershon *et al.* 2003; Nordqvist *et al.* 2008; Zellweger *et al.* 2010). The close ownership-management relationship characteristic of the FE could have a decisive influence on the various dimensions of EO-IC (innovation, risk, pro-activeness, aggressive competitiveness and autonomy) (Zahra 2005; Casillas *et al.* 2011; Hernández-Linares and López-Fernández 2018).

In light of the above, any growth and profitability differences among FEs could be due to variations in resource endowments, especially with respect to intangible resources, where acquisition, replication, accumulation and imitation by rival firms are more difficult (Barney 1991). Among the various intangible resources, R&D investment, human capital training and corporate reputation are worth exploring as the three basic strategic inputs for building firms' competitiveness (Huselid 1995; Roberts and Dowling 2002; Cho and Pucik 2005). The Resource-Based View (RBV) theory therefore serves as a potentially useful tool for explaining EO-IC in the EF in terms of intangible asset investment (R&D, human capital training, reputation). Various studies supporting this idea, point towards a shift from the use of tangible to intangible resources as leverage for more efficient exploitation of assets and the achievement of competitive advantage over rivals (Orlitzky *et al.* 2003; Rua 2018; Khan *et al.* 2019). However, the process through which these resources drive competitive advantage is unclear, having even been dubbed by the strategic management literature as "the missing link" (Chatzoglou. *et al.* 2018). Recent research suggests that firms use these resources to strengthen their dynamic skills and capabilities and thus gain an edge over their rivals (Teece 2007; Wu 2010).

Some of the variables cited in the literature as innovation and entrepreneurship conditioners are country-level factors. Duran *et al.* (2016) mention minor shareholder protection or the skills level of the country's labour force as paradigmatic examples of institutional drivers. Our study attempts to contribute to the search for the explanatory variables of EO-IC in the FE in two contrasting institutional environments (Latin America and Spain) where the internal and external barriers to entrepreneurship and innovation are potentially so diverse. Some issues worth highlighting related to the labour market (skills development problems and labour contracts), internal organizational factors (lack of funds and readiness for change in management and the workforce), and the institutional environment (the fiscal treatment of R&D investment; minor shareholder protection; development of the financial system; scientific and technical knowledge; governance regulations). This study calls for investigation into the main contributing factors and indicators of the capacity for sustainable competitive advantage driven by growth and profitability and based on EO-IC in FEs; that is, corporate governance, corporate strategy and performance or value creation (Gómez-Mejía *et al.* 2014).

The research on corporate governance and its relationship with EO-IC considers variables such as the family's involvement in management (Arzubiaga *et al.* 2018; Calabrò *et al.* 2020); CEO generation (Durán *et al.* 2016); family ownership concentration (Gómez-Mejía *et al.* 2014; Decker and Günther 2017; Arzubiaga *et al.* 2018); or the volume of external resources (Nieto *et al.* 2015).

With respect to corporate strategy variables, the research focuses on the relationship between EO-IC and the productivity of labour and capital, particularly in the FE. Thus, Block (2010) claims that sole ownership by the founder has a positive impact on EO-IC and also on intangible asset productivity. In a similar vein, Classen *et al.* (2014) in a comparative analysis of innovation activity in FEs and non-FEs find higher levels of tangible asset productivity and lower innovation costs in FEs, albeit with a lower level of labour productivity relative to non-FEs. However, Morck and Yeung (2003) highlight that an aversion to investment in tangible assets hampers the productivity of innovation investment in FEs. Finally, Zellweger (2007) claims that, due to their focus on long-term objectives, FEs are more likely to rely on tangible investment to strengthen their EO-IC.

Finally, in several studies value-added or resource-creation variables are found to explain innovation in the FE. Internal and family resources play an essential role; firstly, because access to external funding is limited by small firm size or guarantee shortage and, secondly, because conflict can arise between external investors focused on short-term profits and the family who have a long-term commitment to socio-emotional wealth preservation (Cruz *et al.* 2012).

Our research objective, therefore, is to compare the behaviour of these variables in Latin American and Spanish FEs and check for variation attributable to differences in the legal-institutional framework, financial system or cultural environment. This study contributes to the literature on FEs and the tendency to innovate in several ways. One is to provide a fuller understanding of the process through which intangible assets can lead to a competitive advantage for FEs, the distinctive characteristics of which provide a novel context for exploring the underlying factors of EO-IC or any of its dimensions (innovation, pro-activeness, and risk assumption). Another is to probe deeper into the impact of the new variables (relating to corporate governance, corporate strategy and performance) on EO-IC. In this way, we aim to validate the reported effects of the paradigm shift on entrepreneurship in general and the FE in particular. Finally, our study will analyse the gap in terms of family firm EO-IC between two institutional environments as diverse as Latin America and Spain, thereby admitting the possible influence of institutional factors which could help to explain the relationship that concerns us.

Our study continues as follows. Section 2 comments on the main theories on EO-IC developed in the business management literature, taking into consideration the analysis of the component dimensions of corporate governance, corporate strategy and value added. Section 3 describes the specification of the empirical model for testing our hypotheses using data on 182 large family firms (1,820 observations for the period 2008-2018) domiciled in Argentina, Brazil, Chile, Colombia, Mexico, Peru, Uruguay and Spain. Section 4 gives the interpretation of the results, and the paper concludes in Section 5 with a general discussion and summary of the findings.

2. THEORY AND HYPOTHESES

2.1. Corporate governance mechanisms, business strategy, internal funding and EO-IC in the family enterprise

As stated in the introduction, entrepreneurial activity promotes creativity and innovation and is a transcendental means to long-term survival for FEs (Arzubiaga 2019). The characteristics of these firms in terms of ownership and governance structure, corporate strategy and emphasis on internal funding provide an ideal case study for the analysis of innovation and entrepreneurship issues (Steier 2003; Lumpkin *et al.* 2005).

A joint socio-emotional wealth (SEW) and resource-based (RBV) approach is a useful choice for the study of non-complex, intangible-intensive organizations, such as FEs (Habbershon and Williams 1999; Gómez-Mejía *et al.* 2011). Our first area of analysis concerns the family ownership level and percentage of family board members and the implications of these for the FE corporate governance structure and its relationship with EO-IC.

In this respect, higher ownership concentration and a lower degree of board autonomy from family control lead to heavier investment in human and financial capital and higher profitability gains (Andres 2008; Munari *et al.* 2010). This lack of autonomy increases the emotional burden on family members and their commitment to the business. Thus, the greater the involvement of family owners in EO-IC decisions, the stronger their tendency to prioritize family concerns over business interests (Le Breton-Miller *et al.* 2011). The current owners will want to do everything in their power to hand down the family business and wealth to future generations, and will therefore take a cautious and discouraging attitude with respect to EO-IC (Gómez-Mejía *et al.* 2010). Thus, a large family ownership could have a negative effect on its EO-IC performance (Chrisman and Patel 2012). This leads us to propose our first hypothesis:

H1: High family ownership concentration or board dependence on the family will have a negative impact on EO-IC in the FE.

Borrowing is another FE corporate governance practice which is closely related to family control and managerial discretion through two mechanisms: the use of free cash flow and the ambidextrous nature[1] of innovation investment.

[1] Ambidextrous in the sense of simultaneous innovation exploration and exploitation.

With respect to managerial discretion in free cash flow usage, it is worth noting that tight control by a majority of family ownership could dissuade non-family managers from the discretionary use of free cash flow, especially in large firms. However, the responsibility for strategic EO-IC decisions lies with top management team (TMT), in line, specifically, with long-term survival objectives, which could be hampered by excessive family control over the use of free cash flow (Talke *et al.* 2010).

Meanwhile, a preference for autonomy and family control clearly impacts on owners' financing decisions (Dreux 1990). Thus, some authors describe entrepreneurs prioritizing autonomy and using their own resources or retained profits to finance innovation (Shrivastiva and Grant 1985; Hutchison 1995), while Stoney and Winstanley (2001) report that family firms' aversion to shared ownership drives them to use credit for that purpose. Meanwhile, Van der Wijst (1989) claims that new generation CEOs show less resistance to borrowing and a greater willingness to embrace non-family investment. Various studies find an association between a control-oriented family business plan and a higher propensity to borrow.

Furthermore, the low-risk investment decisions typical of FEs bring the interests of majority family shareholders closer into line with those of creditors than those of minority shareholders, thereby easing access to credit from financial markets (Croci *et al.* 2011).

The above reasoning motivates the following hypothesis:

H2: The use of debt financing in FEs, associated with family control and constraints on managerial discretion, will have a positive impact on the financing of EO-IC activities.

Another variable with potentially significant implications for EO-IC development is the proportion of family managers and degree of generational diversity on the board of directors (Murphy and Lambrechts 2015; Querbach *et al.* 2020). Family involvement in the management team fosters a propensity towards EO-IC activities through family members' strong commitment to firm survival (Casillas *et al.* 2011). Meanwhile, younger generations, being less risk averse, more highly trained, and more diverse than their predecessors, are able to contribute tacit knowledge of business processes and information passed down by previous generations (Kellermanns 2008). This leads us to formulate the following hypothesis:

H3: A higher proportion of family board members and greater generational board diversity have a positive impact on EO-IC in FEs.

The distinctive management and succession patterns of family firms enable the identification of certain traits of corporate strategy (basically, the productivity of capital and labour) relating to their levels of innovation, risk taking and pro-activeness in EO-IC (Habbershon and Pistrui 2002; Lumpkin *et al.* 2005). The resource-based theory claims that a company's profits are due in large part to the stock of tangible and intangible resources (Barney 1991; Aiello *et al.* 2020) which it uses to build EO-IC capacity as a means to gain a competitive advantage and thereby promote long-term survival. Thus, a firm's critical assets in terms of knowledge, entrepreneurial capacity and innovation ultimately reside in its human and tangible capital. Calabrò *et al.* (2020) show precisely how the presence of family board members contributes to the accumulation and efficient use of intangible assets (R&D, tacit knowledge) and thereby improves EO-IC in the family firm.

Based on these assumptions we posit the following hypothesis:

H4: Tangible/intangible and labour productivity are positively related to EO-IC in the EF.

One of the main potential obstacles to EO-IC is access to internal or external financial resources. According to the behavioural agency theory and the socio-emotional wealth perspective (Kotlar *et al.* 2018), external funding through new equity issues can lead to conflict between the long term goals of the current generation of family owners and the short-term goals usually adopted by external investors. The EO-IC process, therefore, works better if the external investors are specialized in some area and able to provide value-added services as well as financial resources (Cirillo *et al.* 2019). According to Benfratello *et al.* (2008), the main form of R&D investment in the private sector is through internal financing. Muñoz-Bullón and Sánchez-Bueno (2011) note that FEs have less opportunity for R&D investment because of an internal resource deficit, which in many cases forces them to seek credit or other forms of external funding. In short, the desire to perpetuate the family dynasty and maintain control over assets makes the owners of family businesses more inclined to use internal than external funding to finance R&D investments (Bacci *et al.* 2018; Kupp *et al.* 2019).

Therefore we propose the following hypothesis:

H5: There is a positive link between internal resource generation and EO-IC in the FE.

2.2. *Institutional environment and EO-IC in the FE: Latin America vs. Spain*

A comparative analysis of entrepreneurial capacity and innovation in the FE in institutional contexts as disparate as those of Latin America and Spain will help us to determine whether the explanatory power for the process underlying EO-CI resides in institutional or country-level factors. From precisely this institutional perspective, Duran *et al.* (2016) reach the conclusion that the impact of family-firm characteristics on innovation performance varies between environments with different levels of minority shareholder protection or workforce education.

Family firms still make a decisive contribution to national economies in areas such as tangible and labour competitiveness, export volume or job creation. In developing countries, family firms form the nucleus of new business creation and wealth transfer (Carney 2007). Similarly, the prevalence of FEs in a given geographical area stimulates cooperation and thereby the creation and ongoing development of innovations (Block and Spiegel 2013). As a consequence, Latin America is a geographical area of rapid growth and international influence. With a population of around 600 million, it is a major supplier of raw materials for manufacturing markets where it has partnerships with leading companies worldwide (Nicholson 2011). Family firms form the majority in this area of the world (Pérez and Lluch 2016) and thus provide a context of unsurpassable research relevance. The contrasting cultural, legal and financial contexts of Spain and Latin America will determine the potential influence of corporate governance, corporate strategy and value creation variables on EO-IC in their respective FEs.

Three institutional factors that could impact differently on Latin American and Spanish FEs are the economic and financial environment, the political and social context and the legal framework. Speaking from the financial and economic angle, we could say that Latin America has switched from a policy of regional protectionism in the 1960s (Lansberg and Perrow 1991) to one of destabilizing and deeply challenging trade openness. This switch was instigated by the leading countries of Latin America (Argentina, Brazil, Mexico, Colombia, etc.) in a process beginning with state intervention and gradually evolving towards the privatization of businesses (Gras and Mendoza-Abarca 2014).

Latin American countries are characterized by the shallowness of their banking systems (credit/GDP ratio below 50%), which raises the cost of banking services. Another characteristic feature is small bank size, which prevents economies of scale and the adoption of new technologies that would boost competitiveness and enable a more fluid and efficient relationship with the business sector. Many Latin American economies are highly dollarized, a fact which leaves their financial systems more vulnerable to solvency and liquidity risks while conditioning their lending policy towards businesses.

Spain's geopolitical environment, on the other hand, which features a deregulated financial system with a low degree of government intervention, a high level of protection for minority investors and a recent history of multiple bank mergers, has acted as a lever for improving corporate productivity and efficiency. Another important factor which should not be overlooked is that the European Union has a single currency and a market with 400 million potential consumers. Four decades of financial stability within the context of the European single market, therefore, have boosted the competitiveness, funding potential and growth capacity of Spain's family businesses. At the political and social level, meanwhile, three key contrasting factors between Latin American and Spanish firms have their origin in the constant economic changes in Latin American economies which have created an environment of social conflict that has triggered a migratory flow to the cities, which accommodate 80% of the population (UNEP 2010). The results of these population shifts are higher unemployment, structural deficits, and education systems with insufficient capacity to train a skilled workforce (Poza 1995; Nordqvist *et al.* 2011). These social issues are also reflected in business organizations, which have been forced into a process of constant evolution and adaptation to government norms and policies (Lansberg and Perrow 1991).

The second notable factor is the strong political involvement of some family managers of FEs. In countries where political instability is the norm, dual commitment to family and business interests on the one hand and government policies on the other can create potential conflicts of interest within the family and even among board members. A third and last peculiarity of the Latin American family enterprise is its youthfulness in comparison with those of Europe or North America. This, together with a high concentration of family ownership, forms a so-called group-structured business with a single and clear objective, which is none other than to pave the way for new family generations. This results in multigenerational involvement and

sufficient decision-making autonomy to enable the promotion of EO-IC within the firm. In Spain, on the other hand, only exceptionally does one find either politically involved board members or corporate diversification in family firms.

With respect to legal frameworks, Cabrera-Suárez and Santana-Martín (2004) note that FE corporate governance practices are inevitably affected by the legal framework within which they operate. Both Latin America and Spain have civil law systems, traditionally associated with low-level protection for minority shareholders and high corporate ownership concentration (La Porta *et al.* 1999; Faccio and Lang 2002). In Spain, however, EU regulations (Directive 2017/828), developed by the Central European Bank and incorporated into Spanish stock market rules, promote market transparency and prevent the diversion of profits by large shareholders. This is far from the case in Latin America, where the weakness of the legal system can lead to the replacement of state functions by FEs. Thus, we can observe how micro-enterprises emerge in so-called subsistence entrepreneurship (Beckert and Dewey 2017), small and medium-sized family businesses grabbing economic opportunities as they arise (Basco and Calabrò 2016), or large family conglomerates using a search strategy and exploiting any available profit-making opportunity (Morck and Yeung 2003; Robles *et al.* 2016). In short, we can say that the EU geopolitical environment has enabled Spain to achieve generally higher business competitiveness levels in all firms, FEs included.

Given the above, the climate of greater uncertainty surrounding Latin American FEs necessitates a high level of flexibility and adaptability in their EO-IC management, a fact which differentiates them from their Spanish counterparts in terms of corporate governance structure (Monteferrante and Piñango 2011).

These characteristic differences between the Latin American and Spanish business contexts suggest the following hypotheses:

H6: Corporate governance variables have more impact on EO-IC in Latin American FEs than in Spanish ones.

H7: Labour and capital productivity variables have less impact on EO-IC in Latin American FEs than in Spanish ones.

H8: Firm size and hi tech sector affiliation have a stronger positive impact on EO-IC in Latin American FEs than in Spanish ones.

3. DATA AND METHODOLOGY

3.1. Data

The sample for this study is formed from individualized family-firm cross-industry data drawn from the Orbis (Bureau van Dyjk) database for Spain and Latin America (Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico and Peru) and for a period running from 2008 to 2018. The corporate governance data were taken from a report on Europe, the USA and Latin America published by Heidrick & Struggles Consultors for the same period of analysis. Executive compensation elasticities were calculated from Boardex and ExecuComp. Data firm distributions by country and sector affiliation are shown in Tables 1 and 2, where it can be seen that the initial sample comprised 180 firms (1,800 observations) with full data-availability for each of the study periods, thus constituting a balanced panel. To achieve the research objective of comparing innovation policies in two distinct contexts, 44% of the sample refers to Spanish FEs (80 firms), and the remaining 56% to Latin American FEs (100 firms).

Table 1
Sample distribution by countries (2008-2018)

Country	N. firms	%	N. observations	%
Argentina	17	9.44%	170	9.44%
Brazil	17	9.44%	170	9.44%
Chile	18	10,00%	180	10,00%
Colombia	18	10,00%	180	10,00%
Spain	80	44.44%	800	44.44%
Mexico	18	10,00%	180	10,00%
Perú	12	6.67%	120	6.67%
Total	180	100%	1800	100%

Source: Own elaboration

Table 2 shows the distribution of firms and observations by industries, all of which are adequately represented, with Manufacturing (29%) and Trade (23%) forming the majority.

Table 2
Number of firms per sector

SECTOR	N. firms	%	N. observ.	%
1. Mining and Construction	20	11.11%	200	11.11%
2. Food. Beverages. Tobacco. Wood. Cork and Paper.	53	29.44%	530	29.44%
3. Metals and metal products. Machinery. Equipment. Furniture and Recycling	22	12.22%	220	12.22%
4. Transport and Communications. Gas. Electricity and Water	15	8.33%	150	8.33%
5. Wholesale and Retail	42	23.33%	420	23.33%
6. Banks and other Financial Services	11	6.11%	110	6.11%
7. Services: Hotels and Restaurants. Automobile Repairs	8	4.44%	80	4.44%
8. Other Services: Health. Education. Social. Museums and Consulting	9	4.94%	90	4.94%
Total	180	100.0%	1800	100.0%

Source: Own elaboration

3.2. Variables

The empirical estimation uses the regression model described more fully in the next section and the variables described below (further details in Table 3).

Table 3
List of variables

Dependent Variable			References
Entrepreneurship and innovation capacity	$EO-IC_{i.t}=\frac{IA_{i.t}-IA_{i.t-1}}{Sales_{i.t}-Sales_{i.t-1}}$	Investment in intangibles (R&D expenditure, human capital formation, and goodwill) over sales variation from t to t-1	Miller *et al.* (2015) Surroca *et al.* (2010) Heirman and Clarysse (2007)
Independent Variables:			
A) *Corporate governance*			
Ownership Concentration	$C5_{i.t}$	Percentage ownership held by top 5 shareholders.	Andres (2008) Munari *et al.* (2010) Brunninge and Nordqvist (2004)
Leverage: Degree of family control and managerial discretion	$LEV_{i.t}=\frac{Debt_{i,t}}{Assets_{i.t}}$	Total debt over total assets	Stoney and Winstanley (2001) Van der Wijst (1989) Croci *et al.* (2011)
Ownership status	IND	Bureau van Dijk (Orbis) Ownership independence index which ranges from 1 to 4	Aparicio *et al.* (2019) Arzubiaga *et al.* (2018)
Presence of family members and generational diversity on the Board of Directors	FAMILY	Index constructed from Orbis ownership data and equal to the percentage of board members with ties to the controlling family	Lee and Chu (2017) Casillas and Moreno (2010) Casillas *et al.* (2011) Arzubiaga *et al.* (2018) Murphy and Lambrechts (2015)
B) *Corporate strategy*			
Intangible Capital Productivity	$ICP_{i.t}=\frac{Intangibles_{i,t}}{Assets_{i.t}}$	Intangibles over total assets	Habbershon and Pistrui (2002) Lumpkin *et al.* (2005) Calabrò *et al.* (2020)
Tangible Capital Productivity	$TCP_{i.t}=\frac{Tangibles_{i,t}}{Assets_{i.t}}$	Tangibles over total assets	Habbershon and Pistrui (2002) Lumpkin *et al.* (2005) Calabrò *et al.* (2020)
Labour productivity	$LP_{i.t}=\frac{Operating\ revenue_{i,t}}{N.Employees_{i.t}}$	Operating revenue over number of employees	Habbershon and Pistrui (2002) Lumpkin *et al.* (2005) Calabrò *et al.* (2020)
C) *Performance measured as effective and efficient utilization of resources to generate sales*			
Added value	$AV_{i.t}=\frac{Sales_{i.t}-Sales\ costs_{i.t}}{N.Employees_{i.t}}$	Value added over number of employees	Benfratello *et al.* (2008) Cirillo *et al.* (2019) Bacci *et al.* (2018)
D) *Control Variables*			
Free Cash Flow	$FCF/Sales_{i.t}=\frac{FCF_{i.t}}{Sales_{i.t}}$	Free Cash Flow over total sales	Michiels and Molly (2017) Pindado *et al.* (2011)
Firm age	LnAge	Natural log of years since firm foundation	Huergo and Jaumandreu (2004) Bianchi *et al.* (2015)
Size	LnAssets	Natural log of total assets	Chrisman *et al.* (2015) Duran *et al.* (2016)
Tech level	TECHCODE	Index based on sector and OECD data. Ranges from 1 to 3	Kammerlander and Ganter (2015) Garcés-Galdeano *et al.* (2016)

Source: Own elaboration based on theoretical literature review

The dependent variable to be estimated is firms' entrepreneurship orientation and innovation capacity (EO-IC), taking entrepreneurship and innovation as R&D and other intangible investment inputs (Anderson *et al.* 2012) proxied by the following variable:

$$EO-IC_{i.t}=\frac{IA_{i.t}-IA_{i.t-1}}{Sales_{i.t}-Sales_{i.t-1}}$$

where $IA_{i.t}$ is the stock of intangible assets for firm *i* for period *t* and Sales is its total turnover for the same period. The same notation applies for period *t-1*.

The explanatory or independent variables included in the equations to be estimated are as follows.

The first set relates to Corporate Governance factors: (1) the percentage of capital held by the five main shareholders; (2) corporate debt measured as total debt over total assets; (3) ownership status and (4) the ratio of family and non-family board members.

Second, a group of firm productivity performance indicators; namely, the productivity of intangible (tangible) assets measured as intangible (tangible) investments over total assets; labour productivity, is calculated as operating revenue over the number of employees; and added value per employee measured as the sales/cost ratio over the number of employees.[2]

A third set of variables captures other factors potentially contributing to entrepreneurship orientation and innovation capacity. The first is free cash flow (FCF), which is designed to capture discretionary use of financial slack and its potentially weakening impact on entrepreneurship and innovation capacity. Others are firm age, expressed as the natural log function of the number of years since inception; firm size, expressed as the natural log of total assets (a classic among the variables that might affect FE innovation capacity); and, finally, industry technological intensity, which is one of the potentially most transcendental variables for firm innovation capacity. For classification purposes, we use the sectoral classification guidelines of the OECD Directorate for Science, Technology and Innovation and Structural Analysis Statistics Division (OECD, 2011).

3.3. Methodology

Using the variables described in the previous section, we test the proposed hypotheses with two forms of data analysis. We begin with a descriptive analysis of the dependent variable and the three sets of explanatory variables proposed earlier, and then proceed to the explanatory stage by estimating the model for each set of determining factors of intangible investment intensity.

Using the proxy for corporate innovation capacity and the proposed explanatory variables, the equation to be estimated takes the following form.

$$EO-IC_{i.t}=\alpha+\sum_{j=1}^{4}\beta^{j}CG_{i.t}^{j}+\sum_{k=1}^{4}\gamma^{k}PV_{i.t}^{k}+\sum_{l=1}^{4}\delta^{l}TV_{i.t}^{l}+\eta_{i}+\varepsilon_{i.t}$$

[2] Data on numbers of employees were obtained from the ORBIS database, web pages or via e-mail in the case of some Latin American firms.

In equation (1) the subscripts *i* and *t* refer to firm and time, respectively. The term $\boldsymbol{\beta}^{j}$ is subdivided into four coefficients; one for each of the four governance variables under consideration: ownership concentration, debt, board autonomy and the percentage of family board members. The term γ^{k} represents the 4 coefficients of the productivity variables: intangible assets, tangible assets, labour and value added. Finally, δ^{l} denotes the four traditional control variables included in the model: free cash flow, firm age, firm size, and industry technological intensity. Random noise is divided into two components: one denoted by ε_{it}, which captures all the factors with a degree of impact on firm's innovation capacity and corresponds to the residual standard error. However, the so-called firm-fixed effects (η_{i}) are usually included in the aforementioned noise term, which is potentially correlated with the explanatory variables and may lead to serious biases in the estimation. This "constant unobservable heterogeneity", which may go unnoticed, can be removed by means of first difference estimation. Moreover, the two-step estimator, which includes the first-stage residuals matrix, yields estimates robust to autocorrelation and heteroscedasticity (White 1980).

Nevertheless, since the endogeneity of the independent variables may pose a significant model estimation problem, we first tested for endogeneity in our model using the version proposed by Davidson and MacKinnon (1993) for fixed effects estimation using panel data, the results of which enable us to reject the null hypothesis of exogeneity for tangible and intangible productivity, labour productivity and debt. Ultimately, the most appropriate estimation technique is the Generalized Method of Moments (GMM) estimator proposed by Arellano and Bond (1991) and widely used in the empirical literature, which not only adjusts for simultaneity bias, but also enables us to handle a residual pattern robust to autocorrelation and heteroskedasticity.

The two-stage GMM estimator simultaneously estimates equations in first differences and in levels, thereby overcoming the weak instrument problem which is characteristic of GMM estimation. For the equations in differences, we use a single lag of the level variable, while for the equations in levels we use all the available lags of the first-differenced variables (Blundell and Bond 1998). The GMM system estimator controls for possible model misspecification and instrument validity is assessed by testing overidentifying restrictions, correlation between the instruments and random noise with Hansen's J. Non-rejection of the null hypothesis validates the instruments by ruling out their correlation with the error term (Pindado and Requejo 2014). Since we are using the first-difference GMM estimator, the transformed model should test for potential second-order correlation using the m_2 statistic to avoid serial correlation problems. Finally, Wald's test is used to test the joint significance of the model coefficients.

4. EMPIRICAL APPLICATION

Stage one consisted of an initial descriptive analysis of the selected sample. Thus, Table 4 shows the means, standard deviations, and the minimum, maximum and median values

of the study variable (entrepreneurship orientation and innovation capacity (EO-IC), and the main explanatory variables proposed in the theory and methodology section grouped into three sets: corporate governance variables (CG), productivity variables (PV) and traditional or control variables (TV).

Table 4
Descriptives for total sample

Variables	# Obs	mean	S.D.	min	max	median
EO-IC	1,255	0.0800	0.3192	–0.5277	0.9987	0.0079
C5	1,820	0.6913	0.3768	0.00	100	0.89585
LEV	1,388	0.5865	0.2038	0.2273	0.9077	0.6033
IND	1,820	2.0247	1.0811	1	4	2
FAMILY	1,820	0.5237	0.3202	0.05	1	0.5
ICP	1,372	0.0576	0.0795	0	0.2822	0.0205
TCP	1,372	0.3072	0.1911	0.0152	0.6872	0.2810
LP	1,381	216.52	222.99	35.82	928.62	140.55
AV	1,369	0.2747	0.1584	0.0649	0.6741	0.2379
FCFSALES	1,099	0.0830	0.0732	–0.0106	0.2696	0.0604
AGE	1,820	52.850	36.17	6	110	41
ASSETS	1,388	3.498.728	5.644.363	15.684.14	1.94E+07	752.506
EMPLOYEES	1,388	29.824	62.220	2	516.421	3.537
TECHCODE	1,810	1.5690	0.5777	1	3	2

Source: Own elaboration.

Some values worth mentioning relate to the form of governance in the sample firms. The first notable feature is the high level of ownership concentration (69.13%), a general characteristic of Spanish and Latin American firms alike and particularly pronounced in FEs. Another is high dependency on external resources as reflected in a mean leverage value of 58.65% with a median of 60.33%. The ownership status indicators, taken directly from Bureau van Dijk's database, where values range from 1 (less autonomy) to 4 (more autonomy), show a mean value of 2.02. Finally, the percentage of family board members, unsurprisingly, reaches 52.37% on average.

