



EDUARDO GOMES CARVALHO

**LINKING OPEN INNOVATION, ENTREPRENEURIAL
ORIENTATION AND FIRM PERFORMANCE IN BRAZILIAN
STARTUPS**

LAVRAS – MG

2016

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Tese apresentada à Universidade Federal de Lavras,
como parte das exigências do Programa de Pós-
Graduação em Administração, área de concentração em
Gestão Estratégica, Marketing e Inovação, para
obtenção do título de Doutor

Prof. Dr. Joel Yutaka Sugano
Orientador

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**Ficha catalográfica elaborada pelo Sistema de Geração de Ficha Catalográfica da Biblioteca
Universitária da UFLA, com dados informados pelo(a) próprio(a) autor(a).**

Carvalho, Eduardo Gomes.

Linking open innovation, entrepreneurial orientation and firm
performance in Brazilian startups / Eduardo Gomes Carvalho. -
2016.

155 p. : il.

Orientador(a): Joel Yutaka Sugano.

Tese (doutorado) - Universidade Federal de Lavras, 2016.
Bibliografia.

1. Open innovation. 2. Entrepreneurial orientation. 3. Startups.
I. Sugano, Joel Yutaka. . II. Título.

EDUARDO GOMES CARVALHO

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FIRM PERFORMANCE IN BRAZILIAN STARTUPS**

**VINCULANDO INOVAÇÃO ABERTA, ORIENTAÇÃO EMPREENDEDORA E
DESEMPENHO DA EMPRESA EM STARTUPS BRASILEIRAS**

Tese apresentada à Universidade Federal de Lavras, como parte das exigências do Programa de Pós-Graduação em Administração, área de concentração em Gestão Estratégica, Marketing e Inovação, para obtenção do título de Doutor

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2016**

À minha mãe Beatriz, que me mostrou a importância do conhecimento e do empreendedorismo.

À minha esposa Ana Carolina pelo amor e por apoiar as minhas decisões nos mais variados momentos.

À minha filha Maria Eduarda pelo companheirismo e por ser fonte de incentivo nos momentos de estudo.

AGRADECIMENTOS

À Universidade Federal de Lavras, e principalmente ao Programa de Pós-Graduação em Administração. Com certeza tal agradecimento é prestado por razões que vão além do protocolo institucional.

Ao CEFET-MG, pela liberação parcial e posteriormente integral para que eu pudesse ter cursado o doutorado. Devo agradecer a instituição também devido ao incentivo educacional na forma financeira para realização do curso, ou para participação em congressos. Não obstante, devo agradecer aos colegas da unidade Varginha que apoiaram meu afastamento, principalmente a diretora do campus na época da liberação Professora Gilze Belém Chaves Borges, e aos colegas do curso de informática.

Aos empresários das *startups* que dedicaram um momento para me auxiliar, seja durante as entrevistas, respondendo os questionários, ou me recebendo para as visitas técnicas. Devo agradecer também pelo conhecimento disponibilizado.

Ao Professor Joel Yutaka Sugano, não somente pela orientação, mas pelos questionamentos, diálogo constante, e também pelo apoio e incentivo não somente durante o doutorado, mas para os momentos que precedem tal etapa.

Aos professores do programa, os quais com certeza disponibilizaram muito mais que conteúdos. Aprendi muito com todos. Agradecimento especial também ao Professor André Luiz Zambalde que me acolheu em um primeiro momento em que cursei sua disciplina de forma isolada. Agradecimentos também aos servidores e colaboradores do departamento e da UFLA, que mesmo de forma “anônima” contribuíram nessa etapa.

Aos professores Daniel Carvalho de Rezende, Luiz Marcelo Antonialli, Marcos do Couto Bezerra Cavalcanti, e Carlos Henrique Pereira de Mello pelas valiosas contribuições na fase de qualificação.

À minha mãe Beatriz Guimarães Gomes, que desde minha infância incentiva o gosto e amor pelo conhecimento. Às minhas irmãs Ana Carolina e Viviane.

À minha esposa Ana Carolina Costa Moreira Carvalho, que com muito amor apoiou, torceu, sofreu e compartilhou as alegrias comigo dessa etapa.

À minha filha Maria Eduarda Moreira Carvalho, que já nos seus primeiros momentos de vida estava ao meu lado durante os estudos. Ela que é fonte de força e incentivo para mim.

Aos colegas do programa, especialmente o Rodrigo Marçal Gândia, Cassiano de Andrade Ferreira e Marcelo Garcia.

MUITO OBRIGADO!

RESUMO

As organizações estão migrando de um modelo de negócios tradicional que internaliza as atividades de pesquisa e desenvolvimento para um modelo de negócios aberto, ou seja, elas estão empregando inovação aberta. Contudo, estudos sobre inovação aberta em pequenas e médias empresas são poucos, além do fato dos mesmos não abordarem a relação entre inovação aberta e as disciplinas mais abrangentes da administração e da economia. Também existem poucos trabalhos sobre inovação aberta em países latino-americanos. No Brasil, as pequenas e médias empresas desempenham um importante papel no contexto econômico e social, através da participação no Produto Interno Bruto e geração de empregos. Por outro lado, estudos sobre a inter-relação entre inovação e empreendedorismo são uma tendência de pesquisa que combina conhecimentos de diferentes abordagens acadêmicas. O objetivo do presente trabalho é verificar a relação entre inovação aberta, orientação empreendedora e desempenho empresarial nas *startups* brasileiras. A tese defendida é que as dimensões da orientação empreendedora atuam como *drivers* para os macroprocessos de inovação aberta, tendo ambos impacto positivo sobre o desempenho da empresa. Adicionalmente, espera-se que o impacto dos macroprocessos de inovação aberta sobre o desempenho das *startups* seja maior que o impacto das dimensões da orientação empreendedora sobre o desempenho de tais empresas. A tese adota uma visão filosófica pragmática e privilegia a utilização de métodos mistos, através de uma abordagem exploratória sequencial. Tal abordagem prioriza a coleta e análise de dados qualitativos na primeira fase, através de estudo de casos múltiplos. Cinco *startups* compõem o universo de pesquisa na primeira etapa. A partir dos resultados da primeira fase, desenvolveram-se os procedimentos para coleta de dados quantitativos da segunda fase, os quais visavam testar ou generalizar os resultados iniciais. Após sucessivos refinamentos, dados provenientes de 94 *startups* foram utilizados na segunda fase. Os dados foram analisados utilizando análise multivariada de dados, incluindo modelagem de equações estruturais. As evidências sugerem que apenas algumas dimensões da orientação empreendedora impactam o desempenho das empresas e são *drivers* para inovação aberta, enquanto apenas a inovação aberta *outbound* impacta o desempenho das *startups*.

Palavras-chave: Inovação Aberta. Orientação Empreendedora. *Startups*. Modelagem de Equações Estruturais. Pesquisa de Métodos Mistos.

ABSTRACT

The organizations are changing their business model from a traditional vertical integration model with internal research and development activities to an open business model, i.e., they are using open innovation. However, the main stream of studies about open innovation does not approach small and medium enterprises and it has had a limited impact upon the broader disciplines of management and economics. In addition, there are few studies about open innovation in Latin American countries. In Brazil, small and medium enterprises have an important role in the economic and social context, by GDP (Gross Domestic Product) participation and job generation. On the other hand, the interrelationship between innovation and entrepreneurship has become apparent through a vibrant research trend that fuses insights from different academic approaches. The purpose of this work is to check the relationship between entrepreneurial orientation, open innovation and firm performance in Brazilian startups. The thesis advocated is that dimensions of entrepreneurial orientation are drivers to macroprocess of open innovation, having both positive impact on firm performance. In addition, it is expected more impact on firm performance from macroprocess of open innovation than the dimensions of entrepreneurial orientation. The thesis adopts a pragmatic philosophical view and uses sequential exploratory mix-methods research to propose and examine theory. The exploratory design begins with and prioritizes the collection and analysis of qualitative data in the first phase, using muticase studies. One pilot study case was important to develop the research framework and protocol. Five startups compose the research universe in the first phase. Building from the exploratory results, in the second phase collects quantitative data to test or generalize the initial findings. After successive refinements, data from 94 startups were used in the second phase. The data was analyzed using multivariate data analysis, including structural equation modeling. The evidences point to situation where some dimensions of entrepreneurial orientation have impact on firm performance and are drivers for open innovation, while just outbound open innovation impacts firm performance.

Keywords: Open Innovation. Entrepreneurial Orientation. Startups. Structural Equation Modeling. Mixed Methods Research.

SUMMARY

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General Abstract

Open innovation is a paradigm with growing use by the organizations. However, the seminal works about open innovation focused its use by multinationals and big enterprises. Nevertheless, motivated by popularization of the paradigm, in the last few years some researchers have addressed the gap of open innovation in small and medium enterprises (SMEs). But, studies about open innovation in startups and Latin American SMEs are still scarce. Other gap pointed by some authors is the impact of open innovation upon the broader disciplines of management, among them entrepreneurship. Among the main concepts in entrepreneurship studies for the last decades is entrepreneurial orientation. Thus, a question that arises is: what is the relationship between entrepreneurial orientation, open innovation and firm performance in Brazilian startups? As thesis, we expect that the dimensions of entrepreneurial orientation are drivers to the macroprocess of open innovation, having both positive impact on firm performance. In addition, we expect more impact on firm performance from macroprocess of open innovation than the dimensions of entrepreneurial orientation, because entrepreneurial orientation is known for longer than open innovation. Thus, the purpose of this work is to check the relationship between entrepreneurial orientation, open innovation and firm performance in Brazilian Startups. Because the studies about the relationship between open innovation and entrepreneurship are scarce, an exploratory mixed methods design may help the researcher deepen the knowledge before perform a quantitative study. On the other hand, a quantitative study may provide an opportunity to use sophisticated statistical methods to understand the phenomena, besides of allow generalize the results. At end, besides of the small sample, the research presents important contributions to academic literature, startups managers and public managers. The thesis was partially confirmed. The network dimension of entrepreneurial orientation is driver for inbound open innovation. The proactiveness dimension of entrepreneurial orientation is driver for inbound and outbound open innovation. The constructs which impact on firm performance are network, proactiveness and outbound open innovation.

1 INTRODUCTION

The organizations are changing their business models from a traditional vertical integration model with internal research and development activities to an open business model. In other words, the organizations are adopting open innovation. According to Chesbrough (2003) (who presented the concept of open innovation, being the main reference on the issue) open innovation means that valuable ideas can come from inside or outside the company and can go to market from inside or outside the company as well. This definition is the most employed. However, after three years Chesbrough reviewed and updated the definition emphasizing the intentionality of the knowledge flows into and out of the firm. Thus, Chesbrough (2006) defined open innovation as the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the market for the external use of innovation. Recently, Chesbrough and Bogers (2014) considered the increasing interest in non-pecuniary knowledge flows, defining open innovation as being a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms that are in line with the organization's business model. The upgrades of the definitions show the growth and dynamism of the area.

Open innovation has been target of several kinds of organizations. As example, while most of the firms described in early works on open innovation were large multinational firms, it has become apparent that smaller and medium-sized firms (SME) are also opening up their innovation process (GASSMAN et al., 2010). Several works (VAN DE VRANDE et al., 2009; LEE et al., 2010; PARIDA et al., 2012; HUANG et al., 2013; VAN HEMERT et al., 2013; WYNARCZYK, 2013) approach open innovation in SMEs. The research trend in SMEs identified by Gassman et al. (2010) is now a reality. However, according to Carvalho et al. (2016) quantitative studies in specific regions such as eastern European countries, Asia, Africa, Latin America is a gap, and its addressing can contribute to the theoretical framework of open innovation. Carvalho et al. (2016) identified two more gaps for quantitative studies: microenterprises and startups. Thus, we contribute to open innovation literature, by studying open innovation in Brazilian startups.

As Huizingh (2011) adverts as there is in medicine no panacea, a remedy curing all diseases, it is unlikely that a management concept has positive effects in any situation, implying that the effectiveness of open innovation must be context dependent, and the context is affected by management, cultural and economic issues. Thus, there are situations that open

innovation may be or not beneficial. The effects of open innovation in SMEs may be different in each region, as well as its drivers. Because of this, it is important to scrutinizing open innovation.

1.1 Research question and thesis

Several organizations are practicing open innovation. However, as a relatively new concept there are some gaps. According to West et al. (2014), although open innovation research is frequently cited and has influenced the direction of innovation studies, it has had a limited impact upon the broader disciplines of management and economics. Entrepreneurship is among these disciplines of management, as noted by Hossain (2013). The relationship between open innovation and entrepreneurship deserves receive more attention because, according to Soriano and Huang (2013), over the last few years, the interrelationship between innovation and entrepreneurship, or new business creation, has become apparent through a vibrant research trend that fuses insights from different academic approaches. Authors such as Ndubisi and Iftikhar (2012), Swami and Porwall (2005), Zhao (2005) and Galindo and Mendez-Picazo (2013) explored the relationship between innovation and entrepreneurship. Even Schumpeter (1934) defines entrepreneurship as an endeavor that is centrally characterized by innovation.

Among the main concepts in entrepreneurship studies for the last decades is entrepreneurial orientation. According to Campos et al. (2012) entrepreneurial orientation has received substantial conceptual and empirical attention, representing one of the few areas in entrepreneurship research in which a cumulative body of knowledge is developing. According to Rauch et al. (2009) it has emerged as a major construct in the strategic management and entrepreneurship literature over the years. Entrepreneurial orientation refers to the processes, practices, and decision-making activities used by entrepreneurs that lead to the initiation of an entrepreneurial firm (LUMPKIN; DESS, 1996).

Thus, a question that arises is what is the relationship between entrepreneurial orientation, open innovation and firm performance in Brazilian startups? As thesis, we expect that the dimensions of entrepreneurial orientation are drivers to the macroprocess of open innovation, having both positive impact on firm performance. In addition, we expect more impact on firm performance from macroprocess of open innovation than the dimensions of entrepreneurial orientation, because entrepreneurial orientation is known for longer than open innovation.

1.2 Purpose

The research question and thesis allow defining aims. The purpose of this work is to check the relationship between entrepreneurial orientation, open innovation and firm performance in Brazilian Startups.

The specific objectives are:

- a) to examine the dimensions of entrepreneurial orientation which are drivers for open innovation;
- b) to identify the relationship between the indicators / dimensions of entrepreneurial orientation and the activities / macroprocesses of open innovation;
- c) to identify the impact of entrepreneurial orientation in firm performance;
- d) to identify the impact of open innovation in firm performance.

The thesis consists mainly of publications. Because we use mixed methods design, the articles are not organized by specific objectives. However, the first article aimed to meet the second specific objective and the second article aimed to meet the first specific objective. The third article aimed to meet the first and second specific objectives. The fourth and main article of the thesis met all the specific objectives. The fifth and last article aimed to meet the first and second specific objectives.

1.3 Practical and managerial implications

The present work has also practical and managerial contributions. It is important highlight the role of SMEs to Brazilian economy to understand the practical implications. According to SEBRAE (Brazilian Micro and Small Business Support Service), SMEs account for 27% of GDP (Gross Domestic Product). SMEs also provide livelihood for over 52% of the country's workforce. Furthermore, Brazil has one of the highest basic interest rates. So, capital holders are encouraged to make financial speculation. Thus, who chooses to undertake has no capital for large investments in early stages, being open innovation an alternative. So, the thesis has a social and economic contribution.

By identifying which dimensions of entrepreneurial orientation and which open innovation macroprocess affect the company's performance, the thesis presents avenues for startups managers.

2 THEORETICAL BACKGROUND

The present section has two aims: explain the choice of open innovation as the subject of thesis and to present similar works, to prove the originality of the thesis. In addition, a brief discussion on performance measurement will be presented.

2.1 Why to study open innovation

Although open innovation is among the hottest topics in innovation research, there are several critics about the paradigm. According to Trott and Hartmann (2009) open innovation is old wine in new bottles. From this perspective, Hossain (2013) affirms that open innovation overlaps other concepts such as user generation, crowdsourcing, and distributed innovation. Huizingh (2011) is more emphatic at affirm that open innovation became the umbrella that encompasses, connects, and integrates a range of already existing activities. Indeed the open innovation concept is not contemporary. According to Dodgson and Gann (2014) Josiah Wedgwood advocated the open innovation at propose in 1775 a cooperative program with other ceramists to solve a common technical problem. So, open innovation is practiced over the centuries. Why is open innovation prominent? Dahlander and Gann (2010) provided four reasons. First, it reflects social and economic changes in working patterns, where professionals seek portfolio careers rather than a job-for-life with a single employer. Firms therefore need to find new ways of accessing talent that might not wish to be employed exclusively and directly. Second, globalization has expanded the extent of the market that allows for an increased division of labour. Third, improved market institutions such as intellectual property rights (IPR), venture capital (VC), and technology standards allow for organization to trade ideas. Fourth, new technologies allow for new ways to collaborate and coordinate across geographical distances.

Chesbrough himself answered the question: is there anything new or different about the open innovation paradigm? Chesbrough et al. (2006) affirmed that yes. According to Chesbrough et al. (2006) the points of differentiation for open innovation, relative to prior theories of innovation are:

- a) Equal importance given to external knowledge, in comparison to internal knowledge;
- b) The centrality of the business model in converting R&D into commercial value;
- c) Type I (In statistical hypothesis testing is the incorrect rejection of a true null hypothesis - a "false positive") and Type II (In statistical hypothesis testing is the

- incorrectly retaining a false null hypothesis - a "false negative") measurement errors (in relation to the business model) in evaluating R&D projects;
- d) The purposive outbound flows of knowledge and technology;
 - e) The abundant underlying knowledge landscape;
 - f) The proactive and nuanced role of intellectual property management;
 - g) The rise of innovation intermediaries;
 - h) New metrics for assessing innovation capability and performance.

Despite of downsides of openness, such as intellectual property being difficult to protect and benefits from innovation difficult to appropriate, open innovation is very important. In 1998, Heller and Eisenberg adverted to tragedy of “anticommons”. According to Heller and Eisenberg (1998) while the “tragedy of the commons” metaphor helps explain why people overuse shared resources, the recent proliferation of intellectual property rights in biomedical research suggests a different tragedy, an “anticommons” in which people underuse scarce resources because too many owners can block each other. Thus, more intellectual property rights may lead paradoxically to fewer useful products for improving human health. When the innovation is opened, it may be exploited by other organizations, generating more benefits to society than whether it was under secret. Furthermore, open innovation generates other benefits such as better understanding of customers’ needs, cost reduction, better positioning in competitive terms, revenues with misfit technologies, etc.

2.2 Similar works

The first work to explore the relationship between open innovation and entrepreneurial orientation is Chaston and Scott (2012). They presents evidence about the impact of entrepreneurial orientation and open innovation in firm performance, but they did not link the dimensions of entrepreneurial orientation and open innovation.

In the April 2013 issue of the Technology Innovation Management Review, entitled Open Innovation and Entrepreneurship, authors from Belgium and Norway had the opportunity to share their academic insights and experiences as they correlate open innovation or entrepreneurship, or where these two topics intersect. This issue has five works.

The first work is the article of Vanhaverbeke (2013) that argued that open innovation can be applied in situations where companies do not themselves develop new products or services, and argued that open-innovation scholars have insufficiently differentiated open-innovation initiatives in terms of their impact on companies’ growth. According to

Vanhaverbeke (2013) some open-innovation initiatives lead to incremental innovations in an existing business while, in other cases, open-innovation initiatives are used to establish completely new businesses.

The second work is the article of Solesvik and Gulbrandsen (2013) that considered open innovation from the perspectives of causation and effectuation, and social networking. They examined the challenge of selecting partners for open innovation.

The article of Iakovleva (2013), the third work of that issue of the *Technology Innovation Management Review*, aimed to extend the discussion about entrepreneurial strategies of SMEs by including the concept of open innovation. The article shows how the innovative action of an SME may depend on the combined influence of entrepreneurial orientation within the firm and knowledge-providing cooperative links with knowledge providers. But she did not link the dimensions of entrepreneurial orientation and open innovation.

In the fourth article, Segers (2013) examined the impact of strategic partnerships and open innovation on the success of new biotechnology firms in Belgium by developing multiple case studies of firms in regional biotechnology clusters.

At end, De Cleyn et al. (2013) presented a case study of iMinds, a network organization in Flanders, Belgium. They described how iMinds' incubation and entrepreneurship programs act as a catalyst for open business ecosystems.

Recently, Eftekhari and Bogers (2015), using case study methodology, explored how an open approach to new venture creation can be beneficial for start-up entrepreneurs.

The most similar work is Cheng and Huizingh (2014), that addressed how three types of strategic orientations, among them Entrepreneurial Orientation, moderate the relationship between Open Innovation and innovation performance. In contrast to Cheng and Huizingh (2014), this thesis focuses on firm performance, not in innovation performance. The thesis also analyzes individually the dimensions of entrepreneurial orientation and their relationship with open innovation.

2.3 Performance measurement

Performance measurement is a topic which is often discussed in the literature. According to Neely et al. (1995), performance measurement is defined as “The process of quantifying effectiveness and efficiency of actions”. According to them, effectiveness refers to the extent to which customer requirements are met, while efficiency is a measure of how

economically the firm's resources are utilized when providing a given level of customer satisfaction. There are performance measures relating to quality, performance measures relating to time, performance measures relating to cost, performance measures relating to flexibility, performance measures relating to innovation, among others. However, there is a criticism of traditional performance models, which focused on financial measures. The critics argue that drivers of success in many organizations are intangible assets and the financial measures focus on short-term performance. However, the development of non-financial measures can consume considerable time and expense. Thus, the balanced models are becoming more relevant. Garengo et al. (2005) defined balanced models (also called multidimensional models) are defined as models that adopt different perspectives of analysis and manage them in a co-ordinated way.

Nevertheless, the performance measurement of small and medium enterprises (SMEs) is a separate issue. According to Garengo et al. (2005), the literature has identified the increasing complexity of SMEs and highlighted their sensitivity to differences in managerial culture and management systems. Garengo et al. (2005) revealed that there are basically two main obstacles to introducing performance management in SMEs: 'exogenous' barriers, e.g. the lack of financial and human resources, and 'endogenous' barriers, e.g. short-term strategic planning and the perception of PMSs as bureaucratic systems that cause rigidity. Garengo et al. (2005) highlighted that majority of performance measurement work, although theoretically valid, do not take into consideration the fundamental differences between SMEs and larger organizations, thus resulting in poor take up of performance measurement practices in SMEs.

The situation highlighted by Garengo et al. (2005) also occurs in studies about startups, which includes works using structural equation modeling. As example, Wu (2007) used a latent construct called Start-up performance, with a single-item measure: Average Return on Investment (ROI) of the first 2 years. The performance measurement construct does not take into consideration the fundamental differences between SMEs and larger organizations. Moreover, it does not consider the fact that these firms are younger than other types of SMEs.

Brush and Vanderwerf (1992) presented conclusions from a literature review of 34 current empirical studies from the entrepreneurship field that measured some aspect of performance and describes the results of an exploratory study that tested empirical variation across two methods of data collection and three sources of information used in measuring the performance of new ventures. They identified and queried on different aspects of performance of sixty-six recently formed (4–6 years old) manufacturing firms in Massachusetts. According to Brush and Vanderwerf (1992), measures of performance information included those most

frequently used by researchers, such as annual sales, number of employees, return on sales, growth in sales, and growth in employees. They concluded that competitors are a potentially useful source. However, in our research the use of competitors is not easy. Brush and Vanderwerf (1992) concluded that there is a need to identify measures that make sense for certain venture characteristics, industry conditions, start-up circumstances, and constituencies.

The evidences from literature suggest no evolution on startup performance measurement. Therefore, there is an opportunity to future works to develop a startup performance measurement.

3 METHODOLOGY

The thesis adopts a pragmatic philosophical view and uses sequential exploratory mix-methods research to propose and examine theory. According to Morgan (2007) a pragmatic approach is a new guiding paradigm that can act as a basis for supporting work that combines qualitative and quantitative methods and as a way to redirect our attention to methodological rather than meta-physical concerns. The pragmatic approach offers an effective alternative through its emphasis on the abductive–intersubjective–transferable aspects of our research (MORGAN, 2007). The pragmatic approach is to rely on a version of abductive reasoning that moves back and forth between induction and deduction — first converting observations into theories and then assessing those theories through action (MORGAN, 2007). The classic pragmatic emphasis on an intersubjective approach captures the duality between subjective and objective (MORGAN, 2007), while transferability means that we cannot simply assume that our methods and our approach to research makes our results either context-bound or generalizable; instead, we need to investigate the factors that affect whether the knowledge we gain can be transferred to other settings (MORGAN, 2007).

According to Morgan (2007) the strength of this pragmatic approach to social science research methodology is its emphasis on the connection between epistemological concerns about the nature of the knowledge that we produce and technical concerns about the methods that we use to generate that knowledge. This moves beyond technical questions about mixing or combining methods and puts us in a position to argue for a properly integrated methodology for the social sciences.

The mixed methods design was chosen because the researcher can bring together a more comprehensive account of the area of inquiry in which he or she is interested if both quantitative and qualitative research are employed (CRESWELL; CLARK, 2011). The major mixed methods research design adopted is exploratory sequential design provided by Creswell and Clark (2011). There are others mixed methods designs, like as provided by Morse (1991). The design proposed by Creswell and Clark (2011) was adopted instead of Morse (1991) because she advocates that the qualitative and quantitative aspects of a research project cannot be equally weighted. In the present case, the interdependence of the methods and phases make difficult to define what is more important: quantitative or qualitative. Without the case studies several issues were not considered in the survey. In addition, the case studies confirmed assumptions and presented new doubts to investigate. On the other hand,

the survey presents new evidences, which deepen our understanding about the researched scenario.

According to Creswell and Clark (2011) the exploratory design begins with and prioritizes the collection and analysis of qualitative data in the first phase. Building from the exploratory results, the researcher conducts a second, quantitative phase to test or generalize the initial findings. The thesis adopts the theory-development variant of exploratory sequential design. According to Creswell and Clark (2011) this model is used when the researcher formulates quantitative research questions or hypotheses based on qualitative findings and proceeds to conduct a quantitative phase to answer the questions.

It is important to perform a literature review before the field research. First, a meta-synthesis of qualitative case studies following the stages presented by Hoon (2013) is done. A meta-synthesis seeks to synthesize the key variables and underlying relationships across a set of published qualitative case studies to arrive at a refined, extended, or even new theory (HOON, 2013).

The steps followed in the meta-synthesis of qualitative case studies are:

- a) Framing the research question;
- b) Locating relevant research;
- c) Inclusion/exclusion criteria;
- d) Extracting and Coding Data;
- e) Analyzing on a case-specific level;
- f) Synthesis on a cross-study level;
- g) Building Theory From Meta-Synthesis;
- h) Discussion.

The first step — the research question — was presented before: what do case studies report regarding open innovation in startups or SMEs as related to entrepreneurial orientation?