The productivity values are hard to compare with no frame of reference, although they are considerably higher for tangible than for intangible assets. Table 4 also shows an average firm age of 52.85 years (with a median of 41), a high free cash flow margin ratio (8.30%) and some bias towards low-tech sectors, as reflected in the mean value of the Tech Level variable, 1.56, which has a possible range of 1 to 3.

The estimates of equation (1) for the total sample, shown in Table 5, reveal that the explanatory power for EO-IC in FEs lies in productivity factors, governance and the traditional control variables. Thus, tangible and intangible productivity and labour productivity (H4) and generated added value (H5) have a positive influence on innovation capacity, in complete contrast to that of tangible investment; and widely disparate results emerge for the corporate governance factors. Both financial leverage (H2) and the percentage of family members on the board (H3) have a positive impact on EO-IC, while the impact of family ownership percentage (H1) and ownership status is negative. Finally, the results for the traditional variables reveal a positive impact on innovation from firm size and hi-tech industry affiliation, in line with expectations. Free cash flow and firm age, on the other hand, have a braking effect on R&D investment. The AR2 statistic shows no second-order autocorrelation, while Hansen's J (see Section 3.3.) prevents rejection of the null hypothesis of no correlation between the instruments and the residuals of the GMM estimation, thereby validating the choice of instruments.

The analysis of joint significance[3] by groups of variables given at the foot of Table 5 shows how the variables for corporate governance (family-specific assets), corporate strategy (capital and labour productivity) and internal resource creation (level of financial autonomy) reveal themselves as drivers of EO-IC in the family firm.

[3] The joint significance results presented are for the productivity and corporate governance sets, given that value creation is composed of a single variable (VAP) and individual significance suffices.

Table 5
Equation 1: Firm innovation capacity. GMM estimation

Dependent variable (EO-IC)-Entrepreneurship and innovation capacity	
Independent variables	
ICP	55.5831***
	(0.0000)
LP	0.0059***
	(0.0000)
LNASSETS	4.8747***
	(0.0000)
TCP	–33.7116***
	(0.0000)
AV	6.8699***
	(0.0000)
FCFSALES	–10.0217***
	(0.0000)
LNAGE	–0.8974**
	(0.0153)
TECHCODE	4.7303***
	(0.0000)
C5	–0.1486***
	(0.0000)
LEV	0.8936**
	(0.0290)
IND	–2.4566***
	(0.0002)
FAMILY	20.2103***
	(0.0000)
Observations	931
N. of firms	142
Chi-2	4.550e+07
	0.000
AR1	–1.522
	0.128
AR2	–0.980
	0.327
HANSEN TEST	123.7
	0.876
Productivity	21.87***
(TCP, ICP, LP)	(0.000)
Corporate governance	18.49***
(C5, LEV, IND, FAMILY)	(0.000)

Source: Own elaboration. Coefficient estimates and P>|z| (in parentheses). Hansen test distributed as follows: ÷2 with degrees of freedom equal to the number of estimated coefficients. ***, **, *: significant at the 1%, 5% and 10% levels respectively.

Table 6
Equation 1: Firm innovation capacity. GMM Estimation (Spain vs. Latin America)

Dependent variable (EO-IC): Firm entrepreneurship orientation and innovation capacity		
Independent variables	**(1) FE-SPAIN**	**(2) FE-LATIN AMERICA**
ICP	76.0370***	–21.0820***
	(0.0000)	(0.0000)
LP	0.0057***	0.0022*
	(0.0003)	(0.0574)
LNASSETS	1.7660***	0.6149*
	(0.0000)	(0.0640)
TCP	–19.1537***	–11.9655***
	(0.0000)	(0.0002)
AV	–1.2777	–4.2392**
	(0.3609)	(0.0101)
FCFSALES	–9.1167***	0.8235
	(0.0000)	(0.3345)
LNAGE	1.1777**	0.8201
	(0.0413)	(0.2426)
TECHCODE	18.6312***	3.0623**
	(0.0000)	(0.0167)
C5	–0.1410***	0.0803***
	(0.0000)	(0.0022)
LEV	15.3172***	7.1954***
	(0.0000)	(0.0064)
IND	3.0280***	0.2627
	(0.0017)	(0.7105)
FAMILY	32.4739***	6.6575***
	(0.0000)	(0.0049)
Observations	556	375
N. of firms	76	66
Chi-2	2.105e+06	2470
	0.000	0.000
AR1	–1.157	–1.433
	0.247	0.984
AR2	–1.006	–0.962
	0.314	0.336
HANSEN TEST	59.60	23.21
	0.871	0.152
Productivity	56.88***	–33.04***
(ICP, TCP, LP)	(0.0000)	(0.000)
Corporate governance	50.67***	14.19***
(C5, LEV, IND, FAMILY)	(0.000)	(0.000)

Source: Own elaboration. Coefficient estimates and P>|z| (in parentheses). Hansen test distributed as follows: ÷2 with degrees of freedom equal to the number of estimated coefficients. ***,**, *: significant at the 1%, 5% and 10% levels, respectively.

Table 6 highlights the main differences in EO-IC explanatory factors found in the comparison of FEs based on geographical origin, with Spanish FE data reported in column 1 and Latin American FE data in column 2. The most striking difference lies with intangible productivity, which is positive in the case of Spanish FEs and negative in that of Latin American ones. Ownership structure, on the other hand, has a much greater influence in Latin American FEs, where high ownership concentration usually means a higher level of EO-IC; an effect that is not observed in Spanish FEs. Finally, one of the traditional variables, firm age, strikes another discordant note, by emerging as a valuable asset in Spanish FEs, while appearing irrelevant in those of Latin America. In summary, the analysis of joint significance reported in the bottom rows of Table 6, illustrates how the strongest EO-IC drivers for Spanish FEs (corporate strategy factors and internal resource creation) actually constitute barriers to the innovation process in Latin American FEs, where they have a strongly significant negative impact.

5. DISCUSSION AND CONCLUSIONS

Globalization and technological change have disrupted many aspects of society, particularly the business environment. Changes in social dynamics, together with the looming threat of artificial intelligence, have led to a new paradigm based on entrepreneurship orientation and innovation capacity (EO-IC). With respect to the business sector, this new paradigm plays a key role in market economies, where state-regulated free enterprise is the main driver of economic growth and development. Against this background, the family enterprise offers an exceptional research context which has already attracted the attention of the innovation and entrepreneurship literature. Despite the undeniable benefits of innovation, family firms have certain characteristics which prevent their wholehearted commitment towards it. Thus, the related literature echoes the point that FE traits such as family control, a simultaneous focus on financial and non-financial goals, or the need to conserve socio-emotional wealth make the FE a particularly worthwhile setting in which to explore the underlying factors of EO or any of its dimensions, including innovation, pro-activeness or risk assumption (Hernández-Perlines and Ibarra 2017; Arzubiaga *et al.* 2018; Hernández-Linares and López-Fernández 2018).

In order to analyse the key moderating factors in FE entrepreneurship behaviour, this study focuses on the three main sources of heterogeneity proposed by Gómez-Mejía *et al.* (2014): corporate governance, corporate strategy and performance, some of which have already been addressed individually by other authors (Arzubiaga *et al.* 2018). The results obtained show how the traditional variables of firm size and age, liquidity and industry affiliation have lost some of their explanatory power for EO-IC design and structure dynamics.

Nevertheless, these traditional control variables continue to feature in studies such as Hernández-Perlines and Ibarra (2017) and Arzubiaga *et al.* (2018). Indeed, Gómez-Mejía *et al.* (2014) highlight the role of the hi-tech sector, which they claim can alter the mixed gamble or trade-off between financial and non-financial goals in the FE by incentivizing R&D investment; a claim which is corroborated by our own study. In the mean time, however, other weightier indicators of entrepreneurship capacity and business innovation have been emerging. Corporate strategy variables, for example, should show a positive impact on EO-IC, as suggested by Gómez-Mejía *et al.* (2014) and as upheld by the results reported in this study for all the proposed productivity measures (tangible and intangible assets, added value and labour) except capital investment. The set of corporate governance variables emerge among the most influential, and authors such as Duran *et al.* (2016) emphasize the role played by corporate governance in innovation, heavily underlining the influence of factors relating to family control and ownership concentration. Our results hint at a reduction in risk aversion to the use of debt to stimulate FE growth and development. The presence of family board members, moreover, far from discouraging EO-IC, is seen as a driver, especially if the CEO belongs to a younger generation of the family dynasty. The concurrence of various generations on the board likewise has beneficial effects on EO-IC, by facilitating the discovery of new opportunities and novel entrepreneurial and innovation initiatives. In a study about board of directors in family firms, Arzubiaga *et al.* (2018) observe its negative repercussions on the transformation of entrepreneurship into innovation. However, the same authors obtain evidence showing the benefits from the involvement of the FE board of directors in designing service and control tasks or providing specialised knowledge and skills. Meanwhile, Gómez-Mejía *et al.* (2014) find that EO-IC in the FE improves with the participation of institutional investors. An analysis of the effect of family ownership concentration by Arzubiaga *et al.* (2018) proves inconclusive. According to our results, however, EO-IC in FEs suffers both from excessive family ownership and from too much ownership independence, which can lead to tensions between family and non-family board members.

Our proposal echoes the institutional theory, whereby innovation performance is largely determined by country-level factors (Duran *et al.* 2016). Thus, we analyse whether EO-IC in Latin American vs. Spanish FEs is influenced by the prevailing institutional (legal, economic and cultural) environment. Our results evidence the notable role of productivity variables in the EO-IC of Spanish FEs. The explanation for this could lie in the degree of autonomy in business decision making they are allowed by the Spanish legal and regulatory framework, as a consequence of which the Spanish FE tends to imitate the behaviour of private enterprise in general by exploiting the potential synergies to be gained from placing family members on the board of directors in order to control agency costs.

The influence of the institutional framework in the Latin American FE is rather different, however. Interaction between a weak legal and regulatory environment, labour market inefficiencies and a less developed education system enables an oligarchy formed by a few clans to influence State initiatives through the EO-IC. Under these conditions, and in the presence of weak internal and external governance mechanisms, the results show that the dominant role among the basic EO-IC parameters in the Latin American FE is played by variables relating to family ownership concentration, the presence of family members on

the board of directors and a reliance on debt driven by an underdeveloped financial system.

This study presents a series of implications for professionals. Given the role of family firms as a pillar of economic and social development in both Spain and Latin America, their directors need to understand the enabling power of innovation and entrepreneurship, which can propel them to achieve sustainable competitive advantage. This paper identifies business strategy and ownership and governance factors as the main drivers in this respect, although their role varies considerably with the prevailing legal and institutional environment, such that the traditional variables and ownership factors play the leading role in the case of Latin America, while productivity and governance factors are the most influential in that of Spain.

Finally, while deepening understanding of innovation and entrepreneurship in the family enterprise, this study spotlights the need for further research. For instance, the reported findings are based on a set of eight Latin American countries grouped into a single sample, and could therefore lead to unjustified generalizations. The use of a sample of countries with a specific institutional profile or the inclusion of accurate indicators of institutional strength, minority shareholder protection, etc., will no doubt help to elucidate the influence of this key factor. Furthermore, while this study uses intangible investment as a proxy for entrepreneurship and innovation, the incorporation of more selective variables, such as R&D expenditure, would no doubt help to corroborate or fine-tune the findings (Surroca *et al.* 2006; Gómez-Mejía *et al.* 2014; Duran *et al.* 2016). Finally, although our study considers some measurable features of the family business profile, such as the family's share of ownership and family involvement in the board of directors, the family business is a multidimensional concept and it would therefore be appropriate to analyse the influence of other dimensions, such as the generational stage of the business or the involvement of the family in its management (Casillas and Moreno 2011).

Summing up in relation to the issues raised in the introduction, the results obtained help to build understanding of the process whereby intangible assets lead to a competitive advantage for the FE. They therefore justify the inclusion of new explanatory variables in FE EO-IC patterns, based on productivity and corporate governance (family ownership, family CEO, multigenerational board composition and the presence of non-family board members). Furthermore, Latin American institutional (legal, regulatory, employment and education) frameworks are identified as the explanation for the insignificance of efficiency and productivity variables as compared with more traditional ones such as firm size and ownership concentration with respect to the design and development of EO-IC in the FEs of that part of the world.

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Introduction to the Special Section: Innovation

Introducción a la Sección Especial: Innovación

António Carrizo Moreira

Master in Management, University of Porto. PhD Management, University of Manchester. Department of Economics, Management, Industrial Engineering, and Tourism. GOVCOPP. University of Aveiro, Portugal – amoreira@ua.pt – http://orcid.org/0000-0002-6613-8796

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ABSTRACT

This special issue of the *Management Letters / Cuadernos de Gestión* is dedicated, on one hand, to presenting those articles that are included as part of the special issue on innovation and, on the other hand, to disclose the top priorities on innovation research taking into account challenging topics we are witnessing in the business world that fuel research creativity. The first part of this editorial presents the four articles that make up this special issue on innovation. The second part of this editorial addresses the main topics of the shifting landscape innovation faces: business model innovation, artificial intelligence, Industry 4.0, Internet of things, innovation ecosystems and gamification.

Keywords: Information Technology; Technology-related Startups; Technology Transfer Offices; Strategic Groups; Competitive Dynamics; Innovation.

RESUMEN

Este número especial de *Management Letters / Cuadernos de Gestión* está dedicado, por un lado, a presentar los artículos que forman parte del número especial sobre innovación y, por otro, a dar a conocer las principales prioridades en materia de investigación sobre innovación teniendo en cuenta los temas desafiantes a los que asistimos en el mundo empresarial y que alimentan la creatividad investigadora. La primera parte de este editorial presenta los cuatro artículos que componen este número especial sobre innovación. La segunda parte de este editorial aborda los principales temas del cambiante panorama al que se enfrenta la innovación: la innovación en los modelos de negocio, la inteligencia artificial, la Industria 4.0, el Internet de las cosas, los ecosistemas de innovación y la gamificación.

Palabras clave: Tecnología de la Información; Empresas Emergentes relacionadas con la Tecnología; Oficinas de Transferencia de Tecnología; Grupos Estratégicos; Dinámica Competitiva; Innovación.

Being innovative has always been challenging. Innovation is critical in today's business world as it requires novelty, i.e. bringing new ideas to firms, markets or the world. However, it needs to be tuned into a meaningful problem. As such, one can argue that innovation is normally associated with the process of adding value through the application of meaningful, novel solutions to specific problems. With this approach one can depart from the typical definitions and concepts that typically address innovation from a product, process, organizational, and marketing perspective. As such, the four articles included in this section address newness and add value in very specific ways.

The study on leadership and innovation on technology-based startups, authored by Abadía (2021), concluded that disruptive success only occurs if visionary leadership is present. Furthermore, disruptive/radical innovation is a necessary condition for disruptive success. He also concluded that "location in specialized clusters is a critical factor in determining the rate and level of success of technology-based firms." In his article 'Study on leadership and innovation: clues for success in technology-related startups', Abadía (2021) followed two different methodological strands: one rested on statistical analyses of four different databases with data from technology-based startups in the United States of America (USA) and Spain; and the other rested on nine case studies of particularly successful technology-based startups in the USA, Spain, China and Japan. Based on the former, he concluded that research and development (R&D)—or innovation-based investment, human capital quality-based investment, and the location of technology-based startups in specialized clusters—are factors that decisively influence the rate and level of success of technology-based startups during the introduction and growth stages. Furthermore, the nine case studies showed that visionary leadership as well as disruptive/radical innovation are necessary conditions for disruptive success, and most of the successful cases are located in specific clusters.

In the second study of the special section on innovation, Santos Castellanos (2021) analyzed the impact of information technology (IT) governance on business-IT alignment. In order to do that, he adopted a covariance-based structural equation model technique with a confirmatory factor analysis to evaluate the relationship between IT governance and business-IT alignment. Based on data collected from 672 web-based responses (from three surveys with 126, 107 and 339 responses of companies in Colombia, and using 13 first-order constructs—structures, processes, relational mechanisms, aggressiveness, analysis, defensiveness, futurity, proactiveness, riskiness, IT environment scanning, strategic use of IT, IT planning and control, and IT acquisition and implementation—he concluded that IT governance significantly and directly affects business-IT alignment. Moreover, he found that there were no differences per industry type or company size, which indicates certain homogeneity among the analyzed firms. This research clearly indicates the necessity of proper IT governance of firms to align their business-IT practices.

The third paper of this special section on innovation addresses a noble objective: the development of the university–enterprise relationship based on a viable model that underpins continuous education, consultancy, collaborative R&D, and technology transfer between stakeholders. Based on universities' third-mission, Taouaf *et al.* (2021) proposed an effective and efficient institutional technology transfer (TT) policy backed up by a complete repository related to the establishment of a university technology transfer office (UTTO). For that purpose, the authors proposed a business-like framework that considers the different maturity levels that characterize TT activities in Moroccan universities. They developed a plan to implement UTTO assignments, services, roles, conditions, operating standards, components, objectives, a mission statement, and an organizational chart. Nevertheless, these authors claimed that public authorities need to be aware of the importance of promoting innovation to integrate all Moroccan stakeholders into the knowledge economy to ensure that a high competitiveness level results in a successful outcome.

Finally, this special section on innovation also includes an article on competitive dynamics in which Rosário *et al.* (2021) analyzed the Portuguese retail banking industry in three different time periods: 2008-2010; 2011-2013; and 2014-2016. The novelty of their approach is that they took into account the financial and economic assistance program (FEAP), which is monitored by the European Commission, the European Central Bank, and the International Monetary Fund, because of the difficult economic situation that Portugal underwent in 2011. After analyzing the Portuguese banking industry—based on data collected from the Banco de Portugal database and using strategic groups and competitive dynamics theory—these authors concluded that there were three main types of strategic groups: universal banking, traditional banking and specialized banking– as a result of their dissimilar resources and competitive strategies. They also concluded that the three periods were completely different: the 2008-2010 period was considered as 'deregulated', in which the banks were not prepared for the difficult contextual events; 2011-2013 was a period of 'imposed regulation', in which the main stakeholders of the FEAP imposed tight financial controls; and 2014-2016 was a period of 'strategic consolidation', in which strategic changes were implemented as a result of the low mobility barriers in the banking industry.

Innovation: a shifting landscape

Globalization did not occur overnight. It has evolved over time, though with exponential growth in the last forty years. It brought about the acceleration of cross-border innovation. As with globalization, innovation did not occur overnight either. It has grown steadily, incrementally, and radically, giving new lives to life.

Innovation has been fed by the relentless growth of international collaborations, international trade, and the use of patents, which have had a profound impact on emerging countries' growth (and which have caused the downfall of some). Innovation does not take place homogeneously, industry wise or country wise. It needs to be promoted with an open mind.

Although innovation takes many different strands, and it is impossible to cover the main future trends, one can argue that

there are several strands that will be important in the near future. As such, I would like to propose the following ones as having the most novel, added value for all stakeholders involved in innovation: business model innovation (BMI), artificial intelligence (AI), Industry 4.0, Internet of Things (IoT), innovation ecosystems and gamification.

Business model innovation is certainly not something new. It has historically facilitated firms' ability to create and capture value. It emerged based on Osterwalder and Pigneur's (2010) proposed concept. Although there are countless papers on the subject, there is still room for brand new service economy research, namely the health industry as well as the not-for-profit sector, for different reasons. In the former case, the health industry still needs a more business-like perspective in the provision of services. In the latter case, as most organizations struggle to survive due to a lack of resources as well as poor business orientation, BMI might help to provide evidence of why some of them thrive and some of them still struggle to survive. Furthermore, there is still a huge gap addressing bottom of the pyramid markets and companies/organizations, which could entail brand new perspectives for BMI.

Natural intelligence is normally displayed by humans and animals and involves consciousness and emotions. However, artificial intelligence is the type of intelligence demonstrated by machines (e.g. Vlačić *et al.* 2021). With the relentless pace of digital and technological evolution, innovation studies addressing how AI will affect marketing, strategy, leadership, and consumer behavior are in high-demand as fast-paced AI activities will considerably affect future supply (firms) and demand (consumers) interactions. Furthermore, it will have consequences for product and services and for how consumers will be served. AI will certainly have pervasive effects on business activities throughout the world. It is a must for future studies.

Industry 4.0 is also known as the fourth industrial revolution; it involves the digital transformation of production and related industries as well as all value creation processes, and it represents a new stage in the organization and control of the industrial value chain (Fromhold-Eisebith *et al.* 2021).

Industry 4.0 is composed of cyber-physical systems (e.g. 'smart machines') that use modern control systems, as well as embedded software systems, to connect to Internet addresses that can be reached through IoT. Thus, all means of production and end products can communicate, enabling new production methods, value creation, and real-time optimization. For that it is necessary to create a network of products, factories and smart machines and also develop new capabilities to enable and explore new industrial systems. Their applications are endless, as, for example, in the energy systems as well as in the health industry (Ghobakhloo and Fathi 2021).

The Internet of Things is another technology-based change that will affect the way consumers and firms interrelate. IoT is related to the network of physical objects—things or objects—that are embedded with sensors, software, and other technologies that aim to facilitate the connection and data interchange with other devices and systems that use the Internet as a means of communication (Haaker *et al.* 2021). The IoT will probably evolve to include multiple technologies (including AI, automation, and embedded systems), which will drive new products, services, concepts, and things that have a pervasive effect on consumer, organizational and industrial applications; this will change how firms and consumers interact. Similarly to AI, IoT will alter manufacturing and services applications, how the medical/healthcare industry works, and how smart cities and smart territories will be addressed.

Innovation does not take place in isolation. Rather, it is the effort of complex relationships between actors and entities that work together to enable the development of socio-economic and technological innovation (Scaringella and Radziwon 2018; Radziwon and Bogers 2019). As such, one can claim that the innovation ecosystem is what really matters because it involves the dynamics of relational actors that share resources, human knowledge and capital among all the entities involved. The resources include funds, equipment, facilities, etc. that support innovation development. Knowledge and human capital involve all the industry workers, managerial staff, industry researchers, students, faculty members and staff, industry representatives, among others, who support the involvement of the institutional entities that participate in the ecosystem. The entities encompass business firms, angel and venture capitalists, policy makers, higher education institutions, industry–university research institutes, federal or industrial supported centers of excellence, and state and/or local economic development agencies, among others, that drive innovation from fundamental research to the marketplace. This innovation ecosystem is at the heart of the evolution of innovation because it involves multiple actors and entities that need to be intertwined if innovation is to thrive (Järvi *et al.* 2018; Benitez *et al.* 2020; Linde *et al.* 2021).

Gamification approaches use game-based elements in non-gaming contexts to encourage users to perform desired behaviors (Dale 2014, Patrício *et al.* 2018; Patrício *et al.* 2020); it is also used to develop possible solutions to overcome the encountered difficulties when managing the early stage of innovation through more structured, engaging and game-like activities. It can also be defined as a set of activities and processes that seek to use or apply game elements' characteristics to develop new products or to provide new services. Although it is not a new concept, the use of gamification has increased, providing new organizational solutions and the provision of new services.

As referred to above, innovation growth is relentless. Only the future will tell if these strands will be really important. You are invited to join this journey.

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Impact of Information Technology (IT) Governance on Business-IT Alignment

Impacto del gobierno de las Tecnologías de Información (TI) en el alineamiento entre negocio y TI

Weimar Santos Castellanos*

CENTRUM Catolica Graduate Business School – Pontificia Universidad Católica del Perú, Lima, Perú

* ***Corresponding author***: *Weimar Santos Castellanos. Centrum Católica Graduate Business School, Jr. Daniel Alomía Robles n.° 125, urbanización Los Álamos de Monterrico, Surco, Lima (Perú) – a20134372@pucp.pe – https://orcid.org/0000-0002-5304-5160*

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ABSTRACT

Purpose: This basic, quantitative, descriptive, cross-sectional research aims to empirically examine the impact of IT governance on business-IT alignment. Method: This study adopts the Structural Equation Model (SEM) technique with Confirmatory Factor Analysis (CFA) to evaluate the relationship between IT governance and business-IT alignment, testing three basic hypotheses on the data collected from 672 web-based surveys of companies in Colombia. Main finding: IT governance significantly and directly affects business-IT alignment, but there are no differences in such influence as per industry type or company size. Limitations: This study only considered companies located in Colombia with a limited sample size in several industry types, which may become a possibility for further studies. Additionally, the data collected relies on the honesty of respondents and is not completely free of bias.

Keywords: Information Technology, IT governance, IT governance practices, Business-IT alignment, IT strategic alignment, IT management.

RESUMEN

Objetivo de la investigación: El propósito de esta investigación básica, cuantitativa, descriptiva y transversal es examinar empíricamente el impacto de la gobernanza de TI en el alineamiento de negocio y TI. Metodología: Este estudio adopta la técnica Modelo de Ecuaciones Estructurales (SEM) con Análisis Factorial Confirmatorio (CFA) con el fin de evaluar la relación planteada entre gobierno de TI y alineamiento de negocio y TI, poniendo a prueba tres hipótesis básicas, usando los datos recolectados procedentes de 672 encuestas realizadas vía web a empresas en Colombia. Hallazgos: Este estudio encontró que el gobierno de TI afecta de manera significativa y directa la alineación de negocio y de TI, pero no existen diferencias en dicha influencia entre tipos de industria y tamaños de empresa. Limitaciones: Este estudio solo tomó en cuenta empresas localizadas en Colombia con limitación en tamaño de muestra en varios sectores de actividad, lo que puede constituirse como una posibilidad para estudios posteriores. Adicionalmente, los datos recolectados están basados en la honestidad de los encuestados y no están completamente libres de sesgo.

Palabras clave: Tecnología de Información, Gobierno de TI, Prácticas de Gobierno TI, Alineamiento de negocio y TI, Alineamiento estratégico de TI, Gestión de TI.

1. INTRODUCTION

Information technologies (IT) are one of the key factors in organizational competitiveness (Weill *et al.* 2002), along with processes, investments, expenses, IT assets (hardware, software and communications networks), and the firms' knowledge to provide technological services (Aduloju 2014; Mardikyan 2010). This is why organizations increasingly depend on IT and their capabilities to efficiently integrate IT resources into other organizational and management processes (Zhang *et al.* 2016). As a result, the IT management approach in many organizations has evolved from an operational support role to a more strategic role involving aspects such as business transformation, innovation, and obtaining IT-based business opportunities (Tanriverdi *et al.* 2010).

Since an organization's strategic IT management is increasingly based on its IT governance (ITG) (Caluwe and De Haes 2019; Cervone 2017; Kude *et al.* 2018), it is necessary to achieve adequate business and IT alignment (BITA) given its positive effects on business performance (Gerow *et al.* 2014; Wagner *et al.* 2014; Yayla and Hu 2012). Organizations will operate better when key IT resources are aligned with the business strategy and when appropriate structures are used to monitor the deployment and effective management of these resources (Coltman *et al.* 2015).

Despite the abundant body of knowledge of ITG and BITA, there is a need for describing and explaining the nature and scope of the relationships between ITG and strategic BITA, as well additional empirical evidence that allows for an integrated understanding of such relationship (De Haes and Van Grembergen 2009; Raymond *et al.* 2019). This leads to the following research questions: What is the impact of ITG practices on BITA? And consequently, will there be any differences in that impact depending on industry type or company size?

In response to the above questions, the research objectives are formulated: a) to study the direct effect of ITG on BITA, and b) to examine the moderating effects of industry type and company size on the relationship between ITG and BITA. To achieve these two objectives, an empirical research model was developed and tested using a Structural Equation Model (SEM), using survey data from a sample of 672 Colombian companies. It was found that ITG has a positive effect on BITA and there are no differences in the relationship according to industry type and company size.

The rest of the article is divided as follows: Section 2 presents the literature review and the following section shows the theoretical background, hypotheses, and research model. Section 4 then expounds on the research method. Section 5 contains the empirical results obtained from the analysis of the SEM method. The last section presents the conclusions, describes the limitations of the study, discusses the contributions and implications for future research, and provides some closing remarks.

2. LITERATURE REVIEW

This study is based on three research streams in the literature on IT business use: (1) the components and practices of ITG (Caluwe and De Haes 2019; Lunardi *et al.* 2017); (2) the BITA model and its measurement (Gerow *et al.* 2014; Jia *et al.* 2018; Zhang *et al.* 2018), and (3) the relationship between ITG and BITA (De Haes and Van Grembergen 2009; Héroux and Fortin 2018). As discussed in the introduction, there is still a need for knowledge that involves the measurement of ITG practices and their ability to generate BITA.

This study was based on recent articles that reviewed the literature on each construct. In the case of ITG, the definitions and mechanisms or practices of ITG studied by Levstek, Hovelja and Pucihar (2018) were reviewed. The research gap raised by Caluwe and De Haes (2019) on the uncertainty of ITG consequences was also taken into account. In the case of BITA, the 5W1H (When, Who, What, Why, Where, How) analysis by Zhang, Chen and Luo (2018) was considered to understand BITA from the perspective of the company's architecture. Likewise, this study analyzes the four main research topics on BITA (model, measurement, background, and dynamics) suggested by Jia, Wang and Ge (2018).

2.1. IT Governance (ITG)

Academic and practitioner literature has addressed the issue of ITG since the 1990s, focusing on two perspectives, one that analyses it as a derivation of corporate governance and another that sees it as a determining factor of the alignment between business objectives and IT (Balocco *et al.* 2013). ITG can be understood as part of corporate governance that enables the IT function to add value to the business by controlling the risks associated with IT processes and making better use of available technology resources (IT Governance Institute 2003). However, ITG is not an easy notion to understand, and previous research has examined different aspects of ITG in various contexts that often have different interpretations (Buchwald *et al.* 2014).

In a longitudinal study on large enterprises, Peterson (2004) offered a roadmap for the IT Governance Assessment Process (ITGAP), which has four stages: "(1) Describe and assess ITG value drivers, (2) Describe and assess the differentiation of IT decision-making authority for the portfolio of IT activities, (3) Describe and assess the capabilities of ITG, and (4) Describe and assess IT value realization" (Peterson 2004, p. 20).

Weill and Ross (2004) defined ITG in the following terms: "Specifying the decision rights and accountability framework to encourage desirable behavior in the use of IT" (p. 8). According to these authors, ITG is a framework of interaction among three key components: the first is known as structures that derive from business units, functions, roles, and responsibilities for proper IT decision-making. The second is processes, which refer to the design of procedures for implementing management following IT strategies and policies. The last component is relational mechanisms, which are considered the devices that look for opportunities to guarantee the effectiveness of ITG implementation.

Derived from studies by Van Grembergen *et al.* (2004), Peterson (2004), Weill and Ross (2004) and De Haes (2007), De Haes and Van Grembergen (2008) argued that, "IT governance can be deployed using a mixture of various structures, processes, and relational mechanisms" (p. 1). ITG structures "include

structural (formal) devices and mechanisms for connecting and enabling horizontal, or liaison, contacts between business and IT management (decision-making) functions" (Peterson 2004, p. 14). ITG processes have to do with "formalization and institutionalization of strategic IT decision-making or IT monitoring procedures" (Peterson 2004, p. 15). ITG relational mechanisms are understood as "the active participation of, and collaborative relationships among, corporate executives, IT management, and business management" (Peterson 2004, p. 15).

Caluwe and De Haes (2019) set out to find knowledge gaps in board-level ITG at the, summarizing existing research and identifying opportunities for future research. Such a study found that at the level of ITG structures there is extensive research on background and consequences. It concluded that there is little research available on ITG processes, as well as on ITG relational mechanisms. This suggests that while ITG structures are quite clear and described in detail in previous research, little was found about ITG processes and relational mechanisms (Caluwe and De Haes 2019). This study leverages this gap and seeks to study and measure ITG in its three dimensions together (structures, processes, and relational mechanisms).

2.2. Business-IT Alignment (BITA)

BITA is defined as the degree of alignment between IT and business strategy (Jia *et al.* 2018) and has been a concern of senior management for decades (Queiroz 2017). This can be seen, for example, in the study by Luftman *et al.* (2013) in which they state that BITA has consistently been ranked as one of the top three challenges for scholars, IT professionals, and business executives over the past three decades, showing that BITA remains the ultimate goal of organizations. This is not so easy to achieve and, as such, it has become the main concern of IT management in the US and Europe, the second in Latin America and the sixth in Asia. However, despite much research, the effect of IT strategic alignment on organizational performance remains evident (Sabherwal *et al.* 2001; Yayla and Hu 2012; Gerow *et al.* 2015, 2016), but with mixed results in the literature (Queiroz 2017).

In a bibliometric review of literature on BITA, Jia *et al.* (2018) identify four relevant BITA research factors, model, measurement, background, and dynamics. The first factor referred to is the BITA model. In a widely publicized study, Henderson and Venkatraman (1993) characterized the strategic alignment model (SAM) as describing all possible alignment relationships among four key components: business strategy, IT strategy, business infrastructure and processes, and IT infrastructure and processes.

The second BITA factor analyzed is how alignment is measured. There have been many methods for measuring BITA but the existing ones are based on a static perspective. In essence, each method is different and can lead to different types of results (Jia *et al.* 2018). For example, Luftman (2000) designed a widely publicized survey based on the SAM model, while Bergeron *et al.* (2004) present a form of alignment measurement that attempts to explain the impact of various factors on alignment and at the same time its impact on organizational performance.

The third factor is the BITA background; Jia *et al.* (2018) identify numerous BITA antecedents that subsequently group into four dimensions (social, cultural, strategic, and structural). Within the various BITA antecedents studied, some ITG practices can be found but these studies deal with individual effects of some ITG practices on BITA and not the joint effect of ITG practices (structures, processes, and relational mechanisms) on BITA.

The fourth factor is the BITA dynamics; Chan and Reich (2007) argued that there are two basic ways of looking at alignment. The first way is to appreciate alignment as a continuous process, which is subject to variations resulting from decisions made, adjustment of adopted strategies over time, and improvement of IT management capabilities. The second way is alignment as a final state, which is conceived as resulting from either action taken or the strategies the organization has planned.

Thus, in this research, BITA is reviewed from the perspective of alignment measurement, taking into account the proposal of Bergeron *et al.* (2004) and not that of Luftman (2000) since ITG maturity is one of its dimensions, causing endogeneity. From the perspective of BITA dynamics, this study, given its cross-sectional nature, looks at the current state of alignment in the organization and not its continuous process.

2.3. Relationship between ITG and BITA

In different studies (De Haes and Van Grembergen 2004; Van Grembergen 2004; Van Grembergen *et al.* 2004; Van Grembergen and De Haes 2008), the authors collected previous studies and suggested that ITG can be implemented through a combination of structures, processes, and relational mechanisms. They then suggested that there is a relationship between ITG and BITA (De Haes and Van Grembergen 2009).

Some authors have taken up in many ways the formulation of De Haes and Van Grembergen (2009) on the implementation of TI governance practices. Kuruzovich, Basselier, and Sambamurthy (2012) assessed how the strategic importance of IT influences the governance practices of IT involving the board of directors and how they affect IT alignment. Besides, Ping-Ju Wu *et al.* (2015) examined how ITG mechanisms and strategic alignment influence organizational performance.

Asante (2010) studied how the ITG structures (Focused, Decentralized, and Federal) established by Weill and Ross (2004) impact the maturity of IT strategic alignment, using the model of Luftman (2000). Harguem, Karuranga and Mellouli (2014) empirically proved through a quantitative study in US companies that ITG mechanisms positively affect the organization's global IT management capabilities, contributing to improved strategic alignment that could be reflected in the organization's performance.

As can be seen, the authors have used each of the ITG practices separately. There is consensus that organizations should use ITG mechanisms, but few researchers attempt to describe and provide a complete explanation for ITG mechanisms or practices (Levstek *et al.* 2018). For this reason, this study attempts to assess ITG practices or mechanisms (structures, processes, and relational mechanisms) together to observe their impact on BITA.

3. THEORETICAL BACKGROUND, HYPOTHESIS, AND RESEARCH MODEL

Seminal researchers have argued that organizations that actively seek to plan and implement ITG structures perform significantly better than those that do not consider ITG (Van Grembergen and De Haes 2008; Weill *et al.* 2002; Weill and Ross 2004). Other authors argue that alignment, communication, and the relationship between IT and business are important aspects to consider in the implementation of ITG (Alreemy *et al.* 2016).

In a qualitative exploratory study, Buchwald *et al.* (2014) affirmed that the greater the success of ITG, the greater the alignment of business and IT objectives. De Haes and Van Grembergen (2009) suggested that the maturity of BITA is greater when organizations apply a combination of mature ITG practices (structures, processes, and relational mechanisms).

Therefore, it can be assumed that better ITG development will result in the firm's ability to achieve a better level of BITA. Under the previous arguments, the following hypothesis can be formulated:

H1: IT governance has an impact on business-IT alignment

From the above description, the characteristics of the organization could influence the specified relationship. In this regard, previous researchers have argued that "it is acknowledged that the use of ITG practices might be different in different types of industries" (De Haes and Van Grembergen 2009, p. 125). Similarly, other researchers on strategic alignment (Chan *et al.* 2006; Chan and Reich 2007; Luftman *et al.* 2008; Tallon and Pinsonneault 2011) argued that this relationship is conditioned by industry type. This leads to the following hypothesis:

H2: There is a difference in the impact of IT governance on business-IT alignment depending on industry type.

Small and medium-sized enterprises (SMEs) evolving in a dynamic environment are characterized by an unpredictable market and technological change and face more pressures than large companies in the same environment (Raymond *et al.* 2019). Concerning ITG, most theories and frameworks have been criticized as being more appropriate to large enterprises and less so to SMEs (Bergeron *et al.* 2015). In fact, in their study on the effect of ITG on organizational performance, Ping-Ju Wu *et al.* (2015) stated that ITG is most practiced in large enterprises. Some authors argue that IT adoption is faster in large firms than in SMEs because large firms assume that ITG practices or mechanisms create value for the business, while in SMEs, decision-making is primarily focused on one person (Levstek *et al.* 2018).

In terms of alignment, there are different views. Chan *et al.* (2006) found that firm size is related to BITA, but not in all industry types. Chan and Reich (2007) suggested that certain components of alignment occur in small rather than medium-sized firms. Gutiérrez, Orozco, and Serrano (2009) concluded that the factors considered necessary to achieve alignment are relevant to all organizations, regardless of their size. Charoensuk, Wongsurawat, and Khang (2014) found that company size acts as a moderator rather than a predecessor to BITA. Shihab and Rahardian (2017) found that organizations of different sizes differ significantly in their approach to alignment. The above information leads to the following hypothesis:

H3: There is a difference in the impact of IT governance on business-IT alignment depending on company size.

The purpose of this research is to further explain the effects of ITG implementation on BITA, as shown in Figure 1. The proposed framework involves examining the interrelationship between two fundamental structures. First, about ITG practices, this study is based on the approach of De Haes and Van Grembergen (2009), which involves three basic elements: structures, processes, and relational mechanisms. These ITG practices correspond to variables that measure maturity, "This maturity assessment was based on a generic maturity model as proposed by the IT Governance Institute (2003), providing a scale from 0 (non-existent) to 5 (optimized)" (De Haes and Van Grembergen 2009, p. 127).

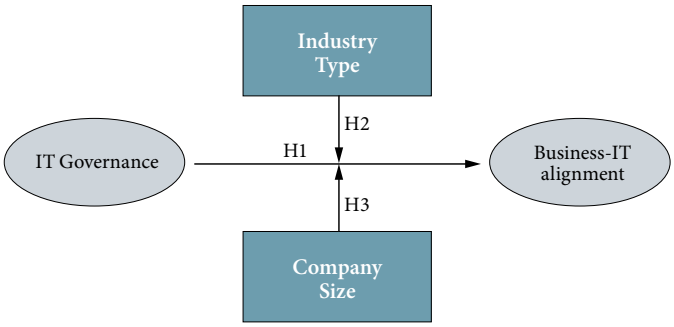

Figure 1
Theoretical Framework
Source: Own elaboration.

Secondly, in the case of BITA, this study employs a measurement model with a holistic approach as proposed by Bergeron *et al.* (2004), which evaluates BITA from four perspectives: business strategy, IT strategy, business structure, and IT structure. The business strategy dimension includes a 7-point scale instrument called Strategic Business Orientation (STROBE), developed by Venkatraman (1989) to measure strategic orientation, and consists of six components: aggressiveness, analysis, defensiveness, futurity, proactivity, and riskiness.

Based on the study by Damanpour (1991), Bergeron *et al.* (2004) argued that the most common structural dimensions in organizational theory and Information Systems studies are formalization, centralization or administrative intensity, professionalization, specialization, and vertical differentiation. Bergeron *et al.* (2004) suggested that IT strategy includes two components, one of which, the analysis of the IT environment, refers to how the firm can detect and react to technological changes compared to its competitors. The second concerns the strategic use of IT and measure how IT implementation increases quality, competitiveness, and business performance.

According to Bergeron *et al.* (2004), the IT structure has two components. The first is IT planning and control, which shows how the company manages its IT function, resources, and infrastructure concerning its competitors. The second component is IT acquisition and implementation, which refers to how the firm manages the selection and introduction of new IT applications.

4. METHOD

4.1. Research design

This research studies the phenomenon of the specified relationship at a particular time and is therefore considered cross-sectional (Saunders *et al.* 2019). The study aims to determine the impact of ITG on BITA, based on the relationship suggested by De Haes and Van Grembergen (2009) in their case study of the Belgian financial sector, and it is, therefore, necessary to include analysis and hypothesis testing in this research design.

This research used the SEM as an alternative to estimate the effects and relationships among multiple variables (Kline 2016). SEMs allow us to suggest the type and direction of the relationship expected to be found among variables, seeking to estimate the parameters associated with the proposed theoretical relationships (Ruiz *et al.* 2010). This research takes an SEM technique with Confirmatory Factor Analysis (CFA) as a mechanism to show the analysis of the theoretical relationships between ITG and BITA.

The SEM technique includes six steps for implementation: (1) specification, (2) identification, (3) measure selection and parameter estimation, (4) model estimation and fit evaluation, (5) model re-specification and (6) result interpretation (Kline 2016). In general, in the specification phase, the researcher draws a diagram model using a standard set of graphic symbols. However, the researcher can also describe the model through a series of equations that define the model's parameters and the assumed relationships among variables (Kline 2016).

Byrne (2010) argued that schematic representations of models are called causal diagrams because they provide a visual representation of the relationships among variables that will be used in the study. The general SEM model comprises two sub-models, a measurement model, and a structural model. The structural model defines the relationships among non-observable variables, including exogenous latent variables (ITG practices in this case) and endogenous latent variables (BITA in this case), as shown in Figure 2.

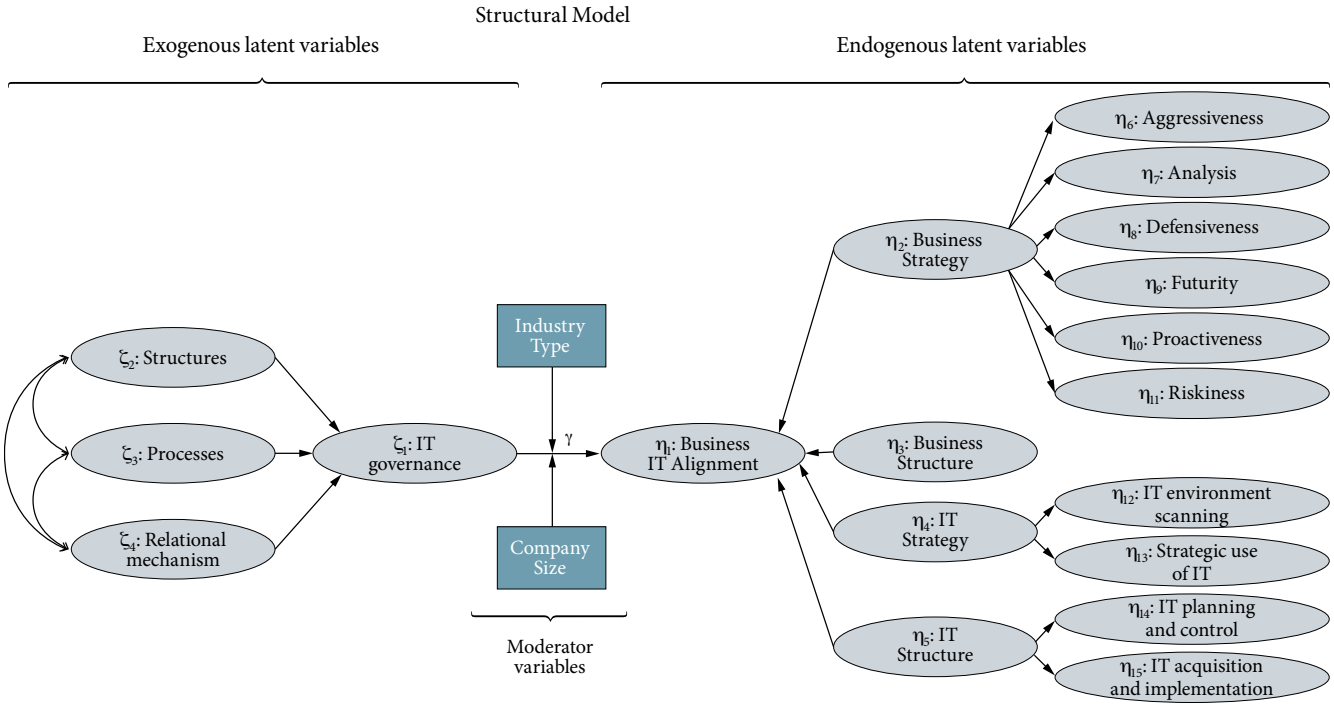

Figure 2
Structural Model
Source: Own elaboration.

The measurement model defines the relationships between observed and unobserved variables, providing the link between scores on a measurement instrument (observed indicator variables) and the underlying model for measuring variables (unobserved latent variables) (Byrne 2010).

Coltman *et al.* (2008) argued that there are three theoretical considerations in deciding whether a measurement model is reflective or formative. The first concerns the nature of the construction. Therefore, in the reflective model, the latent variable exists independently of measurements. In contrast, in the formative model, the latent variable is a combination of indicators. The second consideration is to focus on the direction of causality. In reflective models, causality flows from latent variables to indicators and in the formative model, it flows in the opposite direction. The last consideration is the characteristics of indicators. In reflective models, a change in the latent variable precedes a change in the indicator; elements are expressed by the latent variable and share common themes. In contrast, in training models, indicators define latent variables and do not necessarily share common themes. This research adopts a reflexive model between latent variables and indicators, based on the proposal of Bergeron *et al.* (2004) in their research model.

The design of this research took into account the moderating variables that regulate the degree of intensity with which one variable impacts another (Chion and Charles 2016). For this research, the moderating variables are industry type and company size. Chan *et al.* (2006) argued that there are several precedents that the importance of alignment depends on the industry in which the organization operates and that the size of the organization is associated with alignment. Chan and Reich (2007) suggested that communication and coordination in small firms are easy to implement, so these firms may tend to align themselves better than medium-sized firms, where there may be less evidence of alignment.

This research aims to address the different sizes of enterprises; ITG studies have focused primarily on large enterprises, but this does not mean that ITG does not exist in SMEs (Bergeron *et al.* 2015). In fact, most SMEs use IT for their basic needs but show a tendency to use it for more advanced activities (Mardikyan 2010). However, implementing ITG in the context of SMEs is a complex effort, mainly due to their nature and structure (Olutoyin and Flowerday 2016).

4.2. Measurement

A. IT governance (ITG)

To measure ITG, this study was based on the generic model of ITG maturity (De Haes and Van Grembergen 2009; IT Governance Institute 2003), in which 12 items are used to evaluate structures (e.g., the existence of a steering committee at executive or senior management level responsible for determining business priorities in IT investments), 11 items to evaluate processes (e.g., the existence of regular self-assessments or independent assurance activities on IT governance and control), and 10 to evaluate relational mechanisms (e.g., the existence of systems to share and distribute knowledge of ITG framework, responsibilities, tasks, etc.). Then, using a 6-point scale (0- Non-existent, 1- Initial/ad hoc, 2- Repeatable but intuitive, 3- Defined process, 4- Managed and measurable, and 5- Optimized), the respondent indicates the extent to which each ITG practice is applied by the enterprise.

B. Business-IT alignment (BITA)

To measure BITA, this study was built on the holistic model by Bergeron *et al.* (2004), which has four dimensions (business strategy, IT strategy, business structure, and IT structure). The first dimension of the model is the business strategy, which attempts to evaluate the strategy carried out rather than the strategy planned, focusing on the idea of deploying the resources needed to achieve business objectives. Bergeron *et al.* (2004) based their analysis on the proposal of Venkatraman (1989) to measure strategic orientation on six elements: aggressiveness (4 items), analysis (6 items), defensiveness (4 items), futurism (5 items), proactivity (5 items), and riskiness (5 items). Then, using a 7-point ordinal scale (1- Strongly disagree, ..., 7- Strongly agree), the respondent indicates the extent to which the company meets each criterion.

The second dimension is the business structure measured by five variables. The first is formalization, which can be measured by the number of rules, procedures, and activities that are written and documented. The second is administrative intensity, also known as centralization, calculated by the relationship between the number of managers and the number of employees. The third element is professionalization, calculated by dividing the number of professionals by the number of employees. The fourth is related to specialization, also known as horizontal differentiation, which includes the number of different job titles in the organization chart. The last one is vertical differentiation and refers to the number of organizational levels that are below the CEO.

The third dimension suggested by Bergeron *et al.* (2004) is the IT strategy, which is measured from two components. The first is IT environment scanning (4 items), which attempts to explain the organization's capacity to detect and respond to changes generated by competitors. The second component is the strategic use of IT (6 items), trying to synthesize the extent to which the organization uses IT to increase the quality of its products and services and improve competitiveness and productivity. Then, using a 7-point ordinal scale (1- Strongly disagree, ..., 7- Strongly agree), the respondent indicates the extent to which the company meets each criterion.

Finally, the fourth dimension is the IT structure, which is made up of two components. One is IT planning and control (9 items), which includes activities designed to observe the IT management function, IT resources and IT infrastructure. The other component is IT acquisition and implementation (9 items), which refers to activities that explain the selection and introduction of new IT applications into the business. Then, using a 7-point ordinal scale (1- Strongly disagree, ..., 7- Strongly agree), the respondent indicates the extent to which each criterion is met by the enterprise.

C. Moderating variables

This research takes the form of categorizing company size according to Ping-Ju Wu *et al.* (2015), in which small companies are those with less than 100 employees, medium companies are those with 100 to 1000 employees, and large companies are those with more than 1000 employees.

Mardikyan (2010) argued that there are significant differences in the use of IT among different industry types. Then, this study will use ten industry types, to wit, manufacturing, services, IT, health, education, energy, customer products, transportation, retail, and chemical-pharmaceutical.

D. Data collection

This research used an instrument developed by other researchers (Bergeron *et al.* 2004; IT Governance Institute 2003). The instrument was translated into Spanish under the supervision of a reviewer based on the indices proposed by the authors. The questionnaire was tested with a group of 100 people to observe different aspects. Initially, it was observed that the respondents had no comprehension problems because the questions and instructions were provided both in the invitation to participate and on the survey website and were very clear to them. Finally, it was demonstrated that the information was stored comprehensively and that the participant could know that his or her answers were effectively saved.

Based on the database of 26,533 companies that report to the Superintendence of Companies in Colombia in the SIREM system as of 2015, 1,500 companies were randomly selected and contacted by phone, email, or in-person to take part in the study. In this way, their existence and contact information were confirmed and it was validated that they have an IT department or an area that fulfills the appropriate functions of IT management to evaluate their interest in participating in this research (Kaur *et al.* 2011).

The instrument was coded and entered into an institutional web platform to generate an individual link to the questionnaire for each company; then, on the same platform, a list of companies invited to participate was created with their contact emails. The questionnaire was divided into four sections and the website was programmed in such a way that it was impossible to save the data from each section until all the questions were answered. First, of the 1,500 companies selected, 945 were verified and sent specific information to the emails, including a letter of introduction to the study, an informed consent form, and the individual link to the survey. In the first round, 126 surveys were completed. In a second round, 829 emails were sent to the remaining companies, eliciting 107 responses, with a total of 333 responses at the time.

To complete the sample, awareness-raising work was carried out with associations and chambers of commerce to contact companies interested in participating in the research. In this third round, after several days of work in which a group of 339 companies completed the questionnaire, 672 companies ended up participating in the study. The data were collected from October 2016 to February 2018 on a web platform, from which they were coded and loaded into a data file in SPSS, version 24 for statistical analysis and in AMOS add-on, version 24, for reviewing the structural equation model.

5. RESULTS

Initially, the quality of the measures used in the relationship model was determined to contrast the causal relationships of the conceptual model. The phases of application of the SEM technique are as follows: (a) specification, (b) identification, (c) measure selection and data collection, (d) model estimation (evaluation of model fit and interpretation of parameter estimates), (e) re-specification and (f) result interpretation (Kline 2016).

5.1. Review of the Measures Involved in the Model

To perform an analysis of the measures used in the model, a review of reliability, convergent validity, and discriminant validity was performed (Table 1). Reliability was obtained through Cronbach's alpha (α), achieving indicators above the recommended limits in all variables (greater than 0.7). Regarding convergent validity, the indicators of composite reliability (CR) and mean extracted variance (AVE) were used, which show favorable results (higher than 0.7 and 0.5, respectively) and ensure the consistency of the measurements used (Farooq 2016).

Likewise, discriminant validity was analyzed to verify that each variable shares more variance with its indicators than with other variables. To this end, the square root of the AVE was extracted and placed in the diagonal of Table 1. The result of the values found in the diagonal is higher than the correlations among the variables reflected in the values outside the diagonal, which supports the discriminant validity of the measures used (Kline 2016).

Table 1
Reliability and Validity Indexes

Construct	Reliability	Convergent Validity		Discriminant Validity												
	α	CR	AVE	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Structures	0.98	0.98	0.78	0.88												
2. Processes	0.97	0.97	0.74	0.30	0.86											
3. Relational Mechanisms	0.97	0.97	0.75	0.26	0.46	0.86										
4. Aggressiveness	0.95	0.95	0.82	0.05	0.01	–0.03	0.90									
5. Analysis	0.96	0.96	0.80	0.04	0.02	0.00	0.80	0.90								
6. Defensiveness	0.94	0.94	0.81	0.03	0.06	0.02	0.75	0.75	0.90							
7. Futurity	0.95	0.95	0.79	0.04	–0.01	–0.02	0.67	0.82	0.63	0.89						
8. Proactiveness	0.94	0.94	0.75	0.01	0.00	–0.04	0.60	0.70	0.53	0.78	0.87					
9. Riskiness	0.94	0.94	0.77	0.01	0.02	–0.01	0.71	0.68	0.65	0.59	0.54	0.88				
10. IT environment scanning	0.94	0.94	0.77	0.02	0.04	0.00	0.65	0.64	0.61	0.56	0.52	0.60	0.88			
11. Strategic use of IT	0.96	0.96	0.78	0.03	0.05	0.00	0.57	0.59	0.56	0.52	0.48	0.56	0.83	0.89		
12. IT planning and control	0.97	0.97	0.77	0.05	0.03	0.01	0.59	0.61	0.58	0.55	0.51	0.55	0.85	0.75	0.88	
13. IT acquisition and implementation	0.97	0.97	0.78	0.02	0.01	0.01	0.54	0.56	0.53	0.49	0.46	0.50	0.77	0.69	0.87	0.88

α: Cronbach's Alpha; CR: Composite Reliability; AVE: Average Variance Extracted

Source: Own elaboration.

5.2. *Analysis of the Structural Model*

The six phases of application of the SEM technique are described below. The first phase is known as the specification phase and establishes the hypothetical relationship between latent and observed variables and is represented graphically (Figure 3).

The second step of the SEM technique is identification. A model is identified if it is theoretically possible to provide a unique estimate for each of the model parameters; otherwise, the model is not identified (Kline 2016). There are several general rules for identifying a model, one of which, for example, is the rule of degrees of freedom (df), which states that the model's degrees of freedom must be greater than or equal to zero (dfM ≥ 0). Since dfM = 4255 (a value greater than zero), the model is identified.

Before analysis and model estimation, it is advisable to examine all variables in order to assess the quality of the database. The first problem to address is the sample size; determining its requirements for SEM is often a challenge researchers face (Wolf *et al.* 2013). Some authors have suggested that sample size depends on the desired power, bias, and evaluation of the null hypothesis and the complexity of the model; if the model is more complex, a larger sample is required (MacCallum *et al.* 1996; Iacobucci 2010; Wolf *et al.* 2013). In this research, the sample size is 672 which is considered appropriate for improving statistical power, "For studies with moderate to large df, reasonable power is achieved with moderate sample sizes, and very high power is achieved with large samples. For instance, with df = 100, power is well above 0.90 if N is 200 or more" (MacCallum *et al.* 1996, p. 139).