In the next step we choose the research database. The search was performed in SCOPUS using the following string: (TITLE-ABS-KEY("open innovation") AND (TITLE-ABS-KEY(startup) OR TITLE-ABS-KEY(high-technology) OR TITLE-ABS-KEY("new venture") OR TITLE-ABS-KEY(SMEs))) AND (LIMIT-TO(DOCTYPE, "ar")) AND (LIMIT-TO(LANGUAGE, "English") OR LIMIT-TO(LANGUAGE, "Portuguese")) AND (LIMIT-TO(SRCTYPE, "j")). The aim was to locate articles in English or Portuguese that were published in journals. The articles had to contain in the title, abstract or keywords the term “open innovation” and least one of the following terms in the title, abstract or keywords: startup, high-technology, new venture or SMEs. The search returned 70 results. However, the

institutional access provided in Brazil by CAPES (government agency linked to the Brazilian Ministry of Education in charge of promoting high standards for post-graduate courses in Brazil) allowed access to only 45 articles.

The third step is the appropriate inclusion of relevant qualitative case studies. The exclusion criteria are: quantitative studies; conceptual works, no focus in open innovation; no focus in startups, SMES or high-tech firms. One work was excluded because it was a duplicate (printing mistake of journal). In the end, 14 articles were suitable. The abstracts of the articles were checked to verify they met the criteria.

The fourth step, extracting and coding data, involves the development of a coding form. The coding form contains the following fields: Author(s), Title, Journal, Year, Literature Gap, Broader aim(s) of study, Research Question, Intended Contribution, Country, Sector, Longitudinal, Research Method, Multimethods, Unit of Analysis, Number of Cases Included, Sampling Strategy, Timing and Sequencing of Data Collection, Data Collection Techniques Used by the Original Researcher, Data Sources, Key Findings as Summarized by the Original Researcher in Abstract/Introduction/Conclusion Section, Inbound Open Innovation Activities, Outbound Open Innovation Activities, Environmental Conditions, Visualization of Conceptual Model or Framework as Provided by the Originals Author(s), Discussion of Key Finding(s), Contribution(s) as Stated by the Original Researcher(s), Contribution to the Field of Open Innovation, Contribution to Other Fields, Limitations as Discussed by the Authors, Other Limitations, Study Relevance, Study Reliability, Missing Information, and Further Comments.

As the interest was in the intersection between open innovation activities and entrepreneurial orientation, a case dynamics matrix was chosen to analyze on a case-specific level. According to Miles and Huberman (1994), a case dynamics matrix displays a set of forces for change and traces the consequential processes and outcomes. The entrepreneurial orientation dimensions were considered the set of forces for change, and open innovation activities were considered as the consequential processes.

The cross-case analysis was then performed. Why did we use cross-case analysis? According to Miles and Huberman (1994), one reason is to enhance generalizability. They assert that although it's argued that enhanced generalizability is inappropriate for qualitative studies, multiple case studies, properly sampled and analyzed, can help answer reasonable questions. A partially ordered meta-matrix was adopted. According to Miles and Huberman (1994), meta-matrices are master charts assembling descriptive data from each of several cases in a standard format. The simplest form, as identified by Miles and Huberman (1994), is

a juxtaposition – a stacking-up – of all of the single-case displays on one very large sheet or wall chart. This simplest form of a meta-matrix was chosen for this study.

Next, a systematic review conducted following the stages presented by Tranfield et al. (2003) is done. The objective of this systematic review is to present hypotheses about the impact of the dimensions of entrepreneurial orientation in open innovation activities. The stage I (planning the review) has three phases: identification for the need for a review (phase 0), preparation of a proposal for a review (phase 1), and the development of a review protocol (phase 2). The phase 0 and 1 were presented respectively in introduction and theoretical background sections of the first article. The review protocol used the keywords “open innovation” and “autonomy” or “competitive aggressiveness” or “proactiveness” or “risk taking”. The bibliographic databases are Web of Knowledge and Scopus. The articles are published in English between 2003 and may of 2014. The exclusion criteria are: Articles which do not appear one of the keywords in the text (the keywords appear only in references), not published articles, repeated articles, articles not provided by CAPES and proceeding papers. The stage II (conducting a review) has 5 phases: identification of research (phase 3), selection of studies (phase 4), study quality assessment (phase 5), data extraction and monitoring progress (phase 6), and data synthesis (phase 7). The review protocol (phase 2) comprises the phases 3, 4 and 5. The data-extraction forms included details of the information source (title, authors, journal, publication details) and any other features of the study such as population characteristics, context of the study and an evaluation of the study's methodological quality, following the recommendations of Tranfield et al. (2013). The data synthesis used (phase 7) is a narrative review that according to Tranfield et al. (2003) is the simplest and best-known form of research synthesis. The stage 8 (stage in-reporting and dissemination) has one phase: The report and recommendations. The second article is the report, which has eight hypotheses.

Figure 1 shows thesis phases. Phase 1 is to check the hypotheses using multiple case studies (EISENHARDT, 1989; YIN, 1994). According to Eisenhardt (1989) the case study is a research strategy which focuses on understanding the dynamics present within single settings. First, the interview protocol was developed. Next, a pilot case study helped to improve the interview protocol.

The interview protocol to pilot case study was based on the framework proposed by Ndubisi and Iftikhar (2012). Ndubisi and Iftikhar (2012) developed a framework that considers the relationship between entrepreneurship, innovation and quality performance in small and medium-size enterprises. In our framework, innovation is replaced by Open

Innovation, divided in outbound open innovation and inbound open innovation. The Entrepreneurial Orientation is used instead of entrepreneurship and has three constructs: risk taking, proactiveness and autonomy. In questionnaire, the risk taking construct has five items, while the proactiveness construct has five items and autonomy construct has three items. The inbound open innovation construct and outbound open innovation construct are the adopted by Huang et al. (2013). In questionnaire, both the constructs have five items. Firm performance construct used by Huang et al. (2013) was adopted instead of quality performance construct adopted by Ndubisi and Iftikhar (2012). In questionnaire, the firm performance construct has four items and analyzes profit, return on sales, quality of products/services and reliability of products. A single pilot test was performed with an academic that was an entrepreneur too.

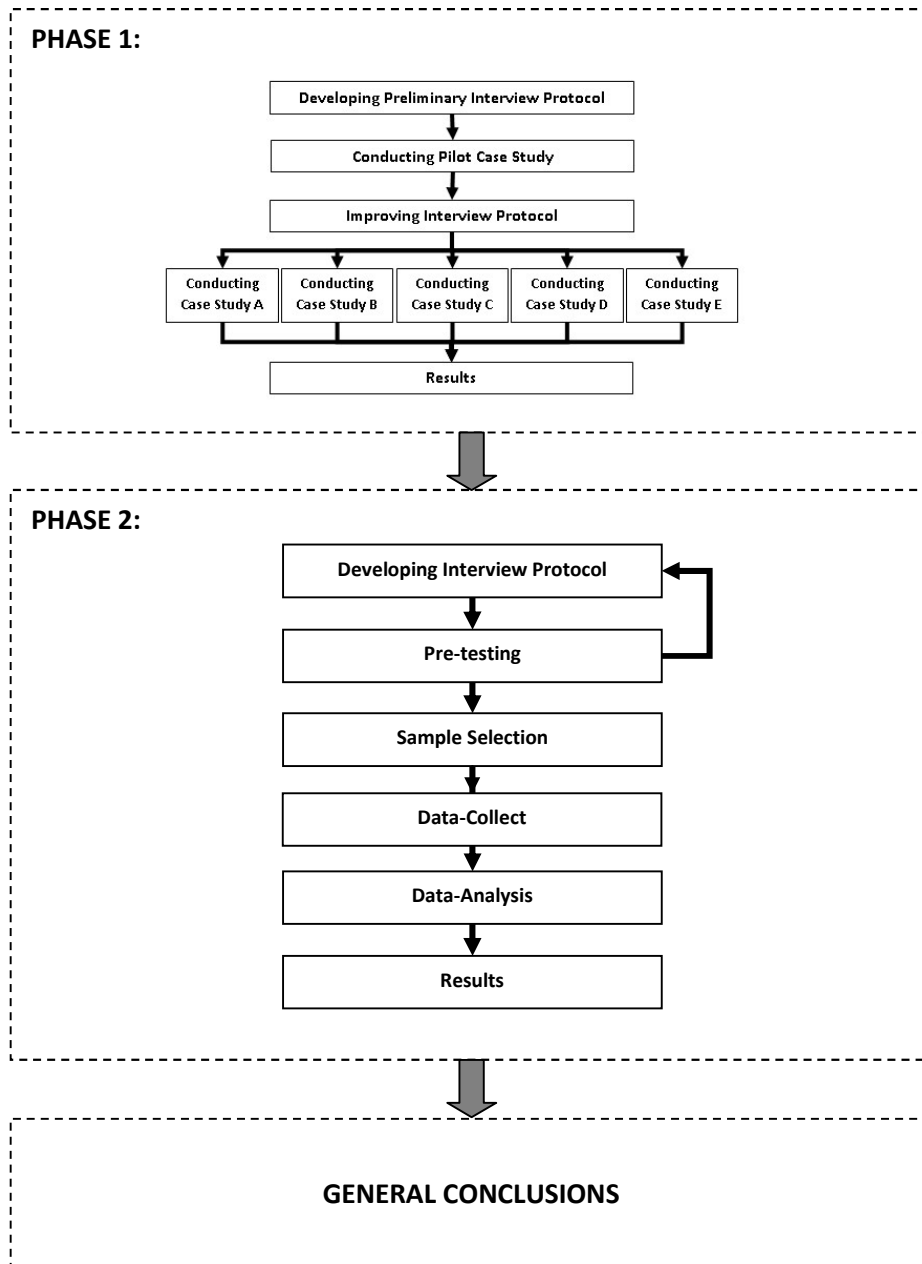
The owner was interviewed and he has knowledge about open innovation and the firm strategy. The interview was conducted in the firm. There were no problems to understand the questions, however other problems are evidenced. First, a structured questionnaire is not adequate to a deep understanding. It is important opened questions to a better understanding. Second, the questions were not adequate to small and medium enterprises. Third, there were problems with translation. The fourth problem is the absence of network dimension. Thus, a new interview protocol must be developed, based in three premises: using preferentially constructs in Portuguese, and/or focused in small and medium enterprises and with opened questions. As precondition the constructs should preferably be derived from studies that applied structural equation modeling, aiming future quantitative studies.

Thus, a new interview protocol was developed. To collect data about Open Innovation we did not find an interview protocol in Portuguese language. However, we defined van de Vrande et al. (2009) as construct because it is the first and the most cited work to analyze Open Innovation in small and medium enterprises. The Entrepreneurial Orientation construct was Li et al. (2005). The construct of Li et al. (2005) was chosen because we did not find a construct in Portuguese language. Two questions were inserted in this construct to analyze hypotheses presented in the second article. The network dimension was evaluated using the construct provided by Bonner et al. (2005). Again, we did not find a construct in Portuguese language. Yet, to collect information about firm performance was used the construct provided by Fernandes and Santos (2008), because it is in Portuguese Language. However, the firm performance construct is very similar to that used in the pilot case. The degree of agreement toward each item can be categorized into seven levels from “extremely disagree” to “extremely agree”. Also, the questionnaire has questions of identification and opened

questions about each construct. Because of the need of translations and to verify the understanding of questions 7 pilot test were applied in entrepreneurs and academicians. After each application the questionnaire was changed. There were no problems in the last two applications, and then we considered that the instrument was ready. After, the conceptual model (figure 2) was developed, considering the interview protocol and the hypotheses presented in the second article.

Next, the case studies were conducted. The enterprises were selected to case study not because the easy access reason, but because they are in evidence newspaper clippings. We take care to interview the owner, because reliability issues. All companies are located in Minas Gerais. The companies A, B and E are distant about 129 miles at south from the pilot case. The company C is distant about 115 miles at south from pilot case, while the company D is distant about 149 miles at north from pilot case. The sources of evidence were three: interviews, direct observations and documentation. The documentation is mainly based in newspaper clippings and other articles appearing in the mass media. By making a field visit to the case study “site”, we created the opportunity for direct observations. The interviews have two kinds of questions: opened and closed. The opened questions were applied first. The data from the closed questions were analyzed using radar chart. Next, the hypotheses were checked and new hypotheses were presented.

Figure 1 – Thesis Phases

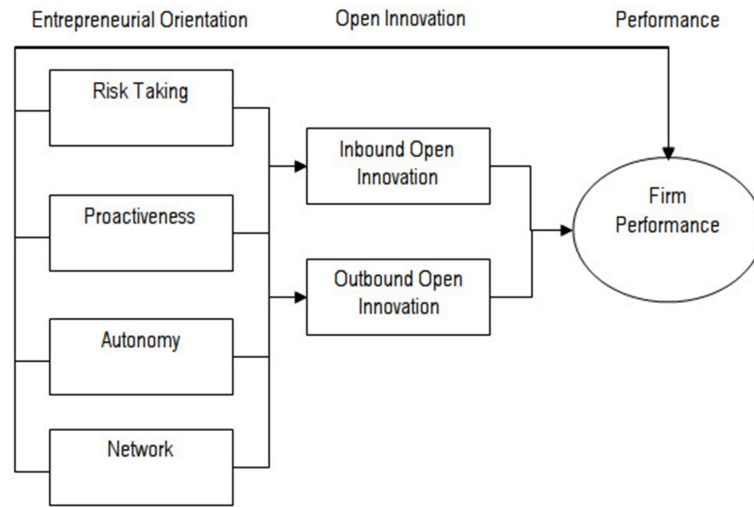


Phase 2 examine the conceptual model (FIGURE 2) that emerged from Phase 1. The research method used is survey (BRYMAN, 1989; FINK; KOSECOFF, 1998). The survey's design is cross-sectional. We adopt a self-administered questionnaire by computer (Google Form) to collect data. The empirical basis of the project was generated using information from the Brazilian Association of Startups (ABStartups). We check the records looking for inconsistencies. We identified 1950 valid records. Using random sampling, we contacted the startups using facebook, e-mail and phone call, asking who would like to participate in the survey. The link to access the questionnaire was sent to the companies that have committed to

answer. We contacted nearly all startups after three months. Our initial sample had 136 startups. However, we excluded 26 records because of the validity question. The validity question asks to respondent choose a specific answer to avoid random answers. We considered a high tech startup as a young firm (less than 8 years). So, we excluded six startups. We cannot evaluate the performance of very young enterprise (less than 1 year). Aiming to not reduce the sample, we exclude a variable which evaluates the performance considering the last two years. At the end, our sample has 94 startups.

The data analysis was performed in two steps. First, the hypotheses which approach the relationship between latent constructs (H1, H1e, H3, H4, H5, H11 and H11a) were analyzed using structural equation modeling. Because the complexity of analysis, the article 4 is devoted only to these hypotheses. On the other hand, the remaining hypotheses were analyzed in article 5 using first-generation and second-generation techniques of multivariate data analysis. To check hypotheses H1a, H1b, H2, H7, H8, H9 and H10 we use first-generation techniques. Most analyses we use non-parametric tests. We use parametric tests after transform variables closer to the Normal distribution. The other hypotheses and the subjacent hypothesis are checked using use partial least squares structural equation modeling (PLS-SEM). We used bivariate correlation to check hypotheses H1a, H1b and H2. In order to use the parametric tests, it is necessary to check the following conditions: the dependent variable is continuous quantitative measured at least in an interval scale; normality (we used two normality tests: Kolmogorov-Smirnov and Shapiro-Wilk); homoscedasticity among groups; and large sample ($n > 30$). As the condition of normality is not fulfilled, we used non-parametric tests. The statistical test used was the Spearman coefficient. To check hypothesis H7 we used cluster analysis using Ward's method and squared Euclidean distance to generate two groups: low risk taking and high risk taking. Variables chosen for cluster modeling were OERT1 and OERT2. Next, we use two normality tests which indicated that the condition of normality is not fulfilled. Next we use the Mann-Whitney U test to compare differences between two independent groups. To check hypothesis H8 we apply the Box-Cox transformation, because the normality tests indicated that the condition of normality is not fulfilled, and used multiple correlation using multiple regression. To check hypothesis H9 and H10 we apply the Box-Cox transformation, because the normality tests indicated that the condition of normality is not fulfilled, and used multiple regression. We used PLS-SEM to support the hypotheses H1c, H1d and H4, but using single-item construct.

Figure 2 – Conceptual model



4 GENERAL CONSIDERATIONS

This section aims to present general considerations about the work.

4.1 Considerations about the organization of thesis

This is a thesis by publication, comprising previously journal papers. Each paper will appear as a separate chapter in the thesis. This type of organization has the advantage of the problem to be addressed by different perspectives and methods.

This general introduction chapter appears at the beginning of the thesis. Because the scarcity of quantitative works, the first paper is a meta-synthesis of qualitative case studies, which explores the relationship between open innovation and entrepreneurship and open innovation in SMEs. The second paper aims to examine which entrepreneurial orientation dimensions works as open innovation drivers. The third paper uses case studies to check the previously presented hypotheses. The fourth and fifth papers are results from a survey that aims to check all hypotheses. The conclusions are presented in each paper and the present section aims a general conclusion.

However, some considerations should be done. First, there are criticisms about this type of organization, but some are mistaken. The main criticism is that the authors violated rigor by splitting their study. According to Morse and Cheek (2015) the mixed method design is more than simply using two or more research approaches or parts thereof in a single study. Morse and Cheek (2015) also claim that the point of interface of those approaches and the consequent integration of the results of the various components in the research that makes the study a mixed-method design. This last affirmation of Morse and Cheek (2015) answer the other question: Is there loss of originality due to the fact that some or all of the work to be published? Whether the thesis is the point of interface, the work is still original.

Moreover, this type of organization presents several benefits. One objective of the doctoral program is to enable the student to engage in advanced study and research. When the doctoral student is submitting articles, he or she is engaging in research. The feedback of the examiners allows him or her to improve his work, while he or she is interacting with other researchers. Another benefit is to present the work to scientific community, which may be a way to communicate the interest in fill the gap. Furthermore, there are gains in efficiency, trough the possible time reduction and improvements in the doctoral program indicators and the candidate curriculum. However, it is important to highlight the Herculean task that is to

integrate the set of works, requiring careful planning. As the work has gained complexity, it becomes hard to merge in one document. These limitations will be presented below. Regardless, this type of organization (thesis by publication) is very efficient in several aspects and must be valued.

4.2 Considerations about the methodology

The mixed methods design makes easy the planning. When the work is divided in several and distinct steps, it becomes more manageable, because the milestones are more evident. Another advantage is the use of sequential exploratory mixed methods approach. In the present case, important references were scarce and the method allows the researcher to gain intimate with the research subject using first a qualitative method research. The qualitative research shows important details to be taken into account before the quantitative work. As example, the fact that the managers do not know the concept of open innovation. As the construct of open innovation is formative, the convergent validity might show a false negative.

Other important detail: it is important to a researcher know several approaches and methods. Thus, the employ of mixed methods design contributes to formation of researcher.

4.3 Considerations about the results

The considerations about the results are from three types: academic, managerial and social. The present work fills some gaps in the literature about open innovation. According to Carvalho et al. (2016) quantitative studies in Latin America is a gap. The present work show evidence about the use of open innovation in Brazil, a Latin American Country. Carvalho et al. (2016) also identified two more gaps for quantitative studies: microenterprises and startups. Thus, we contribute to open innovation literature, by studying open innovation in Brazilian startups. Another important contribution: the hypotheses were deducted from literature and most of them were not supported. This situation reinforces the context issue to open innovation. The Brazilian business environment has peculiarities in terms of culture, law and economy which impact the management of enterprises. Some of these issues will be described below.

Another important contribution to the open innovation literature is the role of inbound and outbound open innovation. The fourth article shows evidences that inbound open

innovation has no impact on firm performance, while the outbound open innovation has impact on firm performance. The first one is widely employed, while outbound open innovation has been relegated by organizations and researchers.

The thesis does not contribute only with Open Innovation literature, but also it contributes to Entrepreneurial Orientation literature. The third article highlighted the fact that a number of ontological questions persist in the Entrepreneurial Orientation literature, between them there are ongoing conversations regarding the dimensionality of Entrepreneurial Orientation. We confirmed the importance of network dimension presented by Mello and Leão (2005), which justify the absence of the competitive aggressiveness dimension. In the third article it became clear that the startups are using the concept of “the blue ocean” by developing innovative products. Therefore, they have no competitors. However, they must work with partners to develop and to commercialize their product. So, the alliances, and consequently the network dimension, are important.

However, the study of the relationship between open innovation and entrepreneurship is the main contribution. The thesis was partially confirmed. Some dimensions of entrepreneurial orientation are drivers to the macroprocess of open innovation. The evidences show a significant impact of network and proactiveness dimensions of entrepreneurial orientation on inbound open innovation, but only proactiveness dimension of entrepreneurial orientation has significant impact on outbound open innovation. Only network and proactiveness dimensions of entrepreneurial orientation have positive impact on firm performance. The evidences also suggest a situation where open innovation is not effective: the use of inbound open innovation to improve the firm performance. It reinforces the affirmation of Huizingh (2011) that the effectiveness of open innovation is context dependent. Besides all, open innovation has not more impact on firm performance than entrepreneurial orientation. The network dimension has more impact on firm performance, followed by outbound open innovation and proactiveness. And the last contribution to literature is the tool proposed: the Open Innopreneurial Orientation.

The Open Innopreneurial Orientation is important not just to academic literature, but also to managers. Through the presented evidences in the fourth and fifth article, we can suppose the network and proactiveness dimensions of entrepreneurial orientation and outbound open innovation have positive impact on firm performance. Thus, we have three observations in terms of business. First, the managers should be concerned with strategic network identity, establishing a strong position within a network of alliance partners. The firm should have a high degree to which it perceives itself to be a ‘partner of choice’ for other

firms in the market. The competitive strength of firms' alliance network and the strength of its relationships with key alliance partners are very important too. The startup must to have the ability to select partners to complement its own business strategy. As young and small enterprise, the social capital of the manager is very important, which allows the firm to get access to favorable information and negotiation advantages.

Second, startups should implement proactive strategies such as introducing new products/trademarks ahead of their competition, searching for new opportunities (which may or not be related to the current firm's technology core), and anticipating future needs. Far beyond, the case studies show the importance to create and discover uncontested market spaces. It is not new, but the term "discover uncontested markets" does not mean "discover niche markets". The startups must to pursuit high product differentiation to difficult the competition. High product differentiation comes through innovation, which lead us to third observation. The innovation is not only outside-in, but inside-out too, i.e., the firms should not only use external ideas, but they also should use external paths to market. Despite of all activities of outbound open innovation be significant, the employee involvement has the biggest weight, followed by outward intellectual property licensing, being the last venturing activity. Therefore, the managers of startups should be critical as to the hiring employees, even the employees who are not involved in research and development. So, the managers of startups have to take up suggestions, exempting the employees to implement ideas. In addition, the managers have to invest in the educational formation and training of their employees. The managers must to invest in empowerment of employees too. The managers of startups also should protect their creations using intellectual properties and sell licenses or royalty agreements to other organizations to better profit from theirs. The venturing activity means start up new organizations drawing on internal knowledge.

By articulating the three observations we can offer more suggestions. The managers can improve the strength of firms' alliance network, offering licenses or royalty agreements to the partners at the same time that they improve the strength of its relationships with key alliance partners. So, they can work together to develop new products, creating uncontested market places through high product differentiation. This may result in new business opportunities. The managers of startups can implement proactive strategies using open innovation. Along with enjoying opportunities arising from intellectual properties, they can take advantage of the ideas of employees by creating new business ventures.

The social contributions may be deduced from what has been presented. The first and most basic contribution to public managers is about education. The Brazilian politicians are

focused in to insert disciplines in disciplinary curriculum, but they forget the importance to develop ability and competencies among the students. As example, in this conception the entrepreneurial education may be achieved inserting a discipline of entrepreneurship in the elementary and high school. However, the main concern must be the formation of abilities and competencies. An entrepreneurial education should be focused in social capital formation, proactiveness and innovativeness. Children should be encouraged to work with other children and thus learn the concept of reciprocity aiming the social capital formation. The transdisciplinary approach is very important because it can incentive the innovative behavior. Cultural issues are an obstacle. First, some people believe to be nonsense entrepreneurial education to young students. Second, the common-sense is that entrepreneurial behavior is for who wants to venture, being useless to the others.

However, there are short-term actions. According to van Hemert et al. (2012), in the Netherlands, a government subsidy called the “innovation voucher programme” was introduced to stimulate SMEs to develop innovation in cooperation with knowledge institutes. The vouchers allow SMEs to buy research and advice from knowledge institutes in the Netherlands and a selection of European knowledge institutes on a first-come first-served basis. The “innovation voucher programme” may provide two main benefits: the development of alliances by the SMEs, and the development of applied and useful research by the knowledge institutes (by stimulating the interaction between university and enterprises), being the last one particularly important to a country like Brazil, where the researchers define the application of funds from science and technology (leading to the pulverized application of financial resources often in researches without effects in social and economic problems). Cultural issues are an obstacle. Some people believe the university and professors and researchers should not profit. Other suggestion is the improvement of the programs to support to insertion of masters and doctors in the enterprises. These programs are few divulged, besides of the problem of the value paid to the professionals. Despite of the value be high to the SMEs, the value is low to the professionals, discouraging their participation.

Moreover, there are problems with Brazilian law. Starting up a new venture is very complex and laborious, which leads to discouraging the entrepreneurs. The taxes and the bureaucracy are obstacles. In addition, the entrepreneur does not want grow, because the taxes to big firms are high. This situation may disturb important improvement processes for companies such as internationalization, which impacts the country growth through exportation reduction. The Brazilian law must be revised. Lastly, the Brazilian businessmen

prefer copy or imitation, instead of to innovate, because they do not want and / or they do not know and / or because of the costs and /or the weak intellectual property protection.

4.4 Limitations and avenues for future research

Every research has limitations and weakness. The biggest weakness is the sample. Despite of accomplish the statistical assumptions to generalize, the sample is small. However, we must highlight two important aspects. First, the results are reliable, due the cautions adopted. The question of validity was very important. We avoid the “lottery effect” with random answers. The profile of respondents is another important detail. Most questionnaires were answered by owners and managers. Second, in Brazil make research using survey method is very hard. As example, Maia and Iarozinski Neto (2016) had a sample of 118 companies, Brasil et al. (2016) had a sample of 70 companies, and Souza and Rachid (2016) had a sample of 95 companies. Therefore, our sample is consistent with other works.

Another weakness is the methodology of contact. We contacted the startups following the sequence: facebook, e-mail and phone. Some startups did not answer. We must take into account the possibility of the facebook page or the site be not used. Thus, future research must be more careful in this point.

At end, another weakness is the firm performance construct. The variables compare the firm performance with the main competitor, however most startups has no competitors. So, future researches addressing startups must develop other construct.

As the results differ from theory, the context issue is proved important. Thus, replicate the research in others countries or sectors as agribusiness, multinationals, energetic enterprises may contribute to open innovation literature.

Another subject to future studies is the role of social capital to strategic network identity and open innovation. What is the role of weak ties to network identity? What is the role of weak ties to open innovation? Is the social capital a moderator between network identity and open innovation?

Even the present work may continue using an explanatory approach. By identifying in the sample the startups with best performance, case studies may help develop a best practices guide. After all, a work is not just important because of its results, but also because of its contributions to future works.

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**Toward a Theory of Open Innovation and Entrepreneurship: a Meta-Synthesis
from Qualitative Studies in Small and Medium Enterprises**

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Abstract

After a decade of literature, open innovation is still considered an emergent topic, and thus, there are few gaps left to be explored. However, two gaps that have not been explored are the relationship between open innovation and entrepreneurship, and open innovation in small and medium enterprises (SMEs)—the latter because most studies focus on large enterprises. Our research question in this study is: what do case studies report regarding open innovation in startups or SMEs as related to entrepreneurial orientation? Our study is a meta-synthesis of qualitative case studies following the stages presented by Hoon (2013). A theory is developed and presented considering the entrepreneurial orientation dimensions and open innovation activities. In the concluding section, limitations and suggestions for future works are presented.

Keywords: open innovation; entrepreneurship; entrepreneurial orientation; startups, small and medium enterprises.

Resumo

Inovação aberta é ainda, após uma década, tema emergente na literatura e em razão disso apresenta ainda algumas lacunas a serem exploradas. Duas dessas lacunas são o relacionamento entre inovação aberta e empreendedorismo, e inovação aberta em pequenas e médias empresas (PMEs). O presente estudo apresenta como questão de pesquisa: o que os estudos de caso reportam sobre inovação aberta em startups ou pequenas empresas que estaria relacionado com a orientação empreendedora? O presente estudo é uma meta-síntese de estudos qualitativos, que segue os passos propostos por Hoon (2013). Uma teoria foi desenvolvida e apresentada considerando as

dimensões da orientação empreendedora e as atividades de inovação aberta. Nas considerações finais foram apresentadas limitações e sugestões para trabalhos futuros.

Palavras-chave: inovação aberta; empreendedorismo; orientação empreendedora; *startups*, pequenas e médias empresas.

Resumen

La innovación abierta sigue siendo, después de una década, el tema en la literatura emergente y porque todavía tiene algunas brechas a examinar. Dos de estas brechas son la relación entre la innovación abierta y la iniciativa empresarial y la innovación abierta en las pequeñas y medianas empresas (PYME). Este estudio se presenta como una pregunta de investigación: ¿Qué estudios de caso informe sobre la innovación abierta en nuevas empresas o pequeñas empresas que se relaciona con la orientación emprendedora? Este estudio es un meta-síntesis de estudios cualitativos, siguiendo los pasos propuestos por Hoon (2013). Una teoría fue desarrollada y presentada teniendo en cuenta las dimensiones de la orientación emprendedora y las actividades de innovación abierta. En las consideraciones finales fueron presentadas limitaciones y propuestas para el trabajo futuro.

Palabras clave: innovación abierta; iniciativa empresarial; orientación emprendedora; *startups*, pequeñas y medianas empresas.

1. Introduction

The present article was submitted to *Interciencia Journal*, being a preliminary version according first review and examiners suggestions. The journal may suggest new changes.

Chesbrough (2003) coined the term open innovation, creating not only new possibilities for innovation managers but also a new field for study and research. According to West et al. (2014), although open innovation research is frequently cited and has influenced the direction of innovation studies, it has had a limited impact upon the broader disciplines of management and economics. One of these disciplines of management, as noted by Hossain (2013), is entrepreneurship. This topic receives more attention because, according to Soriano and Huang (2013), over the last few years, the interrelationship between innovation and entrepreneurship, or new business creation, has become apparent through a vibrant research trend that fuses insights from different academic approaches.

Several authors (Bianchi et al., 2011; Hossain, 2013; van de Vrande et al., 2009) also recognize that the topic of open innovation in small and medium enterprises represents a gap in the current literature. According to these authors, current research in open innovation only emphasizes large and multinational companies. SMEs, however, are important to almost all economies in the world. SMEs contribute to job creation, play an important role in technology development, and are drivers of major economic growth - especially in developing countries.

Considering the gap of studies about open innovation and its relationship with entrepreneurship, and few studies about open innovation in small and medium enterprises, startups may be a promising area of research. The academic literature defines a high-tech startup as a young firm (less than 8 years) launched by individuals

for developing and exploiting (in various forms) an innovation (Freeman, 1982; Shan, 1990). According to the Brazilian Association of Startups, startups are early stage companies that develop innovative products or services with the potential for fast growth. By these definitions it is clear that the entrepreneurship element is present. Most startups are SMEs. Thus, startups are ripe for research and relatively unexplored by current open innovation literature. Therefore, our research question is: what do case studies report regarding open innovation in startups or SMEs as related to entrepreneurial orientation?

Entrepreneurial orientation was chosen because according to Rauch et al.(2009) it has emerged over the years as a major construct in the strategic management and entrepreneurship literatures. To answer the research question, this study will conduct a meta-synthesis of empirical studies following the stages presented by Hoon (2013). According to Hoon (2013) meta-synthesis is an exploratory, inductive research designed to synthesize primary qualitative case studies for the purpose of making contributions beyond those achieved in the original studies. A meta-synthesis constitutes an understanding of synthesis that is interpretive, aiming at synthesizing primary qualitative case studies that have not been intended as part of a unified multisite effect (Hoon, 2013).

The study proceeds by presenting the theoretical background, the methodology, and the theory and discussion, followed by a concluding section.

2.Theoretical Background

The purpose of this section is to provide the reader with the broad theoretical framework used for interpreting the research. First, the open innovation paradigm will be presented, followed by the entrepreneurial orientation framework.

2.1. Open Innovation

The definition of open innovation is still unclear, and what exactly open innovation is and what it is not, is still being debated (Hossain, 2013). In fact, the definition of open innovation has evolved with time, as noted by West et al. (2014). The first and most used definition of open innovation was provided by Chesbrough (2003): open innovation means that valuable ideas can come from inside or outside the company and can go to market from inside or outside the company as well. However, later, Chesbrough (2006) emphasized the intentionality of the knowledge flows into and out of the firm. Thus, Chesbrough (2006) affirms that open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the market for the external use of innovation. However, in a new effort to define open innovation West et al. (2014) presented the most recent definition of open innovation provided by Chesbrough and Bogers (2014), which considers the increasing interest in non-pecuniary knowledge flows, as being a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms that are in line with the organization's business model.

To understand the concept of open innovation, it is important to know its activities. Huizingh (2011) affirms that open innovation became the umbrella that encompasses,

connects, and integrates a range of already existing activities. Hossain (2013) affirms that open innovation overlaps other concepts such as user generation, crowdsourcing, and distributed innovation. So, open innovation is not a novelty, but a range of existing concepts and activities. Gassmann and Enkel (2004) divided open innovation into three macroprocesses or archetypes, as follows:

- The outside-in process: enriching the company's own knowledge base through the integration of suppliers, customers and external knowledge sourcing can increase a company's innovativeness. Conboy and Morgan (2011) note that this process is also referred to as inbound. Bianchi et al. (2011) recognize various organizational modes for outside-in open innovation including: in-licensing, minority equity investments, acquisitions, joint ventures, R&D contracts and research funding, purchase of technical and scientific services and non-equity alliances.

- The inside-out process: earning profits by bringing ideas to market, selling intellectual property and increasing technology by transferring ideas to the outside environment. Conboy and Morgan (2011) note that this process is also referred to as outbound. Bianchi et al. (2011) recognize various organizational modes for inside-out open innovation including: licensing out, spinning out of new ventures, sale of innovation projects, joint venture for technology commercialization, supply of technical and scientific services, corporate venturing investments and non-equity alliances.

- The coupled process: coupling the outside-in and inside-out processes by working in alliances with complementary partners in which give and take is crucial for success. According to Conboy and Morgan (2011) the coupled process approach combines the outside-in (gaining external knowledge) with the inside-out process (bringing ideas to market), and because of this hybridization is sometimes not examined

by some authors. To accomplish both the outside-in and inside-out approaches, these companies collaborate and cooperate with other stakeholders such as partner companies (e.g., strategic alliances, joint ventures), suppliers and customers, as well as universities and research institutes.

As previously mentioned, the coupled process is a combination of the inside-out and outside-in processes in strategic R&D alliance, thus, justifying the fact that authors such as Chesbrough and Crowther (2006) and Wang and Zhou (2012) adopt only inside-out and outside-in processes in their works. Other authors, like van de Vrande et al. (2009), adopt the terms technology exploration and technology exploitation to define, respectively, inbound and outbound open innovation. In our work, we will use the processes adopted by van de Vrande et al. (2009) because they are among few to explore open innovation in SMEs. Van de Vrande et al. (2009) cite as examples of outbound open innovation: venturing, outward IP licensing and employee involvement. Additionally, van de Vrande et al. (2009) cite as examples of inbound open innovation: customer involvement, external networking, external participation, outsourcing R&D and inward IP licensing.

According to West et al. (2014), open innovation has also had a considerable impact on practice. Daily industry press releases tout the latest “open innovation” initiative of an industrial or consulting firm (West et al., 2014). West et al. (2014) observe that middle managers have adopted “open innovation” in their job title, and conferences regularly promise to reveal open innovation secrets to their attendees. However, Huizingh (2011) adverts that just as there is no panacea, a remedy to cure all types of disease, in medicine, it is unlikely that a management concept will have positive effects in every situation, implying that the effectiveness of open innovation is context dependent. The

context is affected by management and economics issues. However, West et al. (2014) affirm that while open innovation research is frequently cited and has influenced the direction of innovation studies, it has had a limited impact upon the broader disciplines of management and economics. One example of this is that the role of managers and entrepreneurs in implementing open innovation is still unexplored. Thus, studies that combine entrepreneurship and open innovation research may help to strengthen our understanding (Hossain, 2013).

2.2. Entrepreneurial Orientation

One of the main concepts in entrepreneurship studies over the last decade has been entrepreneurial orientation. According to Campos et al. (2012), entrepreneurial orientation has received substantial conceptual and empirical attention, representing one of the few areas in entrepreneurship research in which a cumulative body of knowledge is developing. Entrepreneurial orientation facilitates understanding of the entrepreneurship process. According to Lumpkin and Dess (1996), entrepreneurial orientation refers to the processes, practices, and decision-making activities used by entrepreneurs that lead to the initiation of an entrepreneurial firm.

Lumpkin and Dess (1996) identify five dimensions of entrepreneurial orientation:

- **Autonomy:** defined as independent action by an individual or team aimed at bringing forth a business concept or vision and carrying it through to completion.
- **Competitive aggressiveness:** reflects the intensity of a firm's effort to outperform industry rivals, characterized by a strong offensive posture and a forceful response to competitor's actions (Lumpkin and Dess, 2001);

- Innovativeness: reflects a firm's Schumpeterian tendency to engage in and support new ideas, novelty, experimentation, and creative processes that may result in new products, services, or technological processes. Innovativeness represents a basic willingness to depart from existing technologies or practices and venture beyond the current state of art. (Lumpkin and Dess, 1996);
- Proactiveness: defined as acting opportunistically to shape the environment by influencing trends, creating demand, and becoming a first mover in a competitive market (Lumpkin and Dess, 1996);
- Risk taking: involves the determination and courage to make resources available for projects that have uncertain outcomes, in other words—those which involve risk (Villiers-Scheepers, 2012). According to Lumpkin and Dess (2001), risk taking refers to a tendency to take bold actions, such as venturing into unknown new markets, or committing a large portion of resources to ventures with uncertain outcomes.

Mello and Leão (2005) identified a sixth dimension called networks. According to them, this dimension was inserted because the entrepreneur must build relationships with partners to make the venture viable. Mello and Leão (2005) further state that the key concept to this dimension is network identity. Mello and Leão (2005) ultimately conclude that the emergence of this dimension should replace the competitive aggressiveness dimension.

The term network refers to two or more organizations involved in a long-term relationship (Thorelli, 1986). Probably the most salient part of the environment of any firm is other firms (Thorelli, 1986). Interfirm relations have been given surprisingly little or no attention or consideration in marketing, industrial organization economics and organization theory (Thorelli, 1986). Strategic network identity consists of a firm's

calculated and consolidated assessment of its set of existing and past relationships across partners over time (Bonner et al., 2005). Strategic network identity also embraces the value of a firm's alliance network (Bonner et al., 2005). Therefore, it seems reasonable to argue that a firm that perceives its strong strategic network identity has both the impetus to seek competitive advantage through its identity and has the ability to attract profitable partners and be favorably compensated, which, in turn, should enhance its marketplace performance (Bonner et al., 2005). Bonner et al. (2005) considered three factors in analyzing strategic network identity: reputation of the organization as a "partner of choice," competitive strength of alliance network and strength of relationships with key alliance partners.

3. Methodology

Our study is a meta-synthesis of qualitative case studies. A meta-synthesis seeks to synthesize the key variables and underlying relationships across a set of published qualitative case studies to arrive at a refined, extended, or even new theory (Hoon, 2013). The research interests of our meta-synthesis study focus on open innovation in startups or SMEs. The steps followed are:

1. Framing the research question;
2. Locating relevant research;
3. Inclusion/exclusion criteria;
4. Extracting and Coding Data;
5. Analyzing on a case-specific level;
6. Synthesis on a cross-study level;

7. Building Theory From Meta-Synthesis;

8. Discussion.

The first step — the research question — was presented before: what do case studies report regarding open innovation in startups or SMEs as related to entrepreneurial orientation?

In the next step we choose the research database. The search was performed in SCOPUS using the following string: (TITLE-ABS-KEY("open innovation") AND (TITLE-ABS-KEY(startup) OR TITLE-ABS-KEY(high-technology) OR TITLE-ABS-KEY("new venture") OR TITLE-ABS-KEY(SMEs))) AND (LIMIT-TO(DOCTYPE, "ar")) AND (LIMIT-TO(LANGUAGE, "English") OR LIMIT-TO(LANGUAGE, "Portuguese")) AND (LIMIT-TO(SRCTYPE, "j")). The aim was to locate articles in English or Portuguese that were published in journals. The articles had to contain in the title, abstract or keywords the term “open innovation” and least one of the following terms in the title, abstract or keywords: startup, high-technology, new venture or SMEs. The search returned 70 results. However, the institutional access provided in Brazil by CAPES (government agency linked to the Brazilian Ministry of Education in charge of promoting high standards for post-graduate courses in Brazil) allowed access to only 45 articles.

The third step is the appropriate inclusion of relevant qualitative case studies. The exclusion criteria are: quantitative studies; conceptual works, no focus in open innovation; no focus in startups, SMES or high-tech firms. One work was excluded because it was a duplicate (printing mistake of journal). In the end, 14 articles were suitable. The abstracts of the articles were checked to verify they met the criteria.

The fourth step, extracting and coding data, involves the development of a coding form. The coding form contains the following fields: Author(s), Title, Journal, Year, Literature Gap, Broader aim(s) of study, Research Question, Intended Contribution, Country, Sector, Longitudinal, Research Method, Multimethods, Unit of Analysis, Number of Cases Included, Sampling Strategy, Timing and Sequencing of Data Collection, Data Collection Techniques Used by the Original Researcher, Data Sources, Key Findings as Summarized by the Original Researcher in Abstract/Introduction/Conclusion Section, Inbound Open Innovation Activities, Outbound Open Innovation Activities, Environmental Conditions, Visualization of Conceptual Model or Framework as Provided by the Originals Author(s), Discussion of Key Finding(s), Contribution(s) as Stated by the Original Researcher(s), Contribution to the Field of Open Innovation, Contribution to Other Fields, Limitations as Discussed by the Authors, Other Limitations, Study Relevance, Study Reliability, Missing Information, and Further Comments.

As the interest was in the intersection between open innovation activities and entrepreneurial orientation, a case dynamics matrix was chosen to analyze on a case-specific level. According to Miles and Huberman (1994), a case dynamics matrix displays a set of forces for change and traces the consequential processes and outcomes. The entrepreneurial orientation dimensions were considered the set of forces for change, and open innovation activities were considered as the consequential processes.

The cross-case analysis was then performed. Why did we use cross-case analysis? According to Miles and Huberman (1994), one reason is to enhance generalizability. They assert that although it's argued that enhanced generalizability is inappropriate for qualitative studies, multiple case studies, properly sampled and analyzed, can help

answer reasonable questions. A partially ordered meta-matrix was adopted. According to Miles and Huberman (1994), *meta-matrices* are master charts assembling descriptive data from each of several cases in a standard format. The simplest form, as identified by Miles and Huberman (1994), is a juxtaposition – a stacking-up – of all of the single-case displays on one very large sheet or wall chart. This simplest form of a meta-matrix was chosen for this study.

The next section presents the theory from the meta-synthesis and discussion.

4. The Theory and Discussion

The present section is organized by activities of open innovation. The outbound open innovation is neglected in SMEs. Van de Vrande et al. (2009) presented three ways to accomplish outbound open innovation: venturing, outward intellectual property licensing, and employee involvement. The selected articles do not show examples of venturing performed by SMEs. This corroborates the conclusion by van de Vrande et al. (2009) that SMEs successfully engaged in venture activities tend to be the exception.

Regarding outward intellectual property licensing, Bianchi et al. (2010) suggest that a critical success factor in the practice of open innovation is the timely identification of opportunities for out-licensing a firm's technologies outside its core business. Bianchi et al. (2010) assert that this can be particularly challenging for SMEs because of their focused business portfolio, specialized knowledge basis, and limited financial resources available for innovation activities. They presented a methodology, developed in collaboration with an Italian SME, for identifying viable opportunities for out-licensing a firm's technologies outside its core business. However, entrepreneurial orientation

dimensions were not identified and only one observation was presented: patent attorneys intentionally use cryptic terms to describe inventions to hide them from competitors. This behavior may be considered an example of competitive aggressiveness, but is not a specific characteristic of that Italian SME or that case study. Furthermore, the results of one case cannot be generalized.

The same situation occurs with employee involvement. Only one article explored the activity and presented evidence of the relationship with entrepreneurial orientation dimensions. According to Hutter et al. (2013), in the investigated SMEs, internal sources such as employees are still considered important sources of innovation and they have autonomy to work. Furthermore, the employees and the firms are proactive—they are looking to get ahead of the competitors by introducing a new idea or product.

Unlike outbound open innovation, inbound open innovation is frequently used, specifically customer involvement and external networking. There are studies about outsourcing R&D, but none were found that also related to entrepreneurial orientation. Because there are multiple case studies, and the same are adequately sampled, a theory may be built.

Customer involvement is strongly related to the network dimension, despite evidence linking the relationship with the risk-taking and proactiveness dimensions. Chesbrough (2003), in the seminal work about open innovation, stressed the importance of value networks. According to Chesbrough (2003), creating and appropriating value also involves third parties outside the immediate value chain and, taken together, these outside parties form a value network. Chesbrough (2003) asserts that the value network created around a given business shapes the role that suppliers, customers, and third parties play in influencing the value captured from the commercialization of an

innovation. Even customer involvement was cited by Chesbrough (2003). The networked world, according to Chesbrough (2003), essentially brings customers into the lab as co-producers, allowing the firm to tap both the customers' explicit and implicit knowledge. Chesbrough (2003) maintains that prototypes used by real customers working in the real world afford a type of screening that helps to flush out serious flaws, misleading instructions, and missing functionality before the product is brought to market. Ståhlbröst (2012) states that the risk of opening up the firm's process decreases if it opens up as early as possible because the firm gets to know the users' needs early on. Furthermore, according to Ståhlbröst (2012), the Living Labs approach represents the proactiveness dimension because it anticipates future applications of a product. According to the European Network of Living Labs (ENoLL), a Living Lab is a real-life test and experimentation environment where users and producers co-create innovations.

For instance, in Ståhlbröst's (2012) study the Living Lab approach created value for both the involved SME and the intended customers by fostering an improved design of the innovation (Ståhlbröst, 2012). Brunswicker and Ehrenmann (2013) cited an example of a German software firm that builds up downstream partnerships to increase sales potential. Increased sales potential is a result of better understanding customers' needs.

However, when should the customer be involved? Lazzarotti et al. (2011) set out four different open innovation models that represent the degree of openness with respect to two variables: the number and type of partners with whom the company collaborates and the number and type of phases of the innovation process that are actually open to external collaborations. They are: open innovators, closed innovators, integrated collaborators and specialized collaborators. Grimaldi *et al.* (2013) used this open innovation model approach and presented the case of a specialized innovator company,

where the relationship between the company and one association enabled the firm to develop a better understanding of *coeliac disease* and, as a consequence, to successfully develop a line of products that would fully meet the needs of individuals with *coeliac disease*. Relying still on the assertion of Ståhlbröst (2012), that the risk of opening up the firm's process decreases if it opens up as early as possible because the firm gets to know the users' needs early on, the customer must take part in the idea generation and concept defining phases. Grimaldi et al. (2013) showed that even in an integrated collaborator firm, the impulse for innovation came from an idea of a client, who had expressed a specific need to the company.

The company studied by Brunswicker and Ehrenmann (2013) defined itself, according to the above specified open innovation paradigm, as a networked enterprise and as an open innovator. Such a company is aware of its customers, suppliers, complementors, competitors and intermediaries and uses its network both for the commercialization of products (i.e., operations) and for innovation management. In other words, the company uses both customer involvement and external networking as part of its inbound open innovation strategy.

The participation of suppliers is very important, but does not play a fundamental role in developing innovations. In a study by Grimaldi et al. (2013) a strong relationship with the suppliers helped enable a company to finalize a product with a high electronic content in an integrated collaborator firm. In that case, although the partnership relationship previously established by the company was an asset to the realization of a successful product, the network resources did not play a fundamental role in implementing the innovation. Rather, the flexibility of the personnel to rapidly adjust to the new production process, the capacity to coordinate an in-depth study of the different

packaging methods of the new product (working in close contact with the suppliers), the ability to finalize the new product in 12 months and the realization of new commercial and marketing policies led to the success of one of the innovations in an open innovation firm (Grimaldi et al., 2013).

Intermediaries, however, are very important. The Living Labs approach by Ståhlbröst (2012) promotes interaction between SMEs and customers. The company studied by Brunswicker and Ehrenmann (2013) implemented a relationship promoter (i.e., in addition to champions, a power promoter) to facilitate cross-company innovation within networks.

Networking with public research bodies are also a good innovation source for SMEs. Grimaldi et al. (2013) presented an example of an innovation developed by a specialized innovator company. The innovation was the production of a line of pasta made from raw material of certified origin, which was the result of a process of research and development that, after a few years, led to the launch of a new product. The relationship between the company and certain public research bodies, in particular the universities, proved to be a determining factor in the success of the innovation.

Hutter et al. (2013) show that within the small and micro firms surveyed, other external sources for ideas, inventions and inspiration are mainly other corporations and partner firms. Even within the venture capital (VC) firms (a type of inbound open innovation activity) the interaction and collaboration between VC firms and large corporations is not only common, but, as demonstrated by Watkins (2010), has become a critical component to VC activity in the United Kingdom. This collaboration provides VC firms with an important mechanism for accessing external or extra-regional knowledge, thereby changing industry dynamics and corporate product innovation needs. The value

of this collaboration is particularly felt in the very early stages (i.e., investment selection) and the very late stages of the investment cycle (i.e., investment exit).

Finally, it is important to highlight that there are two types of knowledge networks: global and local. The outcomes from a study by van Geenhuizen and Nijkamp (2012) shows use of both local and global knowledge networks in city-regions, and the loss of local connectedness by some globalized companies, particularly those involved in co-creation of products with global customers and those acting as learning partners of global multinational corporations.

Table I shows the activities of open innovation and the dimensions of entrepreneurial orientation which they have links.

TABLE I - Activities of open innovation and the dimensions of entrepreneurial orientation

| Activities of Open Innovation / Dimensions of Entrepreneurial Orientation | Autonomy | Competitive Aggressiveness | Proactiveness | Risk Taking | Network |
|--|-----------------|---------------------------------------|----------------------|------------------------|----------------|
| Venturing | | | | | |
| Outward IP licensing | | | | | |
| Employee involvement | X | | X | | |
| Customer involvement | | | X | X | X |

| | | | | | |
|-------------------------------|--|--|--|--|----------|
| External networking | | | | | X |
| External participation | | | | | |
| Outsourcing R&D | | | | | |
| Inward IP licensing | | | | | |

5. Final Considerations

Two preliminary considerations are important before presenting the conclusions about the results from the meta-synthesis. The first consideration is: the relationship between open innovation and entrepreneurial orientation is still under explored. Despite the specificity of our research, the theoretical background shows that there are few cases studies dealing with open innovation and entrepreneurship. Labeling open innovation as a young, or new research area is an unsubstantiated excuse, because the relationship between innovation and entrepreneurship has been known for a long time. Several gaps were found in the meta-matrix: the risk-taking dimension is related with only one activity of open innovation (only customer involvement was present), the proactiveness dimension is related with only two activities of open innovation (employee involvement and customer involvement), the autonomy dimension is related only with employee involvement, and the competitive aggressiveness dimension has no relationships. The only dimension of entrepreneurial dimension with more than two relationships found is networks (with customer involvement and external networking). Despite this, there are

no relationships between networks and outbound open innovation activities or some inbound open innovation activities (external participation, outsourcing R&D and inward IP licensing). Exploratory studies are needed to fill these gaps.

The second consideration is: the outbound open innovation is neglected in both multinationals and SMEs. Despite the small infrastructure of SMEs and startups, they present a good opportunity to create revenue and establish a strategic position. It is understandable that venturing is difficult for this type of firm, but through employees the firm can develop technologies to sell. The literature presents a gap regarding the use of outbound open innovation in SMEs and is an opportunity for future case studies, which may collaborate with academics and practitioners, to explore.

The most prominent entrepreneurial orientation dimension was networks. Despite the fact that Lumpkin and Dess (1996) did not present this dimension, empirical evidence was pointed to by Mello and Leão (2005) concerning the presence of this dimension and the absence of competitive aggressiveness in high-tech enterprises in Brazil. Our work corroborates the findings of Mello and Leão (2005), including the absence of approaches dealing with the competitive aggressiveness dimension. The networks dimension is strongly related to customer involvement and external networking. Customer involvement is very important in the first phases of development, because the risk of opening up a process decreases if it opens up as early as possible because the company gets to know the users' needs early on. It is expected that customer involvement will increase sales potential. Despite the literature about customer involvement, it is still important to understand how to implement this involvement — thus, another opportunity for future studies.

External networking was very important. The Living Labs approach in the early phases of development is useful to SMEs because of their small infrastructure. Unlike customer involvement, the suppliers and other partners are important in later phases, such as production, distribution and commercialization.

One important observation: the literature is entirely comprised of success cases. Successes are attractive, but in understanding a new area it is important to know what does not work, to not repeat the mistakes. It is almost impossible that all cases of open innovation will be a success. Researchers must look for unsuccessful cases, and even these cases must be analyzed through secondary data. However, it is likely that companies are not open to reporting their failures.

Finally, our work has limitations. Not all articles were analyzed because of our limited access provided by CAPES. Furthermore, other terms could be applied in the research query, such as smart companies or young companies.

However, a theory is presented and must be authenticated. Future studies in the form of surveys and case studies are needed to confirm the presented theory and contribute to the body of knowledge surrounding open innovation.

Acknowledgements

The authors thank FAPEMIG (Minas Gerais State Foundation for Research Development) for its financial support.

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Entrepreneurial Orientation Dimensions as Open Innovation Drivers: a Literature Review

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Abstract

Even past a decade, open innovation may be considered one of the hottest topics in innovation management. However, there are few gaps to be explored. One of these gaps is the relationship between open innovation and entrepreneurship. Entrepreneurship is a very rich and wide topic, thus aiming to delimit the range of concepts, the entrepreneurial orientation dimensions were chosen. The purpose of this work is to examine which entrepreneurial orientation dimensions works as open innovation drivers. This study is a systematic review conducted following the stages presented by Tranfield et al. (2003). Several hypotheses were presented to future studies. The contribution of the paper is the identification of issues about the impact of entrepreneurial orientation dimensions on open innovation.