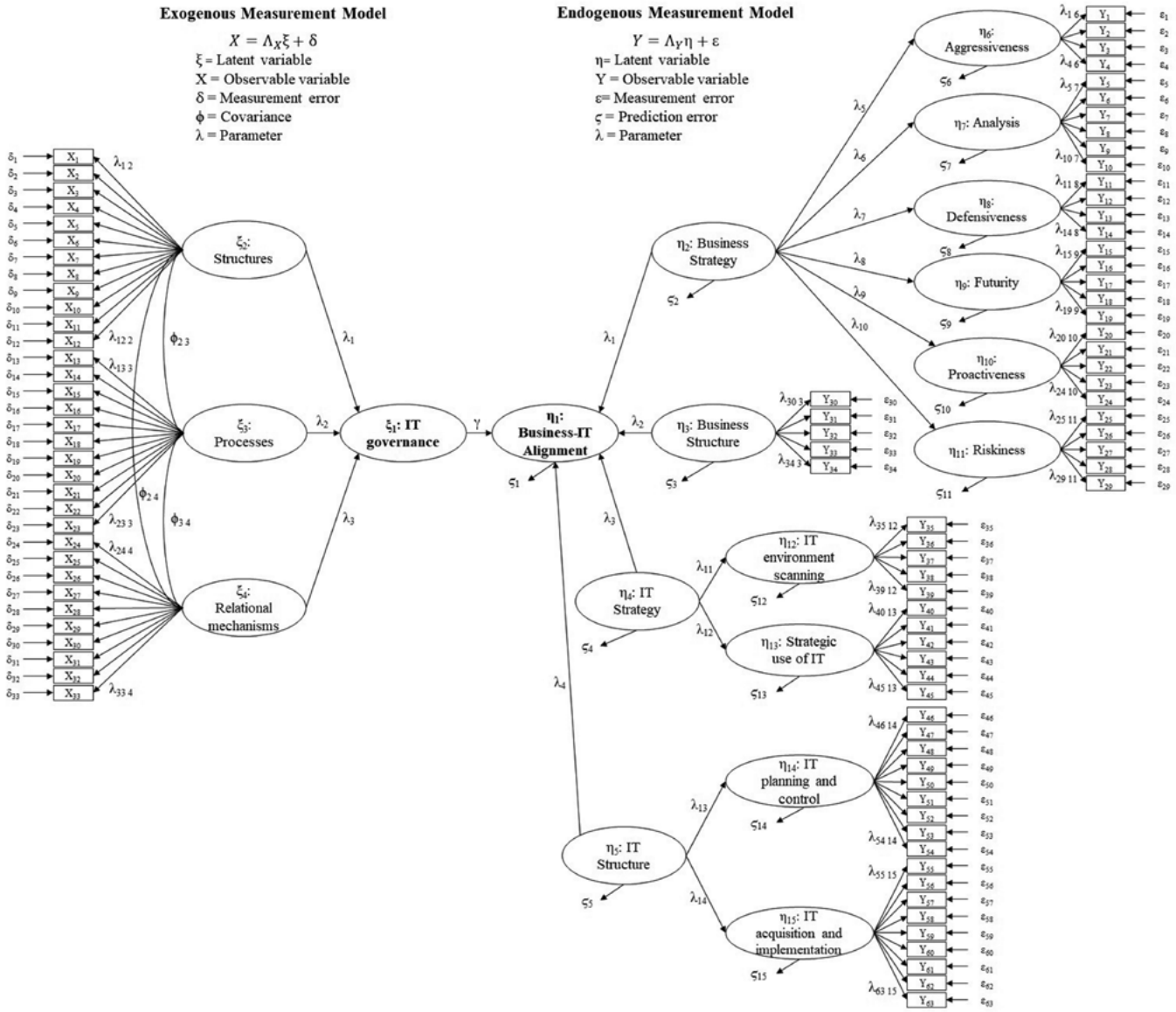

Figure 3
Research Model
Source: Own elaboration.

Another aspect to consider is multicollinearity among variables, where highly correlated variables are considered redundant. In this research, collinearity tests were performed; the multiple squared correlations (R^2) between each variable and the others were initially calculated, obtaining a maximum value of 0.0043 that is lower than the reference value (> 0.90) for extreme multivariate collinearity (Kline 2016). Also, collinearity statistics were calculated for each of the independent variables (Table 2). Tolerance points to the proportion of the total standardized variance that is unique and not explained by other variables (values < 0.10 indicate extreme multivariate collinearity), while the variance inflation factor (VIF), whose reference value is VIF > 10, may indicate that the variable may be redundant (Kline 2016). As can be seen, multi-collinearity occurs in neither case. Finally, the results of univariate normality tests show that of 94 observable variables, only two did not have adequate values of asymmetry and kurtosis. Concerning multivariate normality, AMOS provided the result of the Mardia's coefficient (452.1) and showed that there is no multivariate normality. To counteract the absence of normality, the sample size is sufficient to demonstrate that the impact of the sampling error could be minimal (Kline 2016).

Table 2
Collinearity Statistics

Independent Variable	Tolerance	Variance Inflation Factor (VIF)
Structures	0.89	1.12
Processes	0.75	1.33
Relational Mechanisms	0.77	1.30

Source: Own elaboration.

In the estimation phase, the values of the unknown parameters are determined, as well as their respective measurement error. The parameter estimation process was carried out under the Maximum Likelihood Estimation (MLE), which is considered efficient and not biased when multivariate assumptions of normality are not found. In this phase, the results of the model goodness-of-fit were obtained and some modifications were made to the specification model to improve the fit. Measures of fit quality can be of three types: absolute fit, incremental fit, and measures of parsimony fit. The model results without the moderating effect achieve satisfactory fit to data

Table 3
Goodness-of-fit Measures

Measure	Index	Shorthand	Value	Rating		
				Low	Medium	High
Absolute Fit	Chi-square	CMIN	5898.20	X		
	Minimum Discrepancy (Normed Chi-Square)	CMIN/DF	1.39			X
	Non-Centrality Parameter	NCP	1643.20	X		
	Scaled Non-Centrality Parameter	SNCP	2.45	X		
	Goodness-of-Fit Index	GFI	0.84		X	
	Adjusted Goodness-of-Fit Index	AGFI	0.84		X	
	Root Mean Square Residual	RMR	0.08			X
	Akaike Information Criterion	AIC	6318.20	X		
	Expected Cross Validation Index	ECVI	9.07	X		
	Browne-Cudeck Criterion	BCC	6387.47	X		
	Bayes Information Criterion	BIC	7265.35	X		
	Root Mean Square Error of Approximation	RMSEA	0.02			X
	Hoelter .05 Index	HOELTER05	502			X
	Hoelter .01 Index	HOELTER01	509			X
Comparative or Incremental Fit	Tucker–Lewis Index	TLI or Rho 2	0.98			X
	Normed Fit Index	NFI or Delta 1	0.93			X
	Relative Non-centrality Fit Index	RFI or Rho 1	0.92			X
	Incremental Fit Index	IFI or Delta 1	0.98			X
	Comparative Fit Index	CFI	0.98			X
Parsimonious Fit	Parsimony-Adjusted NFI	PNFI	0.90			X
	Parsimony-Adjusted CFI	PCFI	0.95			X
	Parsimony Goodness of Fit Index	PGFI	0.81		X	
	Parsimony Ratio	PRATIO	0.97			X

Source: Own elaboration using AMOS indexes.

as shown in Table 3. The minimum discrepancy ratio CMIN/DF (5898.2/4255) takes a value of 1.39, proof of the statistical significance of the model; the root mean square error of approximation (RMSEA) shows a value of 0.02 and the goodness-of-fit index (GFI) takes a value of 0.84. As for the incremental fit indexes, they are all above the cut-off value (0.90), with the Comparative Fit Index (CFI) taking a value of 0.97 and the Normalized Fit Index (NFI) taking a value of 0.93. As for the parsimony fit indexes, most of them are above the reference value (0.90). This shows that the ratio model estimates are above the recommended threshold for a good fit (Schreiber *et al.* 2006).

To verify the relative capacity of the model to explain the total variance of BITA, the determination coefficient (R^2) was used, obtaining a result of 0.955. This value indicates that the joint explanatory capacity of the variables is high since they represent 95.5 % of the variability of BITA. The path coefficients for the research model are shown in Figure 4.

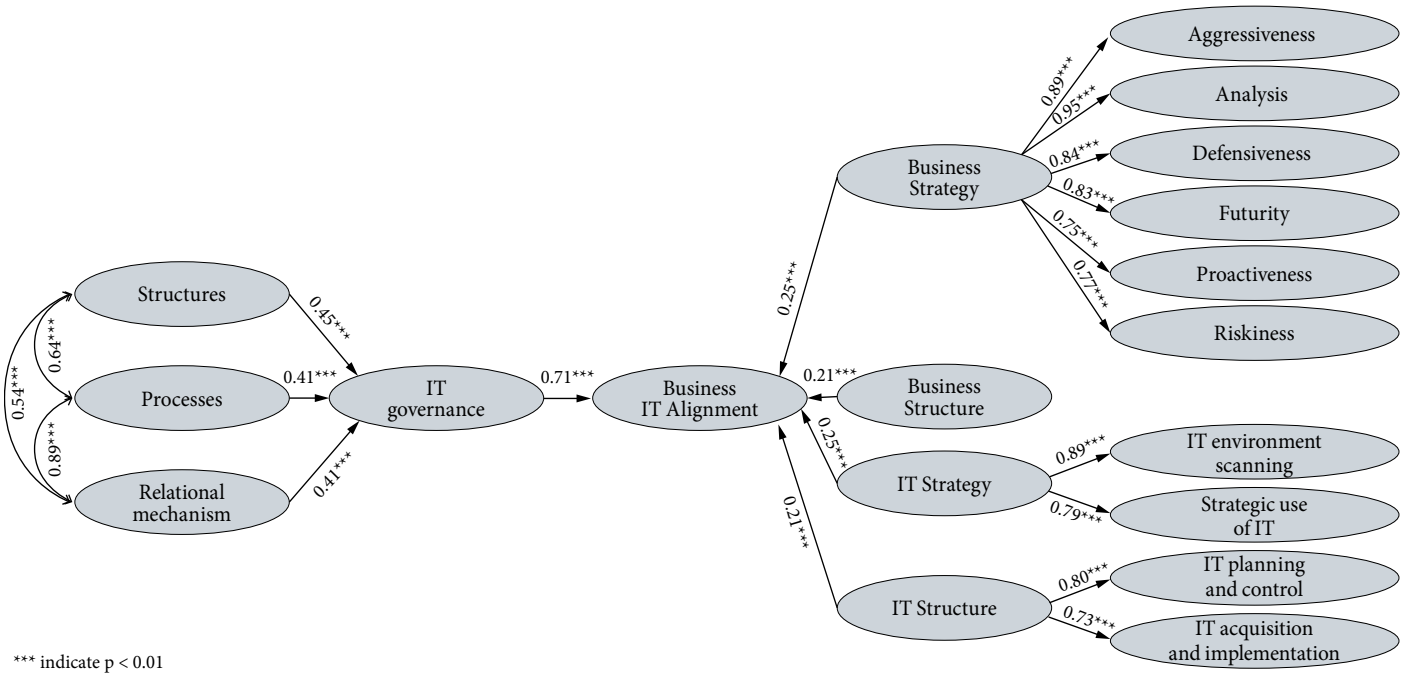

Figure 4
Research Model Results
Source: Own elaboration.

Once the good fit of the model was demonstrated, the resulting relationships were analyzed to verify the validity of the hypotheses and thus determine their predictive capacity (Table 4). Initially, the strong and direct relationship between ITG and BITA is shown (0.71), which is significant for a p-value < 0.01 and allows rejecting $H1_0$ and accepting $H1_a$.

The relationship model includes moderating variables that try to explain whether there are differences in the relationship between different sizes and types of companies. For this purpose, a multi-group analysis was carried out to test hypotheses 2 and 3. In this regard, the data set was divided into two variables (company size and industry type) to estimate whether the proposed relationship behaved differently depending on the effect that the moderating variables might have. For this, the sample was distributed into several groups depending on the moderating variables; the results of the parameters and adjustment are shown in Table 4.

The results show that the parameters vary in the case of industry type ranging from 0.68 to 0.78 with the same level of significance (p-value < 0.01); in the case of company size, they are in the range of 0.58 to 0.62 with the same level of significance (p-value < 0.01). The chi-square test of ratios was applied to H2 and H3, i.e., if there is no difference in the moderation of the impact of ITG on BITA by industry type and company size, respectively. In the first case, the value was 0.999 and in the second case, 0.998, which certified the non-rejection of $H2_0$ and $H3_0$.

Table 4
Model Results

Results	Default Model	Industry Type						Company Size		
		Manufacturing	Services	IT	Healthcare/ Medical	Education	Retail	Small	Medium	Large
	n = 672	n = 109	n = 100	n = 101	n = 106	n = 103	n = 104	n = 340	n = 228	n = 104
CMIN/DF	1.39	1.67	1.88	1.83	1.72	1.88	1.71	1.32	1.28	1.83
GFI	0.84	0.53	0.51	0.49	0.50	0.49	0.53	0.75	0.68	0.49
RMSEA	0.02	0.08	0.09	0.09	0.08	0.09	0.08	0.03	0.04	0.09
CFI	0.98	0.80	0.75	0.75	0.79	0.75	0.79	0.96	0.95	0.75
ITG → BITA	0.71***	0.78***	0.73***	0.71***	0.68***	0.69***	0.69***	0.58***	0.62***	0.59***
R^2 - ITG	0.91	0.89	0.92	0.91	0.90	0.90	0.90	0.82	0.85	0.83
R^2 - BITA	0.96	0.94	0.96	0.96	0.95	0.95	0.95	0.94	0.94	0.94

*** $p < 0.01$

Source: Own elaboration using AMOS estimates.

6. CONCLUSIONS, LIMITATIONS, AND FURTHER RESEARCH

Given the need to delve into the causal explanations in ITG studies (Tiwana *et al.* 2013), this research aimed to identify whether ITG had an impact on BITA following the suggestion of De Haes and Van Grembergem (2009). Furthermore, some authors consider BITA to be an important aspect of ITG (Tanriverdi 2006; Information Systems Audit and Control Association [ISACA] 2012; De Haes *et al.* 2013).

Several authors have studied certain relationships between the two main constructs of this study from different perspectives and found different results. Asante (2010) in an exploratory study identified a statistical correlation between some of the ITG structures proposed by Weill and Ross (2004) and strategic alignment. On the other hand, Gordon (2012) replicated Asante's (2010) study with a different sample using Luftman's model (2003) and adding the moderating effects of industry type and company size, without finding a relationship between ITG structures and BITA.

Meanwhile, Kuruzovich *et al.* (2012) found that the four ITG practices outlined by De Haes and Van Grembergem (2009) involving the board of directors affect BITA. Similarly, Hiekkanen (2016) used a mixed-method based on De Haes and Van Grembergem's (2009) model to measure ITG and Luftman's (2000) model to measure BITA, applied the above models qualitatively in a case study, and then conducted quantitative work with a sample of 42 surveys from 29 companies, finding a moderate positive relationship between ITG and BITA. Similarly, Lunardi *et al.* (2017) conclude that the adoption of structural, procedural, and relational mechanisms of ITG is positively associated with ITG domains, including strategic alignment. In contrast, Parry (2014) found no significant linear relationship between Weill and Ross's (2005) effective ITG and Tanriverdi's (2006) approach to BITA, based on a sample of 201 participants.

Unlike the studies mentioned above, this study used a method different from Luftman's (2000) to measure BITA in order to avoid endogeneity issues, as the latter looks at ITG as part of BITA. This research found that the mechanisms or practices of ITG (structures, processes, and relational mechanisms) have an impact on BITA, so a model was proposed to understand this impact. Due to the methodological application, results and the model evaluation show an adequate statistical adjustment of the proposed model, as well as the verification of the main hypothesis, which allows us to affirm that the model explains the relationship between ITG and BITA. About the moderating effect of the industry type and company size variables, it can be shown that it is not significant. From this finding, it is inferred that, although BITA is affected by ITG, there are no differences when it comes to firms of different sizes and sectors of activity.

The importance of jointly evaluating ITG mechanisms or practices is also noted, given their high correlation values and their contribution to the impact of ITG on BITA. The results described here have practical implications for enterprises, suggesting that the implementation of better ITG practices will generate better degrees of BITA and therefore improve organizational performance indicators. Instead, the non-implementation of such ITG practices may be one of the factors why BITA may not be developed. Having demonstrated ITG impact on BITA, one might think that BITA would act as a mediator of ITG impact on other constructs, for example, a firm's innovation capacity.

Future research should also include additional moderating or mediating effects, such as the type of ITG framework used by the company, the maturity of the company's IT department, whether multinational or not, and so on. Additional longitudinal research could also be conducted to analyze variation in ITG and BITA over time.

Finally, it should be noted that this study is not without its limitations, which could be considered in future research. The data have been obtained in Colombia during a specific period, and it would be convenient to consider other countries, with larger samples of companies that include other industry types.

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The Technology Transfer Office (TTO): Toward a Viable Model for Universities in Morocco

La Oficina de Transferencia de Tecnología (OTT): hacia un modelo viable para las universidades en Marruecos

Ilham Taouaf*, Omar Elyoussoufi Attou[a], Said El Ganich[b], Moha Arouch[c]

[a] *PhD in Innovation Management and Technology Transfer, Engineering, Industrial Management & Innovation Laboratory, Faculty of Sciences and Technics (FST), Hassan First University of Settat, Km 3, B.P. : 577 Route de Casablanca, Morocco – om.elyoussoufi@gmail.com*

[b] *PhD in management sciences, Strategy and Management of Organizations Laboratory. National School of Business and Management (ENCG). Hassan First University of Settat, Km 3, B.P. : 658 Route de Casablanca, Morocco – elganich@yahoo.fr*

[c] *Professor of higher education, Engineering, Industrial Management & Innovation Laboratory. Faculty of Sciences and Technics (FST), Hassan First University of Settat, Km 3, B.P. : 577 Route de Casablanca, Morocco – moha.arouch@uhp.ac.ma*

* ***Corresponding author***: *PhD Student, Engineering, Industrial Management & Innovation Laboratory. Faculty of Sciences and Technics (FST), Hassan First University of Settat. Km 3, B.P. : 577 Route de Casablanca. Morocco – i.taouaf@uhp.ac.ma – https://orcid.org/0000-0002-6617-6258*

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ABSTRACT

The link between the enterprise and the university in Morocco is positioned within the framework of what is commonly known as the "University's Third-Mission". This relationship is primarily concerned with continued education, consultancy, collaborative research and development (R&D) and technology transfer from the university to the enterprise. This third mission has been promoted by the university through the establishment of specialized structures such as university enterprise interfaces, incubators and technological information centres for invention patents. Also, several strategies and programs of incentives for innovation have been promoted by the public authorities to create a national system of innovation in Morocco. However, all these efforts failed to unleash and activate the potential of Moroccan universities. In this work, we will propose an effective and efficient institutional Technology Transfer (TT) policy backed up by a complete repository related to the establishing of the University Technology Transfer Office (UTTO). This proposal complements the work done in a previous paper, which assesses the different policies and programs within Moroccan universities, related to TT activities, and proposes a remodelling of the value chain of the process of technology transfer in the universities.

Keywords: Innovation, Technology Transfer Offices, University's Third-Mission, National Innovation System, Morocco.

RESUMEN

El vínculo entre la empresa y la universidad en Marruecos se posiciona en el marco de lo que comúnmente se conoce como la «tercera misión de la universidad». Esta relación se refiere principalmente a la educación continua, consultoría, investigación y desarrollo colaborativo (I + D) y transferencia de tecnología de la universidad a la empresa. Esta tercera misión ha sido promovida por la universidad mediante el establecimiento de estructuras especializadas tales como interfaces empresariales universitarias, incubadoras y centros de información tecnológica para patentes de invención. Además, las autoridades públicas han promovido varias estrategias y programas de incentivos para la innovación a fin de crear un sistema nacional de innovación en Marruecos. Sin embargo, todos estos esfuerzos no lograron liberar y activar el potencial de las universidades marroquíes. En este trabajo, propondremos una política institucional eficaz y eficiente de Transferencia de Tecnología (TT) respaldada por un repositorio completo relacionado con el establecimiento de la Oficina de Transferencia de Tecnología de la Universidad (UTTO). Esta propuesta complementa el trabajo realizado en un documento anterior, que evalúa las diferentes políticas y programas dentro de las universidades marroquíes, relacionadas con las actividades de TT, y propone una remodelación de la cadena de valor del proceso de transferencia de tecnología en las universidades.

Palabras clave: Innovación, Oficinas de Transferencia de Tecnología, Tercera Misión de la Universidad, Sistema Nacional de Innovación, Marruecos.

1. INTRODUCTION

The link between the enterprise and the university in Morocco is positioned within the framework of what is commonly known as the "University's Third-Mission". This relationship is primarily concerned with continued education, consultancy, collaborative research and development (R & D) and technology transfer from the university to the enterprise.

This third mission has been promoted by the university through the establishment of specialized structures such as university enterprise interfaces, incubators and technological information centres for invention patents. Also, several strategies and programs of incentives for innovation have been promoted by the public authorities to create a national system of innovation in Morocco. All these efforts have been made since 2000 (Elyoussoufi Attou and Arouch 2016).

Indeed, the adoption of Law n° 01-00 governing the functioning of Moroccan universities marked the beginning of the third mission. In particular, it widened the scope of the university (Law n° 01-00, 2000), enabling it to valorise and commercialise the results of research and the transfer of technology to companies (Etzkowitz 2003; Rasmussen *et al.* 2006). Therefore, beyond the traditional activities of creating and disseminating knowledge, the third mission of the university is to manage, protect and commercialise intellectual property (invention patents), promote the creation of start-ups and spin-offs, carry out collaborative R & D projects and transfer technology to economic partners (Etzkowitz 2003; Rasmussen *et al.* 2006; Wright *et al.* 2008).

Recently, activities and structures related to the third mission have gained popularity in universities and research institutes around the world (Van Looy *et al.* 2011).

The Technology Transfer Office (TTO) (Ambos *et al.* 2008; Siegel *et al.* 2007; Tushman and O'Reilly 1996) is one of the most important functions created by the universities. They are autonomous units that support most of the TT activities.

The results of commercialisation, research and the missions of the TTOs have been widely discussed in the literature. They focus primarily on the following concerns:

— The role of the TTO in licensing (Siegel *et al.* 2003b; Thursby *et al.* 2001) and patenting (Coupe 2003).
— The creation and performance of university spin-offs (Link and Scott 2005; Lockett and Wright 2005; Lockett *et al.* 2003).
— The encouragement of researchers to disclose their inventions and the assessment of patentability, technological validity and commercial potential (Siegel *et al.* 2003a; Vohora *et al.* 2004).
— The role of the interface, which promotes solutions to the problem of asymmetrical information between industry and the university (Macho-Stadler *et al.* 2007) and alleviates uncertainty related to the profitability of new inventions (Hoppe and Ozdenoren 2005).

Some studies included detailed inventories of the activities and functions of the TTO (Siegel *et al.* 2007). As for the organization of the TTO, in addition to the classic form of unit under the central authority of the university, several other forms have been identified and analysed:

— The three archetypes identified by Markman *et al.* (2005) vary according to the degree of autonomy granted to the TTO (traditional university structure, non-profit foundation and a profit-making subsidiary undertaking).
— Four organizational forms proposed by Bercovitz *et al.* (2001): unitary structure (U-form), multi-divisional structure (M-form), holding company (H-form) and matrix structure (MX-form).
— The decentralized TTO (Debackere and Veugelers 2005).

A review of the TTO literature showed the specific context of universities in industrialised countries, especially Anglo-Saxon universities. This explains the scarcity of research focusing on the role of TTOs in the upstream phases of the Technology Transfer (TT) process that strongly influence the degree of success. In the case of Moroccan universities, the specific TT process has been identified and modelled in a previous study (Elyoussoufi Attou *et al.* 2019). Also, we have identified the characteristics and primary functions of the TTO in Moroccan universities that we refer to as the University Technology Transfer Office (UTTO).

At the Moroccan level, the equivalent of the TTO is the university-enterprise interface structures established since 1998 in Moroccan universities and research centres (Elyoussoufi Attou and Arouch 2016; Elyoussoufi Attou *et al.* 2019).

As part of our previous study (Elyoussoufi Attou *et al.* 2019), we were able to:

— Analyse the policies, programs, practices and achievements of Moroccan universities related to TT.
— Analyse and model the current TT process in Moroccan universities.
— Propose a value chain for the TT process more appropriate to Moroccan universities, while detailing the characteristics and main functions of the UTTO in the universities.
— Propose measures for adoption by Moroccan universities to professionalize UTTO activities.

In our current study, we will document the mission and role of UTTOs in the stages of the TT process value chain with a focus on the upstream phases. For Moroccan universities, we also propose an efficient TT institutional policy supported by a complete repository relating to the implementation of UTTOs. This repository includes setting up conditions, the attributions and activities, the components and the organizational aspect.

2. METHODOLOGY

To define the missions and roles of the UTTOs and develop an institutional policy for efficient TT, we proceeded through the following steps:

— Analyse the reports from the various stakeholders in the Moroccan scientific research and innovation community (MHESRET 2013; CNRST 2017; MIITDE 2017; MNEPTHESR 2017a; OMPIC 2017).
— Analyse the programs promoting innovative R & D for enterprises:

- Technology Diffusion Network —RDT— (2003-2011) (MHESRET 2013).
- INNOV'ACT program (2009-2012) (MHESRET 2013, 2017c).

— Analyse the TT process and Intellectual Property (IP) management in the 8 out of 12 Moroccan universities most affected by these activities:
  - Select public universities based on their valuation and technology transfer structures (MNEPTHESR 2017a).
  - Organise direct interviews with current and former managers in charge of University-enterprises Interfaces.

The methodology adopted for this study is a holistic approach, which consists of the following:

— Use the results of our previous study (Elyoussoufi Attou *et al.* 2019) in which we proposed modelling the value chain for the TT process in Moroccan universities as the basis for an institutional policy for TT in Morocco;
— Examine the existing national and institutional TT policies and innovations based on direct interviews with:
  - Managers of TT activities in the universities.
  - Officials of national agencies and other bodies involved in the national TT system: The Moroccan Office of Industrial and Commercial Property (OMPIC), Ministry of Industry, Investment, Trade, and the Digital Economy (MIITDE), National Agency for the Promotion of Small and Medium Enterprises (ANPME), Ministry of Scientific Research and Innovation (MSRI) and The Moroccan National Centre for Scientific and Technical Research (CNRST).

3. THE TTO IN MOROCCO

3.1. University-enterprise interfaces

Since 1998, university-enterprise interfaces have been established in Moroccan universities (Elyoussoufi Attou and Arouch 2016) through a national support program (MNEPTHESR 2017a, 2017b). The National Program for University-Enterprise Interface Structures (NPUEI) had, as its primary motivation, the need for rapprochement between the University and the Enterprise to meet the following challenges:

— The openness of the Moroccan economy (Globalization of markets).
— Technological evolution (Knowledge Economy).
— Requirements for economic competitiveness.
— Social expectations of the Moroccan population.
— Compliance with new laws adopted between 1998 and 2000 (Law n° 01-00) as the legal framework for the charter of investment, and the R & D provisions within the framework of the finance law (2000-2009)

This program encourages the creation, professionalization, and federation of Interfaces. These interfaces were created as structures in the university (MNEPTHESR 2017a, 2017b).

The evolution of these structures has been ongoing since 1998 when a pilot program incorporating the "University-Enterprise Interface" concept was launched. By 2011, there were 26 operational interfaces at the national level.

NPUEI (1998-2011) allowed Moroccan universities to embrace the international concept of TTO. To capitalize on the success of NPUEI, we were able to propose measures to professionalize UTTO activities (Elyoussoufi Attou *et al.* 2019). These measures cover all facets of the TTO issue: legal and regulatory, coordination and governance, technical coaching and financial support at the national level and measures to be taken by the university.

In addition, we will focus on the crucial role of the TTO in bridging the gap between the University-Enterprise partnership and the need for a university program (proof of concept) managed by the TTO.

3.2. Measures to professionalize UTTO activities

The following table summarizes the measures to be adopted and the roles to be played by the university's partners to professionalize the activities of the UTTOs. The measures take into account the context of the university and rely on the literature relating to the performance factors of the university TTOs for executing TT activities (Tornatzky and Waugaman 1999).

Table 1
Measures to operationalise and develop UTTO activities

Measures at the National level	Measures at the University Level
Technical and Financial Support Establish programmes and mechanisms for technical and financial support. Adopt a contractual approach with universities to improve the performance of their UTTO.	**Legal and Regulatory** Adopt a legal framework (associations, private valorisation company) that offers advantages such as: – Financial and administrative autonomy. – Simplification of procedures. – Strengthening good governance. – Encouragement of researchers. – Effective involvement of the private sector in the UTTO's decision-making body. Pending the determination of legal status: – Formalize the status of the UTTO within the university. – Formally identify the missions of the UTTOs. – Mobilise sufficient human and financial resources in line with the expected objectives (Expertise, IP Management, proof of concept activities, etc.). – Ensure that researchers have access to the financial performance of completed projects. – Develop a culture conducive to TT activities in the university. – Professionalise the TTO structure (business oriented TTO). – Adopt well-defined policies, rules, and procedures. – Adopt an approach for long-term tangible results.
Coordination and Governance Roles of national administrations and public agencies: – Technical and financial support. – create the material and organizational conditions to facilitate the work of UTTOs. Roles of regional authorities: – Participate in the funding effort. – Provide land necessary to establish appropriate infrastructure. – Participate in identifying regional priorities. Roles of industrial companies: – Participate in the identification of needs to better guide TT efforts. – Work directly on R&D and innovation projects with laboratories and research teams. Roles of financial and investment institutions: – Integrate into the UTTO institutional network to offer investment opportunities.	