Keywords: open innovation; entrepreneurship; entrepreneurial orientation; systematic review.

Introduction

The present article was accepted in *Espacios Journal* and has no differences of published version.

Past more a decade that Chesbrough (2003) coined the term open innovation, the literature still has gaps. Although open innovation has triggered considerable attention in recent years (Du et al., 2014), generating an avalanche of interest (West et al., 2014) and covered many topics, others need attention (Gambardella and Panico, 2014). According to West et al. (2014), while open innovation research is highly cited and has influenced the direction of innovation studies, it has had a limited impact upon the broader disciplines of management and economics. One of these disciplines of management is entrepreneurship. Hossain (2013), in a literature review, affirms that the relationship between open innovation and entrepreneurship is still unexplored. This topic is interesting because according to Soriano and Huang (2013), over the last few years, the interrelationships between innovation, entrepreneurship or new business creation have become apparent within a vibrant research trend which fuses insights from different academic approaches.

However, some initiatives appeared focusing the relationship between open innovation and entrepreneurship. In the April 2013 issue of the *Technology Innovation Management Review*, entitled *Open Innovation and Entrepreneurship*, authors from Belgium and Norway had the opportunity to share their academic insights and experiences as they relate open innovation or entrepreneurship, or where these two topics intersect. This issue has five works.

The first work is the article of Vanhaverbeke (2013) that argued that open innovation can be applied in situations where companies do not themselves develop new products or services, and argued that open-innovation scholars have insufficiently differentiated open-innovation initiatives in terms of their impact on companies' growth. According to Vanhaverbeke (2013) some open-innovation initiatives lead to incremental innovations in an existing business while, in other cases, open-innovation initiatives are used to establish completely new businesses.

The second work is the article of Solesvik and Gulbrandsen (2013) that considered open innovation from the perspectives of causation and effectuation, and social networking. They examined the challenge of selecting partners for open innovation.

The article of Iakovleva (2013), the third work of that issue of the *Technology Innovation Management Review*, aimed to extend the discussion about entrepreneurial strategies of small and medium-sized enterprises (SMEs) by including the concept of open innovation. The article shows how the innovative action of an SME may depend on the combined influence of entrepreneurial orientation within the firm and knowledge-providing cooperative links with knowledge providers.

In the fourth article, Segers (2013) examined the impact of strategic partnerships and open innovation on the success of new biotechnology firms in Belgium by developing multiple case studies of firms in regional biotechnology clusters.

At end, De Cleyn et al. (2013) presented a case study of iMinds, a network organization in Flanders, Belgium. They described how iMinds' incubation and entrepreneurship programs act as a catalyst for open business ecosystems.

Other initiative was the work of Chaston and Scott (2012) that presents evidence about the impact of entrepreneurial orientation and open innovation in firm performance, but as the work of Iakovleva (2013), did not link the dimensions of entrepreneurial orientation and open innovation.

Considering previously reported an interesting research question is: what entrepreneurial orientation dimensions are drivers of open innovation activities? Entrepreneurial orientation has emerged as a major construct in the strategic management and entrepreneurship literature over the years (Rauch et al., 2009), and for this reason it was chosen.

So, the objective of this work is to present hypotheses about the impact of the dimensions of entrepreneurial orientation in open innovation activities. To carry out this objective, a systematic review will be done. Considering the few works covering these topics, the systematic review will adopt as keywords for research the dimensions of entrepreneurial orientation: proactiveness, risk taking, autonomy and competitive aggressiveness. The dimension innovativeness will not be explored to avoid redundancy in the results.

After this section are presented the theoretical background, the method, discussion and hypotheses, followed by the concluding section.

Open Innovation

Open innovation is a very rich and complex concept. Hossain (2013) believes that open innovation overlaps other concepts such as user generation, crowdsourcing, and distributed innovation. Huizingh (2011) seems to agree with Hossain, when he affirms that open innovation became the umbrella that encompasses, connects, and integrates a range of already existing activities.

The definition of open innovation is yet to be clear-cut, and what open innovation is and what it is not, is still being debated (Hossain, 2013). The most accepted definition of open innovation is provided by Chesbrough (2003): open innovation means that valuable ideas can come from inside or outside the company and can go to market from inside or outside the company as well. However, according to West et al. (2014), even Chesbrough's definition of open innovation has evolved during this period and it was revised three years later to emphasize the intentionality of the knowledge flows into and out of the firm. Chesbrough (2006) affirms that open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. Open innovation is frequently contrasted with closed innovation. In closed innovation, a company generates, develops and commercializes its own ideas (Padilla-Melendez and Garrido-Moreno, 2012).

Yet Huizingh (2011) adverts as there is in medicine no panacea, a remedy curing all diseases, it is unlikely that a management concept has positive effects in any situation, implying that the effectiveness of open innovation must be context dependent.

To understand open innovation is important to know its activities. As affirmed by Hossain (2013) and Huizingh (2011) open innovation overlaps existing concepts as joint ventures, licensing in, licensing out, between others. However, these activities are classified in macroprocess or archetypes. Gassmann and Enkel (2004) divided the open innovation in:

- The outside-in process: Enriching the company's own knowledge base through the integration of suppliers, customers and external knowledge sourcing can increase a company's innovativeness. According to Lind et al. (2012), through this process the company's resource base is enriched by external knowledge sourcing. According to Conboy and Morgan (2011), this process is also

referred to as inbound. Bianchi et al. (2011) cites as organisational modes for outside-in open innovation: in-licensing, minority equity investments, acquisitions, joint ventures, R&D contracts and research funding, purchase of technical and scientific services and non-equity alliances.

- The inside-out process: earning profits by bringing ideas to market, selling intellectual property and multiplying technology by transferring ideas to the outside environment. According to Lind et al. (2012), this process refers to how companies externalize their knowledge to bring their ideas to the market. According to Conboy and Morgan (2011), this process is also referred to as outbound. Bianchi et al. (2011) cites as organisational modes for inside-out open innovation: licensing out, spinning out of new ventures, sale of innovation projects, joint venture for technology commercialisation, supply of technical and scientific services, corporate venturing investments and non-equity alliances.
- The coupled process: coupling the outside-in and inside-out processes by working in alliances with complementary partners in which give and take is crucial for success. According to Conboy and Morgan (2011) this open innovation approach combines the outside-in (gaining external knowledge) with the inside-out process (to bring ideas to market). In order to accomplish both, these companies collaborate and cooperate with other stakeholders such as partner companies (e.g. strategic alliances, joint ventures), suppliers and customers, as well as universities and research institutes.

Nevertheless several authors Chesbrough and Crowther (2006) and Wang and Zhou (2012) adopt only inside-out and outside-in processes in their works. It happens because the coupled process is a combination of the inside-out and the outside-in process in strategic R&D alliance. Furthermore, authors as van de Vrande et al (2009) adopt the terms technology exploration and technology exploitation to define respectively inbound and outbound open innovation. Van de Vrande et al (2009) cite as example of outbound open innovation: venturing, outward IP licensing and employee involvement. Moreover, Van de Vrande et al (2009) cite as example of inbound open innovation: customer involvement, external networking, external participation, outsourcing R&D and inward IP licensing. In our work we will use the processes adopted by van de Vrande et al (2009).

According Gassmann and Enkel (2004), all three the core processes represent an open innovation strategy, but not all are equally important for every company. Several authors such as Abulruba and Lee, (2012); Enkel et al. (2009); and Huizingh (2011) affirm that outside-in open innovation which is more predominant than inside-out. According to Inauen and Schenker-Wicki (2012), because ideas are indivisible, information can only be transferred once: it is impossible to share or sell just part of an innovative idea. The appropriability problem is a dilemma that firms face in the inside-out process, and because of this, the firms may fail to generate a profit from an innovation that they reveal, or they may even fail to retain the value that they have created with that innovation (Inauen and Schenker-Wicki, 2012). According to Huizingh (2011), one possibility is that while many organizations use external knowledge, only a few provide it, other potential explanations are that either the measurement scales, the respondents, or the samples in these studies are biased. However, Inauen and Schenker-Wicki (2012) adverts companies may consider capturing additional value from their technologies using an inside-out open innovation strategy for R&D management.

According to West et al. (2014), open innovation has also had a considerable impact on practice. Daily industry press releases tout the latest “open innovation” initiative of an industrial or consulting firm (West et al. 2014). West et al. (2014) affirms that middle managers have adopted “open innovation” in their job title, and conferences regularly promise to reveal open innovation secrets for their industry participants. However, according to Hossain (2013), the role of managers and entrepreneurs to implement open innovation is still unexplored and studies that bring connection between entrepreneurship literature and open innovation may help to strengthen our understanding.

Entrepreneurship and Entrepreneurial Orientation

The previous section concluded with the importance of studies that bring connection between entrepreneurship literature and open innovation. Although relationship between open innovation and entrepreneurship is still few explored, the relationship between innovation and entrepreneurship is obvious in literature. Authors such as Ndubisi and Iftikhar (2012), Swami and Porwall (2005), Zhao (2005) and Galindo and Mendez-Picazo (2013) explored the relationship between innovation and entrepreneurship. One the mainly definitions of entrepreneurship shows this relationship. Schumpeter (1934) defines entrepreneurship as an endeavor that is centrally characterized by innovation.

Entrepreneurship is perceived as crucial activity that fuels the economic development of regions. Entrepreneurship is a milestone on the road towards economic progress, and makes a huge contribution towards the quality and future hopes of a sector, economy or even a country (Soriano and Huang, 2013).

According to Audretsch (2012), with the rapid emergence of scholarly thinking and analysis about entrepreneurship has come a multiplicity of approaches, emanating from different academic traditions. This has resulted in an academic field that is complex and heterogeneous with respect to approaches, methodologies and even the understanding about what exactly constitutes entrepreneurship.

One of the main concepts in entrepreneurship studies for the last decades is entrepreneurial orientation. According to Campos et al. (2012) entrepreneurial orientation has received substantial conceptual and empirical attention, representing one of the few areas in entrepreneurship research in which a cumulative body of knowledge is developing. Entrepreneurial orientation refers to the processes, practices, and decision-making activities used by entrepreneurs that lead to the initiation of an entrepreneurial firm (Lumpkin and Dess, 1996).

Entrepreneurial orientation has a positive impact in organization performance (Fernández-Mesa et al., 2012). Fernández-Mesa et al. (2012) in their study used structural equations modeling in a sample of 182 ceramic tile industry firms, and explored the relationship between entrepreneurial orientation and innovation performance taken organizational learning capability as a mediating variable. They show that organizational learning capability plays a significant role in determining the effects of entrepreneurial orientation on innovation performance, in other words, their study suggests that entrepreneurial orientation is an antecedent of organizational learning capability and innovation performance.

Although Lumpkin and Dess (1996) identify five dimensions of entrepreneurial orientation (autonomy, competitive aggressiveness, innovativeness, proactiveness and risk taking), typical conceptualizations of entrepreneurship orientation include three dimensions: innovativeness, proactiveness and risk taking. The dimensions will be described below.

- **Autonomy:** is defined by Lumpkin and Dess (2001) as independent action by an individual or team aimed at bringing forth a business concept or vision and carrying it through to completion. In contrast with Lumpkin and Dess (1996) view that autonomy is part of entrepreneurship behavior, the paper of Villiers-Scheepers (2012) argues that autonomy precedes entrepreneurial

behavior in a firm-context; therefore, autonomy forms part of the organizational antecedents of strategic entrepreneurship, which influences the organizational climate;

- **Competitive aggressiveness:** is said to reflect the intensity of a firm's effort to outperform industry rivals, characterized by a strong offensive posture and a forceful response to competitor's actions (Lumpkin and Dess, 2001);
- **Innovativeness:** according to Lumpkin and Dess (1996) innovativeness reflects a firm's Schumpeterian tendency to engage in and support new ideas, novelty, experimentation, and creative processes that may result in new products, services, or technological processes. Innovativeness represents a basic willingness to depart from existing technologies or practices and venture beyond the current state of art. (Lumpkin and Dess, 1996);
- **Proactiveness:** is defined as acting opportunistically to shape the environment by influencing trends, creating demand, and becoming a first mover in a competitive market (Lumpkin and Dess, 1996). According to Jalali et al. (2014) a positive relationship between proactiveness and firm performance is evident;
- **Risk taking:** involves the determination and courage to make resources available for projects that have uncertain outcomes, in other words those which involve risk (Villiers-Scheepers, 2012). According to Lumpkin and Dess (2001), risk taking refers to a tendency to take bold actions such as venturing into unknown new markets, committing a large portion of resources to ventures with uncertain outcomes.

However some authors differ in the application of these dimensions. George and Marino (2011) and Martens et al. (2011) presented each one a summary of the dimensions of entrepreneurial orientation by author. Table 1 presents our own compilation of relevant works and its dimensions of entrepreneurial orientation.

| Study | Dimension | | | | |
|--|-----------|----------------------------|----------------|---------------|-------------|
| | Autonomy | Competitive aggressiveness | Innovativeness | Proactiveness | Risk taking |
| Covin and Slevin (1989) * | | | X | X | X |
| Covin and Slevin (1991) * | | | X | X | X |
| Covin and Covin (1990) * | | X | X | X | X |
| Lumpkin and Dess (1996) | X | X | X | X | X |
| Lumpkin and Dess (2001) | X | X | X | | X |
| Kropp et al. (2008) | | | X | X | X |
| Martens et al. (2011) | X | X | X | X | X |
| Fernández-Mesa et al. (2012) | | | X | X | X |
| Ndubisi and Iftikhar (2012) | X | | | X | X |
| Jalali et al. (2014) | | | X | X | X |
| Campos et al. (2012) | X | X | X | X | X |
| Antonites and Nonyane-Mathebula (2012) | X | X | X | X | X |
| Parkman et al. (2012) | X | X | X | X | X |
| Kirkman (2013) | | | X | X | X |
| Awwad and Ali (2012) * | | | X | X | X |

Table 1 – Dimensions of entrepreneurial orientation adopted by different works.

Source: elaborated by authors

* These studies consider competitive aggressiveness in proactiveness dimension or as synonymous.

Mello and Leão (2005) apud Martens et al. (2001) considers still a sixth dimension called networks. The variations in the applicability of the dimensions are justified by Lumpkin and Dess (1996). According to Lumpkin and Dess (1996) the dimensions may vary independently, depending on the environmental and organizational context.

Method

This study is a systematic review. According to Tranfield et al. (2003), systematic reviews identifies key scientific contributions to a field or question and differ from traditional narrative reviews by adopting a replicable, scientific and transparent process. Table 2 presents the stages of systematic review used.

| Stage I - Planning the review |
|--|
| Phase 0 - Identification for the need for a review |
| Phase 1 - Preparation of a proposal for a review |
| Phase 2 - Development of a review protocol |
| Stage II - Conducting a review |
| Phase 3 - Identification of research |
| Phase 4 - Selection of studies |
| Phase 5 - Study quality assessment |
| Phase 6 - Data extraction and monitoring progress |
| Phase 7 - Data synthesis |
| Stage in-Reporting and dissemination |
| Phase 8 - The report and recommendations |

Table 2. Stages of a systematic review.

Source: adapted from Tranfield et al. (2003)

The phase 9 (Getting evidence into practice) proposed by Tranfield et al. (2003) was not performed, being suggestion to future studies. The phase 0 and 1 were presented previously, respectively in introduction and theoretical background sections. Table 3 shows the review protocol (phase 2), that includes the phases 3, 4 and 5 criteria. The data extraction was paper based. The data-extraction forms included details of the information source (title, authors, journal, publication details) and any other features of the study such as population characteristics, context of the study and an evaluation of the study's methodological quality, following the recommendations of Tranfield et al. (2013). The data synthesis used (phase 7) is a narrative review that according to Tranfield et al. (2003) is the simplest and best-known form of research synthesis and will be presented in this article that is also the report (phase 8).

The present study has a considerable limitation. The access to journals and scientific databases in Brazil is provided by CAPES (acronym in Portuguese to Coordination for the Improvement of Higher Education Personnel), a Foundation within the Ministry of Education in Brazil whose central purpose is to coordinate efforts to improve the quality of Brazil's faculty and staff in higher education through grant programs. CAPES is particularly concerned with the training of Doctoral candidates, Pre-doctoral short-term researchers, and Post-doctoral Scholars. However CAPES does not offers access to all databases.

| | |
|--------------------------------|--|
| Keywords | Open innovation AND Autonomy or competitive aggressiveness or proactiveness or risk taking |
| Bibliographic databases | Web of Knowledge and Scopus |
| Years | 2003-2014 May |
| Language | English |
| Exclusion criteria | Articles which do not appear one of the keywords in the text (the keywords appear only in references). Not published articles. Repeated articles. Articles not provided by CAPES. Proceeding papers. |

Table 3. Review protocol

Source: developed by authors

Discussion and hypotheses

The search in bibliographic databases found 339 articles. After exclusion criteria remained 91 articles. However, one article is a retracted article and because this was not considered. Thus, 90 articles were evaluated. The narrative review will be presented grouped by dimension of entrepreneurial orientation.

Autonomy

Autonomy dimension returned the most results. Stock (2014) at study what are the drivers of effective inter-organizational new product development teams as means to integrate customers into the new product development process, found a correlation between decision-making autonomy and openness.

Chatenier et al. (2009) explored the gap of human resource development on open innovation, and according to them, to increase the success rates of open innovation, it is vital to learn how individuals create knowledge in open innovation teams and the problems they face. According to Chatenier et al. (2009) autonomy, among others factors, is a condition set by the parent firm(s) that could influence the collaborative knowledge creation process in open innovation teams. Chatenier et al. (2009) affirms that autonomy indicates the degree to which the team is allowed to make its own decisions about the content and results of the innovation process.

According to Markman et al. (2009), because large organizations are complex and require division of labour, the choice of structure has implications for work coordination and resource allocation. Despite of their study focuses on technology licensing offices in research universities, Markman et al. (2009) developed a hypothesis that concern all kind of organizations, consistent with open innovation theory: An autonomous, or decentralized organizational structure is positively related to commercialization outcomes. By commercialization outcomes we understand outbound open innovation.

Thus, the first hypothesis of our study is:

H1. Autonomy has a positive effect on open innovation.

H1a. The independent action of an individual or a team in bringing forth an idea or a vision and carrying it through to completion has a positive effect on customer involvement.

H1b. Actions free of stifling organizational constraints have a positive effect on customer involvement.

H1c. The independent action of an individual or a team in bringing forth an idea or a vision and carrying it through to completion has a positive effect on open innovation.

H1d. Actions free of stifling organizational constraints have a positive effect on open innovation.

H1e. Autonomy is positively related to outbound open innovation.

Support or not the first hypothesis is very important. According to Breunig et al. (2014), to guarantee alignment between ongoing activities and organizational goals, innovation management theory emphasizes management control and explicit innovation strategies as prerequisites for innovation performance. However, the same authors affirm that the theory on open services innovation emphasizes individual autonomy and incentives to foster open innovations. It may be a trade-off situation between control and autonomy. Controlled organizations and processes may constrain the innovation processes, limiting the employees' creativity. According to Brodner (2013) knowledge-intensive value creation processes, characterized by creative processing of knowledge, continuous problem solving and permanent innovation, decisively depend on human working capacity, on 'actionable' knowledge, knowledge sharing and self-management, in order to productively cope with the complexity, dynamics and inevitable uncertainties of turbulent markets deriving from that. Brodner (2013) stress that the tacit dimension of action competence, therefore, is of essential relevance for mastering these processes and according to its nature, knowledge sharing in work requires a high degree of autonomy, self-control, free interaction, and mutual appreciation.

Breunig et al. (2014) found that individual autonomy facilitates the internal and external networking required in open innovations, but individualized incentives do not suffice to motivate, mobilize and direct the collaboration and collective effort needed to ensure successful implementation of open innovation processes. On the other hand, Brodner (2013) stress the importance of collective effort. Brodner (2013) affirms that complex problem solving and customer-oriented innovations in the context of turbulent markets typically call for multifunctional teams for 'interactive value creation' across organisational borders. In this perspective, Breunig et al. (2014) offered the following proposition: innovation activities benefit from incentives and performance measures that capture innovation activities at the collective level, and not only individual behavior. So, the second hypothesis of our study is a changed first proposition of Breunig et al. (2014):

H2 – Open innovation activities benefit from incentives and performance measures that capture open innovation activities at the collective level, and not only individual behavior.

Competitive Aggressiveness

While autonomy returned the most results, competitive aggressiveness has the opposite result. Only two works are related to this dimension. Park et al. (2014) focuses in downsides of external ties of individuals in knowledge acquisition. The work of Bengtsson and Johansson (2011) developed a conceptual framework that describes three contending market regimes in converging industries. Bengtsson and Johansson (2011) argue that several actors are involved in innovation process, developing knowledge using information from others. According to Bengtsson and Johansson (2011) the literature on open innovation and forms of collaborative innovation is growing and they find a gap in exploring the co-competitive regime and the need to balance cooperation and competition in emerging communities.

Mello and Leão (2005) at perform an exploratory case study research in three Brazilian technologic small and medium enterprises, found no evidences of competitive aggressiveness. They pointed as possible reason to the absence of competitive aggressiveness dimension the situation of cooperation, intrinsic at business networks. Mello and Leão (2005) identified one more dimension: networks. Even in the seminal work about open innovation, Chesbrough (2003) affirmed that creating and appropriating value also involves third parties outside the immediate value chain. Taken together, these outside parties form a value network. According to him the value network created around a given business shapes the role that suppliers, customers, and third parties play in influencing the value captured from the commercialization of an innovation.

According to Mello and Leão (2005) the key concept to understand the business network is network identity. According to him, the network identity refers how the firm sees itself. Thus, it suggests in empirical studies replace the competitive aggressiveness dimension by network dimension, focused in identity dimension. Therefore, the third hypothesis of our study is:

H3. Network dimension has a positive effect on open innovation.

Proactiveness

The relationship between proactiveness and open innovation is also few explored. According to Fernandes et al. (2013), to the extent by which globalisation has advanced and deepened the level and consequences of interdependence between national economies, the business world has become ever more complex and exponentially more competitive. Fernandes et al. (2013) stressed that this scenario has driven companies to adopt proactive strategies designed to seek out sustainable competitive advantage and innovation has thereby now emerged as one of the core strategic priorities for companies seeking success in their business dealings.

Martínez-Román and Romero (2013) explored the nature and determinants of product innovation in small businesses from a survey of more than 1,500 small firms in Spain. They considered two levels of factors affecting innovation: the personal characteristics of the entrepreneurs (their age, motivations, educational background and degree of interpersonal trust) and the characteristics of the organizations' management, between them cooperation, risk taking, proactivity and specific innovation and growth policies.

Martínez-Román and Romero (2013) used as variable to identify proactive small businesses: alertness and identification of new markets and business opportunities. This variable may be explained as a systematic search for new markets and business opportunities. This way, the third hypothesis of this study is:

H3. Alertness regarding new business opportunities has a positive effect on open innovation.

Risk Taking

The last dimension investigated is risk taking. A considerable range of works analyzed this dimension. According to Kraus et al. (2012), to make the transition from the closed innovation model to the open innovation model, the firm needs to also create or adopt a different set of managerial and organizational tools. They affirm that firms need to be able to manage their R&D networks efficiently and have an organization capable of acquiring external knowledge. However, Keupp and Gassmann (2009) affirm that open innovation implies costs and risks that should not be underestimated. Keupp and Gassmann (2009) still advocate that risks associated with innovation should promote R&D collaboration. Banholzer and Vosejpka (2011) make similar statement. According to Banholzer and Vosejpka (2011) in programs that

cost hundreds of millions of dollars, collaboration between customer and supplier, as example of Procter & Gamble's Open Innovation, is another risk mitigation technique. Hence, our fourth hypothesis is:

H4. Risk taking has a positive effect on open innovation.

According to Schroll and Mild (2011) while inbound activities do not include a great risk, outbound activities could be more risk because the firm may lose possibility to capture the created value. Considering this affirmation, the fifth hypothesis of this study is:

H5. There is a significant relationship between risk taking and outbound open innovation.

Jeong et al. (2013) deepens the debate, pointing the difference between licensing and selling. According to Jeong et al. (2013), relating the sales of the licensee to the licensing fee enables the licensee to lower the initial payment; however, this method increases the uncertainty associated with the overall revenue of the technology supplier. They explain that this is because the total amount of the licensing fee that the technology supplier will receive later cannot be fully determined until the licensee finalizes her economic activities derived from the technology. Jeong et al. (2013) still affirm that on the other hand, in the case of selling, the technology supplier faces no risk regarding revenue from the technology acquirer, having surrendered all rights to the technology. So, our sixth and seventh hypothesis is:

H6. Organizations with high-level of risk taking level adopt license, as outbound open innovation, more than organizations with low-level of risk taking.

H7. There is a negative relationship between risk taking and selling as outbound open innovation.

Conclusions

Ford (1996) affirmed that the quality of a new theory should be judged based on its ability to suggest new interpretations of previous research and its ability to offer productive new directions for future studies. In this work new hypotheses were developed and presented to future works.

One point must be emphasized. The mainly aspect must be highlighted is the fact of to be a recent topic. The results of the research are recent works, mostly with less than four years. It shows the relevance of the topic.

However, the present work has one limitation: the authors have no access to all databases, although the most articles were read. Few articles were not analyzed, but even so, this situation is a limitation.

The first suggestion is to perform the phase 9 pointed by Tranfield et al. (2003). Empirical works are necessary to evaluate the presented hypotheses. It is important perform a qualitative study to present more hypotheses, followed by quantitative study.

The empirical works should replace the competitive aggressiveness dimension by network dimension or, in case of qualitative studies, consider both dimensions and evaluate that possibility. Despite, it suggests use the network identity as construct for network dimension.

Despite of do not be the objective of our study, the impact of open innovation and entrepreneurial orientation on firms performance should be analyzed, mainly because that is a literature gap. Chaston and Scott (2012) found no evidences about the business performance to be higher among firms exhibiting an entrepreneurial orientation, but they support the hypothesis that business performance is higher among firms involved in open innovation. However that study was performed only between Peruvian firms, so we suggest a eighth and final hypothesis:

H8. Business performance will be higher among firms involved in open innovation than among firms exhibiting an entrepreneurial orientation.

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ORIENTAÇÃO EMPREENDEDORA E INOVAÇÃO ABERTA EM STARTUPS
BRASILEIRAS: UM ESTUDO MULTICASO

ENTREPRENEURIAL ORIENTATION AND OPEN INNOVATION IN BRAZILIAN
STARTUPS: A MULTICASE STUDY

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ORIENTATION ENTREPRENEURIALE ET INNOVATION OUVERTE DANS DES
STARTUPS BRÉSILIENNES: UNE ÉTUDE CAS MULTIPLES

Resumo :

Empreendedorismo e inovação são bases para o desenvolvimento regional e nacional. Portanto, empreendedores e startups passam a ser protagonistas neste cenário. No entanto, um novo paradigma surge em estudos de inovação: Open Innovation. Mas a relação entre inovação aberta e empreendedorismo é pouco explorada. Assim, nosso trabalho visa preencher esta lacuna. Usando estudos de caso vamos verificar as hipóteses apresentadas por Carvalho & Sugano (2016). Ao final, um *framework* e novas hipóteses foram apresentados para estudos futuros.

Palavras-chave: Empreendedorismo; Orientação Empreendedora; Inovação Aberta.

Abstract:

Entrepreneurship and innovation are the basis to regional and national development. Therefore, entrepreneurs and startups are protagonists in this scenario. However, a new paradigm emerges in innovation studies: Open Innovation. But the relationship between Open Innovation and entrepreneurship is few explored. Thus, our work aims to fill this gap. Using case studies we check the hypotheses presented by Carvalho & Sugano (2016). At end, a framework and new hypotheses were presented to future studies.

Keywords: Entrepreneurship; Entrepreneurial Orientation; Open Innovation.

Resumen:

El espíritu emprendedor y la innovación son la base para el desarrollo regional y nacional. Por eso, los emprendedores y startups convierten en protagonistas en este escenario. No obstante, un nuevo paradigma emerge en los estudios de innovación: la innovación abierta. Pero la relación entre la innovación abierta y el espíritu emprendedor es poco explorada. Así, nuestro trabajo tiene como

objetivo llenar este vacío. Utilizando estudios de caso, comprobamos las hipótesis presentadas por Carvalho & Sugano (2016). Al final, fueron presentados un *framework* y nuevas hipótesis para futuros estudios.

Palabras clave: Espíritu Emprendedor; Orientación Emprendedora; Innovación Abierta.

Résumé:

Entrepreneuriat et innovation sont la base du développement régional et national. Par conséquent, les entrepreneurs et les startups sont les protagonistes de ce scénario. Toutefois, un nouveau paradigme émerge dans les études d'innovation: l'innovation ouverte. Mais la relation entre l'innovation ouverte et de l'entrepreneuriat est peu exploré. Ainsi, notre travail vise à combler cette lacune. En utilisant des études de cas, nous vérifions les hypothèses présentées par Carvalho & Sugano (2016). Enfin, un *framework* et de nouvelles hypothèses pour de futures études ont été présentés.

Mots-clés: Entrepreneuriat; Orientation Entrepreneuriale; Innovation ouverte.

1. Introduction

The present article was accepted in Interações Journal and has no differences of published version. Open innovation is between the hottest topics in innovation studies. However the relationship between open innovation and the broader disciplines of management is unexplored, as pointed by West *et al.* (2014). An important discipline of management (and highly linked with innovation) is entrepreneurship. Even before West *et al.* (2014), Hossain (2013) identified the gap of studies about open innovation and entrepreneurship.

As affirmed, the relationship between innovation and entrepreneurship is relevant in the literature. A pioneer in the studies about entrepreneurship and innovation is Schumpeter (1934). Schumpeter (1934) viewed the entrepreneur as innovator. Schumpeter (1934) maintained that innovation contributes to the growth of the economy because entrepreneurs produce innovations. After Schumpeter (1934), other important author that touched on the conceptual relationship between innovation and entrepreneurship is Drucker (1994). Other several works (Ndubisi & Iftikhar, 2012; Swami & Porwal 2005; Zhao, 2005 and Galindo & Mendez-Picazo, 2013) explored the relationship between innovation and entrepreneurship. But, why the relationship between open innovation and entrepreneurship is still unexplored?

First, open innovation is still under scrutiny, and it is rooted in technology. Therefore, the relationship between open innovation and the disciplines of economics and management is the next step to understand the phenomenon of open innovation. Second, this relationship is not entire unexplored. For example, Chaston & Scott (2012), through a survey, presented evidences about the

impact of entrepreneurial orientation and open innovation in firm performance, but they did not link the dimensions of entrepreneurial orientation and open innovation. After, the issue of April 2013 of the *Technology Innovation Management Review*, entitled *Open Innovation and Entrepreneurship*, works of authors from Belgium and Norway that explore this relationship were presented (DE CLEYN *et al.*, 2013; IAKOVLEVA, 2013; SEGERS, 2013; SOLESVIK & GULBRANDSEN, 2013; VANHAVERBEKE, 2013). Recently, Eftekhari & Bogers (2015), using case study, explored how an open approach to new venture creation can be beneficial for start-up entrepreneurs. Cheng & Huizingh (2014) addressed how three types of strategic orientations, between them Entrepreneurial Orientation, moderate the relationship between Open Innovation and innovation performance. But, no one explored Entrepreneurial Orientation as driver for Open Innovation.

Notwithstanding, Carvalho & Sugano (2016), using systematic review, presented some hypotheses that explore the relationship between open innovation and entrepreneurial orientation, defending the hypothesis of Entrepreneurial Orientation as driver for Open Innovation. Thus, our work aims to check the hypotheses presented by Carvalho & Sugano (2016). At check those hypothesis we are trying to answering the following question: What is the relationship between Open Innovation and Entrepreneurial Orientation? Our proposition is that Entrepreneurial Orientation dimensions are correlated with Open Innovation, and both impact the firm performance. The research method adopted is case study. In contrast to Cheng & Huizingh (2014), we aim to focus on firm performance, not in innovation performance.

Next we present a theoretical background about open innovation and entrepreneurial orientation, followed by methodological section. Posteriorly, the discussion is presented. At end, we present the final considerations.

2. Theoretical Background

2.1. Open Innovation

Chesbrough is the pioneer in the studies of Open Innovation. The book of Chesbrough (2003) not just compiled reflections from a former Silicon Valley manager's, but presented a first definition of Open Innovation. According to Chesbrough (2003) open innovation means that valuable ideas can come from inside or outside the company and can go to market from inside or outside the company as well. However, posteriorly, Chesbrough (2006) emphasize the intentionality of the knowledge flows into and out of the firm. Thus, Chesbrough (2006) affirms that open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. But, in a new effort to define open innovation West *et al.* (2014) presented the most actual definition of open innovation provided by Chesbrough & Bogers (2014), that considerate the increasing interest in non-pecuniary knowledge flows, being

open innovation defined as a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization's business model.

Saebi & Foss (2015) analyzed the definitions provided by Chesbrough and others and pointed three points. First, open innovation studies are congruent with regard to their understanding of open innovation as a set of practices that facilitate both purposive inflows and outflows of knowledge; thus open innovation generally encompasses both inbound and outbound dimensions of innovation processes. Second, studies seem to agree that pursuing open innovation requires a certain degree of permeability of organizational and innovation process boundaries to guarantee successful innovation. Third, extant definitions of open innovation are kept broad, arguably to reflect what Huizingh (2011) calls the “appeal” of open innovation, namely that it provides the “umbrella that encompasses, connects and integrates a range of already existing activities”.

The first observation of Saebi & Foss (2015) reflects what is known as macroprocess or archetypes of Open Innovation. Gassmann & Enkel (2004) present three macroprocess of Open Innovation: outside-in, inside-out and coupled. The outside-in process is related to enriching the company's own knowledge base through the integration of suppliers, customers and external knowledge sourcing can increase a company's innovativeness. The inside-out process refers to profits by bringing ideas to market, selling intellectual property and multiplying technology by transferring ideas to the outside environment. The coupled process involves coupling the outside-in and inside-out processes by working in alliances with complementary partners in which give and take is crucial for success. In order to accomplish both, these companies collaborate and cooperate with other stakeholders such as partner companies (e.g. strategic alliances, joint ventures), suppliers and customers, as well as universities and research institutes.

Usually, most works refers only to outside-in and inside-out dimensions. Furthermore, Conboy & Morgan (2011) use the terms inbound and outbound to define respectively outside-in and inside-out. The other case is van de Vrande et al. (2009), which adopt the terms technology exploration and technology exploitation to define respectively inbound and outbound open innovation.

Lazarotti *et al.* (2011) distinguish four different open innovation models with respect to two variables, representing the degree of openness: the number and type of partners with whom the company collaborates (partner variety) and the number and type of phases of the innovation process actually open to external collaborations (innovation phase variety). The open innovation models are:

- Open Innovators: corresponds to companies that are really able to manage a wide set of technological relationships, that impact on the whole innovation funnel and involve a broad set of different partners;

- Closed Innovators: corresponds to companies that access external sources of knowledge only for a specific, single phase of the innovation funnel and typically in dyadic collaborations;
- Integrated Collaborators: corresponds to companies that open their whole innovation funnel but only to contributions coming from a few types of partners and;
- Specialized Collaborators: corresponds to companies that are able to work with many different partners but concentrate their collaborations at a single stage of the innovation funnel.

Carvalho *et al.* (2016) point studies about open innovation in startups are a gap in literature. Startups are a kind of company which is expected a more prominent entrepreneurial behavior. But, what makes a firm entrepreneurial, and how do we distinguish entrepreneurial firms from those more conservatively managed?

2.2. Entrepreneurial Orientation

The previous section closes with a question. According to Anderson *et al.* (2015) the foundational paper of Miller (1983) provided much needed clarity regarding this fundamental issue to management scholars. The objective of the research of Miller (1983) was to discover the chief determinants of entrepreneurship, the process by which organizations renew themselves and their markets by pioneering, innovation, and risk taking. The first constructs of entrepreneurial orientation rely on three dimensions identified by Miller (1983): innovativeness, proactiveness and risk taking. Later, Lumpkin & Dess (1996) identified more two dimensions of entrepreneurial orientation: autonomy and competitive aggressiveness. Autonomy is defined by Lumpkin & Dess (2001) as independent action by an individual or team aimed at bringing forth a business concept or vision and carrying it through to completion. Competitive aggressiveness is said to reflect the intensity of a firm's effort to outperform industry rivals, characterized by a strong offensive posture and a forceful response to competitor's actions (LUMPKIN & DESS, 2001). Innovativeness reflects, according to Lumpkin & Dess (1996), a firm's Schumpeterian tendency to engage in and support new ideas, novelty, experimentation, and creative processes that may result in new products, services, or technological processes. Proactiveness is defined as acting opportunistically to shape the environment by influencing trends, creating demand, and becoming a first mover in a competitive market (LUMPKIN & DESS, 1996). Risk taking is defined by Lumpkin & Dess (2001) to a tendency to take bold actions such as venturing into unknown new markets, committing a large portion of resources to ventures with uncertain outcomes.

According to Anderson *et al.* (2015) despite the burgeoning scholarly interest in this area, a number of ontological questions persist in the Entrepreneurial Orientation literature, between them there are ongoing conversations regarding the dimensionality of Entrepreneurial Orientation. For example, there are works that adopt four dimensions, such as Covin & Covin (1990): innovativeness,

proactiveness, risk taking and competitive aggressiveness. There are works that competitive aggressiveness in proactiveness dimension or as synonymous, such as Covin & Slevin (1989) and Covin & Slevin (1991). Other example is Mello & Leão (2005), that identified a sixth dimension in high-tech enterprises in Brazil called networks. According to them, this dimension was inserted because the entrepreneur must build relationships with partners to become viable the venture. According to Mello & Leão (2005), the key concept to this dimension is network identity. Mello & Leão (2005) concluded that the emergence of this dimension justify the absence of the competitive aggressiveness dimension. Our work adopts five dimensions: autonomy, innovativeness, proactiveness, risk taking and networks.

We must stress that entrepreneurial orientation is among the main concepts in entrepreneurship studies in the last decades. According to Rauch *et al.* (2009) and Anderson *et al.* (2015) entrepreneurial orientation has emerged as a major construct in the strategic management and entrepreneurship literature over the years. Entrepreneurial orientation has been used around the world to measure the level of entrepreneurial behavior of the firms. According to Campos *et al.* (2012) entrepreneurial orientation has received substantial conceptual and empirical attention, representing one of the few areas in entrepreneurship research in which a cumulative body of knowledge is developing.

3. Methodology

Given the objective of the study and the hypotheses presented by Carvalho & Sugano (2016), we conducted a case study (EISENHARDT, 1989; YIN, 1994). According to Eisenhardt (1989) the case study is a research strategy which focuses on understanding the dynamics present within single settings. Figure 1 provides a summary of the research steps discussed below.

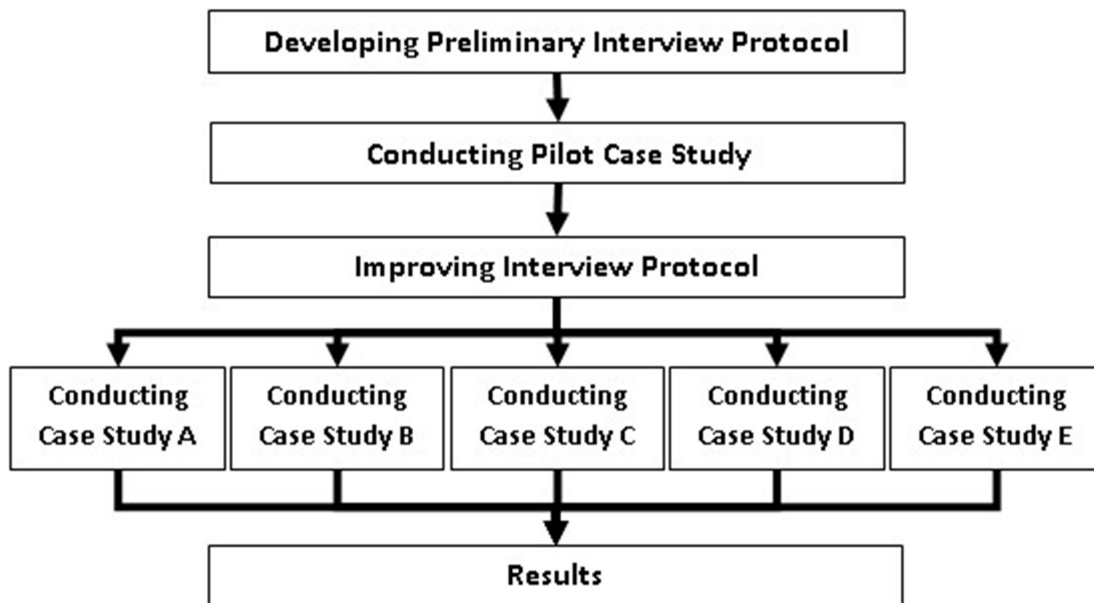


Figure 1 – Research Steps

First, a preliminary interview protocol was developed. The interview protocol and the pilot case study are presented next. Afterward, the interview protocol was improved and the case studies were conducted. At end, the data were analyzed and the results are presented in discussion section.

3.1. Pilot Case Study

The interview protocol to pilot case study was based on the framework proposed by Ndubisi & Iftikhar (2012). Ndubisi & Iftikhar (2012) developed a framework that considers the relationship between entrepreneurship, innovation and quality performance in small and medium-size enterprises. In our framework, innovation is replaced by Open Innovation, divided in outbound open innovation and inbound open innovation. The Entrepreneurial Orientation is used instead of entrepreneurship and has three constructs: risk taking, proactiveness and autonomy. In questionnaire, the risk taking construct has five items, while the proactiveness construct has five items and autonomy construct has three items. The inbound open innovation construct and outbound open innovation construct are the adopted by Huang *et al.* (2013). In questionnaire, both the constructs have five items. Firm performance construct used by Huang *et al.* (2013) was adopted instead of quality performance construct adopted by Ndubisi & Iftikhar (2012). In questionnaire, the firm performance construct has four items and analyzes profit, return on sales, quality of products/services and reliability of products. A single pilot test was performed with an academic that was an entrepreneur too.

The enterprise chosen is a high tech startup that develops solutions in information technology to agribusiness. The firm was chosen, because it was considered in 2012 top 10 between Brazilian startups, according Info (a Brazilian magazine). The firm has two mainly products based in image

analysis technology, is situated in Minas Gerais state, in Brazil, and was established in 2008. The firm has 14 employees.

The owner was interviewed and he has knowledge about open innovation and the firm strategy. The interview was conducted in the firm. There were no problems to understand the questions, however other problems are evidenced. First, a structured questionnaire is not adequate to a deep understanding. It is important opened questions to a better understanding. Second, the questions were not adequate to small and medium enterprises. Third, there were problems with translation. The fourth problem is the absence of network dimension. Thus, a new interview protocol must be developed, based in three premises: using preferentially constructs in Portuguese, and/or focused in small and medium enterprises and with opened questions. As precondition the constructs should preferably be derived from studies that applied structural equation modeling, aiming future quantitative studies.

Thus, a new interview protocol was developed. To collect data about Open Innovation we did not find an interview protocol in Portuguese language. However, we defined van de Vrande *et al.* (2009) as construct because it is the first and the most cited work to analyze Open Innovation in small and medium enterprises. The Entrepreneurial Orientation construct was Li *et al.* (2005). The construct of Li *et al.* (2005) was chosen because we did not find a construct in Portuguese language. Two questions were inserted in this construct to analyze hypotheses presented by Carvalho & Sugano (2016). The network dimension was evaluated using the construct provided by Bonner *et al.* (2005). Again, we did not find a construct in Portuguese language. Yet, to collect information about firm performance was used the construct provided by Fernandes & Santos (2008), because it is in Portuguese Language. However, the firm performance construct is very similar to that used in the pilot case. The degree of agreement toward each item can be categorized into seven levels from “extremely disagree” to “extremely agree”. Also, the questionnaire has questions of identification and opened questions about each construct. Because of the need of translations and to verify the understanding of questions 7 pilot test were applied in entrepreneurs and academicians. After each application the questionnaire was changed. There were no problems in the last two applications, and then we considered that the instrument was ready.

The framework was developed, considering the interview protocol and the hypotheses presented by Carvalho & Sugano (2016). Thus, the framework of this research is shown in Figure 2.

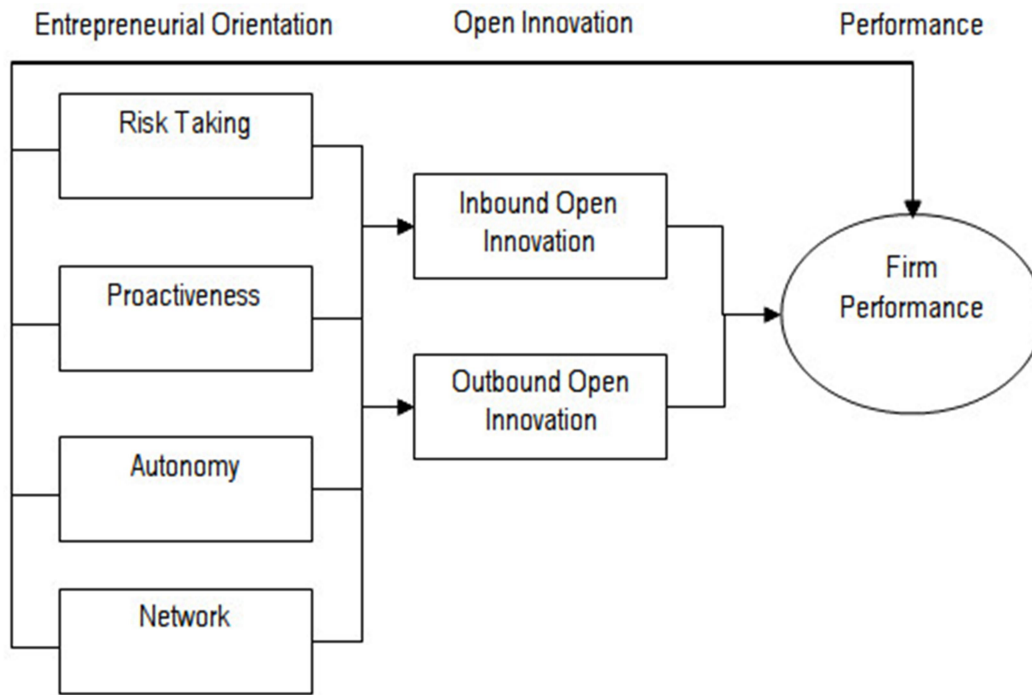


Figure 2 – The proposed conceptual framework.

3.2. The Case Studies

The enterprises were selected to case study not because the easy access reason, but because they are in evidence newspaper clippings. We take care to interview the owner, because reliability issues. All companies are located in Minas Gerais. The companies A, B and E are distant about 129 miles at south from the pilot case. The company C is distant about 115 miles at south from pilot case, while the company D is distant about 149 miles at north from pilot case.

Company A is located at town of Santa Rita do Sapucaí, south of state of Minas Gerais. Before describing the company, it is important to note that the town of Santa Rita do Sapucaí is known as Electronic Valley and it is an important cluster. Because of this, several works (BOTELHO *et al.*, 2013; GARCIA *et al.*, 2015, SOUSA *et al.*, 2015) study the cluster of Santa Rita do Sapucaí and its enterprises. Company A begins its activities in 2010 in Business Incubator Inatel (*Instituto Nacional de Telecomunicações* – National Institute of Telecommunications) and it has 7 employees. Since 2013 the company is working out of business incubator. Company A develops products and provides services in information and communications technologies. The company has a subsidiary in the city of São Paulo (an important Brazilian economic center located 144 miles from the Company A). Company A is winner of MPE Brazil award in 2012, in the category information technology. The MPE Brazil award – a competitiveness award for micro- and small-sized companies – is intended to spread the concepts of the Management Excellence Model (from the Portuguese language acronym MEG – *Modelo de Excelência da Gestão*). Company A may be considered an open innovator, following the criteria provide by Lazzarotti *et al.* (2011).

Company B is also located at town of Santa Rita do Sapucaí, south of state of Minas Gerais. Company B begins its activities in 2012 in Business Incubator Inatel and it has 22 employees. Company B supplies internet service providers. Its products have electricity concentrator system that provides the Internet service provider the ability to provide broadband via optical fiber, at very low cost. The company has won several awards, such as Startup Session at Futurecom 2013 (largest exhibition of technology in Latin America) and the third place in National Award for Innovative Entrepreneurship provided by Sebrae (Brazilian Service of Support to Micro and Small Enterprises - *Serviço Brasileiro de Apoio às Micro e Pequenas Empresas*) and Anprotec (National Association of Entities Promoting Innovative Enterprises - *Associação Nacional de Entidades Promotoras de Empreendimentos Inovadores*). Company B may be considered an open innovator.

Company C is located at city of Pouso Alegre, south of state of Minas Gerais. The company begins its activities in 2014 and it has only 2 employees: the owner and the partner. Company C works with mobile software development. The main product is an application to supermarkets. In 2015, the company was chosen to uMov.me Labs project. The uMov.me Labs project is a startup acceleration project created by an enterprise focused in mobile solutions to corporative market. Company C may be considered an open innovator.

Company D is located at town of Santa Rita do Sapucaí, south of state of Minas Gerais. It begins the activities in 2012 in Business Incubator Inatel and it has 4 employees. Company D works with energy solutions. Its main product is a digital electrical switchboard that allows tracking power consumption. The company is in evidence in national media, mainly after national energy crisis. Company D is in internationalization process. Company D may be considered an open innovator.

At end, Company E is located at City of Belo Horizonte, the state capital of Minas Gerais. The company begins its activities in 2015. It has 6 employees and works with smart vehicle systems. The main product is a device to collect information about the vehicle and generates reports to maintenance. The company was conceived inside the Federal University of Minas Gerais and it works in BHTec (Technological Park of Belo Horizonte). Company E has won several awards, such as Startup Farm (largest program of startup acceleration of Latin America), UFMG Challenge and Plano Beta, the last two about business plan. Company E may be considered a specialized collaborator.

4. Discussion

The sources of evidence were three: interviews, direct observations and documentation. The documentation is mainly based in newspaper clippings and other articles appearing in the mass media. By making a field visit to the case study “site”, we created the opportunity for direct observations. The interviews have two kinds of questions: opened and closed. The opened questions

were applied first. According to Carvalho & Sugano (2016) empirical works should replace the competitive aggressiveness dimension by network dimension or, in case of qualitative studies, consider both dimensions and evaluate that possibility. So, we first analyzed the divergence between network and competitive aggressiveness dimensions. As Mello & Leão (2005), we did not find evidences of competitive aggressiveness. The owner of Company A affirmed they prefer work in network. He even did not know how to compare the situation of the company and the competitors. Company B has proposals to work with competitors. Company C focuses in partnership with other companies, including a big software developer. The owner of Company E affirmed they did not need to use strategies of competitive aggressiveness. In really, he emphasized the mutual help between startups in Belo Horizonte. The main explanation is provided in the speech of owners of Company C and D: theirs products is new, they have no competitors. These enterprises can succeed not by battling competitors, but rather by creating uncontested market space. Other explanation is the importance of partnership, as emphasized by owner of Company C. Startups have few resources and because of this alliances are very important. Thus, we employed network dimension rather competitive aggressiveness dimension.

The first question was: do you know open innovation? The owners of Company A and Company D knew the term, but they did not know the definition. Others have never heard. After we explain the concept, they affirmed that they have using open innovation activities.

Even not present in framework the innovation dimension was analyzed. Figure 3 shows a graphic that analyzed the entrepreneurial orientation of firms. The standard deviation of innovativeness, risk taking, proactiveness, autonomy and network dimensions were respectively 0.55, 1.95, 2.10, 0.71 and 0.71. Thus, the values of innovativeness, autonomy and network may be considered homogeneous, while the values of risk taking and proactiveness may be considered heterogeneous. Homogeneous values difficult check relationships. Despite of the homogeneity and the broad use of open innovation activities, the values of Innovativeness were the lowest. However, evidences from direct observation and documentation, such as awards and newspaper clippings, show innovativeness enterprises. We cannot discard problems with the interview protocol. Can be open innovation or innovativeness an uneventful something? It is possible. Autonomy, network and risk taking dimensions have the highest values. Thus, the use of network dimension is adequate. The high level of risk taking is coherent, confirming the postulate of the owners of Company C and Company E. According to the owner of Company C “undertake without risk is not entrepreneurship”. The owner of Company E said a similar phrase: “startup is risk”.

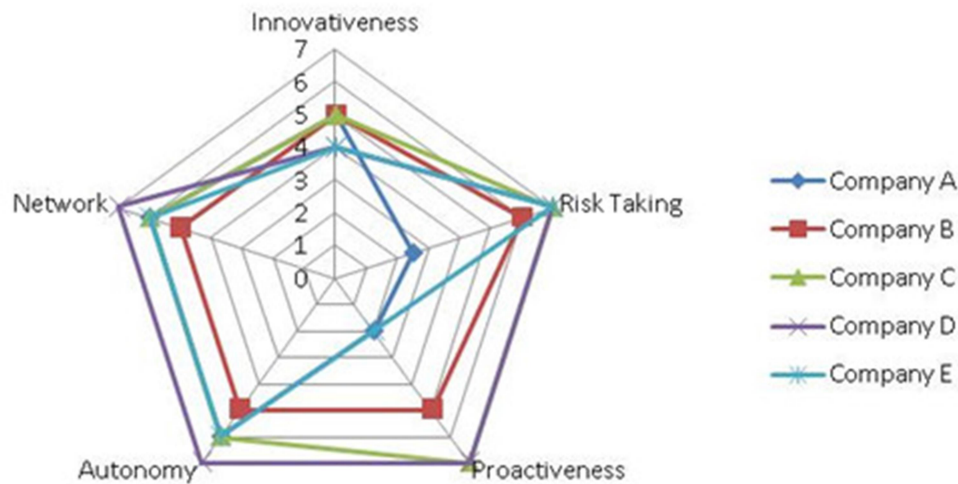


Figure 3 – Entrepreneurial orientation of firms.