Source: Own elaboration.

3.3. *Promoting technology transfer from the perspective of a public university: roles of the TTO*

TTOs often experience a delicate balance between actors with opposing interests. For example, in the U-E interface that is typical of a Moroccan university, the stakeholders include:

— Professors-researchers, administrative staff, and students.
— Licensees, industry sponsors, and investors.
— Public funders, administrations, and the general public.

A successful TTO must find common ground where the interests of all its stakeholders are represented. This requires a great deal of effort to encourage collaboration.

A. University-enterprise partnerships

The primary indicators of TTO performance are patents, licenses and royalties. However, other means of developing upstream of TT activities should not be neglected, particularly those pertaining to university-enterprise collaboration through expertise and consultation.

Although there is a significant variety of TTOs in relation to the services offered, it is also generally accepted that the two primary ways to transfer technology are by licensing the technology to companies or creating new companies (the so-called university spin-off companies or USOs). Statistics collected by Bray and Lee (2000) showed that the income from university spin-offs is several times higher than the annual income from conventional licenses.

However, several spin-off initiatives by Moroccan universities have been confronted with the difficulties in getting final authorization from the Ministry of Finance due to poor coordination between the two ministries to implement Law n° 01-00. Simplifying the final authorization process is a necessity to encourage the development of Moroccan spin-off companies. (Elyoussoufi Attou *et al.* 2019)

The role of the TTO is to facilitate industry-sponsored research. Successful collaborations often start with personalized relationships with university researchers who share a common scientific interest with their counterparts in a developing enterprise. In addition, the TTO and the university must create a favourable environment in which to foster and strengthen these relationships for a sustainable collaboration.

The challenge for TT managers is to conduct well-documented readiness and technological risk assessments at key points in the program life cycle. Technological Maturity Levels (TRL) is a systematic process for assessing the maturity of a particular technology. It also compares the level of maturity between different types of technology (Mankins 1995).

The TRL was developed between 1970 and 1980 by the National Aeronautics and Space Administration (NASA) and which guaranteed a more effective assessment of the maturity of new technologies and more effective in this regard (Mankins 2009). Since then, TRLs have been adopted by the General Accountability Office (GAO) of the United States Congress, adopted by the United States Department of Défense (DOD), and are being considered for use by many other organizations. Overall, TRLs have proven to be very effective in communicating the state of new technologies within often diverse organizations (Mankins 2009). The TRL scale has largely contributed to the discipline of assessing technological readiness. And, scale is likely to continue to play an increasingly important role in the future of technology and systems management. As systems become increasingly dependent on the simultaneous development of multiple technologies, the use of TRL is more widespread (Mankins 1995).

University research rarely exceeds Level 4 of the TRL. However, national funding mechanisms aimed at innovation in universities focus on levels 0 to 3. This confirms the high-risk nature of projects that often require several years to achieve a marketable product or service.

However, this university research may be attractive for companies that are looking for strategic positioning themselves with new products or ground-breaking technologies. In particular, this affects big companies that have the resources to commit to the early stages of research and development.

As for the Small and Medium-sized Enterprises (SME)/ the Small and Medium-sized Industries (SMI), the university, through the TTO, can promote the expertise and skills of university researchers to solve problems facing technology start-ups and provide them with the support they need for technological upgrading.

Promoting industry-sponsored research achieves several goals:

— Enables the company to take advantage of the university experience, expertise and infrastructure to pursue research interests consistent with its long-term vision.
— Allows the university to offer access to researchers that goes beyond basic research and directs them to applications that can find a place in the market.

This collaborative research combines the expertise of both parties. Industry researchers and engineers can partner in future research and guide academic researchers to better understand how their work will be applied in real life conditions.

A TTO can facilitate collaboration and proactively involves industry partners upstream of the TT value chain by identifying projects of interest to industry and researchers. This collaboration can build a solid footing for licensing and patent assignment downstream of the TT value chain.

B. Role of the TTO: bridging the gap in the university-enterprise partnership

Scientific research is similar to a high-risk company that has the potential for significant profitability. Research projects are at an early stage of development with respect to market access, while focusing on potential breakthrough discoveries.

The analysis of programs, innovation support mechanisms, and activities related to TT in Moroccan universities shows the weakness of collaborative projects with economic partners and technology services provided by universities (Elyoussoufi Attou and Arouch 2016; Elyoussoufi Attou *et al.* 2019).

When applying the TRL scale, we can see the gap between the point where the public funding of research ends and industry and private investors are willing to partner with the university (Usually from TRL 6 or TRL 7 levels).

Figure 1
The Technology Readiness Levels (TRL) and coverage of public funding mechanisms in Moroccan universities from TRL 0 to TRL 3
Source: E.C. (2013).

Researchers must demonstrate a certain level of feasibility before seeking a venture partner willing to accept the risk of investment in early-stage technology. In Morocco, there is still no estimate of the budget needed to produce a "proof of concept" sufficient to exploit the potential of a technology or product under development. This important step in the TT process reduces the risk to an interested company. At present, however, very little funding is dedicated to "proof of concept" in Morocco. One exception is some small projects for university prototyping centres oriented primarily toward education and training established by OMPIC (2017) in Casablanca (Morocco).

The opportunity remains for allocating a budget and implementing a grant program within the university under the responsibility of the TTO to bridge the gap between research and commercialisation through "proof of concept".

C. Role of the TTO: "proof of concept" program in the university

Such a program should benefit projects with a clearly defined obstacle between research and commercialization and make it easy to achieve the following goals:

- Accelerate both the commercialization of technologies developed in the university's research laboratories and the university IP portfolio.
- Ensure better visibility and attractiveness of the technologies either for licensing or development of start-ups.
- Attract investment and participate in job creation.
- Stimulate the local and national technology-based economy.

To evaluate proposals on their technical value and commercial potential, a certain number of directives must be respected:

- The IP must be disclosed to the TTO and must be owned by the university.
- The technology must be free from any license agreement, sponsored research or investment partners.
- To be supported, projects must include either prototype for development, commercial feasibility studies or studies to overcome a specific obstacle identified by industry.
- Requests for assistance should describe a precise and clear roadmap for business development, the market potential of the technology and how the requested support would reduce any impediments to marketing.

4. PROPOSED STANDARDS FOR ESTABLISHING A UNIVERSITY STRUCTURE RESPONSIBLE FOR THE TRANSFER OF UTTO TECHNOLOGY

Most universities, research institutes, and institutions not affiliated with universities have units to manage relations with economic partners. These units are called "university-enterprise interfaces". Their mission is to promote scientific research through collaboration between universities and businesses and the transfer of technology to the social and economic fabric.

These structures have staff (teacher-researchers, researchers, and administrative staff) that link the university with the enterprise and provide all the skills, know-how and technologies to solve the technical and technological problems facing the companies.

Until now, there has been a network that links these interface structures but provides only basic coordination. The existence of a body in charge of TT within the university is an important prerequisite for any technology transfer from the university to an enterprise.

In the following sections, we propose a scaling reference for UTTOs that takes into account the different levels of maturity that characterize the TT activities and the units that ensure them in Moroccan universities. This scaling reference contains:

— A mission statement and objectives for the UTTO.
— Assignments, services, and roles provided by the UTTO.
— Conditions and operating standards of the UTTO.
— Components and organisational chart of the UTTO.

4.1. UTTO mission statement and objectives

The UTTO has two primary objectives. Those general objectives are further broken down into specific objectives that consider the level of initial investment and the different levels of maturity that characterize technology transfer activities in a given university.

1) Create an appropriate and efficient space that allows the articulation of supply and demand for R & D activities. On the one hand, the university presents its offer of technology and know-how that promotes the competitiveness of enterprises and increasing the level of added value in their production. In response, the company provides additional financial resources to the university and contributes to research to be harnessed to the economy. This space allows the UTTO to:

— Value the university offer that is linked to:
  - Qualified and experienced human resources (researchers and students).
  - Quality research and scientific expertise at regional and national levels.
  - Research laboratories covering high priority areas at the regional and national levels.

— Meet the needs of enterprises and the economic fabric of the region. This fabric is currently characterized by:
  - The absence of research and development units in the companies.
  - The need to achieve effective results and move as quickly as possible to the production stage.

2) Create an interactive platform that promotes technology transfer, completes the missing links in the innovation value chain, and achieves the following results:

— Launch the process of technological innovation by stimulating the transfer of skills and knowledge between the university and the enterprise. In turn, this will facilitate the development of new products and services as well as the initiation of innovative projects.
— Attract investors by improving the visibility of the university's technological offer locally, regionally and internationally.
— Facilitate the transfer of technology between the university and the enterprise by overcoming various obstacles**.**
— Enable and energise the innovation value chain by benefiting enterprises and researchers who will see their research activities valued and rewarded.
— Stimulate the creation of high value-added jobs for university graduates.
— Reposition the university as an important player in the socio-economic fabric of the region.
— Improve the competitiveness of local and regional enterprises.
— Perpetuate and diversify the sources of funding for R & D activities.
— Help to identify regional and national research priorities.

4.2. UTTO responsibilities, services and roles

The expected services and roles of the UTTO are embodied in:

— Its mission statement and objectives.
— The different phases and stages of the TT process in Moroccan universities. The UTTO will be responsible for ensuring the activities and related services. Technology transfer in the academic context is a complex and repetitive process that involves overlapping steps and phases to form a "value chain". We will use our proposed value chain to model the TT process in Moroccan universities to develop an institutional technology transfer policy in Morocco.
— The measures taken to activate and professionalize its functions and to overcome the constraints that hinder achievement of the objectives for university technology transfer.

In addition, it is necessary to explore the different axes of economic development on which the UTTO can work. Those axes are summarized as follows:

— Providing the university with a source of revenue from commercialising the results of scientific research through:
  - Establishing research partnerships with public and private customers.
  - Innovation management through services provided by technology testing and analysis platforms and design and prototype centres.
  - Stimulating the demand for services offered by the platforms and the design and prototyping centres that are coming out of the university. In turn, they will enhance the capacity and scientific and technical potential by using a proactive approach to the systematic research of economic partners. Hence, the need to have within the UTTO a unit responsible for communication and marketing.
  - Establishing innovative incubator projects whose objective is to fund and secure contributions to promising technological projects. This should be developed with a minimum number of participating companies for a fixed period to ensure a stable income that achieves financial balance.

— Providing the university with a stable source of income by creating additional business activities such as:
  - An innovative business incubator offering pre-incubation, incubation, and post-incubation services. The objective is to fund and secure stakes in promising technology companies. It should be developed in such a way that a minimum number of enterprises are hosted for a fixed period to ensure a stable income.

- Training services specifically designed to meet the needs of local and regional economic partners.
- Services similar to those provided by the technical centres such as issuing certificates of conformity for the products of export and import companies. This means that the UTTO must secure the necessary accreditations from the relevant authorities.

—Finding other potential sources of income, which might include:

- Professional management of relations with sponsors and sources of subsidies, donations, and legacies at the national and international levels (international organizations, national enterprises, etc.).
- Active participation in international networks of research centres, incubators, etc.
- Establishment of strategic partnerships with potential investors, "business angels", venture capital companies and banks.

Based on the objectives and activities outlined above, we have summarized the services and roles expected of the UTTO in Figure 2. Services and responsibilities are organized according to the different stages of the proposed value chain we will use to model the process of technology transfer at the university.

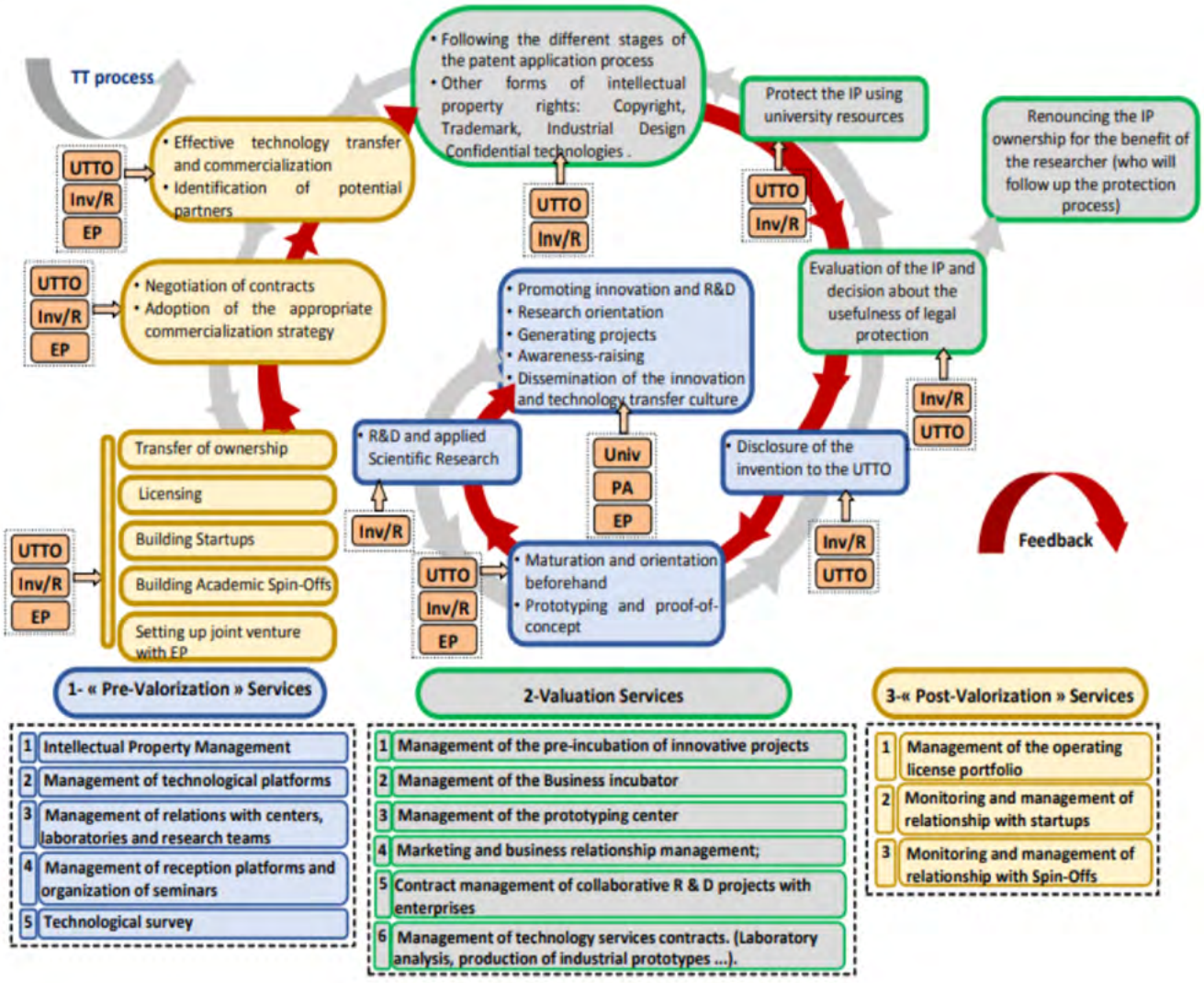

Figure 2

Services and roles expected of the UTTO in the different stages of the proposed technology transfer value chain within the University

Source: Own elaboration based on our previous work: Elyoussoufi Attou *et al.* (2019).

Legend: Figure 2

UTTO: University Technology Transfer Office
In/Res: Inventor/Researcher
EP: Economic Partners
Univ.: University
PA: Public Authorities
IP: Intellectual Property
TT: Technology Transfer

4.3. UTTO operating standards

To achieve its objectives and assume the roles defined in its mission statement, the UTTO must be established at each university. In so doing, it must comply with the following standards:

1) Ensure that the objectives and activities of the UTTO are consistent with the vision, intellectual property policy, and priorities for scientific research and technological development at the university.

2) Prepare detailed procedures under which the UTTO which will resolve potential disputes that may arise between the university's stakeholders: staff (including officials), relevant ministries, the University Council, students, public and private partners, local and regional authorities, trade unions, competing universities and civil society.

3) Ensure that infrastructure planning managed by the UTTO is consistent with the adopted development strategy. The strategy must consider the future direction of the local and national economy.

4) Provide appropriate space for the reception and/or daily operation of the companies and/or their teams collaborating on research and development projects in partnership with researchers.

5) To develop cooperative networks between the enterprises and university research centres, provide a range of services and facilities to meet the needs of target enterprises.

6) Create the initial conditions to ensure a successful project. This includes a significant initial investment, quality mobilized skills and quality equipment necessary to demonstrate its commitment, professionalism and credibility to the university and its economic partners.

7) Manage effectively and efficiently the various operational activities related to technology transfer (those responsible for operational management must be highly qualified experts in their fields).

8) Adopt detailed and transparent procedures for managing technology transfer.

4.4. UTTO Management Components

The ability of a university to comply with the standards outlined in section 4.3 will significantly affect the organizational structure of the UTTO. We have developed two contrasting management scenarios characterized first by a minimum (or cautious) commitment to a maximum level of commitment by the university. Each university can adopt the approach most suited to its vision for the UTTO, going from the minimum scenario to the maximum scenario:

A. The minimum scenario

The basic version is characterized by caution considering the reluctance of potential economic partners. This scenario is characterized by the following:

1) Limited technical infrastructure in the form of offices, a reception service and communication equipment. University facilities such as training rooms and conference rooms are requested and used when needed.

2) Use of existing university laboratories without establishing a specialized technological infrastructure designed for specific industrial or technological sectors.

3) No spaces reserved for the reception and operation of enterprises.

4) The UTTO is responsible for managing a university incubator for innovative enterprises intended exclusively for researchers and students. Or, where applicable, for coordinating with the incubator management if it is an independent unit within the university.

5) The UTTO is responsible for managing a centre on patent information at the university.

6) Common support, accompaniment, and advisory services limited to supporting researchers in their commercialisation activities.

B. The maximum scenario

The UTTO takes the form of a complex for valorisation and innovation within the university (developed version). This scenario is characterized by the following:

1) From the outset, significant initial investment and a substantial financial contribution from institutional and private donors and certain companies.

2) A strong mobilization of human resources and talents within the university to manage technological platforms.

3) Recruitment of contract human resources that are experienced in areas related to the management of technology enterprises, intellectual property and research and development projects.

4) General technical infrastructure:

— Located near the city centre and attached to the university presidency.
— Having general facilities and equipment (training rooms, conference and meeting rooms, communication infrastructure and reception service).

5) Specialized technological infrastructure targeting specific industrial or technological sectors:

— Certified testing and analysis platforms (depending on the technologies selected as a priority). These must be the most sophisticated to attract the best companies.
— Prototyping platforms.

6) Suitable spaces for the reception and/or domiciliation of enterprises or their teams collaborating on research and development projects in partnership with researchers.

7) An academic incubator for innovative enterprises.

8) A university unit in charge of intellectual property management (UUIP).

9) A unit responsible for communication and marketing.

10) Common support, coaching and consulting services; this will be responsible for contractual services, follow-up of collaborative projects and management of technologies developed at the university.

4.5. UTTO organizational structure

The proposed organization chart takes into consideration the specifications, the initial conditions, and the attributions of the UTTO presented in Section 4.3. In the following, we will detail the three major poles of the UTTO and the tasks associated with them:

A. Top Management

This group is responsible for overall coordination of the structure's work. It oversees the following tasks and duties:

— Management of administrative and general affairs (administration of the site and the general technical infrastructure).
— Reception and secretarial and service.
— Human resources management (recruitment, training and career management).
— Financial management: accounting, budgeting, diversification and intensification of funding sources and monitoring and management of relationships with start-ups and spin-offs.
— Promotion of UTTO services, communication, marketing and development of relations with companies:

- Promotion of scientific and technological services provided by the university.
- Development of media used for information and communication.
- Organization of events, seminars and awareness and information campaigns.

B. Research and Development

This division is oriented primarily toward the university and has a thorough knowledge of its research work, its skills, and its scientific and technological expertise. It oversees the following duties:

— Management of relations with the research centres, laboratories and research teams of the university.
— Management of the prototyping centre.
— Management of specialized technology platforms targeting priority industrial or technological sectors of the university:

- Conducting tests and analyses and executing technology service contracts.
- Maintenance of machines and appliances.

C. Valuation and Intellectual Property (IP)

This pole is oriented primarily toward the companies and the socio-economic environment. It oversees the following duties:

— Management of the university incubator for innovative projects.
— Management of continuous training.
— Management of intellectual property and the portfolio of operating licenses.
— Management of collaborative R&D projects:

- Supporting the disclosure of inventions and legal protection.
- Supporting the development of innovative start-up and spin-off projects as well as R&D projects of university researchers.
- Managing technology service contracts (Testing and analysis of platforms, production of industrial prototypes, etc.).
- Ensuring a technological watch.

4.6. Proposed UTTO organizational structure

The proposed organizational chart sets a flexible reference framework (Figure 3). Which allows each university to make the choice according to the initial conditions it has managed to meet for its project of setting up the "UTTO".

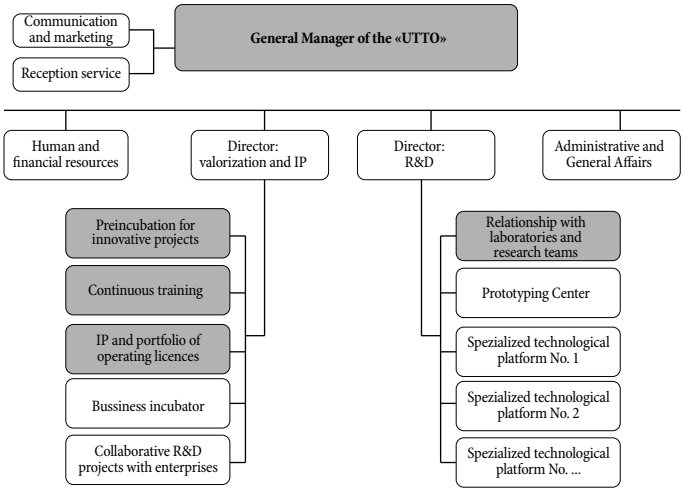

Figure 3
Proposed organization of the UTTO in its developed form (white and grey) and its basic form (grey only)
Source: Own elaboration.

Legend: Figure 3
IP : Intellectual Property
R&D : Research and Development

5. CONCLUSIONS

The investments and efforts made to date have not yielded results that could materialize the economic role of the university targeted by the third mission. However, on one side, the public authorities that oversee higher education and scientific research and, on the other side, the universities have for 20 years continued to invest in developing new strategies, creating administrative bodies, mobilising human resources and promoting the means of funding.

The role, attitude, and motivation of the top university management are key parameters for the success of activities related to the university's third mission. Our study involved two complementary paths of research. First was a model of the technology transfer value chain, which examines the TT activities in Mo-

roccan universities. In the second study, we proposed an effective and efficient institutional TT policy backed by a complete reference framework for the implementation of the University Technology Transfer Office (UTTO).

Awareness by public authorities of the importance of promoting innovation to integrate Morocco into the knowledge economy and ensure a high level of competitiveness has resulted in gradual work since 1998. Our previous study highlighted and analysed the mechanisms for promoting innovation in Morocco and identified three components: creation of innovative business, development of research results and innovative activity within the company (Elyoussoufi Attou, and Moha 2016).

The essential factors that characterize the current state of innovation in the country focus on the economic and cultural environments. Several additional factors interact in complex ways to further innovation. For example, policies and strategies have been developed and adopted, mechanisms and structures copied or designed, and financial and human resources allocated. All these were implemented and managed take account of the unique characteristics of the country as well as international standards. However, the pace of development has failed to exploit the latent potential of Moroccan universities. Nevertheless, the success of the university in the third mission remains closely connected to the developing system of innovation at the regional and national levels. Indeed, the university is increasingly considered to be the anchoring institution in its community, representing the first port of call for individuals, companies and organizations (public and private) with a variety of commercial and research innovations (Rubens *et al.* 2017).

According to Lockett *et al.* (2005), the success of universities in fostering a spinoff's success is based on greater expertise (in addition to the TTO) and more developed networks with both external organizations and individuals with access to critical resources and financing. The success of the university in its third mission greatly depends on the strategy adopted by the public authorities to encourage innovation and the exploitation of research results and the subsequent transfer of technology. This success also depends on the legal capacity put in place to emancipate universities to take on the risk. This means that, in Morocco, it will be necessary to develop a regional and national framework conducive to innovation and technology transfer.

The analysis and modelling of the so-called National Innovation System in Morocco (NIS) and all of the parameters that interact in complex ways to form the NIS will be examined in depth in subsequent studies.

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Estudio sobre el liderazgo y la innovación: las claves del éxito en *startups* tecnológicas

Study on leadership and innovation: clues for success in technology-related startups

Alberto Abadía*

Universitat Politècnica de Catalunya (UPC)

* ***Corresponding author***: *Departamento de Administración de Empresa, Universitat Politècnica de Catalunya (UPC). Avinguda Diagonal, 647, 08028, Barcelona (España) – alberto.abadia@upc.edu – https://orcid.org/0000-0003-2708-7321*

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RESUMEN

Este artículo describe la evaluación de distintas teorías, propuestas por el autor (Abadia 2016) o por reputados investigadores como Porter (1985), Christensen (1997) y Tellis (2006), sobre por qué las *startups* tienden a ser más exitosas desarrollando productos disruptivos y liderando nuevos mercados que las multinacionales ya establecidas. Con este fin, el autor completó (i) cuatro estudios estadísticos de distinto tipo (agregación de datos, segmentación, comparación en tiempo y regresión / correlación lineal) sobre bases de datos con información financiera de *startups* tecnológicas en Estados Unidos (EE. UU.) y España, y (ii) nueve estudios de casos de *startups* tecnológicas, localizadas en EE. UU., España, China y Japón, que finalmente se convirtieron en líderes mundiales en sus respectivos sectores. Los estudios demostraron que (1) el liderazgo visionario es una condición necesaria en el éxito disruptivo, (2) la innovación disruptiva o, cuanto menos, revolucionaria, es una condición necesaria para el éxito disruptivo, y (3) la ubicación en clústeres especializados también es, generalmente, una condición necesaria para el éxito disruptivo. Los emprendedores y ejecutivos deban buscar y explotar estos tres elementos competitivos en las etapas de introducción y crecimiento. Sin embargo, en el caso de la etapa de madurez, el énfasis debe orientarse hacia nuevos elementos que sean menos elitistas y volátiles.

Palabras Claves: Emprendimiento, innovación disruptiva, *startup* tecnológica, liderazgo visionario, clusterización, estrategia corporativa.

ABSTRACT

This article tests different theories, as proposed by the author (Abadia 2016) and by reputed researchers such as Porter (1985), Christensen (1997) and Tellis (2006), on why some technology-related startups are successful in fast-changing environments, while well-established firms are not. To this end, the author conducted (i) four different database statistical analyses – data aggregation, segmentation, time comparison, and linear regression/correlation – on the financial statements of a large sample population of technology-related startups, in two countries, the United States of America (USA) and Spain, and (ii) nine cases studies of particularly successful technology-related startups in four countries, the USA, Spain, China and Japan. The combination of the statistical and case studies concludes that (1) visionary leadership is a necessary condition for 'disruptive success', (2) disruptive or, at least, revolutionary innovation is a necessary condition for disruptive success, (3) location in specialized clusters is a critical factor in determining the rate and level of success of technology-related firms. On the other hand, the study concluded that entrepreneurs and executives should seek and exploit these three competitive elements in the stages of introduction and growth. However, in the case of the maturity stage, the emphasis should be directed towards other elements that are less elitist and volatile.

Keywords: Entrepreneurship; disruptive innovation; technology-related startup; visionary leadership; clustering; corporate strategy.