Figure 4 shows the Open Innovation activities values. The highest value is from Customer Involvement. This result is compatible with the literature (VAN DE VRANDE *et al.*, 2009; WYNARCZYK, 2013). As van de Vrande *et al.* (2009) the second mode more used is also External Networking. External Participation, Inward IP Licensing and Outward IP Licensing are the less used activities, which is compatible with the literature (VAN DE VRANDE *et al.*, 2009; WYNARCZYK, 2013).

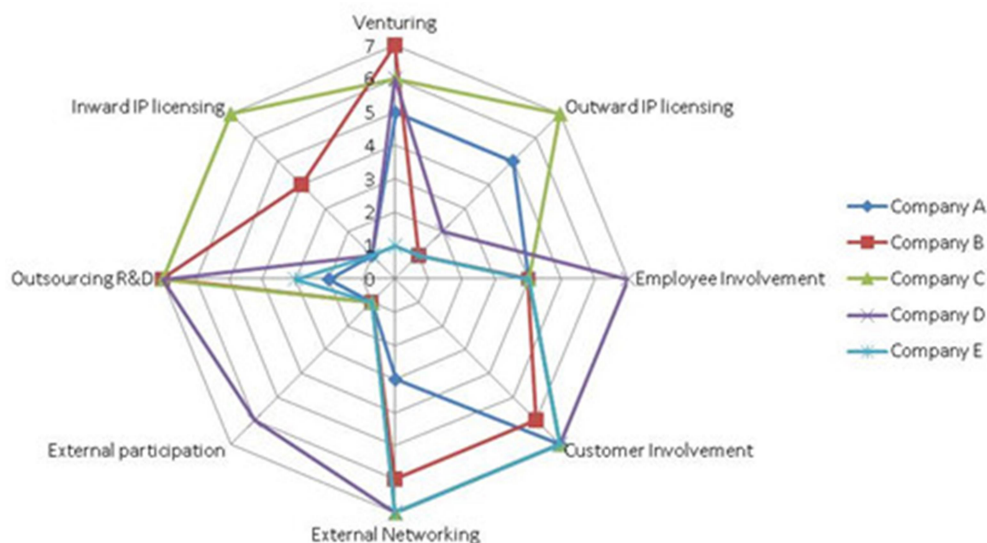


Figure 4 – Open Innovation activities.

The hypotheses were checked. Carvalho & Sugano (2016) presented two hypotheses about the relationship between autonomy dimension and Open Innovation. However the first hypothesis has 5 under hypotheses. The first hypothesis is:

H1. Autonomy has a positive effect on open innovation.

About the first hypothesis we can affirm that there is a positive relationship between autonomy dimension and Open Innovation, but it is no significant. The 5 under hypotheses are:

H1a. The independent action of an individual or a team in bringing forth an idea or a vision and carrying it through to completion has a positive effect on customer involvement.

H1b. Actions free of stifling organizational constraints has a positive effect on customer involvement.

H1c. The independent action of an individual or a team in bringing forth an idea or a vision and carrying it through to completion has a positive effect on open innovation.

H1d. Actions free of stifling organizational constraints has a positive effect on open innovation.

H1e. Autonomy is positively related to outbound open innovation.

The hypothesis H1a can be confirmed. The independent action of an individual or a team in bringing forth an idea or a vision and carrying it through to completion has a positive effect and significant effect on customer involvement. However the hypothesis H1c cannot be confirmed, because the relationship is almost nonexistent. About other hypotheses we can affirm that there is a positive, but not significant, relationship. The second and last hypothesis related to autonomy dimension is:

H2. Open innovation activities benefit from incentives and performance measures that capture open innovation activities at the collective level, and not only individual behavior.

About the second hypothesis we can affirm that there is a positive, but not significant, relationship.

About network dimension Carvalho & Sugano (2016) present only one hypothesis:

H3. Network dimension has a positive effect on open innovation.

Again, there is a weak, not significant and positive relationship. However, we must emphasize the limitation of case study method, because Chesbrough (2006) stresses the role of networks to shape Open Innovation. Thus, a quantitative study is very important and necessary.

About the relationship between proactiveness dimension and Open Innovation, Carvalho & Sugano (2016) presented only one hypothesis:

H4. Alertness regarding new business opportunities has a positive effect on open innovation.

The evidences suggest that alertness regarding new business opportunities has a positive and strong, but no significant, effect on open innovation. Thus, the systematic search for new markets and business opportunities can make the organization become careful to Open Innovation opportunities. For example, despite of the focus of firm, most owners affirm to be alert to develop new products. It is the case of Company A, which changed the focus in the beginning.

Carvalho & Sugano (2016) presented four hypotheses about the relationship between Risk taking dimension and Open Innovation, to know:

H5. Risk taking has a positive effect on open innovation.

H6. There is a significant relationship between risk taking and outbound open innovation.

H7. Organizations with high-level of risk taking level adopt license, as outbound open innovation, more than organizations with low-level of risk taking.

H8. There is a negative relationship between risk taking and selling as outbound open innovation.

The fifth hypothesis points to a positive effect of risk taking on Open Innovation. We found a positive and moderate relationship between risk taking and Open Innovation. On the other hand, we did not find evidences that support the sixth hypothesis. On the contrary, we found a negative, but not significant relationship between risk taking and outbound open innovation. Carvalho & Sugano (2016) rely on Schroll & Mild (2011), which affirmed that while inbound activities do not include a great risk, outbound activities could be more risk because the firm may lose possibility to capture the created value. The firms may be aware of this problem and not use outbound Open Innovation. The seventh and eighth hypotheses are contradictory. Thus, we expected evidences to support only one. The evidences support the eighth hypothesis.

Our initial proposition is confirmed in part. Some dimensions of Entrepreneurial Orientation are correlated with Open Innovation, but we cannot check the impact of both in the firm performance.

However, some relationships became apparent. Because the values of risk taking and proactiveness dimensions are heterogeneous we can affirm that some relationships are relevant. We found a strong and positive relationship between risk taking and external networking as Open Innovation mode. Other relevant relationship is between proactiveness and outsourcing R&D. So, we present two new hypotheses to future works:

H9. There is a significant relationship between risk taking and external networking.

H10. There is a significant relationship between proactiveness and outsourcing R&D.

We cannot offer a satisfactory explanation to those relationships. We can speculate that working in alliance is a risk and only firms which high levels of risk taking are ready to assume. About the tenth hypothesis is more difficult to speculate, so if this hypothesis is confirmed then we need more exploratory studies.

We also found a positive and significant relationship between proactiveness dimension and Open Innovation and inbound Open Innovation. According to Fernandes et al. (2013), to the extent by which globalisation has advanced and deepened the level and consequences of interdependence between national economies, the business world has become ever more complex and exponentially more competitive. Fernandes et al. (2013) stressed that this scenario has driven companies to adopt proactive strategies designed to seek out sustainable competitive advantage and innovation has thereby now emerged as one of the core strategic priorities for companies seeking success in their business dealings. Thus, open innovation emerge as strategy to develop innovation. So, we present more hypotheses to future works:

H11. Proactiveness has a positive effect on open innovation.

H11a. Proactiveness has a positive effect on inbound open innovation.

5. Final Considerations.

Our work aimed to check the hypotheses presented by Carvalho & Sugano (2016). Most hypotheses were confirmed, but only one hypothesis has a significant result. Thus, quantitative works with a wide sample is important. It is import check if Entrepreneurial Orientation is a driver for Open Innovation.

Cheng & Huizingh (2014) concluded that when comparing the three strategic orientations (Entrepreneurial Orientation, market orientation and resource orientation), their findings show that entrepreneurial orientation has the strongest moderation effect on the relation between open innovation and innovation performance. Thus, it makes sense expect Entrepreneurial Orientation as driver of Open Innovation.

Our work does not contribute only with Open Innovation literature, but also it contributes to Entrepreneurial Orientation literature. According to Anderson *et al.* (2015) a number of ontological questions persist in the Entrepreneurial Orientation literature, between them there are ongoing conversations regarding the dimensionality of Entrepreneurial Orientation. First we confirmed the importance of network dimension presented by Mello & Leão (2005), which justify the absence of the competitive aggressiveness dimension. Second, based in the evidences presented here, we advocate that innovativeness dimension should be replaced by a new dimension: Open Innovation dimension. According to Chaston & Scott (2012) the impact of Open Innovation on firm performance is bigger than the impact of Entrepreneurial Orientation on firm performance. Furthermore, Gündoğdu (2012) coined the term Innopreneurship. According to Gündoğdu (2012) existing traditional entrepreneurs also should turn out as innopreneurs not to face the danger of being isolated outside the system. The innopreneur is an entrepreneur turned for innovation and partnerships. Thus, we suggest the constructs of our framework can be merged into a single tool: Open Innopreneurial Orientation.

Moreover, we contribute with new hypotheses to future works. However, we must advert that our work has limitations. These limitations are the method and the units of analysis. Therefore we cannot generalize the results.

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Linking Entrepreneurial Orientation and Open Innovation: a Survey in Brazilian Startups

Abstract:

Since Chesbrough (2003) presented the concept of open innovation, its relationship with broader disciplines of management is few explored. Among these disciplines is entrepreneurship. Entrepreneurial orientation construct has emerged over the years as a major construct in the entrepreneurship. We aim to check the relationship between entrepreneurial orientation, open innovation and firm performance. Our subjacent hypothesis is: entrepreneurial orientation dimensions are drivers for open innovation macroprocessess, while both impact firm performance, being the impact of open innovation macroprocessess more significant than entrepreneurial orientation dimensions. We adopt survey as research method. Structural Equation Modeling was adopted as tool of analysis. The sample is from the database of Brazilian Association of Startups. The subjacent hypothesis was partially supported. The constructs which impact on firm performance are network, proactiveness and outbound open innovation. Suggestions to future works are presented.

Highlights

- Only network and proactiveness dimensions of entrepreneurial orientation are drivers to open innovation macroprocesses.
- Only network and proactiveness dimensions of entrepreneurial orientation impact on firm performance.
- Only outbound open innovation impacts on firm performance.

Keywords: Open Innovation, Entrepreneurial Orientation, Firm Performance, Structural Equation Modeling.

1. Introduction

This article was submitted to the International Business Review and may change suggested by the editorial board.

Since Chesbrough (2003) presented the concept of open innovation, its relationship with broader disciplines of management is few explored, as pointed by West *et al.* (2014). Among these disciplines is entrepreneurship. Hossain (2013) confirms this gap, when he affirms that the relationship between open innovation and entrepreneurship is unexplored.

However, some authors (CHASTON & SCOTT, 2012; SEGERS, 2013; VANHAVERBEKE, 2013; EFTEKHARI & BOGERS, 2015; CARVALHO & SUGANO, 2016a, CARVALHO & SUGANO, 2016b) explored this gap.

We highlight the paper of Carvalho & Sugano (2016a), which advocates entrepreneurial orientation as driver for open innovation. Moreover, Carvalho & Sugano (2016b) emphasized the importance of quantitative works with a wide sample to check entrepreneurial orientation as driver for open innovation.

What is the relationship between entrepreneurial orientation, open innovation and firm performance? Carvalho & Sugano (2016a) addressed entrepreneurial orientation dimensions as drivers for open innovation. Our subjacent hypothesis is entrepreneurial orientation dimensions are drivers for open innovation macroprocesses, while both impact firm performance, being the impact of open innovation macroprocesses more significant than entrepreneurial orientation dimensions. We aim to check the relationship between entrepreneurial orientation, open innovation and firm performance.

After this section are presented a literature review, the methodology, the results and discussions, followed by the concluding section.

2. Literature Review

The seminal work about open innovation was Chesbrough (2003). According to Chesbrough (2003) open innovation means that valuable ideas can come from inside or outside the company and can go to market from inside or outside the company as well.

Usually, open innovation is divided in three macroprocess or archetypes. The first is outside-in which, according to Conboy & Morgan (2011), is also referred to as inbound. Van de Vrande *et al.* (2009) adopt the term technology exploration to refer to outside-in process. The outside-in process enriches the company's own knowledge base through the integration of

suppliers, customers and external knowledge sourcing. Bianchi *et al.* (2011) cites as organizational modes for outside-in open innovation: in-licensing, minority equity investments, acquisitions, joint ventures, R&D contracts and research funding, purchase of technical and scientific services and non-equity alliances.

The second is inside-out process which, according to Conboy & Morgan (2011), is also referred to as outbound. Van de Vrande *et al.* (2009) adopt the term technology exploitation to refer to inside-out process.. The inside-out process earning profits by bringing ideas to market, selling intellectual property and multiplying technology by transferring ideas to the outside environment. Bianchi *et al.* (2011) cites as organizational modes for inside-out open innovation: licensing out, spinning out of new ventures, sale of innovation projects, joint venture for technology commercialization, supply of technical and scientific services, corporate venturing investments and non-equity alliances.

On the other hand, Other concept used here is entrepreneurial orientation. According to Lumpkin & Dess (1996), entrepreneurial orientation refers to the processes, practices, and decision-making activities used by entrepreneurs that lead to the initiation of an entrepreneurial firm. Lumpkin & Dess (1996) identify five dimensions of entrepreneurial orientation:

- **Autonomy:** is defined by Lumpkin & Dess (2001) as independent action by an individual or team aimed at bringing forth a business concept or vision and carrying it through to completion.
- **Competitive aggressiveness:** is said to reflect the intensity of a firm's effort to outperform industry rivals, characterized by a strong offensive posture and a forceful response to competitor's actions (LUMPKIN & DESS, 2001);
- **Innovativeness:** according to LUMPKIN & DESS (1996) innovativeness reflects a firm's Schumpeterian tendency to engage in and support new ideas, novelty, experimentation, and creative processes that may result in new products, services, or technological processes.
- **Proactiveness:** is defined as acting opportunistically to shape the environment by influencing trends, creating demand, and becoming a first mover in a competitive market (LUMPKIN & DESS, 1996);

- Risk taking: according to Lumpkin & Dess (2001), risk taking refers to a tendency to take bold actions such as venturing into unknown new markets, committing a large portion of resources to ventures with uncertain outcomes.

Mello & Leão (2005) identified also a sixth dimension called networks. According to them, this dimension was inserted because the entrepreneur must build relationships with partners to become viable the venture. According to Mello & Leão (2005), the key concept to this dimension is network identity. Mello & Leão (2005) concluded that the emergence of this dimension justify the absence of the competitive aggressiveness dimension. Carvalho & Sugano (2016b) also confirmed the network dimension and the absence of the competitive aggressiveness dimension. According to Carvalho & Sugano (2016b) the main product of startups is often innovative, thereby eliminating competition.

We use the following dimensions in the model: autonomy, proactiveness, risk taking and network (rather than competitive aggressiveness). The innovativeness dimension was not used for three reasons. The first reason is the absence in the model of Carvalho & Sugano (2016b). The second reason is to avoid creating an extended questionnaire. The last reason is to avoid redundancy, because it is expected that a company that practices open innovation is innovative.

Carvalho & Sugano (2016a) advocates that the dimensions of entrepreneurial orientation are drivers for open innovation. Carvalho & Sugano (2016a) using a literature review proposed some hypotheses. They proposed that risk taking has a positive effect on open innovation. More specifically Carvalho & Sugano (2016a) proposed that there is a significant relationship between risk taking and outbound open innovation. Thus, our first two hypotheses are:

H1. Risk Taking has a positive effect on inbound open innovation.

H2. Risk Taking has a positive effect on outbound open innovation.

Carvalho & Sugano (2016b) found evidences of a possible relationship between proactiveness and open innovation. Carvalho & Sugano (2016b) proposed a hypothesis that proactiveness has a positive effect on open innovation. In addition Carvalho & Sugano (2016b) proposed that proactiveness has a positive effect on inbound open innovation. Thus, we have another two hypotheses:

H3. Proactiveness has a positive effect on inbound open innovation.

H4. Proactiveness has a positive effect on outbound open innovation.

Carvalho & Sugano (2016a) proposed that autonomy has a positive effect on open innovation. Thus, we have two more hypotheses:

H5. Autonomy has a positive effect on inbound open innovation.

H6. Autonomy has a positive effect on outbound open innovation.

However, Carvalho & Sugano (2016a) did not find evidences of the relationship between competitive aggressiveness and open innovation. Moreover, Carvalho & Sugano (2016b) did not find evidences of competitive aggressiveness among the startups, just as Mello & Leão (2005). Both articles identified network dimension. In the seminal work about open innovation, Chesbrough (2003) affirmed that creating and appropriating value also involves third parties outside the immediate value chain. Chesbrough (2006) also pointed the importance of networks to open innovation. So, Carvalho & Sugano (2016a) proposed the hypothesis that network dimension has a positive effect on open innovation. Thus, we proposed our two last hypotheses:

H7. Network has a positive effect on inbound open innovation.

H8. Network has a positive effect on outbound open innovation.

Carvalho & Sugano (2016b) analyzed the network dimension ‘using the three factors to analyze strategic network identity provided by Bonner *et al.* (2005): reputation of the organization as a “partner of choice”, competitive strength of alliance network and strength of relationships with key alliance partners. Therefore, we adopt the same construct.

In addition, we suggest hypotheses about the relationship between entrepreneurial orientation and firm performance, and open innovation and firm performance.

H9. Risk Taking has a positive effect on firm performance

H10. Proactiveness has a positive effect on firm performance

H11. Autonomy has a positive effect on firm performance

H12. Network has a positive effect on firm performance

H13. Inbound open innovation has a positive effect on firm performance

H14. Outbound open innovation has a positive effect on firm performance

3. Methodology

We adopt a self-administered questionnaire by computer (Google Form) to collect data. The survey's design is cross-sectional. According to Fink & Kosecoff (1985) a cross-sectional design provides a portrait of things as they are at a single point in time.

Figure 1 shows the research framework provided by Carvalho & Sugano (2016b). We used the questionnaire developed by Carvalho & Sugano (2016b), which was developed in English and then translated it into Portuguese by one of the researchers. We contacted seven individual, including academics and entrepreneurs, that agreed to fill out the pre-test. To assess the face validity of the instrument we asked the interviewees to comment on the questionnaire. This also helped the researchers to improve the content validity of the survey instrument (e.g., structure, suitability, jargon terms, translation issues, etc.). As a result, several modifications were made to the initial questionnaire. In addition, all measurements adapted existing scales that the independent and dependent variables were measured using a seven-point scale being “1–strongly disagree” and “7–strongly agree”.

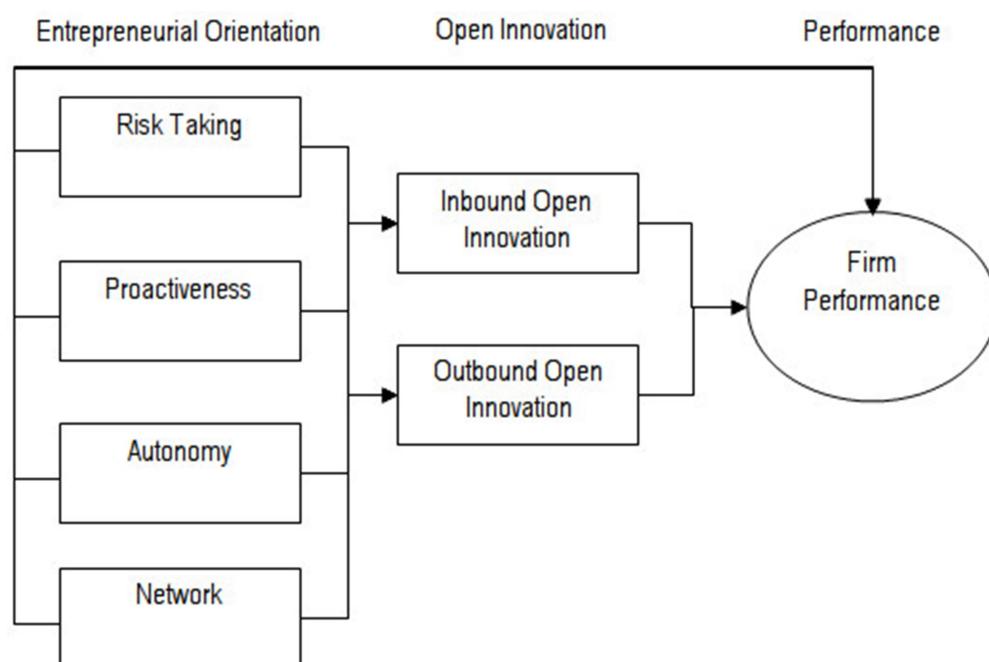


Figure 1 – The research framework

Source: Carvalho & Sugano (2016b)

The empirical basis of the project was generated using information from the Brazilian Association of Startups (ABStartups). We check the records looking for inconsistencies. We

identified 1950 valid records. Using random sampling, we contacted the startups using facebook, e-mail and phone call, asking who would like to participate in the survey. The link to access the questionnaire was sent to the companies that have committed to answer. We contacted nearly all startups after three months. Our initial sample had 136 startups. However, we excluded 26 records because of the validity question. The validity question asks to respondent choose a specific answer to avoid random answers. We considered a high tech startup as a young firm (less than 8 years). So, we excluded six startups. We cannot evaluate the performance of very young enterprise (less than 1 year). Aiming to not reduce the sample, we exclude a variable which evaluates the performance considering the last two years. At the end, our sample has 94 startups.

It is important to note that 95% of the respondents were owner-managers, while the remaining is Managers, CEO, CTO or Sales Manager. The startups have a total of 596 employees. The largest company has 85 employees. As we use forced-choice questions, there are no missing values

Next we analyze the data. The statistical method used to analyze the data is structural equation modeling.

4. Results

Despite of Anderson & Gerbing (1988) be the main reference in structural equation modeling, we follow Hair *et al.* (2014) because of the approach based in SmartPLS software.

According to Hair *et al.* (2011), we use PLS-SEM rather CB-SEM (Covariance-based structural equation modeling) when the goal is identifying key “driver” constructs, formatively measured constructs are part of the structural model, the structural model is complex (many constructs and many indicators), and the sample size is small and/or the data are non-normally distributed . All conditions are satisfied.

Our framework has 5 reflective measurement models and 2 formative measurement models. The formative measurement models are inbound open innovation and outbound open innovation. According to Hair Jr. *et al.* (2014) the decision as to which measurement model is appropriate has been the subject of considerable debate in a variety of disciplines and is not fully resolved. According to guidelines provided by Hair Jr. *et al* (2014) whether the construct is a combination of the indicators, rather a trait explaining the indicators, we choose formative measurement model. In addition, in formative measurement models it is not necessarily true

that if the assessment of the trait changes, all items will change in a similar manner. The formative indicators represent independent sources of the construct's content, they do not necessarily need to be correlated (in fact, they should not be highly correlated, which is our case). Other criterion is the items are not mutually interchangeable. We check the formative measurement models for collinearity of indicators. At last, we consider the indicators as causes, and not consequences, of the construct.

Following Cohen's (1988) recommendations for multiple OLS regression analysis or running a power analysis using the G*Power program, one would need 114 observations to detect effect size of 0.15, assuming a significance level of 5% and a statistical power of 80%. According to Hair *et al.* (2014) statistical power is the probability to detect a significant relationship significant when it is in fact significant in the population. However, according to Hair Jr. *et al.* (2014) the minimum sample size for PLS path model estimation should at least meet the 10 times rule (10 times the largest number of formative indicators used to measure a single construct, or 10 times the largest number of structural paths directed at a particular construct in the structural model). The construct which has the largest number of structural paths directed at it is inbound open innovation. This construct has 9 structural paths directed to it. Thus, 90 represent the minimum number of observations needed to estimate the PLS path model. We have 94 observations.

We used the SmartPLS software. About the parameters to run PLS-SEM algorithm, the PLS-SEM algorithm stops when the maximum number of 300 iterations or the stop criterion of $1.0E-5$ (i.e., 0.00001) has been reached. According to Hair Jr. *et al.* (2014) the selection of a maximum number of 300 iterations should ensure that convergence is obtained at the stop criterion of $1.0E-5$. We applied the path weighting scheme, because according to Hair Jr. *et al.* (2014) it provides the highest R^2 value for endogenous latent variables. Figure 2 shows the model.

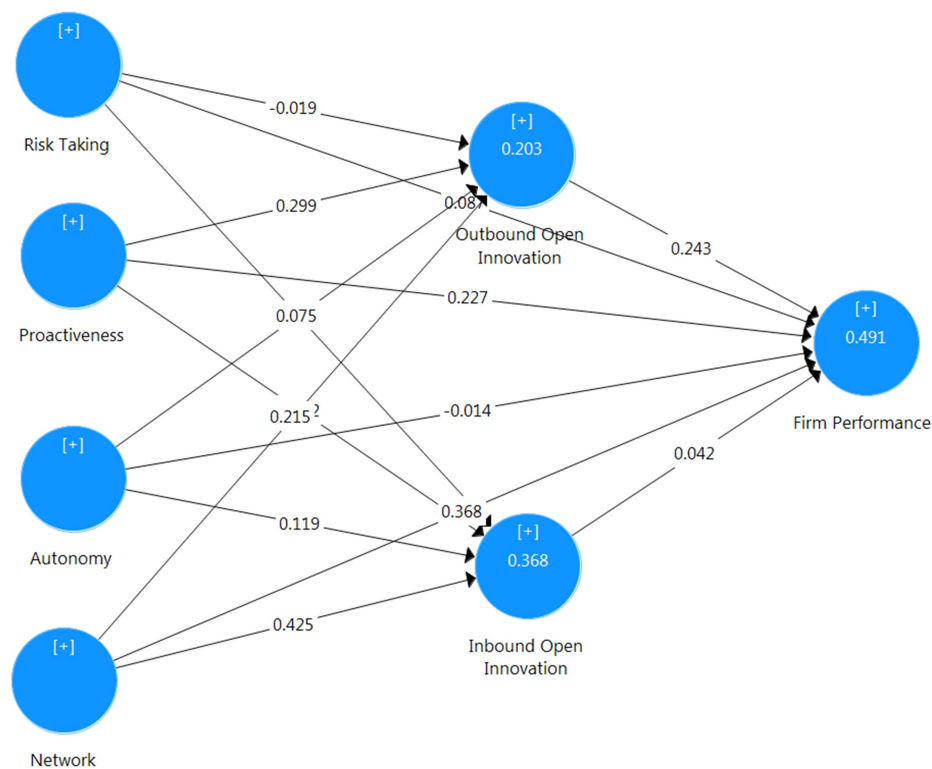


Figure 2 – The model

Source: SmartPLS Software

Next, we evaluate the measurement models. However, before we need check if the algorithm converged. The stop criterion of the algorithm was reached after iteration 8. This number is lower than the maximum number of iterations (300) that we defined in the PLS-SEM algorithm.

Thus, we can evaluate the measurement models. The criteria for reflective measurement models cannot be universally applied to formative measurement models, because according to Hair Jr. *et al.* (2014) the two approaches are based on different concepts and therefore require consideration of different evaluative measures. Reflective measurement models are assessed on their internal consistency reliability and validity. According to Hair Jr. *et al.* (2014) the specific measures include the composite reliability (as a means to assess the internal consistency reliability), convergent validity, and discriminant validity. To guarantee convergent validity we eliminate two indicators in autonomy construct, but we did not eliminate automatically indicators when their outer loading is below 0.70. Rather, we carefully examine the effects of item removal on the composite reliability. After check cross loadings, we eliminate one indicator in proactiveness. Table 1 summaries the results of the reflective measurement model assessment.

Table 1 – Results summary for reflective measurement models

| Latent Variable | Indicators | Loadings (weights) | Composite Reliability | AVE | Discriminant Validity? |
|------------------|------------|--------------------|-----------------------|-------|------------------------|
| Risk Taking | OERT1 | 0.925 (0.575) | 0.912 | 0.839 | Yes |
| | OERT2 | 0.906 (0.516) | | | |
| Proactiveness | OEP1 | 0.873 (0.512) | 0.865 | 0.682 | Yes |
| | OEP2 | 0.854 (0.372) | | | |
| | OEP3 | 0.746 (0.316) | | | |
| Autonomy | OEA1 | 0.726 (0.578) | 0.752 | 0.604 | Yes |
| | OEA2 | 0.825 (0.704) | | | |
| Network | OER1 | 0.808 (0.414) | 0.880 | 0.710 | Yes |
| | OER2 | 0.827 (0.354) | | | |
| | OER3 | 0.891 (0.418) | | | |
| Firm Performance | DG1 | 0.888 (0.239) | 0.944 | 0.773 | Yes |
| | DG2 | 0.903 (0.246) | | | |
| | DG3 | 0.871 (0.221) | | | |
| | DG4 | 0.835 (0.211) | | | |
| | DG5 | 0.898 (0.219) | | | |

Source: SmartPLS Software

The traditional criterion for internal consistency is Cronbach's alpha. However, according to Hair Jr. *et al.* (2014), due to Cronbach alpha's limitations in the population, it is more appropriate to apply a different measure of internal consistency reliability, which is referred to as composite reliability (ρ_c). Eq. 1 presents the formula of composite reliability.

$$\rho_c = (\sum_i l_i)^2 / ((\sum_i l_i)^2 + \sum_i \text{var}(e_i)) \quad (\text{eq. 1})$$

Whereby:

- l_i symbolizes the standardized outer loading of the indicator variable i of a specific construct;

- e_i is the measurement error of indicator variable i ;
- and $var(e_i)$ denotes the variance of the measurement error, which is defined as $1-l_i^2$;

The average variance extracted (AVE) is a common measure to establish the convergent validity on the construct level. According to Hair Jr. *et al.* (2014) convergent validity is the extent to which a measure correlates positively with alternative measure of the same construct.

According to Hair Jr. *et al.* (2014), discriminant validity is the extent which a construct is truly distinct from other constructs by empirical standards. Thus, establishing discriminant validity implies that a construct is unique and capture phenomena not represented by other constructs in the model (HAIR Jr. *et al.*, 2014). We applied two measures of discriminant validity: Fornell-Larcker criterion (the more conservative approach to assessing discriminant validity on basis of the “shared variance” measure suggested by Fornell & Larcker, 1981) and examining cross loadings (where an indicator’s outer loading on the associated construct should be greater than all of its loadings on other constructs). The Fornell-Larcker compares the square root of the AVE values with the latent variable correlations. Specifically, the square root of each construct’s AVE should be greater than its highest correlation with any other construct (HAIR Jr. *et al.*, 2014). According to Hair Jr. *et al.* (2014) the logic of this method is based on the idea that a construct shares more variance with its associated indicators than with any other construct.

As can be seen, all model evaluation criteria have been met, providing support for the reflective measures’ reliability and validity.

Next, we evaluate the formative measurement models. According to Hair Jr. *et al.* (2014) the internal consistency perspective that underlies reflective measurement model evaluation cannot be applied to formative models since formative measures do not necessarily covary. Thus, any attempt to purify formative indicator based on correlation patterns can have negative consequences for a construct’s content validity (HAIR Jr. *et al.*, 2014). The first step involves assessing the formative measured convergent validity by correlating the formatively measured construct with a reflective measure of the same construct. We need two questions similar to “My firm employs inbound / outbound open innovation” to work as dependent variable. However, Carvalho & Sugano (2016b) shows that the managers do not know the concept of open innovation. The question could not be understood by the respondents. In

addition, including new questions increase the survey length. Thus, our study presents this limitation.

In the next step, we check the formative measurement models for collinearity of indicators. According to Hair Jr. *et al.* (2014), unlike reflective indicators, which are essentially interchangeable, high correlations are not expected between items in formative measurement models. In fact, high correlations between two formative indicators, also referred to as collinearity, can prove problematic from a methodological and interpretational standpoint (HAIR Jr. *et al.*, 2014). The SmartPLS software does not provide users with the tolerance and the variance inflation factor (VIF) values. We used SPSS Statistics, which present collinearity statistics in their linear regression modules. We run a multiple regression with the formative indicators of the constructs as independent variables and any other indicator, which is not included in the specific measurement models, as the dependent variable. Table 2 shows the variance inflation factor results. The VIF (or tolerance) results are uniformly below the threshold value of 5.

Table 2 – Variance Inflation Factor Results

| Latent Variable | Indicators | VIF |
|--------------------------|-------------------|------------|
| Outbound Open Innovation | IAO1 | 1.023 |
| | IAO2 | 1.025 |
| | IAO3 | 1.005 |
| Inbound Open Innovation | IAI1 | 1.353 |
| | IAI2 | 1.451 |
| | IAI3 | 1.210 |
| | IAI4 | 1.227 |
| | IAI5 | 1.121 |

Source: SPSS Software

Next, we assess the significance and relevance of the formative indicators. So, we need to analyze the outer weights for their significance and relevance. We first consider the significance of the outer weights by means of bootstrapping. The method for dealing with sign changes during the bootstrapping iterations is no sign changes. Sign changes in the

resamples will be ignored and sample estimates are taken as they are. This is the most conservative estimation method. In bootstrapping, subsamples are created with observations randomly drawn from the original set of data (with replacement). To ensure stability of results, the number of subsamples should be large. We adopt 5,000 subsamples. Now we can check the significance levels to find significant formative indicators. Table 3 shows outer weights significance testing results.

Table 3 – Outer Weights Significance Testing Results

| Formative Constructs | Formative Indicators | Outer Weights (Outer Loadings) | t Value | p Value |
|-----------------------------|-----------------------------|---------------------------------------|----------------|----------------|
| Outbound Open Innovation | IAO1 | 0.454 (0.504) | 2.749 | 0.006 |
| | IAO2 | 0.554 (0.579) | 3.178 | 0.001 |
| | IAO3 | 0.699 (0.645) | 5.144 | 0.000 |
| Inbound Open Innovation | IAI1 | 0.238 (0.599) | 1.676 | 0.094 |
| | IAI2 | 0.564 (0.808) | 3.409 | 0.001 |
| | IAI3 | 0.341 (0.651) | 2.021 | 0.043 |
| | IAI4 | 0.195 (0.496) | 1.343 | 0.179 |
| | IAI5 | 0.260 (0.321) | 1.782 | 0.075 |

Source: SmartPLS Software

Looking at the significance levels, we find that all formative indicators are significant except IAI1, IAI4 and IAI5. When the outer weight is not significant, we must analyze the formative indicator's outer loading. The outer loading of IAI1 is above 0.5, so the indicator should be interpreted as absolutely important but not as relatively important. In this situation, the indicator would generally be retained. Yet the indicator IAI4 and IAI5 have a nonsignificant weight and the outer loading is below 0.5, and according to Hair Jr. *et al.* (2014) the researcher should decide whether to retain or delete the indicator by examining its theoretical relevance and potential content overlap with other indicators of the same construct. The indicators represent R&D outsourcing and Licensing in activities. The theory of open innovation (CHESBROUGH, 2003; CHESBROUGH, 2006) provides support for the

relevance of these indicators. Thus, we decide to retain the indicator. The analysis of outer weights concludes the evaluation of the formative measurement models.

Considering that all reflective and formative constructs exhibit satisfactory levels of quality we can proceed with the evaluation of the structural model. Assessment of the structural model results enables you to determine how well empirical data support the theory/concept and therefore to decide if your theory/concept has been empirically confirmed (HAIR Jr. *et al.*, 2014).

The first step involves assessing collinearity. First, we need to make use of the latent variable scores. After importing the latent variable scores into SPSS, we run a multiple regression with a set of predictor constructs as independent variables and any other latent variable, which does not serve as a predictor in this specific analysis as the dependent variable. Table 4 shows the collinearity assessment. As can be seen, all VIF values are clearly below the threshold of 5. Therefore, collinearity among the predictor constructs is not an issue in the structural model.

Table 4 – Collinearity Assessment

| First Set | | Second Set | | Third Set | |
|---------------|-------|--------------------------|-------|------------------|-------|
| Constructs | VIF | Constructs | VIF | Constructs | VIF |
| Autonomy | 1,302 | Inbound Open Innovation | 1,534 | Firm Performance | 1,000 |
| Network | 1,332 | Outbound Open Innovation | 1,534 | | |
| Proactiveness | 1,395 | | | | |
| Risk Taking | 1,357 | | | | |

Source: SPSS Software

Next, we assess the level of R^2 . According to Hair *et al.* (2014) the most commonly used measure to evaluate the structural model is the coefficient of determination (R^2 value). It is difficult to provide rules of thumb for acceptable R^2 values because studies of open innovation are recent. Thus, to us, the R^2 values of Firm Performance (0.491) and Inbound Open

Innovation (0.368) can be considered moderate, whereas the R^2 value of Outbound Open Innovation (0.203) is rather weak.

Next step involves assessing structural model path coefficients. To assess the relationships significance, we run the bootstrapping procedure. Table 5 displays the path coefficients, the t values and their p values.

Table 5 – Significance testing results of the structural model path coefficients.

| | Path Coefficients | t values | p values |
|--|--------------------------|-----------------|-----------------|
| Autonomy -> Firm Performance | -0.014 | 0.142 | 0.887 |
| Autonomy -> Inbound Open Innovation | 0.119 | 0.874 | 0.382 |
| Autonomy -> Outbound Open Innovation | 0.075 | 0.573 | 0.567 |
| Inbound Open Innovation -> Firm Performance | 0.042 | 0.377 | 0.707 |
| Network -> Firm Performance | 0.368 | 3.682 | 0.000 |
| Network -> Inbound Open Innovation | 0.425 | 4.123 | 0.000 |
| Network -> Outbound Open Innovation | 0.215 | 1.850 | 0.064 |
| Outbound Open Innovation -> Firm Performance | 0.243 | 2.428 | 0.015 |
| Proactiveness -> Firm Performance | 0.227 | 2.356 | 0.018 |
| Proactiveness -> Inbound Open Innovation | 0.242 | 2.328 | 0.020 |
| Proactiveness -> Outbound Open Innovation | 0.299 | 2.537 | 0.011 |
| Risk Taking -> Firm Performance | 0.087 | 0.886 | 0.376 |
| Risk Taking -> Inbound Open Innovation | -0.032 | 0.274 | 0.784 |
| Risk Taking -> Outbound Open Innovation | -0.019 | 0.146 | 0.884 |

Source: SmartPLS Software

Before we present our considerations, we need assess the effect sizes and the predictive relevance. In addition to evaluating the magnitude of the R^2 values as a criterion of predictive accuracy, researchers should also examine Stone-Geisser's Q^2 value (HAIR *et al.*, 2014). According to Hair *et al.* (2014) this measure is an indicator of the model's predictive relevance.

Next, we run the blindfolding procedure. As we have 94 observations, we can choose an omission distance of $D=7$. We cannot use an omission distance in which the division of number of observations used in the model estimation and the distance is an integer. The procedure does not apply for formative endogenous constructs. In our path model, the predictive relevance Q^2 of firm performance has a value of 0.358, which implies that the model has predictive relevance for this construct.

It is important check predictive relevance of exogenous construct. This measure is referred to as the q^2 effect size (eq.2)

$$q^2 = (Q^2_{\text{included}} - Q^2_{\text{excluded}}) / (1 - Q^2_{\text{included}}) \quad (\text{eq.2})$$

In addition to evaluating the R^2 values of all endogenous constructs, the change in the R^2 value when a specified exogenous construct is omitted from the model can be used to evaluate whether the omitted construct has a substantive impact on the endogenous constructs (HAIR *et al.*, 2014). This measure is referred to as the f^2 effect size (eq.3).

$$f^2 = (R^2_{\text{included}} - R^2_{\text{excluded}}) / (1 - R^2_{\text{included}}) \quad (\text{eq. 3})$$

Table 6 summarizes the results of the f^2 and q^2 effect size with respect to significant relationships in the model. Guideline for assessing f^2 and q^2 are that values of 0.02, 0.15 and 0.35, respectively, represent small, medium and large effects of the exogenous latent variable. Thus, we can affirm that network has a medium substantive impact on firm performance, but network has a small predictive relevance for firm performance.

Table 6 – Effect Size

| | f^2 Effect Size | q^2 Effect Size |
|--|-------------------------------------|-------------------------------------|
| Network -> Firm Performance | 0.163 | 0.098 |
| Network -> Inbound Open Innovation | 0.193 | |
| Outbound Open Innovation -> Firm Performance | 0.072 | 0.040 |

| | | |
|---|-------|-------|
| Proactiveness -> Firm Performance | 0.066 | 0.037 |
| Proactiveness -> Inbound Open Innovation | 0.058 | |
| Proactiveness -> Outbound Open Innovation | 0.080 | |

Source: SmartPLS Software

We do not use goodness-of-fit index for validating the PLS model globally, because according to Ringle *et al.* (2014) all constructs must be reflective. In addition, Hair Jr. *et al.* (2014) do not recommend its use.

Therefore, it is advisable for companies to focus on Network activities that positively influence the firm performance. By also taking the construct's indicator weights into consideration, we can even identify which specific element of quality needs to be addressed. Looking at the outer weights reveals that OER3 has the highest outer weight (0.418), followed by OER1 (0.414). These items relate strong relationship with key partners in the alliances and trust. Thus, managers should try to enhance the partners' perception of trust. Regarding outbound open innovation, managers should use employees' ideas and intellectual property.

Thus, we support partially the hypothesis H3, because network dimension has a positive effect only in inbound open innovation. We support hypotheses H11 and H11a. We do not support hypotheses H1, H1e, H5, and H6. We also support partially our subjacent hypothesis. Network dimension is an antecedent of inbound open innovation, while proactiveness dimension is an antecedent of open innovation. We did not found evidences that risk taking and autonomy dimensions are antecedents of open innovation. Furthermore, network has a medium substantive impact on firm performance and proactiveness has a small substantive impact on firm performance, while outbound open innovation has a small substantive impact on firm performance.

5. Discussion

It is important the discussion emphasize three aspects: the hypotheses, the subjacent hypothesis, and the constructs and their impact on firm performance.

First, we discuss the hypotheses. Table 7 shows the hypotheses and if they are supported. Most hypotheses were not supported. It became clear that open innovation is dependent of context, as concluded by Carvalho *et al.* (2016). Some hypotheses are extracted from studies performed in other countries, therefore, different realities. Probably, if we check these

hypotheses in other countries, we will find different results. However, we have some assumptions and contributions.

The subjacent hypothesis is concerned with the role of each dimension, and not the entire entrepreneurial orientation. As we do not use high-level constructs, we can check the impact of each entrepreneurial orientation dimension and each archetype of open innovation. Despite not confirm the entire subjacent hypothesis, we identify relevant strategies to improve the use of open innovation and the firm performance. So, managers can avoid investing in counterproductive actions.

We must highlight the network dimension, which is not provided by original construct of entrepreneurial orientation. The role of networks to open innovation is already known by open innovation literature. However, its impact on firm performance is the most significant among other constructs. Another important highlight is the impact of outbound open innovation on firm performance. Outbound open innovation has been relegated by organizations, but in this scenario of Brazilian startups, it is most important to firm performance.

Table 7 – Hypotheses

| Hypotheses | Supported? |
|--|-------------------|
| H1. Risk Taking has a positive effect on inbound open innovation. | No |
| H2. Risk Taking has a positive effect on outbound open innovation. | No |
| H3. Proactiveness has a positive effect on inbound open innovation. | Yes |
| H4. Proactiveness has a positive effect on outbound open innovation. | Yes |
| H5. Autonomy has a positive effect on inbound open innovation. | No |
| H6. Autonomy has a positive effect on outbound open innovation. | No |

| | |
|---|-----|
| H7. Network has a positive effect on inbound open innovation. | Yes |
| H8. Network has a positive effect on outbound open innovation. | No |
| H9. Risk Taking has a positive effect on firm performance | No |
| H10. Proactiveness has a positive effect on firm performance | Yes |
| H11. Autonomy has a positive effect on firm performance | No |
| H12. Network has a positive effect on firm performance | Yes |
| H13. Inbound open innovation has a positive effect on firm performance | No |
| H14. Outbound open innovation has a positive effect on firm performance | Yes |

6. Final Considerations

In this article we aimed to check the relationship between entrepreneurial orientation, open innovation and firm performance. The evidences suggest that proactiveness dimension is driver for inbound and outbound open innovation. The evidences also suggest that network dimension is driver for inbound open innovation. The constructs which impact on firm performance are network, proactivity and outbound open innovation.

Our work contributes not just with Open Innovation literature, but also it contributes to Entrepreneurial Orientation literature. According to Anderson *et al.* (2015) a number of ontological questions persist in the Entrepreneurial Orientation literature, between them there are ongoing conversations regarding the dimensionality of Entrepreneurial Orientation. We confirmed the importance of network dimension presented by Mello & Leão (2005), which justify the absence of the competitive aggressiveness dimension.

Carvalho & Sugano (2016b) suggested a new tool: Open Innopreneurial Orientation. However, we can reduce the proposed dimensions: outbound open innovation, network and proactiveness. Thus, we present a concise guide to startups' managers.

Our work has some weakness. First the margin of error for the full sample is plus or minus ten percentage points. The second weakness is the formative measured convergent validity, reported and justified previously. However, we must emphasize the reliability of our data, uphold by methodological and statistical accuracy.

Future works should evaluate if the effect from open innovation on firm performance is influenced by a moderator variable entrepreneurial orientation. Another suggestion is to evaluate the effect of open innovation on innovative performance of startups.

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Entrepreneurial Orientation and Open Innovation in Brazilian Startups: a Survey

Abstract:

Since Chesbrough (2003) presented the concept of open innovation, its relationship with broader disciplines of management is few explored. Among these disciplines is entrepreneurship. Carvalho & Sugano (2016a) and Carvalho & Sugano (2016b) performed literature review and exploratory case studies respectively to check the relationship between entrepreneurial orientation and open innovation, and provided some hypotheses. We aim to check some hypotheses provided by Carvalho & Sugano (2016a) and Carvalho & Sugano (2016b). However, the hypotheses are very complex, requiring different statistical methods. Therefore, we aim to check those hypotheses, which be confirmed by first-generation techniques of multivariate analysis or structural equation modeling with single-item construct (second-generation technique). We adopt survey as research method. The sample is from the database of Brazilian Association of Startups. Most hypotheses are not supported. Suggestions to future works are presented.

Keywords: Open Innovation, Entrepreneurial Orientation, startups.

1. Introduction

This article was submitted to the *Exacta Journal* and may change suggested by the editorial board.

Since Chesbrough (2003) presented the concept of open innovation, its relationship with broader disciplines of management is few explored, as pointed by West *et al.* (2014). Among these disciplines is entrepreneurship. Hossain (2013) confirms this gap, when he affirms that the relationship between open innovation and entrepreneurship is unexplored.

However, since 2013 some authors (CHASTON & SCOTT, 2012; DE CLEYN *et al.*, 2013; IAKOVLEVA, 2013; SEGERS, 2013; SOLESVIK & GULBRANDSEN, 2013; VANHAVERBEKE, 2013; EFTEKHARI & BOGERS, 2015; CARVALHO & SUGANO, 2016a, CARVALHO & SUGANO, 2016b) explored this gap. Our study is a continuation of two of these studies. (CARVALHO & SUGANO, 2016a, CARVALHO & SUGANO, 2016b).

We highlight the paper of Carvalho & Sugano (2016a), which advocates entrepreneurial orientation as driver for open innovation. Carvalho & Sugano (2016a) using a literature review proposed some hypotheses. Next, Carvalho & Sugano (2016b) using a multicase study checked the hypotheses presented by Carvalho & Sugano (2016a). In addition, Carvalho & Sugano (2016b) presented more hypotheses.

Carvalho & Sugano (2016b) used qualitative research to identify the factors that affect the area under investigation, and then we use that information to devise quantitative research that assesses how these factors would affect the startups. Moreover, Carvalho & Sugano (2016b) emphasized the importance of quantitative works with a wide sample. Our research question is what is the relationship between entrepreneurial orientation dimensions / features and open innovation macroprocesses / activities? Carvalho & Sugano (2016a) addressed entrepreneurial orientation dimensions as drivers for open innovation.

Thus, we aim to check the hypotheses provided by Carvalho & Sugano (2016a) and Carvalho & Sugano (2016b). We adopt survey as research method.

After this section are presented a short theoretical background, the methodology, the results and discussions, followed by the concluding section.

2. Theoretical background

To offer to the reader an understanding about the concepts approached, this section present a short theoretical background about open innovation and entrepreneurial orientation.

2.1. Open innovation

As stated above the seminal work about open innovation was Chesbrough (2003). According to Chesbrough (2003) open innovation means that valuable ideas can come from inside or outside the company and can go to market from inside or outside the company as well.

To understand the concept of open innovation, it is important to know its activities. Huizingh (2011) affirms that open innovation became the umbrella that encompasses, connects, and integrates a range of already existing activities. Hossain (2013) affirms that open innovation overlaps other concepts such as user generation, crowdsourcing, and distributed innovation. So, open innovation is not a novelty, but a range of existing concepts and activities. Usually, open innovation is divided in three macroprocess or archetypes.

The first is outside-in which, according to Conboy & Morgan (2011), is also referred to as inbound. Van de Vrande *et al.* (2009) adopt the term technology exploration to refer to

outside-in process. The outside-in process enriches the company's own knowledge base through the integration of suppliers, customers and external knowledge sourcing. Bianchi *et al.* (2011) cites as organizational modes for outside-in open innovation: in-licensing, minority equity investments, acquisitions, joint ventures, R&D contracts and research funding, purchase of technical and scientific services and non-equity alliances.

The second is inside-out process which, according to Conboy & Morgan (2011), is also referred to as outbound. Van de Vrande *et al.* (2009) adopt the term technology exploitation to refer to inside-out process.. The inside-out process earning profits by bringing ideas to market, selling intellectual property and multiplying technology by transferring ideas to the outside environment. Bianchi *et al.* (2011) cites as organizational modes for inside-out open innovation: licensing out, spinning out of new ventures, sale of innovation projects, joint venture for technology commercialisation, supply of technical and scientific services, corporate venturing investments and non-equity alliances.

Although several authors as Chesbrough & Crowther (2006) and Wang & Zhou (2012) adopt only inside-out and outside-in processes in their works, the third process is the coupled process. According to Conboy & Morgan (2011) this open innovation approach combines the outside-in (gaining external knowledge) with the inside-out process (to bring ideas to market). Because it accomplishes the two others process, several authors do not adopt this classification. In order to accomplish both, these companies collaborate and cooperate with other stakeholders such as partner companies (e.g. strategic alliances, joint ventures), suppliers and customers, as well as universities and research institutes. In our work we adopt the terminology inbound and outbound open innovation.

2.2. Entrepreneurial orientation

One of the main concepts in entrepreneurship studies for the last decades is entrepreneurial orientation. According Campos *et al.* (2012) entrepreneurial orientation has received substantial conceptual and empirical attention, representing one of the few areas in entrepreneurship research in which a cumulative body of knowledge is developing.

According to Lumpkin & Dess (1996), entrepreneurial orientation refers to the processes, practices, and decision-making activities used by entrepreneurs that lead to the initiation of an entrepreneurial firm. Lumpkin & Dess (1996) identify five dimensions of entrepreneurial orientation:

- **Autonomy:** is defined by Lumpkin & Dess (2001) as independent action by an individual or team aimed at bringing forth a business concept or vision and carrying it through to completion.
- **Competitive aggressiveness:** is said to reflect the intensity of a firm's effort to outperform industry rivals, characterized by a strong offensive posture and a forceful response to competitor's actions (LUMPKIN & DESS, 2001);
- **Innovativeness:** according to LUMPKIN & DESS (1996) innovativeness reflects a firm's Schumpeterian tendency to engage in and support new ideas, novelty, experimentation, and creative processes that may result in new products, services, or technological processes.
- **Proactiveness:** is defined as acting opportunistically to shape the environment by influencing trends, creating demand, and becoming a first mover in a competitive market (LUMPKIN & DESS, 1996);
- **Risk taking:** according to Lumpkin & Dess (2001), risk taking refers to a tendency to take bold actions such as venturing into unknown new markets, committing a large portion of resources to ventures with uncertain outcomes.

Mello & Leão (2005) identified also a sixth dimension called networks. According to them, this dimension was inserted because the entrepreneur must build relationships with partners to become viable the venture. According to Mello & Leão (2005), the key concept to this dimension is network identity. Mello & Leão (2005) concluded that the emergence of this dimension justify the absence of the competitive aggressiveness dimension. Carvalho & Sugano (2016b) also confirmed the network dimension and the absence of the competitive aggressiveness dimension. According to Carvalho & Sugano (2016b) the main product of startups is often innovative, thereby eliminating competition.

Carvalho & Sugano (2016b) analyzed the network dimension ‘using the three factors to analyze strategic network identity provided by Bonner *et al.* (2005): reputation of the organization as a “partner of choice”, competitive strength of alliance network and strength of relationships with key alliance partners.

We use the following dimensions in the model: autonomy, proactiveness, risk taking and network (rather than competitive aggressiveness). The innovativeness dimension was not used for three reasons. The first reason is the absence in the model of Carvalho & Sugano (2016b).

The second reason is to avoid creating an extended questionnaire. The last reason is to avoid redundancy, because it is expected that a company that practices open innovation is innovative.

3. Methodology

We adopt a self-administered questionnaire by computer (Google Form) to collect data. The survey's design is cross-sectional. According to Fink & Kosecoff (1985) a cross-sectional design provides a portrait of things as they are at a single point in time.

We used the questionnaire developed by Carvalho & Sugano (2016b), which was developed in English and then translated it into Portuguese by one of the researchers. We contacted seven individual, including academics and entrepreneurs, that agreed to fill out the pre-test. To assess the face validity of the instrument we asked the interviewees to comment on the questionnaire. This also helped the researchers to improve the content validity of the survey instrument (e.g., structure, suitability, jargon terms, translation issues, etc.). As a result, several modifications were made to the initial questionnaire. In addition, all measurements adapted existing scales that the independent and dependent variables were measured using a seven-point scale being "1–strongly disagree" and "7–strongly agree".

The empirical basis of the project was generated using information from the Brazilian Association of Startups (ABStartups). We check the records looking for inconsistencies. We identified 1950 valid records. Using random sampling, we contacted the startups using facebook, e-mail and phone call, asking who would like to participate in the survey. The link to access the questionnaire was sent to the companies that have committed to answer. We contacted nearly all startups after three months. The number of respondents is 136. However, we excluded 26 records because of the validity question. The validity question asks to respondent choose a specific answer to avoid random answers. Startups had to be less than 8 years. The academic literature defines a high tech startup as a young firm (less than 8 years) launched by individuals for developing and exploiting (in various forms) an innovation (FREEMAN, 1982; SHAN, 1990). So, we excluded six startups. We cannot evaluate the performance of very young enterprise (less than 1 year). Aiming not to reduce the sample, we exclude a variable which evaluates the performance considering the last two years. At the end, our sample has 94 startups.