1. INTRODUCCIÓN

En la década de 1990, cuando la innovación tecnológica y su irrupción se convirtieron en un tema relevante para la investigación académica, Christensen y Bower (1995) y Christensen (1997) desarrollaron una teoría que se denominó la teoría de la innovación disruptiva. La teoría sostiene que, contrariamente a lo que se podría esperar, las innovaciones disruptivas son tecnológicamente sencillas, y consisten en módulos estándar que se usan en una arquitectura de producto o de servicio que es poco sofisticada. Esto explicaría por qué algunas *startups* tecnológicas, como por ejemplo Apple y Microsoft, pudieron desarrollar productos totalmente innovadores y únicos y a la vez adueñarse de mercados completamente nuevos cuando tenían en frente competidores ya exitosos como IBM y Xerox (Sen 1996). La misma teoría también sostiene que los productos que se derivan de la innovación disruptiva acaban fagocitando a los mercados ya existentes (ordenadores *versus* máquinas de escribir o tablas de diseño) y desplazando o eliminando a las corporaciones que eran líderes en esos mercados. Las pequeñas *startups* tienen ventaja en estos contextos porque (i) estos nuevos productos son inicialmente rudimentarios y las corporaciones de renombre no pueden permitirse el lujo de comercializar dispositivos intrínsecamente defectuosos, y (ii) los «early birds», los primeros en adoptar estos productos, son un segmento insignificante y no rentable y, por tanto, poco interesante para las grandes corporaciones.

Algunos investigadores cuestionaron la teoría de Christensen, arrojando dudas sobre la validez de sus definiciones y metodología (Danneels 2004; Lepore 2014; Thurston 2014). Aunque varios ejemplos descritos por Christensen (1997) parecen demostrar su teoría, sigue sin haber estudios que la avalen con precisión estadística, excepto, quizás, por el descrito en el artículo «Christensen Vs. Lepore: A Matter of Fact» (Thurston 2014). Del mismo modo, no hay estudios que hayan intentado cuantificar y medir el concepto de innovación disruptiva, en este caso, con la excepción de un trabajo de Govindarajan y Kopalle (2006).

En 2006, Tellis propuso una razón alternativa para explicar por qué algunas *startups* tecnológicas pueden ser más exitosas que multinacionales consolidadas: el liderazgo visionario. Para testar esta hipótesis, Tellis realizó un estudio estadístico, similar al del autor de este artículo, que examinaba los estados financieros de más de 700 empresas. Su estudio parecía demostrar la validez de su teoría, pero, al mismo tiempo, Tellis finalmente admitió que ésta no era incompatible con la de Christensen (Tellis 2006).

Con anterioridad, Porter (1985) desarrolló y publicitó una teoría según la cual la ubicación en clústeres especializados aumentaría notablemente las probabilidades de éxito en el caso de *startups* en ciertos sectores.

Sin embargo y hasta el presente, ningún autor o estudio había propuesto una teoría que unificara las tres anteriormente descritas y que afirmara que es, en realidad, la combinación necesaria de estos tres factores (innovación revolucionaria o disruptiva, liderazgo visionario y elección de una ubicación en clústeres especializados) lo que posibilita el éxito «disruptivo» de la mayoría de las *startups* tecnológicas que lo consiguen. El objetivo principal de los estudios conducidos por el autor es proporcionar evidencias de esta teoría de consolidación y desarrollar una serie de recomendaciones sobre cómo los emprendedores y gestores de estas *startups* debería modificar las estrategias corporativas y de negocio una vez alcanzaran la cima (y no correr la misma suerte que empresas como Kodak, American Online, Terra, Yahoo o Blackberry).

El trabajo realizado combina los estudios estadísticos con los casuísticos porque, mientras que sí es factible identificar un número razonablemente elevado de *startups* que parecen seguir el camino del éxito disruptivo adentradas ya en la etapa de crecimiento, sólo un número muy reducido de éstas finalmente lo alcanza. Los resultados obtenidos a través del estudio de múltiples casos pueden intuirse como menos sólidos que los obtenidos de estudios estadísticos, por parecer los primeros de naturaleza meramente cualitativa. Sin embargo, la primera metodología no sólo cuenta cada vez con más respaldo entre la comunidad científica, sino que permite, en muchos casos, indagar, identificar e incluso cuantificar las causas que llevan a unos resultados determinados con mayor precisión que la segunda (Gustafsson 2017; Ridder 2017). Como también cita Gustafsson (2017), la práctica del estudio casuístico es ya extensa a nivel de desarrollo de teorías de negocios, e incluye múltiples ejemplos en las áreas de organización de empresa y de estrategia corporativa.

2. METODOLOGÍA

2.1. Estudios Estadísticos

El estudio estadístico realizado por el autor del artículo consistió en análisis de agregación, segmentación, comparación de tiempo y regresión / correlación lineal de los estados financieros de las muestras durante un periodo de cinco años. Las partidas contables analizadas (2013 y 2017) de (empresas con más de cinco años de antigüedad per menos de diez) fueron: (1) ganancias antes de intereses e impuestos (EBIT), (2) ingresos totales, (3) activos totales, (4) activos intangibles, (5) coste promedio por empleado y (6) número de empleados. Los supuestos fueron que (i) el EBIT como porcentaje de los ingresos totales dividido por los activos intangibles como porcentaje de los activos totales es un buen indicador del retorno de la inversión en I + D / innovación, y (ii) el EBIT como un porcentaje de los ingresos totales dividido por el coste medio por empleado es un buen indicador del retorno de la inversión en base a la apuesta por la calidad del capital humano.

En el caso de España, la información se obtuvo de la base de datos SABI (Bureau Van Dijk 2019) y en el caso de los EE. UU., de la base de datos Mergent (FTSE Russel 2019). La base de datos SABI da acceso a los informes contables y financieros anuales de más de 2,5 millones de empresas en España, de las cuales 972.111 están actualmente activas (Bureau Van Dijk 2019). La base de datos Mergent da acceso a los informes contables y financieros anuales de más de 115.000 empresas en los EE. UU. (FTSE Russel 2019). Un total de 1.089 compañías de ambas bases de datos cumplieron con los criterios de ser (i) mayores de cinco años, pero menores de 11 años, y (ii) suficientemente exitosas al final de ese período como para ser consideradas, al

menos, pequeñas y medianas empresas (PYME) según la definición de la Comisión Europea (European Comission 2019)[1]. Finalmente, sólo se seleccionaron *startups* que pertenecieran a sectores y segmentos con altos índices de innovación durante el periodo estudiado y que no pertenecieran a conglomerados o fueran spinoffs. En el caso de España, 95 firmas cumplieron todos estos requisitos. En el caso de los Estados Unidos, la lista final se redujo a 52 firmas.

2.2. Estudios Casuísticos

Los casos seleccionados fueron firmas tecnológicas que (i) pertenecían al top 100 global por capitalización (Keeley *et al.* 2015) y (ii) se convirtieron en líderes de su sector en un período relativamente corto de tiempo – menos de veinte años. La lista final de empresas seleccionadas incluyó corporaciones radicadas en cuatro países distintos: España, Estados Unidos, China y Japón. Las empresas analizadas fueron Apple, Google, Microsoft, General Electric, Facebook, Toyota Motors, Alibaba, Tencent e Inditex; clasifican 1, 2, 5, 13, 17, 15, 22, 32, 67 en los 100 principales mundiales según el valor de mercado (Keeley *et al.* 2015). Se revisaron más de 250 fuentes bibliográficas relacionadas con estas nueve firmas, además de la evolución de sus estados financieros desde la publicación de éstos.

En primer lugar, se trató de determinar si la presencia de innovaciones revolucionarias o disruptivas había sido decisiva en el éxito de estas corporaciones. Luego se evaluó la medida en que los fundadores de estas empresas presentaban los rasgos que habitualmente se le atribuyen a los líderes visionarios. Para completar el estudio, se compararon los atributos de liderazgo de estos emprendedores y los descritos en el artículo «Characteristics of Visionary Leadership» (Patrick 2015). En ese artículo, los líderes visionarios se describen como (1) creadores de visiones positivas e inspiradoras, (2) partidarios del crecimiento personal y profesional dentro de la organización, (3) innovadores y (4) pioneros.

3. RESULTADOS

3.1. Resultados de los Estudios Estadísticos

Las *startups* tecnológicas españolas confrontan el «abismo» que se asocia al final de la etapa de introducción (Moore 1991) cuando han alcanzado entre los cinco y seis años de vida. La duración de la etapa de introducción es aproximadamente la misma que en el caso de *startups* estadounidenses: cinco años. La tasa de fracaso de las *startups* españolas durante dicho abismo fue del 22,76%. En el caso de España, el EBIT de las *startups* exitosas creció una media del 581,14% desde el inicio de la etapa inicial hasta el inicio de la etapa de crecimiento. En el caso de EE. UU., El EBIT de las *startups* exitosas creció un 80,64%. En el caso de las *startups* españolas, los activos totales crecieron un 425,89% entre 2013 y 2017, y, en el caso de las *startups* estadounidenses, un 119,48% entre 2013 y 2017. El valor de la inversión en activos intangibles disminuyó de 7,91% en 2013 a 7,17%, en 2017, en el caso español, y aumentó de 9,84% a 11,31%, en el caso estadounidense.

No se encontró correlación entre el EBIT como porcentaje de los ingresos totales y los activos intangibles como porcentaje de los activos totales (Coeficiente de Correlación de 0,0088). Sin embargo, las representaciones gráficas bidimensionales de la función entre las dos variables mostraban semejanzas con la campana gaussiana.

Esa forma particular podía implicar que, en lugar de la hipótesis de «cuanto más, mejor», el EBIT como porcentaje de los ingresos totales se correlacionaba con un porcentaje óptimo de los activos intangibles como porcentaje de los activos totales. Esta hipótesis finalmente se demostró aplicando la ecuación $z = N - \sqrt{(x-N)^2}$ a los activos intangibles, donde N se ajustaba manualmente, comenzando por el valor medio, |x|.

En este contexto, se determinó que existía una correlación moderada (0,3 ≤ Coeficiente de Correlación <0,5) entre el nivel de éxito (EBIT%) de las *startups* y un porcentaje óptimo de inversión en activos intangibles. En 2013, en los EE. UU., el porcentaje óptimo era del 11,30% y el promedio de la muestra de *startups* era del 10,22%. En el mismo año, en España, el porcentaje óptimo era del 8,50%, mientras que el promedio de la muestra era del 7,11%. En 2017 y en EE. UU., el porcentaje óptimo de inversión en activos intangibles en comparación con los activos totales era del 13,09%. En 2017, no se encontró una correlación relevante o valor óptimo para las *startups* españolas (Coeficiente de Correlación igual a 0,0210), pero sí se hizo para 2013 (Coeficiente de Correlación igual a 0,3146). Estos resultados implicarían que, en el caso español, la inversión en innovación es mucho más importante en la etapa de introducción. En general, la inversión de las *startups* españolas y estadounidenses en la creación de activos intangibles (I + D e innovación) fue de un 10%, un 40% inferior al nivel óptimo.

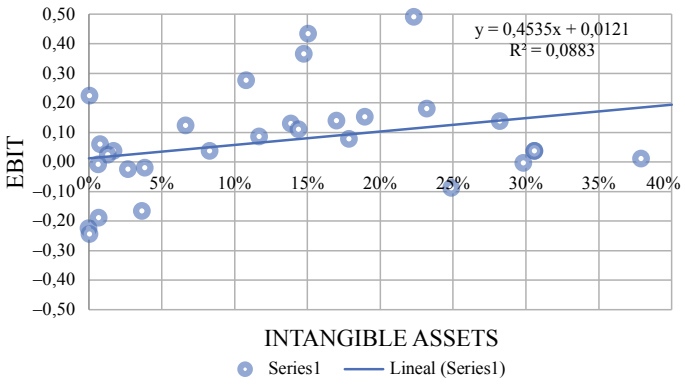

Gráfico 1
Curva de regresión del EBIT vs. Intangibles para *startups* americanas, 2017

Fuente: Elaboración propia a partir de los análisis estadísticos de las bases de datos estudiadas (2014-2019).

[1] La Comisión Europea define como PYME aquella empresa con menos de 250 trabajadores a tiempo completo (o equivalentes) pero más de 50 y que, además, cumpla alguno de los siguientes parámetros financieros: o bien una facturación anual de no menos de 10 millones de Euros, o bien unos activos totales de no menos de 10 millones de Euros.

Tabla 1
Estadísticas de regresión del EBIT vs. Intangibles para *startups* americanas, 2017

Estadísticas de la regresión	
Coeficiente de corr. múltiple	0,29721639
Coeficiente de determ. R2	0,08833758
R2 ajustado	0,05577821
Error típico	0,16843136
Observaciones	30

ANÁLISIS VARIANZA

	Grados de libertad	**Suma de cuadrados**	**Promedio cuadrados**	**F**	**Valor crítico de F**
Regresión	1	0,076968921	0,076968921	2,713123031	0,11070503
Residuos	28	0,794335446	0,028369123		
Total	29	0,871304367			

	Coeficientes	**Error típico**	**Estadístico t**	**Probabilidad**	**Inferior 95%**	**Superior 95%**
Intercepción	0,012094298	0,04738045	0,255259242	0,800388599	–0,084960154	0,109148749
Variable X	0,453516175	0,275332854	1,647156043	0,11070503	–0,11047761	1,01750996

Fuente: Elaboración propia a partir de los análisis estadísticos de las bases de datos estudiadas (2014-2019).

Tabla 2
Estadísticas de regresión del EBIT como porcentaje de ingresos *versus* la fórmula de normalización de intangibles como porcentaje de activos para *startups* americanas, 2013

Estadísticas de la regresión	
Coeficiente de corr. múltiple	0,446794532
Coeficiente de determ. R2	0,199625354
R2 ajustado	0,171040545
Error típico	0,428388119
Observaciones	30

ANÁLISIS VARIANZA

	Grados de libertad	**Suma de cuadrados**	**Promedio cuadrados**	**F**	**Valor crítico de F**
Regresión	1	1,281608096	1,281608096	6,983616897	0,01331592
Residuos	28	5,138458654	0,18351638		
Total	29	6,42006675			

	Coeficientes	**Error típico**	**Estadístico t**	**Probabilidad**	**Inferior 95%**	**Superior 95%**
Intercepción	–0,066839595	0,07883071	–0,847887773	0,40369052	–0,228316985	0,094637794
Variable X	3,608628292	1,365532202	2,642653382	0,01331592	0,811462377	6,405794207

Fuente: Elaboración propia a partir de los análisis estadísticos de las bases de datos estudiadas (2014-2019).

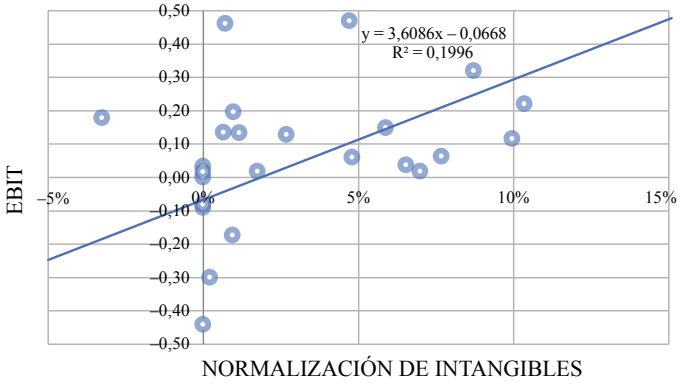

Gráfico 2
Curva de regresión del EBIT como porcentaje de ingresos *versus* la fórmula de normalización de intangibles como porcentaje de activos para *startups* americanas, 2013
Fuente: Elaboración propia a partir de los análisis estadísticos de las bases de datos estudiadas (2014-2019).

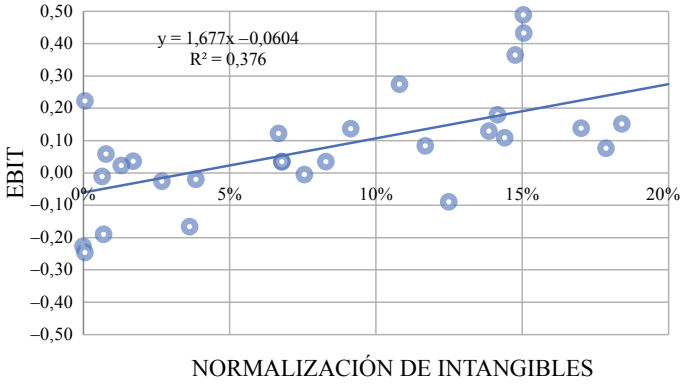

Gráfico 3
Curva de regresión del EBIT como porcentaje de ingresos *versus* la fórmula de normalización de intangibles como porcentaje de activos para *startups* americanas, 2017
Fuente: Elaboración propia a partir de los análisis estadísticos de las bases de datos estudiadas (2014-2019).

Tabla 3
Estadística de regresión del EBIT como porcentaje de ingresos *versus* la fórmula de normalización de intangibles como porcentaje de activos para *startups* americanas, 2017

Estadísticas de la regresión	
Coeficiente de corr. múltiple	0,613155669
Coeficiente de determ. R2	0,375959874
R2 ajustado	0,353672727
Error típico	0,139351673
Observaciones	30

ANÁLISIS VARIANZA

	Grados de libertad	**Suma de cuadrados**	**Promedio cuadrados**	**F**	**Valor crítico de F**
Regresión	1	0,32757548	0,32757548	16,86890961	0,000315048
Residuos	28	0,543728887	0,019418889		
Total	29	0,871304367			

	Coeficientes	**Error típico**	**Estadístico t**	**Probabilidad**	**Inferior 95%**	**Superior 95%**
Intercepción	–0,060449088	0,040974192	–1,475296659	0,151290067	–0,144380915	0,023482739
Variable X	1,676954168	0,408298409	4,107177815	0,000315048	0,840592791	2,513315545

Fuente: Elaboración propia a partir de los análisis estadísticos de las bases de datos estudiadas (2014-2019).

En el caso de España, no se determinó ninguna correlación relevante (Coeficiente de Correlación igual a 0,1236) entre el EBIT como porcentaje de los ingresos totales y el costo promedio por empleado en 2013, o sea, en la etapa de introducción, pero sí la hubo moderada (Coeficiente de Correlación igual a 0,4807) en 2017, llegada la etapa de crecimiento. Si el costo promedio por empleado es un buen indicador de la inversión en la calidad del capital humano, esta inversión sólo produce efectos tangibles una vez llegada la etapa de crecimiento.

Tabla 4
Estadística de regresión del EBIT como porcentaje de ingresos *versus* la fórmula de normalización de intangibles como porcentaje de activos para *startups* españolas, 2013

Estadísticas de la regresión	
Coeficiente de corr. múltiple	0,560866157
Coeficiente de determ. R2	0,314570847
R2 ajustado	0,294411166
Error típico	0,403521731
Observaciones	36

ANÁLISIS VARIANZA

	Grados de libertad	Suma de cuadrados	Promedio cuadrados	F	Valor crítico de F
Regresión	1	2,540789421	2,540789421	15,60395955	0,000373436
Residuos	34	5,536212784	0,162829788		
Total	35	8,077002205			

	Coeficientes	Error típico	Estadístico t	Probabilidad	Inferior 95%	Superior 95%
Intercepción	–0,069992586	0,067760569	–1,03293976	0,308923895	–0,207698629	0,067713458
Variable X	4,558307825	1,153948009	3,950184749	0,000373436	2,21320332	6,90341233

Fuente: Elaboración propia a partir de los análisis estadísticos de las bases de datos estudiadas (2014-2019).

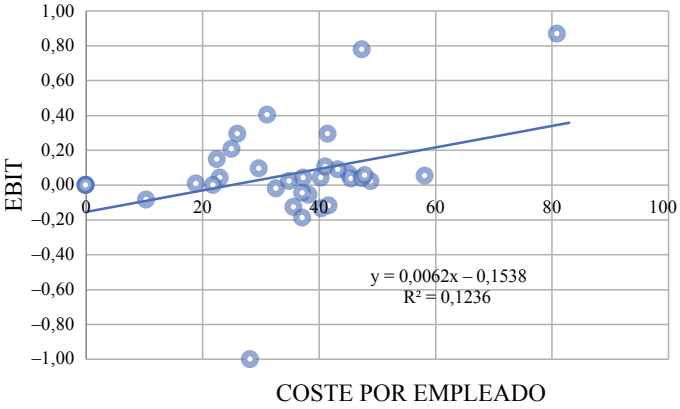

Gráfico 4
Curva de regresión del EBIT como porcentaje del coste medio por empleado para *startups* españolas, 2013
Fuente: Elaboración propia a partir de los análisis estadísticos de las bases de datos estudiadas (2014-2019).

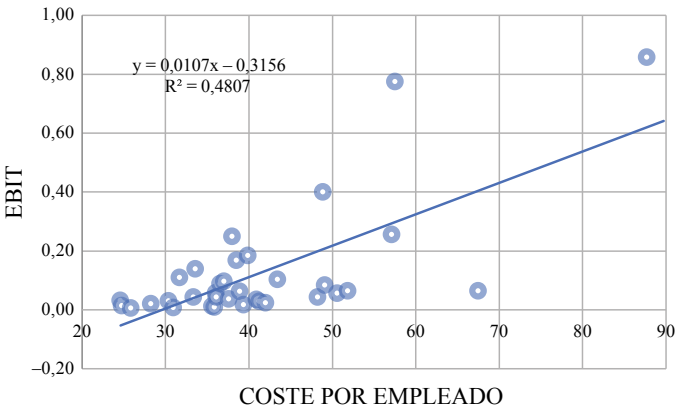

Gráfico 5
Curva de regresión del EBIT como porcentaje del coste medio por empleado para *startups* españolas, 2017
Fuente: Elaboración propia a partir de los análisis estadísticos de las bases de datos estudiadas (2014-2019).

Tabla 5
Estadísticas de regresión del EBIT como porcentaje del coste medio por empleado para *startups* españolas, 2013

Estadísticas de la regresión	
Coeficiente de corr. múltiple	0,351619091
Coeficiente de determ. R2	0,123635985
R2 ajustado	0,09624961
Error típico	0,276659111
Observaciones	36

ANÁLISIS VARIANZA

	Grados de libertad	**Suma de cuadrados**	**Promedio cuadrados**	**F**	**Valor crítico de F**
Regresión	1	0,34554156	0,34554156	4,514507065	0,041428005
Residuos	34	2,449288432	0,076540263		
Total	35	2,794829992			

	Coeficientes	**Error típico**	**Estadístico t**	**Probabilidad**	**Inferior 95%**	**Superior 95%**
Intercepción	–0,153768986	0,109931523	–1,398770637	0,171499666	–0,37769217	0,070154198
Variable X	0,006171878	0,002904773	2,12473694	0,041428005	0,000255049	0,012088706

Fuente: Elaboración propia a partir de los análisis estadísticos de las bases de datos estudiadas (2014-2019).

Tabla 6
Estadísticas de regresión del EBIT como porcentaje del coste medio por empleado para *startups* españolas, 2017

Estadísticas de la regresión	
Coeficiente de corr. múltiple	0,693340179
Coeficiente de determ. R2	0,480720603
R2 ajustado	0,464493122
Error típico	0,143002368
Observaciones	36

ANÁLISIS VARIANZA

	Grados de libertad	**Suma de cuadrados**	**Promedio cuadrados**	**F**	**Valor crítico de F**
Regresión	1	0,605798344	0,605798344	29,62385839	5,47708E-06
Residuos	34	0,654389673	0,020449677		
Total	35	1,260188017			

	Coeficientes	**Error típico**	**Estadístico t**	**Probabilidad**	**Inferior 95%**	**Superior 95%**
Intercepción	–0,315587568	0,084342259	–3,741749071	0,00071922	–0,487387127	–0,143788009
Variable X	0,010665359	0,001959542	5,442780391	5,47708E-06	0,006673902	0,014656816

Fuente: Elaboración propia a partir de los análisis estadísticos de las bases de datos estudiadas (2014-2019).

Bajo el supuesto de una correlación entre el costo promedio por empleado y el valor otorgado a la calidad del capital humano:

— Las *startups* tecnológicas españolas que siguen sin ser rentables después de la etapa de introducción son aquéllas que invirtieron menos en la calidad del capital humano.
— Las *startups* tecnológicas españolas que ya son rentables después de la etapa de introducción son aquéllas que invirtieron más en la calidad del capital humano.
— Las *startups* tecnológicas españolas con mejores resultados son aquéllas que más invirtieron en la calidad de capital humano.

La prueba para *startups* tecnológicas de EE.UU. no se pudo realizar porque la base de datos Mergent no proporciona información detallada sobre los costos laborales.

En términos de agrupamiento en clúster o zonas geográficas particulares, las siete *startups* tecnológicas más grandes en la base de datos española se encontraban situadas en Madrid o Cataluña. Quince de las 16 grandes empresas, o el 93,75%, estaban ubicadas en estas mismas dos regiones. El nivel de concentración de *startups* tecnológicas en los Estados Unidos es más bajo que el caso de las españolas. Sin embargo, la concentración es aún significativa. California alberga el 20% de las *startups* tecnológicas. El 10% de los estados (cinco de 50) alberga el 55% de las *startups* tecnológicas, mientras que el 58% de los estados no aloja a ninguna.

3.2. Resultado de los Estudios Casuísticos

La innovación disruptiva sólo estaba presente en cuatro de los nueve casos analizados: Apple, Microsoft, General Electric y Facebook. Otros tres en la lista de casos estudiados aprovecharon indirectamente algunas innovaciones disruptivas: Google, Alibaba y Tencent. Eventualmente, alguna forma de innovación ya sea disruptiva o revolucionaria estuvo presente en los nueve casos.

El liderazgo visionario se confirmó como un elemento presente en al menos ocho de los nueve casos estudiados. Estos números confirmarían que la innovación disruptiva o revolucionaria, y el liderazgo visionario son condiciones necesarias para el éxito «disruptivo». Además, un momento y ubicación determinados, por ejemplo, Silicon Valley desde los años 90, es un elemento presente en siete de los nueve casos, lo que confirmaría también su relevancia.

4. LECCIONES APRENDIDAS (A CONSIDERAR POR EMPRENDEDORES Y EJECUTIVOS): LA NECESIDAD DE UN CAMBIO ESTRATÉGICO UNA VEZ ALCANZADA LA ETAPA DE MADUREZ

El estudio casuístico también permitió comparar la diferencia entre las nueve empresas analizadas y un número considerable de competidores que llegaron a la cima, pero cayeron con la misma rapidez que la alcanzaron. El análisis de las diferencias y cambios estratégicos entre etapas en las empresas y el mismo análisis en sus competidores permite sugerir algunos ajustes estratégicos recomendables una vez alcanzada la etapa de madurez:

— La innovación en la que deberían invertir las empresas tecnológicas que alcanzan la etapa de madurez no sería más de tipo disruptivo o revolucionario, sino de tipo evolutivo o incremental. Este tipo de innovación se desarrolla en el contexto de trabajo en equipo (y no se basa en la genialidad individual). No produce «picos» extraordinarios de éxito, sino que da como resultado logros más menudos, pero más frecuentes, un modelo que es más adecuado para un crecimiento sostenido. Una estrategia en esta dirección es, por ejemplo, la de actualizar periódicamente productos con nuevas versiones, como Apple realiza con los iPhones y iPads o Microsoft con Windows. La razón probable por la que General Electric es la única compañía que se ha mantenido en la cima por más de cien años es porque ha combinado, desde el principio, la visión de su líder, Thomas Alba Edison, con una sucesión de innovaciones disruptivas (el fonógrafo, el primer dispositivo de luz incandescente, la primera cámara de imágenes en movimiento y la batería de almacenamiento alcalina (Rutgers 2012) que se generaban dentro de un modelo de innovación en equipo (el famoso Laboratorio Menlo Park). Las innovaciones disruptivas dejaron finalmente de producirse, pero el modelo aún funcionó en el contexto de las incrementales.
— La figura del líder visionario parece imposible de sustituir cuando éste desaparece.
— Parece que las empresas tecnológicas de éxito que alcanzaron ya la etapa de madurez, pero siguieron creciendo, lo hicieron a través de la diversificación. Muchas de ellas todavía pudieron incluso entrar en nuevos mercados surgidos de la innovación disruptiva o revolucionaria, pero solamente a través de spin-off, acuerdos y alianzas, joint ventures, y adquisiciones. Por ejemplo, Facebook adquirió Instagram por 1 mil millones de dólares (2012), Face.com por 100 millones de dólares (2012), Atlas Advertiser Suite por 100 millones de dólares (2013), WhatsApp por 19 mil millones de dólares (2014), Oculus VR por 2 mil millones de dólares (2014), Ascenta por 2 mil millones de dólares, (2014), así como muchas otras *startups* de menor valor. En las últimas dos décadas, Microsoft ha realizado ocho adquisiciones por un valor de más de 1.000 millones de dólares: Skype (2011), aQuantive (2007), Fast Search & Transfer (2008), Navision (2002), Visio Corporation (2000), Yammer (2012), Nokia (2013) y Mojang (2014). (Hayes 2016)

Los estudios casuísticos llevan por tanto a concluir que las empresas tecnológicas que estén cercanas a alcanzar la etapa de madurez debe evolucionar hacia (1) un modelo que sea menos dependiente de (a) liderazgo visionario y (b) innovación disruptiva o revolucionaria, (2) la estructura corporativa debe evolucionar hacia una que se adapte mejor a los productos y mercados maduros, enfocándola, por ejemplo, más a la mejora de producto que al desarrollo de productos disruptivos; (3) I +D debe evolucionar hacia un modelo que priorice innovaciones menos dramáticas pero que produzca resultados con mayor frecuencia. A nivel de estrategia corporativa: (1)

el portafolio de productos y segmentos debe ir adquiriendo amplitud y (2) se debe facilitar la creación o desarrollo de (a) spinoffs, (b) acuerdos y alianzas con otras corporaciones, (c) joint ventures y (d) adquisiciones.

5. CONCLUSIONES

Los estudios estadísticos realizados por el autor demuestran que (1) la inversión en I + D / innovación, (2) la inversión en la calidad del capital humano y (3) la ubicación en clústeres especializados son factores que influyen determinantemente en la tasa y el nivel de éxito de las *startups* tecnológicas durante las etapas de introducción y crecimiento. Los estudios casuísticos realizados demuestran que (1) el liderazgo visionario es una condición necesaria para el éxito disruptivo, (2) una combinación de innovación revolucionaria y disruptiva es una condición necesaria para el éxito disruptivo, y (3) una gran mayoría se sitúan en clústeres específicos (como por ejemplo Silicon Valley en San Francisco, EE. UU.).

De los estudios casuísticos se deprende que las empresas tecnológicas que estén cercanas a alcanzar la etapa de madurez deben evolucionar hacia (1) un modelo que sea menos dependiente de (a) liderazgo visionario y (b) innovación disruptiva o revolucionaria; (2) la estructura corporativa debe evolucionar hacia una que se adapte mejor a los productos y mercados maduros, enfocándola, por ejemplo, más a la mejora de producto que al desarrollo de productos disruptivos; (3) I + D debe evolucionar hacia un modelo que priorice innovaciones menos dramáticas pero que produzca resultados con mayor frecuencia. A nivel de estrategia corporativa: (1) el portafolio de productos y segmentos debe ir adquiriendo amplitud y (2) se debe facilitar la creación o desarrollo de (a) spinoffs, (b) acuerdos y alianzas con otras corporaciones, (c) joint ventures y (d) adquisiciones.

En general, los emprendedores y ejecutivos deben considerar que las innovaciones discontinuas de alto impacto, el liderazgo visionario y una ubicación precisa que favorezca el florecimiento de *startups* tecnológicas son elementos únicos para un contexto único, por lo que no se pueden planear o esperar que se puedan repetir reiteradamente (ni nace cada día un Steve Jobs ni surge cada año una industria como la informática). Sería recomendable que los gerentes de empresas tecnológicas tengan en cuenta que, una vez alcanzado el éxito, el camino que los llevó a la cima no será el mismo que los mantendrá en ese lugar. Las *startups* tecnológicas que no anticipen la necesidad de un cambio estratégico tan considerable con suficiente tiempo de antelación pueden experimentar una caída tan espectacular como fue el camino a la cima.

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Competitive dynamics of strategic groups in the Portuguese banking industry

Dinámica competitiva de los grupos estratégicos en la industria bancaria portuguesa

Albérico Travassos Rosário[a], António Carrizo Moreira*, Pedro Macedo[b]

[a] *PhD Marketing and Strategy, University of Aveiro. Research Unit on Governance, Competitiveness and Public Policies (GOVCOPP). University of Aveiro. – alberico@ua.pt – http://orcid.org/0000-0003-4793-4110*

[b] *MSc Economics, University of Porto. PhD Mathematics, University of Aveiro. CIDMA - Center for Research and Development in Mathematics and Applications, Department of Mathematics, University of Aveiro. – pmacedo@ua.pt – http://orcid.org/0000-0002-4371-8069*

* ***Corresponding author***: *Master in Management, University of Porto. PhD Management, University of Manchester. Department of Economics, Management, Industrial Engineering, and Tourism. GOVCOPP. University of Aveiro. – amoreira@ua.pt – http://orcid.org/0000-0002-6613-8796*

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ABSTRACT

The objective of this paper is to analyse the retail banking behaviour in Portugal (2008–2010, 2011–2013 and 2014–2016), by taking into account the financial and economic assistance programme (FEAP) – monitored by the European Commission, the European Central Bank and the International Monetary Fund – that Portugal went through and that started in 2011. With competitive dynamics it is possible to understand the evolution of competitive strategies of the institutions of a strategic group within a given time horizon. Data were collected after consultation of reports and accounts of Banks from Banco de Portugal database. The results were analysed and discussed in light of the theory of strategic groups and their competitive dynamics allows us to conclude that: Banks implemented different competitive strategies; Strategic groups have dissimilar resources; and Strategic groups display different strategies. The 2008–2010 period can be considered as a 'deregulated' period, the 2011–2013 as a period of 'imposed regulation', and the 2014–2016 as a period of 'strategic consolidation' with strategic changes that have prompted strategic groupings of the various institutions as consequence of a low mobility barrier strategy.

Keywords: Strategic Groups; Competitive Dynamics; Strategy; Banking Industry; Portugal

RESUMEN

El objetivo de este artículo es analizar el comportamiento del sector bancario minorista en Portugal (2008-2010, 2011-2013 y 2014-2016), teniendo en cuenta el programa de asistencia económica y financiera (FEAP) —monitoreado por la Comisión Europea, el Banco Central Europeo y el fondo Monetario Internacional— que Portugal atravesó y que empezó en el 2011. La dinámica competitiva permite comprender la evolución de las estrategias competitivas de las instituciones de un grupo estratégico dentro de un determinado horizonte temporal. La recolección de datos se realizó a través de la consulta de los informes y datos contables de los años analizados. Los resultados analizados y discutidos a la luz de la teoría de los grupos estratégicos y de la dinámica competitiva nos permiten concluir que: las instituciones bancarias tienen diferentes estrategias competitivas; los grupos estratégicos no tienen recursos similares; y las estrategias difieren entre los grupos estratégicos. El período 2008-2010 puede considerarse como un período 'desregulado', el 2011-2013 como un período de 'regulación impuesta' y el 2014-2016 como un período de 'consolidación estratégica' con cambios estratégicos que han dado lugar a agrupaciones estratégicas de las diversas instituciones como consecuencia de una estrategia de barrera de baja movilidad.

Palabras clave: Grupos Estratégicos; Dinámica Competitiva; Estrategia; Sector Bancario; Portugal

1. INTRODUCTION

The study of strategic groups (SGs) is not something new, being at the core of strategic management (Hervás *et al.* 2006; Chen and Miller 2012, Bonetti and Schiavone 2014). It involves the study of how a small group of rival companies engage in rivalry against other groups of rival companies, shaping the structure of rivalry within an industry (Porter 1980; Cattani *et al.* 2017). As such, one can argue that SGs follow similar strategies despite their different motivations and results (Chen and Miller 2012; Gur and Greckhamer 2018).

Research on SGs analyses both intra- and inter-SGs relationships and rivalry between companies and groups (e.g., Leask and Parker 2007; Ebbes *et al.* 2010; Pätäri *et al.* 2011; Bonetti and Schiavone 2014; Anwar and Hasnu 2016), which may lead to the study of competitive dynamics and how performance and stability differ among SGs over time (e.g., Más-Ruiz and Sala 1992; Reger and Huff 1993; Martins *et al.* 2010).

The concept of SGs implies that corporate strategies result in a certain degree of homogeneity among the companies within a SG and heterogeneity between SGs. Evidence of homogeneity within the SGs and heterogeneity between SGs over a given time period leads to strategic stability periods in the industry during such period. This strategic stability entails the existence of entry barriers for companies to enter a given SG, and of mobility barriers for companies to swap among SGs (Zúñiga-Vicente *et al.* 2004a; Garcés-Cano 2007; Garcés-Cano and Duque-Oliva 2008; Rebière and Mavoori 2019).

Evidence of high mobility barriers, isolation mechanisms and other type of asymmetries are characteristics of oligopolistic sectoral structures (Garcés-Cano and Duque-Oliva 2008), and Garcés-Cano (2007) claim that the reasons that lead organisations to compete intensely in the short term within SGs are the same that lead them to seek for long-term strategic stability in their SGs. This is clearly shaped by the size and scale of the activities of organisations within the industry they compete, i. e. their real competitive strength is determined by its degree of monopoly or market power. This is an aspect of relevance, especially in the light of the banking system.

The study of the competitive dynamics of SGs may provide clarification on the positioning of a company and of its competitors, thereby increasing their anticipation ability, by foreseeing the strategic actions and reactions of companies within a SG. This has been done in several contexts, such as the bioenergy industry, in which Pätäri *et al.* (2011) compare actors in the bioenergy, in the leisure industry, in which Li and Srinivasan (2019) demonstrate that the sharing economy platforms have strongly influenced traditional industries, and traditional industries, in which Escobar and Vredenburg (2011) analyse the sustainable development pressures multinational companies felt in their strategic responses to social investment and climate change.

The banking industry has also been analysed. For example, Más-Ruiz (1999) analysed how the number of players, composition and strategy of SGs changed over time. Zúñiga-Vicente *et al.* (2004a) analysed the strategic stability of the SGs during periods of huge environmental disturbances. The asymmetry f rivalry within and between SGs has been addressed by Más-Ruiz *et al.* (2014), who claim that dominant positions tolerated. Some studies on SGs and competitive dynamics in the banking industry are analysed in Table 1, although there are more (e.g., Maudos and Pastor 2003; Zúñiga-Vicente *et al.* 2004a; Zúñiga-Vicente *et al.* 2004b; Garcés-Cano 2007; Lozano-Vivas and Pastor 2010).

It is known that the Portuguese banking system went through an unprecedented economic/financial crisis, which led to the implementation of a recapitalisation programme – known as the Financial and Economic Assistance Programme (FEAP) – monitored by the European Commission, the European Central Bank and the International Monetary Fund. The FEAP started in 2011 and ended in 2014. However, although prior research has recognised the importance and reaction of companies to different contextual shocks in the banking industry, there is no study on how the banking industry was affected by an external intervention programme – which is a very specific environmental shock – in a period of crisis, on the response behaviour of the players over time. As such, taking into account the SGs can be identified in the banking industry and their structure over time was supposed to be stable over time, this paper seeks to answer the following two research questions (RQs), based on the context of external intervention of FEAP that is supposed to have affected the Portuguese banking industry: RQ_1 – What are the main strategic groups that emerged over time?; RQ_2 – How was competitive dynamics in the banking industry affected as a result of the FEAP?

As such, the main objective of this article is to analyse the competitive dynamics of SGs as a result of the external recapitalisation programme via the FEAP. To this end, the competitive dynamics of SGs in Portugal's banking sector in the 2008–2010, 2011-2013 and 2014-2016 periods was analysed, and so the following specific objectives have been formulated: (i) identifying whether there are differences in the composition of SGs in the periods under analysis; (ii) identifying whether there are differences in the competitive dynamics between SGs in the periods under analysis; (iii) identifying which changes occur regarding the actors that make up the SGs; and (iv) identifying whether there are differences in the results in SGs.

Given the relevance of the banking industry, in general, and of the banking industry in the context of a small country as Portugal, in particular, this study is of added value for two main reasons: a) the lack of previous studies on how pervasive a FEAP programme can be for the competitive dynamics in the banking industry; and b) it compares the banking industry in three different periods of time: before, during and after the external intervention via the FEAP. For the Portuguese context this is a novel study in the banking industry. Based on the scarcity of studies addressing external intervention programmes, we aim to contribute to the understanding of the strategic behaviour among SGs and competitive dynamics of the banking industry.

This paper is structured as follows: after this introduction, section 2 presents the literature review on competitive dynam-

ics and strategic groups; section 3 characterises the Portuguese banking system; section 4 provides information about the methods used; section 5 presents the main results; and section 6 briefly presents the main conclusions.

2. COMPETITIVE DYNAMICS OF STRATEGIC GROUPS

Companies are in constant interaction with their competitors, committed to defend their market positions and to conquer market share (Smith *et al.* 2001). Those interactions cause a set of actions and reactions, fostering competitive behaviour leading competitors to react to achieve a competitive positioning (Chen *et al.* 1992; Yu and Cannella 2007; Chen and Miller 2014; Meilich 2019). As a result of such competitive interactions, companies actively fight for a competitive advantage, seeking profitability or market shares (Chen and Hambrick 1995; Ferrier 2001; Cattani *et al.* 2017). Understanding these mechanisms is a key factor to understand the market and competitors (Smith *et al.* 2001; Ketchen *et al.* 2004; Gur and Greckhamer 2018; Rebière and Mavoori 2019), since companies foster competitive advantages that can be translated into long-term sustainability of the adopted corporate strategy.

Hunt (1972) defends that an industry can be grouped in several SGs, arguing that they could be composed of companies following similar strategies. Therefore, SGs are useful to study the competition within an industry (Porter 1980).

Although the study of SGs has been known since the mid-1980s, the focus was on the causes and consequences of rivalry among companies, whose approach became known as *competitive dynamics*. In this context, several studies have been developed (e.g., Mascarenhas 1989; Chen and Miller 2012; Chen *et al.* 2017) seeking to analyse the competitive dynamics of SGs and to explain how they are established, based on a strategic orientation.

If some analyse the study of the SGs' internal structure (e.g., McNamara *et al.* 2003), others analyse the role of the SG in the strategic orientation in the decision-making in the company's competitive behaviour (e.g., Chen and Miller 2012, 2014) and in the competitive dynamics behaviour of the SG within a given time period (e.g., Mascarenhas 1989; Lee *et al.* 2002; DeSarbo *et al.* 2009). Another perspective analyses the profitability of companies among SGs by taking into account the barriers to mobility (Prior and Surroca 2006).

Research on SGs shows that companies react differently to the actions of their rivals, whether such actions are undertaken by companies in the same SG or in another SG (e.g., Leask and Parker 2007; Dhandapani *et al.* 2019). Moreover, not all members of a SG have similar returns, as there may be some differences in their profiles and risk levels (Garcés-Cano and Duque-Oliva 2008). Table 1 identifies the main studies on the dynamics of SGs in the banking industry. This focus emerges from the research on understanding the changes in the strategy of the SG and/or the number of SGs over time (Mascarenhas 1989). Although theory claims that the evolution of SGs is relatively stable over time, companies within a SG may show different evolutionary strategic paths over time (DeSarbo *et al.* 2009; Chen and Miller 2014).

During a deregulated period, the behaviour of the companies within and between SGs is asymmetrical. Dominant SGs expect strong retaliation from companies in their own group, but with great strategic propensity to minimise responses from companies within a smaller SG (Más-Ruiz *et al.* 2014). In this context, the size of the SGs is a determinant factor in complex industries undergoing changes. As such, managers need to analyse the environment from the point of view of each competing strategic group (Más-Ruiz *et al.* 2005). Conversely, companies in a given SG can anticipate intra group rivalry and such competitive behaviours are detected by companies from other SGs (Más-Ruiz and Moreno 2011).

It is important to understand the strategic changes implemented by each company within each SG to properly understand the behavior of the industry (Garcés-Cano and Duque-Oliva 2008). Thus, competitive dynamics reflects the constant and continuous competitive actions and reactions among companies over time (Chen and MacMillan 1992; Chen and Miller 2012; Brito and Brito 2014). Research on competitive dynamics has been studying the behaviour across competing companies by analysing companies' competitive movements. Studies have taken up the idea that rivalry among companies (e.g., Mehra 1996; Más-Ruiz *et al.* 2005, 2014; Más-Ruiz and Moreno 2011) has an impact on the competitive dynamics among companies (Chen and MacMillan 1992; Ferrier 2001).

Competitive dynamics is the result of a set of competitive actions and reactions among companies struggling for the same market position (Chatterjee and Samuelson 2001; Smith *et al.* 2001; Zucchini *et al.* 2019). In competitive dynamics, the efficiency and effectiveness of a business strategy is determined by the company's competitive position in the industry and by anticipating competitors' actions and movements (Wiersema and Bowen 2008; Kalnins and Chung 2004) that occur in SGs. Evidently, companies in a given industrial sector are at the heart of competitive dynamics (Mehra 1996; Más-Ruiz *et al.* 2005, 2014; Más-Ruiz and Moreno 2011), in which competitive advantages are key for value creation (McNamara *et al.* 2003). The competitive environment takes on a key role in the competitive movements among companies. Such idea considers the existence of environmental disturbances, corporate changes and direct influences on competitive actions (McGrath *et al.* 1998; Chen and Miller 2012). It is worth to consider two consequences on the effect of corporate behaviour. Once a disturbance occurs in the market, there is a direct effect on the decision-making of competitive measures, and companies are confronted with both a range of new opportunities and the need to seek a way to anticipate competitors, seeking to gain a market advantage (McGrath *et al.* 1998). The second implication, which affects the companies' governance mechanisms and competitive choices (Lieberman and Asaba 2006), leads to question the effectiveness of the decisions of past actions. In addition, market shocks may weaken companies' market positioning by creating competitive tension in decision-making (Chen and Miller 2014).

Table 1
Overview of the dynamics of SGs in the banking industry

Researchers	Analysis periods	Data analysis	Main findings/dynamics
Más-Ruiz (1999)	Spain, 1984–1991, 24 banks in 1984 and 22 banks in 1991, four sub-periods (1984; 1985–1986; 1987–1988; 1989–1991).	(i) stable periods identified by the homogeneity of the average vector and covariance; (ii) analysis of clusters to identify SGs; and (iii) ANOVA to explain the intergroup differences.	The composition and strategy of SGs change over time.
Zúñiga-Vicente *et al.* (2004a)	Spain, 1983–1997, 92–103 banks.	(i) Box's M test and Hotelling's T2 test to check the homogeneity of covariances and the averages of structures; and (ii) analysis of clusters to identify SGs.	Strategic stability exists at a SG level and at a company level, punctuated by a high degree of strategic instability during large environmental disturbances.
Zúñiga-Vicente *et al.* (2004b)	Spain, private banks, 1983–1997, 136 banks.		Performance differences between SGs are stable over time.
Más-Ruiz *et al.* (2005)	Spain, 1994	(i) Large (deposits>2 billion pesetas); medium (415 billion pesetas≤deposits≤2 billion pesetas); small (deposits < 415,000 million pesetas); (ii) Lerner index (describes the relationship between elasticity and the price margin for a profit-maximising company) of the bank in the loan market.	Rivalry between patterns of SGs.
Más-Ruiz and Moreno (2011)	Spain, 1992–1998		Low levels of competitive intensity and high levels of performance in companies within SGs of large companies (market power, efficiency, differentiation and multimarket contact).
Más-Ruiz *et al.* (2014)	Spain, 1992, 1994		Rivalry within and between groups is asymmetrical, supporting the dominant relationship between companies.
Garcés-Cano and Duque-Oliva (2008)	Colombia, 1995, 2004	Strategic positioning approach; the groups are formed from multivariate statistics (cluster) using ANOVA and MANOVA.	The structure is stable over time and shows signs of high mobility barriers, isolation mechanisms and asymmetries, which is a particular reality in current oligopolistic markets. An industry is more than the sum of SGs: it is a synergistic combination of them, whose average indicators only partially explain the behavior of the industrial sector.
DeSarbo and Grewal (2008)	United States (New Jersey, New York and Pennsylvania). COMPUSTAT Banks Database for 2001; 131 banks.	(i) liquidity and leverage indexes; (ii) loan products portfolio; and (iii) deposit products portfolio; (iv) debt to capital; (v) total loans to total assets; and (vi) interest expenses to total assets as indicators of the leverage ratio.	Competition among companies depends on the SG and on the overlap of such SG with other SGs, thereby combining strategic revenues of more than one group.
DeSarbo *et al.* (2009)	United States (New York, Ohio and Pennsylvania) 1995, 1999, 2003	(i) number of SGs; (ii) sizes of SGs; and (iii) development of the strategy of such SGs over time.	There are different evolutionary paths over time. *There are* pronounced differences in the company's performance across all five SGs.

Note: studies (a) not pertaining to the banking industry; (b) not using data analytical techniques to derive SGs over time; (c) relying on the researcher's judgement; (d) relying on an a priori classification; (e) with dynamic data, but that do not study SG dynamics have been excluded.

Source: Own elaboration.

3. CHARACTERISATION OF THE PORTUGUESE BANKING SYSTEM

The Portuguese banking system went through very important structural changes during the last 40 years (Bento 1998; Mendes and Rebelo 2003). In the aftermath of the revolutionary period all Portuguese privately owned banks were nationalised in 1975. In the mid-1980s a period of profound economic liberalisation took place as the banking industry was reopened to the private initiative and in the second half of the 1980s re-privatisation of formerly nationalized banks took-off. In the 1990s bank credit ceilings were abolished (Mendes and Rebelo 2003). After 1993, as part of the European Union (at that time EEC), the European single market for financial services enabled the banking industry to evolve from to a fully government-controlled system to a market-driven environment (Mendes and Rebelo 2003).

This perspective is complemented by Silva (2009), who characterised the Portuguese banking system based on the analysis of the five largest groups (CGD, BCP, BPI, BES and BPSM/BST). Silva (2009) found that between 1992 and 2007: the ratio employee/branch declined 55%; the credit per employee increased 7.5 times; the deposit per employee increased 3 times; and that the concentration in the banking industry increased.

Silva (2009) claims that the Portuguese banking industry is in the hands of large Portuguese financial groups, which opted to homogenise their product/service portfolio and to reduce the number of brands.

In the 2000s left-wing governments started to intervene in the banking system and in the early 2010s Portugal went through a severe economic/financial crisis that lead to the external intervention via FAEP, which led to a deep restructuring of the Portuguese banking industry (Rosário 2018; Rosário *et al*. 2019).

Research analysing the Portuguese banking system is not abundant. Moreira and Mota (2002) analysed the concentration/segmentation challenge of the BCP/Atlântico, as a result of a merger and acquisition strategy. The evolutionary perspective of the banking system in Portugal is addressed by Canhoto and Dermine (2003) who claim that the join effect of deregulation and the granting of new banking licenses led to an increase on operational efficiency never experienced before. After a heavily regulated period after the nationalisation of all Portuguese private-owned banks, Mendes and Rebelo (2003) claim that in the 1990s competition, in a period of profound economic liberalisation, was important to diminish market power.

According to Alcarva (2011), this competition led to the secundarisation of risk and profitability in order to enable rapid growth. This was a deliberate strategy not only to gain market share, but also to avoid being an easy target of hostile takeovers from Spanish banks. The main drawback of this strategy was to increase debt so that the credit/risk assumed did not pay the expected dividends. This led most of the banks to a shortage of cash-flow and over indebtedness.

Costa (1998) analysed the 1988-1997 period and found that there are five clusters (universal banks; specialised banks; foreign banks; investment banks; international focus (credit+deposits)) in which banks follow different evolutionary paths.

Silva (2013) analysed the banking system in Portugal before and after the subprime effect and concluded that the most representative banks in Portugal complied with the stress tests, namely the required capital ratios and liquidity levels. The number of banks in Portugal has been diminishing over time (Rosário 2018; Rosário *et al*. 2019): there were 20 banks in 2008; 18 in 2010; and 15 in 2013.

The Portuguese banking system is very similar to the Eurozone system, although more concentrated vis-à-vis the Spanish banking system (Alcarva 2011). The Portuguese banking system is highly concentrated, as the largest banks (CGD, BCP, BES, Santander Totta and BPI) owned around 70% of the assets in 2010. In Spain, e.g., the largest five institutions have around 40% of the assets (Alcarva 2011).

The study of strategic groups and competitive dynamics in the Portuguese banking is scarce (Rosário 2018; Rosário *et al*. 2019). The analysis of the 2008–2010 period found that among 18 retail banks in Portugal, there were four main SGs (Rosário *et al*. 2019): 'universal', 'traditional', specialised' and 'undefined' banks. These strategic groups are going to be the bedrock of this paper.

In 2011, the Portuguese banking industry went through several legal changes (e.g., Ordinance no. 121/2011) governing the sector, through a mandatory Tier 1 Core ratio of 8% from the 31st of December 2011, as a result of the FEAP. On the other hand, Espírito Santo Financial Group (ESFG) and the French group Crédit Agrícole, on May 15, 2014, dissolved BESPAR holding company, through which Banco Espírito Santo (BES) was controlled, witnessing a three-level cut in its long-term debt rating and a two-level cut in its long-term bank deposits rating, due to concerns about credit capacity, with a loss of 3,577 million euros, culminating in the bank's resolution in 2014.

Based on the characterisation of the retail banking industry, and taking into account that: (a) corporate strategy seeks to adjust internal competences and resources to the external context; (b) the FEAP constituted an 'external disturbance' as it led to the introduction of several legal changes, as referred above; and (c) changes in the number of SGs is the result of strategic actions posed by banks trying to adapt their strategies, in which some of them will be capable of staying in the same SG, while others should be forced to change to another SG (Mascarenhas 1989; Fiegenbaum and Thomas 1993; Más-Ruiz 1999), it is possible to draw the next hypothesis:

Hypothesis H_1: *Strategic groups in Portuguese retail banking industry show temporary changes over time.*

According to Fiegenbaum and Thomas (1993) and Más-Ruiz (1999), it is expected that individual banks with the same strategic characteristics follow homogeneous behaviour of the SG, and swap to another SG whenever they try to change their corporate strategies. As a result of the external disturbance posed by the FEAP, it is expected the individual banks are differently prepared for the external shock and therefore be willing to follow the strategy of another strategic group. As such, it is expected that the composition of the SGs is influenced by the conditions in which the banks muddle through over time. Therefore, the following hypothesis is posed:

Hypothesis H_2: *The composition of strategic groups in Portuguese retail banking industry differs during the three periods analysed.*

As strategy is a continuous process over time that depends on the continuity of the fit between the internal competences with the external context, based on what was posed on the two previous hypotheses, and the disruptive change retail banks were exposed to – see for example the resolution of BES – it will also be hypothesised that it is not expected that all SGs maintain their strategic direction. As such, the third hypothesis is as follows:

Hypothesis H_3: *The external recapitalisation programme via the FEAP affected the Portuguese retail banking industry competitive dynamics.*

4. METHODOLOGICAL APPROACH

According to the objectives identified in the Introduction section, this paper analyses the reality of the Portuguese retail banking sector for three distinct periods, 2008-2010, 2011-2013 and 2014-2016, which were determined following the intervention of the FEAP financial assistance programme. The Portuguese retail banking system underwent drastic changes, altering the competitive environment with enormous changes, reflecting the profound reforms that occurred in the sector, culminating in the resolution of BES in 2014, the leading Portuguese private bank. We can characterize the periods under analysis before the crisis, during and after the crisis. In this context, the Portuguese retail banking sector is empirically analysed, studying its competitive dynamics and implications, discussing its strategic mobility and competitiveness, and determining the existence the structural stability of the main SGs.

4.1. Sample Identification, Data Source

Between 2008 and 2016, the Portuguese banking sector underwent profound legal changes, which regulated the industry with the aim of mitigating systemic risks, as a consequence of the major disturbance provoked by the FEAP intervention programme. The regulatory changes, through the Basel III agreement, led to major changes in the European banking industry, particularly in Portugal, with minimum Common Equity Tier 1 ratios.

In this context, in order to analyse the retail banking industry we used data from statistical bulletins of the Portuguese Banking Association [Associação Portuguesa de Bancos]. The period of analysis covered years 2008 to 2016, which allowed a longitudinal analysis that covers a period of important changes for the banking system. Data from BPN – Banco Português de Negócios, S.A. has not been considered when characterising the Portuguese financial system, since it was undergoing a process of integration into BIC. Data from EFISA – Banco Efisa, S.A. and the Branch of NCG Banco, S.A. have not been included due to unavailability of information. In addition, BPP – Banco Popular Portugal, S.A. stopped drawing up consolidated accounts as of the 2011 financial year, and DEUTSCHE – Deutsche Bank Portugal, S.A. changed its legal form to branch and adopted the name DEUTSCHE – Deutsche Bank AG, Branch in Portugal.

In 2014, as a result of the resolution of BES, in the characterisation of the Portuguese financial system, the data referring to BES and Banco Espírito Santo dos Açores, S.A. (BCA) were excluded. On the other hand, the data of Novo Banco and NB Açores that resulted from the BES resolution were considered, which are the new denominations of the two entities mentioned above. BANIF in 2014 presents consolidated accounts for the last time. Caixa Central – Caixa Central de Crédito Agrícola Mútuo, CRL (CCCAM) is known thereafter as the Sistema Integrado de Crédito Agrícola Mútuo (SICAM). Therefore, this study focuses on retail banking, analysing the period from 2008 to 2016. The total sample is composed of 23 retail banking institutions.

4.2. Identification of Variables

The Portuguese retail banking industry bases its commercial activity on revenues that come from the commercialisation of products/services of their branches, which are very similar across the industry. We decided to analyse the SGs based on corporate strategic dimensions.

SGs are identified based on their strategic reach dimension, which in studies on the banking industry reflects the key variables of the banking industry (e.g., Espitia *et al.* 1991; Reger and Huff 1993; Rhee and Mehra 2006; Garcés-Cano and Duque-Oliva 2008; DeSarbo *et al.* 2009). In this sense, we consider that strategic dimensions define the competitive strategy of retail banking in Portugal, the latter being determined by nine strategic variables, reflecting the strategic reach (Table 2). The variables emerge from the balance sheets and individual and/or consolidated income statements of the Chart of Accounts for the Banking System, with very specific characteristics for determining/identifying the accounts for financial institutions operating in Portugal.

In the literature review of the SGs of the banking system, the reach dimension is very particular of the strategic groups, as is a key dimension of the banking industry that reflects the different products and services of the banking system (e.g., Reger and Huff 1993; Garcés and Duque 2007; DeSarbo *et al.* 2009).

Table 2
Strategic dimension/operationalisation of strategic groups

Strategic Dimensions	Operationalisation	Code
Specialisation (product/ market).	Credit not represented by securities / Total Assets.	V1
	Securitised and non-derecognised credit / Total Assets	V2
	Other credit and values (tittles) / Total Assets	V3
	Overdue credit and interest loan / Total Assets	V4
	Provisions and Impairments / Total Assets	V5
	Call-Demand deposits / Total Liabilities	V6
	Term Deposits / Total Liabilities	V7
Resources.	Central Bank Resources / Total Liabilities	V8
Size of the institution.	Total Assets	V9

Source: Own elaboration.

We selected six ratios that are regularly used to reflect the level of results of banks. Those results are expressed in relative terms and are strongly influenced by personnel and administrative expenses (Sinkey and Joseph 1992), as shown in Table 3.

For the analysis of performance ratios it was taken into account the need of the banking industry to comply with the FEAP requirements imposed by the regulatory changes of the Basel III agreement, which was expected to influence the retail banking activity. There are many aims for capitalising and leveraging the Portuguese banking sector: (i) strengthening

financial strength ratios, whereas the increase in solvency to a minimum of 9% until the end of 2011 and of 10% from 2012 has become mandatory; (ii) decreasing the transformation ratio, by reducing credit weight on deposits to a maximum of 120% until the end of 2014; (iii) lowering stable funding to 100% until the end of 2014, which is a measure intended to reduce dependence on short-term markets; (iv) reducing exposure to the European Central Bank (ECB); financial institutions were required to reduce dependence on ECB funding, to facilitate the return to the markets in 2013; and, lastly, (v) maintaining credit to the productive sector, with the guideline of continuing funding the Portuguese economic fabric, with added focus on small and medium-sized enterprises engaged in tradable goods, and the banking sector started having a quarterly assessment of capital and liquidity plans from the eight largest banks. Therefore, the economic and financial ratios chosen are shown in Table 3.

Table 3
Result variables

Dimension	Variables	Acronym	Operationalisation
Economic and financial dimensions	Economic profitability.	PBMF	Banking product / Financial margin.
		CPMF	Costs with Personnel / Financial margin.
		GGAMF	General administrative expenses / Financial margin.
	Financial profitability.	ROE	Return on Equity (Net results / Shareholder Equity).
		ROI	Return on Investment (Net results / Total Assets).
		GAF	Degree of financial leverage (Operational results / EBIT).

Source: Own elaboration.

4.3. Data Analysis Procedure

In order to achieve the objectives defined in the introductory section, the following stages were defined to analyse the retail banking industry: (i) The identification of the periods of analysis; (ii) The identification of the different SGs; (iii) The characterisation the SGs; (iv) The analysis of the competitive dynamics of SGs; (v) The analysis of differences between SGs; and, finally, (vi) The analysis of strategic consequences of competitive dynamics.

The definition of the periods of analysis was determined *a priori* as composed by the following periods of time: 2008-2010, 2011-2013 and 2014-2016. This was the first stage of the study. This subjective selection of aims at identifying changes occurred over time, recognising breaking points in stable periods (e.g., Zúñiga *et al.* 2004a; Ebbes *et al.* 2010; Más-Ruiz and Moreno 2011; Más-Ruíz *et al.* 2014), based on previous knowledge of the retail banking industry and from the FEAP intervention.

Different hierarchical clustering algorithms were tested (single, average and complete linkage, as well as the Ward's algorithm) and some similar solutions between them were obtained, suggesting the existence of some possible natural groups. Thus, given its desirable properties, the Ward's algorithm (Ward Jr. 1963) was elected for the work. To determine SGs based on the corporate conduct for the three periods of analysis, this second stage involves the creation of clusters using the Ward's method (e.g., Más-Ruiz *et al.* 1992; Reger and Huff 1993; Martins *et al.* 2010; Pätäri *et al.* 2011). The Ward's hierarchical algorithm of minimum variance is applied to the standardized mean values of the variables of each bank for the three periods under analysis. This procedure has shown superior results when compared to other methods of hierarchical groupings, revealing a natural structure of the data (e.g., Fombrun and Zajac 1987; Más-Ruiz *et al.* 1992; Reger and Huff 1993; Martins *et al.* 2010; Pätäri *et al.* 2011).

The third stage involves the characterisation of the SGs' dimension in order to identify similar and dissimilar strategic behaviours. The next procedures have been implemented for that purpose, following Amel and Rhoades (1988): (i) calculating the average values of strategic variables regarding each SG in the identified stability periods; (ii) calculating the average values of the indicators of the stability periods regarding the entire banking industry; and (iii) comparing the averages of each SG to the average of the sample in order to identify any degree of specialisation in the SGs in any specific strategic dimension.

Competitive dynamics of SGs in the banking industry in Portugal, in the periods from 2008-2010, 2011-2013 and 2014-2016, is analysed transversally in relation to the composition and its changes over time, as well as the strategies undertaken by the SGs. It is based on comparing the average values of strategic variables in each strategic group and analysing the centroids of SGs in each period of analysis of the Portuguese retail banking industry.

The fourth stage involves a discussion regarding the features of the competitive dynamics of SGs according to the structure proposed by Mascarenhas (1989). Given the likelihood of a strategic change of some banks in a given SG, there are three possible results: a change in its strategy, in its composition and/or in the number of its members. This is the result of the interdependence between the members of the group, swapping between SGs or of using a diverging strategy from the members of the SG. In this sense, a strategic change may occur when some banks in the same SG change their strategy. The change in the composition of a SG means that some retail bank changed its strategy and is implementing a different strategy, which might be tuned to the strategy of another SG. If the remaining members of the group do not follow the change, we are in the presence of a new SG or a change in the composition of two SGs.

The fifth stage aims at analysing the differences in results of the SGs. Lastly, the sixth stage discusses the strategic consequences of competitive dynamics of SGs in the Portuguese retail banking industry.

5. RESULTS

This paper analyses the unfolding of events culminating in the 2011 recapitalisation programme of the Portuguese banking system and in the resolution of BES in 2014. The major changes in the Portuguese banking system during the 2008-2010, 2011-2013 and 2014-2016 periods are explained by the recapitalisation programme of the Portuguese banking system via the FEAP, which changed the competitive environment of the banking system, by introducing significant changes in the sector's behaviour, particularly regarding the compliance with the new solvency levels imposed on banks and the need to deleverage the banking activity.

Table 4 shows the development of average values of strategic variables in the periods under analysis. From the first to the second period, there is a clear fall in the average ratio of credit not represented by securities on total assets from 0.54 (2008-2010) to 0.44 (2011-2013) albeit it increases in the third period (0.48). The average ratio of overdue credit and interest on total assets increased from 0.01 to 0.03 to 0.04 during the three periods. The same occurred to the provisions and impairments on total assets that increased from a null average value to an average value of 0.03 and then to an average value of 0.05 in the 2014-2016 period. There was a decrease in the average ratio of call deposits on total assets, from 0.20 to 0.09, from the first to the second period and an improvement to 0.06 from the second to the third period. Conversely, the average ratio of central bank resources on total liabilities went from 0.06 in the first period to 0.11 in the second period to 0.07 in the third period The average increase of 3,021 Million euros in total assets from the first period to the second one should also be noted, as well as a decrease of 2,310.57 Million Euros from the second to the third period.

Table 4
Strategic variables over time periods

Variables	Operationalisation	2008-2010	2011-2013	2014-2016
V1	Credit not represented by securities / Total Assets	0.54	0.44	0.48
V2	Securitised and non-derecognised credit / Total Assets	0.04	0.07	0.07
V3	Other credit and values (tittles) / Total Assets	0.01	0.03	0.04
V4	Overdue credit and interest loan / Total Assets	0.01	0.03	0.04
V5	Provisions and Impairments / Total Assets	0.00	0.03	–0.05
V6	Call-Demand deposits / Total Liabilities	0.20	0.09	0.16
V7	Term Deposits / Total Liabilities	0.15	0.29	0.35
V8	Central Bank Resources / Total Liabilities	0.06	0.11	0.07
V9	Total Assets (1)	24,209.07	27,230.97	24,920.40

Note: (1) Million Euros.

Source: Own elaboration.

The SGs have been classified as: "Universal"; "Traditional"; "Specialised"; and "Undefined" SGs. This classification is based on article 4 of Decree-Law no. 298/92. It has the scope of the banking activity as reference for naming the SG, which discloses the main strategic feature of each strategic cluster or group.

Taking into account the assets of the banks, the SG named "Universal Banking" is composed of: small institutions in the 2008-2010 period; very small, small and medium-sized institutions in the 2011-2013 period; and two medium-sized institutions and a large institution in the 2014-2016 period.

The second SG may be referred as "Traditional Banking". In the 2008-2010 period, based on the size of the assets of the banks, this SG is comprised of three large banks and one medium bank. In this SG – composed of banks that traditionally operate at a national level covering all market segments – the primary strategic variables influencing the SG are: total assets, credit not represented by securities and securitised and non-derecognised credit. In the 2011-2013 period, it is composed of one small institution, two medium-sized institutions and three large institutions. In the 2014-2016 period is composed of one very small, two small and two large banks. This SG is comprised of banks that traditionally operate at national level serving all market segments, and is expressed by the following strategic variables: total assets, credit not represented by securities, demand deposits and a high central bank resource ratio on total liabilities.

The third SG is referred as "Specialised Banking". It is composed of three very small banks and one small bank in the 2008-2010 period. In the 2011-2013 period, this SG is composed of two very small banks and one medium bank. In the 2014-2016 period it is composed of two very small, one small and one mid-sized institution. This SG can be characterised by the following two variables: securitised and non-derecognised credit on total assets and a high central bank resource ratio on total liabilities.

The fourth SG may be referred as "Undefined Banking" as it is difficult to prescribe the strategic variables that characterise this SG. BIC is a very small bank that incorporated BPN in 2011 and BPI is a medium-sized bank. Novo Banco, which is a large bank, belongs to this SG in the 2014-2016 period.

In order to complement the analysis of the composition of the SG, it was used the proposal of Reger and Huff (1993) that characterises SGs according to the structural position in the cluster. Based on the Euclidean square distance among individual players, Reger and Huff (1993) distinguish the following typologies: "core"; "secondary"; "transient"; "misfit" and "idiosyncratic", as shown in Table 5. As such, one can claim that "core" players are closer the core of the SG and "idiosyncratic" are likely to have a poor resemblance to the SG behaviour, i.e. the higher the Euclidean square distance the less likely the player is to remain in the SG.

Table 5 characterises the SGs in terms of number and composition for the three periods analysed. For simplicity reasons, the Undefined Banking SG was not represented. In summary, national banking institutions have developed different strategies in the three time periods (2008-2010, 2011-2013 and 2014-2016), impacting the structure of SGs.

Over the three time periods MG and BANIF maintained their strategies as secondary players, but as part of the Universal Banking SG in the first period, as part of the Traditional Banking SG in the second period and as part of the Specialized Banking in the third period. BCP and CGD remain in the Traditional Banking SG during the three periods, although they changed their strategic behaviour as they behaved as core players in the first period and as secondary players in the second and third periods. On the other hand, BES also maintains its position in the Traditional Banking SG. It moved from a core to a secondary position from the first to the second period, becoming insolvent in the third period. Part of its assets were transferred to Novo Banco, which is part of the Undefined SG. Finally, the BST in the first period is in the Traditional Banking SG behaving as secondary player. In the second period BST moves to the Universal SG as a transient player, remaining in the Universal Banking SC as a core player.

Table 5
Characterisation of the composition of main SGs in the periods under analysis

	Universal Banking			**Traditional Banking**			**Specialised Banking**		
Period	**2008/10**	**2011/13**	**2014/16**	**2008/10**	**2011/13**	**2014/16**	**2008/10**	**2011/13**	**2014/16**
Core	—	—	BST	BCP CGD BES	—	—	—	—	—
Secondary	FINI MG BAC CCCAM BBVA BANIF DEUTSCHE	BPP	BIC BPI	BST	MG BCP BES BANIF CGD CCCAM	BCP SICAM BBVA	ITAU BARCLAYS BF BSNP	—	BANIF MG
Transient	BPP	BST BIC BPI BAC BBVA	—	—	—	NBA Açores CGD	—	—	BF
Misfit	—	—	—	—	—	—	—	BARCLAYS BF BSC	BSC
Idiosyncratic	—	—	—	—	—	—	—	—	—

Source: Own elaboration.

The Undefined Banking group was not represented in Table 5 because it does not include any institution in the second period – for all purposes, it was deemed as a strategically undefined group comprised of two medium institutions seeking to position themselves in the banking market, becoming included in the Universal Banking strategic group by means of strategic redefinition.

As shown in Table 5, in the first period there are four SGs (Universal, Traditional, Specialised, Undefined), while the second period is composed of three SGs (Universal, Traditional, Specialised), since the Undefined SG has disappeared. Finally, the third period is composed of four main SGs (Universal, Traditional, Specialised, Undefined), with Novo Banco being set aside as part of the Undefined SG as its only member.

Table 6 presents the individual characteristics of the three main SGs over time.

The Universal Banking SG experienced the following transformations from the first to the second period: from eight banking institutions (MG acquired Finibanco in 2010) to six; their number of workers decreases from 36,415 to 4,987; and total assets increase from 65,993 to 103,841 Million euros. In the third period the number of institutions decreases to three, the number of workers increases to 22,286 and total assets decrease again to 86,027 million Euros. BPP, BAC, BST and BBVA behaved as structural players of the Universal Banking SG during the first two periods.

The Traditional Banking SG also undergoes important changes from the first to the second period: from four to six institutions; from 3,159 to 3,762 offices; from 27,816 to 33,629 workers; and total assets remain relatively stable from 330,095 to 311,702 million euros. In the third period the number of institutions decreases to five, with an increase in the number of workers to 59,989 and a decrease in total assets to 162,044 million Euros. Clearly, BCP (during the three periods) and BES (during the first two periods) remained as structural players within this SG, with the entry of CCCAM and MG coming from the strategic group of Universal Banking in the second period, and BST exiting in the first period. BBVA enters the Traditional SG leaving the Universal Banking SG.

The Specialized Banking SG underwent the following changes from the first to the second period: from four to three institutions; from 251 to 236 offices; from 2,456 to 2,317 workers; and total assets of 24,382 to 26,546 million euros. BARCLAYS (during the first two periods) and BF (during the three periods) are its structural institutions. In the third period, this SG has four institutions, 12,312 employees and a total asset of 40,891 million Euros. Clearly, BANIF and MG become major players coming from the Traditional Banking SG.

For simplicity reasons the Undefined Banking SG is not represented in Tables 5 and 6.

Table 6
Characteristics of the main strategic groups

Periods	Strategic groups	Number of entities	Number of offices [1]	Number of workers [2]	Total assets [3]
2008-2010	Universal Banking	8 [4]	1 793 [4]	36 415 [4]	65 993 437.33
	Traditional Banking	4	3 159	27 816	330 095 376.00
	Specialized Banking	4	251	2 456	24 381 963.83
2011-2013	Universal Banking	6	1 753	4 987	103 841 953.03
	Traditional Banking	6	3 762	33 629	311 702 424.68
	Specialized Banking	3	236	2 317	26 546 115.47
2014-2016	Universal Banking	3	1 378	22 286	86 026 997.00
	Traditional Banking	5	1 276	59 989	162 043 810.30
	Specialized Banking	4	352	12 312	40 891 270.00

Note: [1] coverage in Portugal; [2] in Portugal; [3] thousands of euros; [4] Finibanco in 2010 was purchased by Montepio.
Source: Own elaboration.

As shown in Tables 5 and 7, the following changes were identified between the first and the second period: Eight changes have been identified in the Universal Banking strategic group: MG, CCCAM and BANIF became part of the Traditional BG; BIC and BPI left the Undefined Banking; BST left the Traditional Banking group; DEUTSCHE left the Universal Banking and FINE entered into the Universal Banking. Four changes have been identified in the Traditional Banking SG: entry of MG, BANIF and CCCA from the Universal Banking and BST leaving to the Universal Banking strategic group. Three changes have been identified in the Specialised SG: ITAU and BSNP leaving in the first period and BSC's entry in the second period. On the other hand, between the second period and the third periods, the following major changes are clear: BAC with the resolution of BES in 2014, is no longer present, BBVA and BPP are now part of the Traditional Banking group. MG and BANIF that comprised the Traditional Banking SG moved to the Specialized Banking SG.

SGs have been analysed from both a longitudinal and a composition standpoint, by identifying the number of groups and its variation over time (2008-2016). It was possible to identify 17 strategic changes by comparing the first and the second periods, translating into a strategic redefinition of the institutions that have become integrated in other SGs. Between the second and the third periods 13 strategic changes were identified, as shown in Table 7.

The mobility ratio is calculated by identifying the number of banks remaining in the same strategic group, as well as the number of times they move from a given SG to another. As shown in Table 7, mobility between SGs – assessed by the mobility ratio (MR) – is medium/high between the first and the second periods (average MR = 0.346). This medium/high strategic mobility likely reflects the troubled period of adaptation occurred in the banking industry as a result of the FEAP, which led to the strategic adjustment of the different players. On the other hand, a milder mobility ratio is found between the second and the third period (average MR = 0.277).

Table 7
Mobility ratios (MR) between periods

	2008-2010 and 2011-2013				2011-2013 and 2014-2016			
Strategic Groups	Remains in SGs	Changes among SGs	MR*	Average MR	Remains in SGs	Changes among SGs	MR*	Average MR
Universal Banking	1	8	0.111	0.346	3	3	0.500	0.277
Traditional Banking	3	4	0.429		3	6	0.333	
Specialised Banking	3	3	0.500		2	3	0.400	
Undefined Banking	2	2	0.500		0	1	0	

Note: *Mobility Ratio (MR); MR = 1 no mobility (perfect strategic stability); RM = 0 total mobility (perfect strategic instability).
Source: Own elaboration.

Between the first and the second period the Universal Banking group is the most mobile SG (MR = 0.111) and the Undefined Banking is the SG with the least mobility. In turn, the Specialised and Undefined Banking are the SGs with the least mobility (MR = 0.500). Between the first and the second period, the Undefined SG is the SG with the most mobility, whereas the Universal Banking SG is the one with the least mobility (MR = 0.500). This reorganisation suggests there is a low barrier to mobility between periods, resulting in a low barrier to the entry of institutions into other strategic groups, with strategic mobility diversity. It can be argued that the three periods are characterised by different strategic behaviours. The first period can be characterised as a period of deregulation of the Portuguese retail banking industry, and the second period as resulting from an imposed regulation, in which institutions have been reorganised into SGs in order to adapt to the new economic and legal framework. Finally, the third period can be considered as a period of strategic consolidation.

The analysis of the dynamics of SGs was based on the average values and standard deviations of strategic variables in each SG. The results of the strategic variables are not uniform, thereby evidencing that there are differences in decisions across strategic groups over time. The structure of the SGs changed over time, and the changes demonstrate that the banking institutions of a SG reorganise themselves seeking a new competitive strategic positioning. The results obtained show that not all retail banking institutions move in the same way due to the changing relative distance between the members of a same group over time. Competitive responses from the institutions to the environment differ in decision-making and time thereof.

Table 8 shows the average values of the result variables between periods. There is an average increase of the banking product ratio on the financial margin (BPMF), from 0.647 (2008-2010) to 2.010 (2011-2013) and to 1.938 (2014-2016). The average ratio of personnel expenses on the financial margin (PEFM) went from 0.204 to 0.642 from the first to the second period and to 0.591 in the third period; the general administrative expenses ratio on the financial margin (GAEFM) went from 0.175 to 0.446 from the first to the second period and stabilised in the third period (0.420); ROE (return on equity) went from minus 0.003 to an average value of minus 0.204 and then to a minus 0.069; ROI becomes negative with an average value of minus 0.076 in the second period and then to a minus 0.002 in the third period; lastly, the degree of financial leverage went from 1.006 to an average value of 0.962 in the second period to 0.646 in the third period. There is a clear increase in costs (PEFM and GAEFM) and decrease in financial profitability, indicating deterioration of the banking competitive context. This indicates a deterioration of the competitive context in the banking system in the first two periods, with a decrease in costs (PBMF and CPMF) between the second and third period and with a decrease in financial profitability in the three periods under analysis.

In this framework, the different results over the periods are shown in Table 8, according to the SGs (Universal, Traditional, Specialised and Undefined), using the simple arithmetic average for each strategic group and for each period under study.

Table 8
Results of strategic groups

Variables	Periods	Universal Banking	Traditional Banking	Specialised Banking	Undefined Banking	Average Value
PBMF: Banking product / Financial margin	2008-2010	1.800	1.592	1.951	1.859	0.647
	2011-2013	2.313	1.754	1.371	— (1)	2.010
	2014-2016	1.572	2.232	1.938	1.989	1.938
CPMF: Costs with Personnel / Financial margin	2008-2010	0.542	0.490	0.985	0.616	0.204
	2011-2013	0.781	0.000	0.358	— (1)	0.642
	2014-2016	0.337	0.736	0.527	0.970	0.591
GGAMF: General administrative expenses / Financial margin	2008-2010	0.366	0.560	0.626	0.679	0.175
	2011-2013	0.516	0.000	0.491	— (1)	0.446
	2014-2016	0.234	0.522	0.337	0.808	0.420
ROE: Return on Equity	2008-2010	0.064	–0.887	–0.133	0.049	–0.003
	2011-2013	–0.094	–2.529	0.311	— (1)	–0.204
	2014-2016	0.053	–0.091	–0.130	–0.165	–0.069
ROI: Return on Investment	2008-2010	0.004	0.000	–0.009	0.001	0.002
	2011-2013	–0.044	–0.007	–0.503	— (1)	–0.076
	2014-2016	0.003	–0.003	–0.003	–0.016	–0.002
GAF: Degree of financial leverage	2008-2010	0.827	0.652	0.946	2.534	1.006
	2011-2013	1.265	0.942	1.117	— (1)	0.962
	2014-2016	0.891	0.562	0.746	1.024	0.646

Note: (1) no data.

Source: Own elaboration.

The Universal Banking SG is composed of banks operating in their broader sense. This SG has a negative ROE and ROI in the second period, influenced by the net result, and shows a favourable average leverage in the second period (1.265) that was unfavourable in the preceding period (0.827), decreasing again in the third period (0.891).

The Traditional Banking SG has a negative ROE in the three periods (–0.887; –2.529; –0,091), influenced by the net results, which, in turn, have a negative influence on ROI in the three periods. The results of the Traditional Banking SG worsened in the second period, expressing a low ROE (–2.529) improving in the third period (–0,091). Lastly, the three periods have an unfavourable leverage, improving in the second period (0.942), decreasing again in the third period. The Undefined Banking SG is characterised by an extremely favourable leverage, with an average value of 2.534 in the first period.

It is clear that the change of the competitive environment from a deregulated period to a regulated period and then to a consolidated strategic period significantly changed the composition between periods. Intervention from the FEAP, the European Union (EU) and the International Monetary Fund (IMF) has conditioned individual strategies of retail banking institutions in Portugal. This constraint led to deep changes in the banking activity and caused surgical time changes so as to not introduce large uncertainties in the activity of the institutions, which led to a period of consolidation conditioning the results obtained in the banking industry in a decisive manner. The existence of relationships between structure – conduct – performance and competition indicates an asymmetrical growth in behaviour, showing the difficulties of establishing commitments among banking entities, thereby reducing the benefits for retail banking. The mechanisms of competitive dynamics of SGs are clear between and within periods, which is also the case within and between strategic groups, due to the fact that they are responding to the changes in the competitive environment.

The national retail banking system is comprised of three primary strategic groups: the Universal, the Traditional and the Specialised SGs. It can be argued that competitive dynamics occurs with greater intensity among members in the same group due to the conduct of its members in relation to the activity, creating barriers to mobility and responding in a similar way to the changes in the competitive environment. In addition, it is important to take account the existence of a mutual dependence that may be obstructed by some actors. As such, one can claim that hypotheses H_1 and H_2 are accepted.

The national retail banking sector is comprised of SGs that underwent major changes between the periods under analysis, due to the changes imposed on the competitive environment. The study does not prove that strategic groups are necessarily a cohesive force. In the second period under analysis (2011-2013) there was a greater concern in complying with the requirements of the FEAP than in addressing market competition. The fulfilment of the imposed goals had a decisive influence on the composition and competitive dynamics of SGs, whose number, composition and strategies have changed. In addition, it is apparent that managers/decision-makers are aware of the implications of strategic decisions and recognise the existence of SGs, as well as their competitive dynamics. Decisions made by bank managers or strategic decision-makers by virtue of the FEAP have been different between banking institutions, regardless of the SG in which they were integrated. Such decisions have shaped the strategic groups in the second period of analysis and the search for a consolidation in the third period. Therefore, it can be argued that different decisions have shaped competitive dynamics of the retail banking, led by the three – "Universal", "Traditional" and "Specialised" – main SGs. Competitive dynamics of strategic groups has direct and indirect implications on the conduct of retail banking institutions, their results, the nature of the competitive interactions between banking institutions in a same SG and between SGs in a same industry. As such, one can claim that H_3 is accepted as competitive dynamics of the banking industry is affected by the external recapitalisation programme via the FEAP.

6. CONCLUSION

The study shows the different SGs in Portugal's retail banking sector during the three periods. The analysis allows to reflect on the competitive dynamics of SGs and the (in)direct implications on companies' conduct, results and the nature of competitive interactions. It is clear that the Portuguese retail banks follow different competitive strategies, SGs have dissimilar resources and that different SGs follow different strategies. Variables used in the analysis support the argument that the retail banking in Portugal has changed its commitments and strategies over time, as financial profitability and degree of financial leverage have deteriorated from the first to the second analysis period.

National banking institutions have developed different strategies in all three time periods under study, stimulating the restructuring of SGs as to their number and composition, significantly reflecting the existence of a deep volatility between the periods under analysis, which indicates there were changes in the context of banking with the mandatory requirements determined by the BdP [Bank of Portugal] and imposed by the FEAP, of a Tier 1 Core ratio of 8% from the 31st of December 2011 that enforced minimum capital requirements through Ordinance no. 121/2011. The competitive structure of the retailing banking industry is reflected on the different SGs formed, in which the concern for complying with the requirements imposed by the recapitalisation programme of the Portuguese banking system led to the reorganisation and restructuring of SGs. Thus, the different periods of analysis may be characterised by a medium/high strategic mobility, which presumably reflects a low barrier to the entry into SGs. Therefore, it can be argued that the 2008-2010 period may be considered as a 'deregulated' period, 2011-2013 as a period of 'imposed regulation' and, finally, 2014-2016 as a 'strategic consolidation' period, with strategic changes leading the various institutions to strategically regroup, as a result of a low barrier to strategic mobility, which led to a broad competitive dynamics between periods.

There are important implications for the scientific community. The first one is that this financial and economic foreign intervention had pervasive structural changes in the Portuguese banking industry. This is the result of not only the lack of industry-based stability, but also the individual conditions to the banks, which were not analysed. The second implication is that

a tight regulation seems to be mandatory if the banking industry is to perform properly, which was not the case under analysis as its historical events indicated.

For the business community it would be important to claim that despite the intricacies of strategic actions and reactions institutions need to be aware of the contextual signs that strongly influence the long-term stability of corporate strategies. As such, if institutions want to stay afloat in open competitive markets, they need to define a clear long-term strategic orientation not to be caught in the eye of the storm.

The results contribute to the understanding of the retail banking in Portugal, namely: (i) the competitive position of the players in the sector; (ii) the structure and competitive dynamics; (iii) the analysis of the SGs and their competitive dynamics; and (iv) the analysis of the competitive the dynamics of the SGs of the Portuguese banking sector in the three periods under analysis.

The main limitation of this paper is related to the analysed time horizon – only three time periods, 2008-2010, 2011-2013 and 2014-2016 – that was extremely volatile in the Portuguese banking sector. The second limitation is related to the small sample used. Finally, due to the subjectivity associated to any cluster analysis, the results should be interpreted by taking into account the limitations of this statistical methodology. De la Fuente-Sabaté et al. (2007) and Carroll and Thomas (2019) propose new methodological and theoretical insights in the research on strategic groups that should be considered in future work to study the retail banking behaviour.

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