It is important to note that 95% of the respondents were owner-managers, while the remaining is Managers, CEO, CTO or Sales Manager. The startups have a total of 596 employees. The largest company has 85 employees. As we use forced-choice questions, there are no missing values. It is important highlight that all Cronbach's alpha coefficients, which is a numerical coefficient of reliability, were higher than 0.87.

Next we analyze the data. The statistical methods used to analyze the data are first-generation and second-generation techniques.

4. Results

In this section we detail data analyses. We divided the analyses to provide a better understanding. First, to check hypotheses H1a, H1b, H2, H7, H8, H9 and H10 we use first-generation techniques. Most analyses we use non-parametric tests. We use parametric tests after transform variables closer to the Normal distribution. The other hypotheses and the subjacent hypothesis are checked using use partial least squares structural equation modeling (PLS-SEM). Despite of Anderson & Gerbing (1988) be the main reference in structural equation modeling, we follow Hair *et al.* (2011) because of the approach based in SmartPLS software.

4.1. First-generation techniques

We must use bivariate correlation to check hypotheses H1a, H1b and H2. These hypotheses refer to autonomy dimension of entrepreneurial orientation. In order to use the parametric tests, it is necessary to check the following conditions: the dependent variable is continuous quantitative measured at least in an interval scale; normality; homoscedasticity among groups; and large sample ($n > 30$). We use two normality tests: Kolmogorov-Smirnov and Shapiro-Wilk. The p-values (0.000) indicate that the condition of normality is not fulfilled. So, we must use non-parametric tests. The statistical test used was the Spearman coefficient. According to Lysterly (1952) the Spearman rank correlation coefficient ρ (rho) is a usefulness non-parametric procedure – i.e., to provide tests of the null hypothesis in cases where the population distribution of either or both variables is unknown. Table 1 shows the Spearman correlation coefficient. The symbol “*” shows significant p-value.

Table 1 – Spearman Correlation Coefficient.

| Autonomy Indicators Open Innovation Indicators | OEA1 (p-value) | OEAx (p-value) | OEA2 (p-value) | OEA3 (p-value) |
|---|-----------------------|-----------------------|-----------------------|-----------------------|
| IAO1 | -0.071 (0.497) | 0.026 (0.807) | 0.001 (0.994) | 0.011 (0.918) |
| IAO2 | 0.012 (0.909) | -0.061 (0.558) | 0.063 (0.544) | 0.152 (0.143) |
| IAO3 | 0.163 (0.117) | 0.103 (0.322) | 0.332 (0.001) * | 0.112 (0.283) |
| IAI1 | 0.186 (0.073) | 0.153 (0.140) | 0.308 (0.003) * | 0.226 (0.029) * |
| IAI2 | 0.360 (0.000) * | 0.231 (0.025) * | 0.291 (0.004) * | 0.272 (0.008) * |
| IAI3 | 0.197 (0.057) | 0.183 (0.077) | 0.151 (0.147) | 0.175 (0.091) |
| IAI4 | -0.064 (0.539) | 0.114 (0.273) | 0.080 (0.441) | 0.006 (0.955) |
| IAI5 | -0.121 (0.245) | 0.085 (0.417) | -0.045 (0.669) | -0.049 (0.640) |

Source: SPSS Software

A p-value < 0.05 was considered as statistically significant. The hypothesis H1a is not supported, because the p-value (0.497) for correlation between IAO1 and OEA1 is not statistically significant. The hypothesis H1b is supported, because the p-value (0.029) for correlation between IAI1 and OEA3 is statistically significant. The hypothesis H2 is partially supported. The p-value (0.025) for correlation between IAI2 and OEAx is the only statistically significant.

Next, we check hypothesis H7. First, we use cluster analysis, a group of multivariate techniques whose main purpose is to aggregate objects based on its characteristics (HAIR *et al.*, 2009). The hierarchical cluster analysis using Ward's method and squared Euclidean distance generated two groups: low risk taking and high risk taking. Variables chosen for cluster modeling were OERT1 and OERT2. Next, we use two normality tests: Kolmogorov-Smirnov and Shapiro-Wilk. Table 2 shows the p-values. The p-values (< 0.05) indicate that the condition of normality is not fulfilled.

Table 2 – Tests of Normality

| | | Kolmogorov-Smirnov | Shapiro-Wilk |
|-------------|-------------------------|--------------------|--------------|
| IAO1 | Low Risk Taking | 0.000 | 0.000 |
| | High Risk Taking | 0.000 | 0.000 |
| IAO2 | Low Risk Taking | 0.000 | 0.000 |
| | High Risk Taking | 0.000 | 0.000 |
| IAO3 | Low Risk Taking | 0.000 | 0.000 |
| | High Risk Taking | 0.002 | 0.001 |

Source: SPSS Software

Next we use the Mann-Whitney U test (MANN & WHITNEY, 1947). The Mann-Whitney U test is used to compare differences between two independent groups when the dependent variable is either ordinal or continuous, but not normally distributed. The p-values for IAO1 (0.451), IAO2 (0.312) and IAO3 (0.369) shows no significant differences among groups. Thus, the hypothesis H7 is not supported.

Next, we check hypothesis H8 using multiple correlation. Multiple correlation are statistics that indicate the degree of linear relationship between a number of predictor variables and a single criterion variable. It is connected to multiple regression. Eq. 1 presents the formula of multiple regression.

$$Y = \alpha + \beta x_1 + \beta x_2 + \dots + \varepsilon \quad (\text{eq. 1})$$

Whereby:

- Y is the predicted value of the dependent variable, y, for a particular set of values of explanatory variables, x_1, x_2, \dots, x_k ;
- α is a constant term (the 'intercept', the value of Y when all the x's are zero), estimating the true value, α , in the population;
- ε is the error;

According to Hair *et al.* (2009), the semi partial correlation between dependent variable (Y) and an independent variable (x_1), while it controls a second independent variable (x_2) is given by equation 2.

$$\text{Corr de } Y, X_1 - (\text{Corr de } Y, X_2 \times \text{Corr de } Y_1, X_2) / \sqrt{1 - (\text{Corr de } X_1, X_2)} \quad (\text{eq. 2})$$

First, we must use the normality tests. The p-values (0.000) indicate that the condition of normality is not fulfilled. We need to make a transformation of these variables before attempting a multilinear regression. We use the Box-Cox transformation (BOX & COX, 1964) of XLSTAT software. Thus, the variables are closer to the Normal distribution. The value of R in multiple regression is 0.147, which suggests a positive relationship between selling and risk taking. We do not support hypothesis H8.

At last, we need to check hypotheses H9 and H10 using multiple regression. First, we must use the normality tests. The p-values (<0.05) indicate that the condition of normality is not fulfilled. We use the Box-Cox to transform a variable to be closer to the Normal distribution. The multiple regression provided R^2 of 0.038 (very low) and the dependent variables are not statistically significant. So, we do not support hypothesis H9. About H10, the multiple regression provided R^2 of 0.055 (very low) and the dependent variables are not statistically significant. So, we do not support hypothesis H10.

4.2. Structural equation modeling

We use PLS-SEM to support the hypotheses H1c, H1d and H4, but using single-item construct. Thus, we start working the most complete model because the tests are largely similar.

According to Hair *et al.* (2011), we use PLS-SEM rather CB-SEM (Covariance-based structural equation modeling) when the goal is identifying key “driver” constructs, formatively measured constructs are part of the structural model, the structural model is complex (many constructs and many indicators), and the sample size is small and/or the data are non-normally distributed. All conditions are satisfied.

All models have 2 formative measurement models. The formative measurement models are inbound open innovation and outbound open innovation. According to Hair Jr. *et al.* (2014) the decision as to which measurement model is appropriate has been the subject of considerable debate in a variety of disciplines and is not fully resolved. According to guidelines provided by Hair Jr. *et al.* (2014) whether the construct is a combination of the indicators, rather a trait explaining the indicators, we choose formative measurement model. In addition, in formative measurement models it is not necessarily true that if the assessment of the trait changes, all items will change in a similar manner. The formative indicator represent independent sources of the construct’s content, they do not necessarily need to be correlated (in fact, they should not be highly correlated, which is our case). Other criterion is

the items are not mutually interchangeable. We check the formative measurement models for collinearity of indicators. At last, we consider the indicators as causes, and not consequences, of the construct.

We used the SmartPLS software. About the parameters to run PLS-SEM algorithm, the PLS-SEM algorithm stops when the maximum number of 300 iterations or the stop criterion of $1.0E-5$ (i.e., 0.00001) has been reached. According to Hair Jr. *et al.* (2014) the selection of a maximum number of 300 iterations should ensure that convergence is obtained at the stop criterion of $1.0E-5$. We applied the path weighting scheme, because according to Hair Jr. *et al.* (2014) it provides the highest R^2 value for endogenous latent variables.

First, we need check if the algorithm converged. The number of iterations to each model is lower than the maximum number of iterations (300) that we defined in the PLS-SEM algorithm.

Thus, we can evaluate the measurement models. The criteria for reflective measurement models cannot be universally applied to formative measurement models, because according to Hair Jr. *et al.* (2014) the two approaches are based on different concepts and therefore require consideration of different evaluative measures.

Next, we evaluate the formative measurement models. According to Hair Jr. *et al.* (2014) the internal consistency perspective that underlies reflective measurement model evaluation cannot be applied to formative models since formative measures do not necessarily covary. Thus, any attempt to purify formative indicator based on correlation patterns can have negative consequences for a construct's content validity (HAIR Jr. *et al.*, 2014). The first step involves assessing the formative measured convergent validity by correlating the formatively measured construct with a reflective measure of the same construct. We need two questions similar to "My firm employs inbound / outbound open innovation" to work as dependent variable. However, Carvalho & Sugano (2016b) shows that the managers do not know the concept of open innovation. The question could not be understood by the respondents. In addition, including new questions increase the survey length. Thus, our study presents this limitation.

In the next step, we check the formative measurement models for collinearity of indicators. According to Hair Jr. *et al.* (2014), unlike reflective indicators, which are essentially interchangeable, high correlations are not expected between items in formative measurement models. In fact, high correlations between two formative indicators, also referred to as

collinearity, can prove problematic from a methodological and interpretational standpoint (HAIR Jr. *et al.*, 2014). The SmartPLS software does not provide users with the tolerance and the variance inflation factor (VIF) values. We used SPSS Statistics, which present collinearity statistics in their linear regression modules. We run a multiple regression with the formative indicators of the constructs as independent variables and any other indicator, which is not included in the specific measurement models, as the dependent variable. Table 3 shows the variance inflation factor results. The VIF (or tolerance) results are uniformly below the threshold value of 5.

Table 3 – Variance Inflation Factor Results

| Latent Variable | Indicators | VIF |
|--------------------------|-------------------|------------|
| Outbound Open Innovation | IAO1 | 1.023 |
| | IAO2 | 1.025 |
| | IAO3 | 1.005 |
| Inbound Open Innovation | IAI1 | 1.353 |
| | IAI2 | 1.451 |
| | IAI3 | 1.210 |
| | IAI4 | 1.227 |
| | IAI5 | 1.121 |

Source: SPSS Software

Next, we assess the significance and relevance of the formative indicators. So, we need to analyze the outer weights for their significance and relevance. We first consider the significance of the outer weights by means of bootstrapping. The method for dealing with sign changes during the bootstrapping iterations is no sign changes. Sign changes in the resamples will be ignored and sample estimates are taken as they are. This is the most conservative estimation method. In bootstrapping, subsamples are created with observations randomly drawn from the original set of data (with replacement). To ensure stability of results, the number of subsamples should be large. We adopt 5,000 subsamples. Now we can check the significance levels to find significant formative indicators. Table 4 shows outer weights significance testing results.

Table 4 – Outer Weights Significance Testing Results

| Formative Constructs | Formative Indicators | Outer Weights (Outer Loadings) | t Value | p Value |
|-----------------------------|-----------------------------|---------------------------------------|----------------|----------------|
| Outbound Open Innovation | IAO1 | 0.454 (0.504) | 2.749 | 0.006 |
| | IAO2 | 0.554 (0.579) | 3.178 | 0.001 |
| | IAO3 | 0.699 (0.645) | 5.144 | 0.000 |
| Inbound Open Innovation | IAI1 | 0.238 (0.599) | 1.676 | 0.094 |
| | IAI2 | 0.564 (0.808) | 3.409 | 0.001 |
| | IAI3 | 0.341 (0.651) | 2.021 | 0.043 |
| | IAI4 | 0.195 (0.496) | 1.343 | 0.179 |
| | IAI5 | 0.260 (0.321) | 1.782 | 0.075 |

Source: SmartPLS Software

Looking at the significance levels, we find that all formative indicators are significant except IAI1, IAI4 and IAI5. When the outer weight is not significant, we must analyze the formative indicator's outer loading. The outer loading of IAI1 is above 0.5, so the indicator should be interpreted as absolutely important but not as relatively important. In this situation, the indicator would generally be retained. Yet the indicator IAI4 and IAI5 have a nonsignificant weight and the outer loading is below 0.5, and according to Hair Jr. *et al.* (2014) the researcher should decide whether to retain or delete the indicator by examining its theoretical relevance and potential content overlap with other indicators of the same construct. The indicators represent R&D outsourcing and Licensing in activities. The theory of open innovation (CHESBROUGH, 2003; CHESBROUGH, 2006) provides support for the relevance of these indicators. Thus, we decide to retain the indicator. The analysis of outer weights concludes the evaluation of the formative measurement models.

First, we check hypothesis H1c. The independent action of an individual or a team in bringing forth and idea or a vision and carrying it through to completion is the single item construct H1C. According to Hair Jr. *et al.* (2014) the criteria for the assessment of measurement models are not applicable to single-item constructs. The stop criterion of the algorithm was

reached after iteration 2. Figure 1 shows the model. The only significant path is H1C ->Inbound Open Innovation. Thus, hypothesis H1c is partially supported.

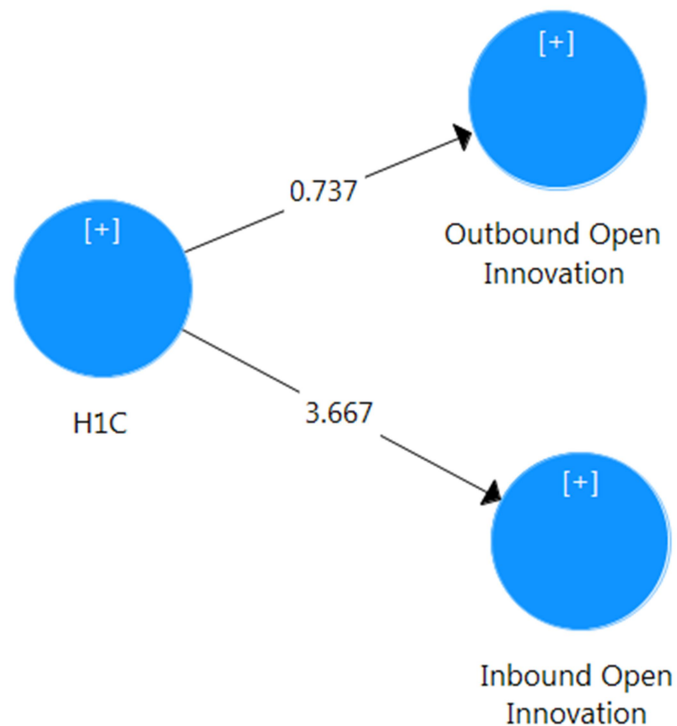


Figure 1 – The model for H1c

Source: SmartPLS Software

Next, we check hypothesis H1d. Actions free of stifling organizational constraints is the single item construct H1D. The stop criterion of the algorithm was reached after iteration 2. Figure 2 shows the model. The only significant path is H1D -> Inbound Open Innovation. Thus, hypothesis H1d is partially supported.

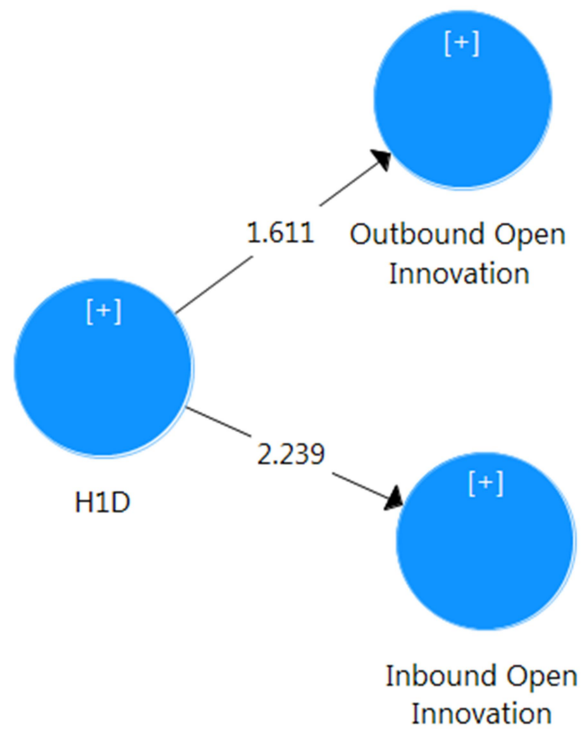


Figure 2 – The model for H1d

Source: SmartPLS Software

At last, we check hypothesis H4. Alertness regarding new business opportunities is the single item construct H4. The stop criterion of the algorithm was reached after iteration 2. Figure 3 shows the model. Both paths are significant. Thus, hypothesis H4 is supported.

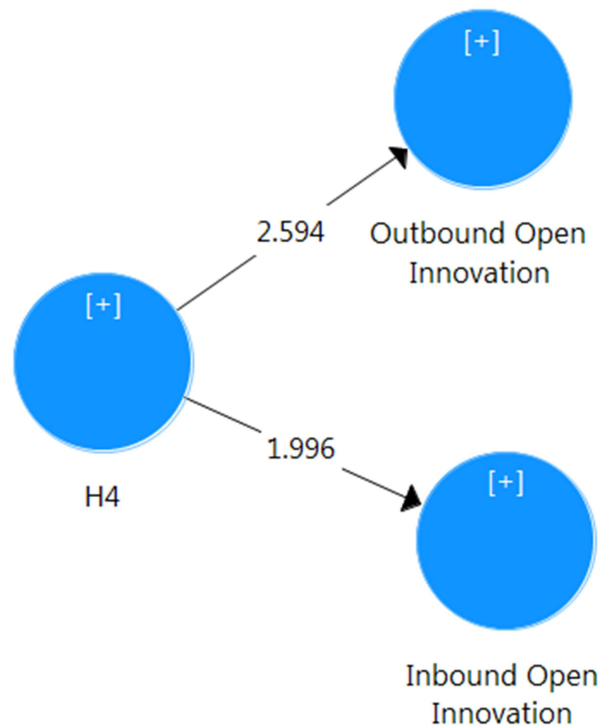


Figure 3 – The model for H4

Source: SmartPLS Software

5. Discussion

First, we discuss the hypotheses. Table 9 shows the hypotheses and if they are supported. Most hypotheses were not supported. It became clear that open innovation is dependent of context, as concluded by Carvalho *et al.* (2016). The hypotheses are extracted from studies performed in other countries, therefore, different realities. Probably, if we check these hypotheses in other countries, we will find different results. However, we have some assumptions and contributions. Actions free of stifling organizational constraints have a positive effect on customer involvement. The customer involvement is important in the early stages of development of a new service or product, avoiding efforts in services or products which do not satisfy the customer. On the other hand, alertness regarding new business opportunities has a positive effect on open innovation, i.e., a systematic search for new markets and business opportunities has a effect on open innovation. Open innovation may be used as model to identify business opportunities.

Table 5 – Hypotheses

| Hypotheses | Supported? |
|---|------------|
| H1a. The independent action of an individual or a team in bringing forth an idea or a vision and carrying it through to completion has a positive effect on customer involvement. | No |
| H1b. Actions free of stifling organizational constraints have a positive effect on customer involvement. | Yes |
| H1c. The independent action of an individual or a team in bringing forth an idea or a vision and carrying it through to completion has a positive effect on open innovation. | Partially |
| H1d. Actions free of stifling organizational constraints have a positive effect on open innovation. | Partially |
| H2 – Open innovation activities benefit from incentives and performance measures that capture open innovation activities at the collective level, and not only individual behavior. | Partially |
| H4. Alertness regarding new business opportunities has a positive effect on open innovation. | Yes |
| H7. Organizations with high-level of risk taking level adopt license, as outbound open innovation, more than organizations with low-level of risk taking. | No |
| H8. There is a negative relationship between risk taking and selling as outbound open innovation. | No |
| H9. There is a significant relationship between risk taking and external networking. | No |
| H10. There is a significant relationship between proactiveness and outsourcing R&D. | No |

6. Final Considerations

Our objective is to check the hypotheses provided by Carvalho & Sugano (2016a) and Carvalho & Sugano (2016b). Carvalho & Sugano (2016a) developed the hypotheses using literature review. Most hypotheses are not confirmed, what reinforces the context-dependency of open innovation. Despite of literature review presents these relationships, we cannot confirm in Brazilian context.

We can draw some conclusions on confirmed hypotheses. About the hypothesis H1c, we can see the importance of empowerment of employees. They tend to amplify the use of inbound open innovation to perform their tasks. The supported hypothesis H1b reinforces this situation. Empowered employees interact with customers, and may generate at least satisfaction from them. Despite of we did not check the impact of autonomy on open innovation, at least one feature of autonomy dimension impacts open innovation.

The independent action of an individual or a team in bringing forth an idea or a vision and carrying it through to completion has a positive effect on inbound open innovation. We can speculate that individuals have ideas, but they use open innovation to learn how to materialize them using, as example, benchmarking.

The other confirmed hypothesis is: alertness regarding new business opportunities has a positive effect on open innovation. Despite of we did not check the impact of proactiveness on open innovation, we can conclude that organizations are using open innovation to enable new business.

At last, the hypothesis that open innovation activities benefit from incentives and performance measures that capture open innovation activities at the collective level, and not only individual behavior was partially supported, because the only positive and significant correlation is with external networking activity of inbound open innovation. This evidence leads us to believe that the groups when encouraged tend to collaborate with external network partners to support innovation processes.

Thus, we must emphasize the importance of empowerment of employees to startups. However, they must be to be careful at hiring employees. On the other hand, public managers and politicians have to invest in education.

Our work has some weakness. First the margin of error for the full sample is plus or minus ten percentage points. The second weakness is the formative measured convergent validity, reported and justified previously. However, we must emphasize the reliability of our data, uphold by methodological and statistical accuracy.

Future works should check the remaining hypotheses.

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APPENDIX A – The Questionnaire

Pesquisa sobre Inovação e Empreendedorismo em Startups

Identificação da Empresa (não obrigatório):

Cargo:

Estado em que a empresa está situada:

Ramo de atividade da empresa:

Ano de fundação:

Quantidade de colaboradores:

Faturamento bruto anual médio da empresa

até R\$ 150.000,00

de R\$ 150.000,01 até R\$ 300.000,00

de R\$ 300.000,01 até R\$ 450.000,00

de R\$ 450.000,01 até R\$ 600.000,00

acima de R\$ 600.000,00

INOVAÇÃO ABERTA

| Variável | Questão |
|----------|---|
| IAO1 | Minha empresa iniciou outro empreendimento a partir de um conhecimento interno e possivelmente também apoiando financeiramente, com capital humano e outros serviços este novo empreendimento |
| IAO2 | Minha empresa vende ou oferece licenças ou contratos de royalties para outras organizações visando melhor aproveitamento de nossa propriedade intelectual, tais como patentes, direitos autorais ou marcas. |
| IAO3 | Minha empresa aproveita o conhecimento e as iniciativas de trabalhadores que não estão envolvidos diretamente em atividades de Pesquisa & Desenvolvimento, por exemplo, utilizando sugestões ou criando equipes autônomas para realizar inovações |

| | |
|------|---|
| IAI1 | Minha empresa envolve diretamente os clientes em nossos processos de inovação, por exemplo, através de pesquisa de mercado para checar suas necessidades, ou desenvolvendo produtos baseados nas especificações dos clientes, ou até mesmo alterando produtos existentes a pedido dos mesmos. |
| IAI2 | Minha empresa utiliza da colaboração com parceiros externos para apoiar os processos de inovação, por exemplo, utilizando conhecimentos ou capital humano externo. |
| IAI3 | Minha empresa investe capital em empresas novas ou estabelecidas visando ter acesso ao conhecimento delas, ou para obter outras sinergias. |
| IAI4 | Minha empresa adquire serviços de Pesquisa & Desenvolvimento de outras organizações, como universidades, organizações públicas de pesquisa, empresas comerciais ou fornecedores. |
| IAI5 | Minha empresa compra ou utiliza de capital intelectual, como patentes, direitos autorais ou marcas de outras organizações para se beneficiar de conhecimentos externos. |

ORIENTAÇÃO EMPREENDEDORA

| Variável | Questão |
|----------|--|
| OERT1 | Minha empresa geralmente tem uma forte tendência para projetos de alto risco (com chances muito elevadas de retorno) |
| OERT2 | Minha empresa está inserida em um ambiente que exige ousadia na tomada de decisões. |
| OEP1 | Ao lidar com os concorrentes, a minha empresa geralmente inicia ações as quais os concorrentes em seguida reagem |

| | |
|------|---|
| OEPx | Minha empresa possui plano e/ou modelo de negócios |
| OEP2 | Ao lidar com os concorrentes, a minha empresa é muitas vezes a primeira empresa a introduzir novos produtos / serviços, técnicas administrativas, tecnologias operacionais, etc |
| OEP3 | Em geral, a alta gerência da minha empresa tem uma forte tendência a estar à frente dos outros na introdução de novas idéias ou produtos |
| OEA1 | Na minha empresa, as ações independentes de um colaborador ou de uma equipe a respeito de uma ideia ou visão são implementadas até sua conclusão |
| OEAx | A minha empresa prefere incentivar atividades inovadoras realizadas coletivamente ao invés de atividades inovadoras realizadas individualmente |
| OEA2 | Minha empresa tem a capacidade e a vontade de buscar oportunidades com ou sem ajuda |
| OEA3 | Minha empresa evita restrições que podem causar constrangimentos organizacionais |
| OER1 | A minha empresa possui uma reputação boa enquanto parceira no mercado |
| OER2 | A rede de alianças de minha empresa é fortemente competitiva |
| OER3 | A minha empresa possui forte relação com os parceiros-chave de nossas alianças |

DESEMPENHO

| Variável | Questão |
|-----------------|---|
| DG1 | Em relação ao principal competidor, a minha empresa teve um aumento da parcela do mercado |
| DG2 | Em relação ao principal competidor, a minha empresa aumentou o crescimento em vendas |
| DG3 | Em relação ao principal competidor, a minha empresa foi mais lucrativa |
| DG4 | Em relação ao principal competidor, a minha empresa aumentou o seu tamanho |
| DG5 | Em relação ao principal competidor, a minha empresa teve uma performance geral melhor |
| DG6 | A minha empresa teve uma performance melhor em relação ao ano retrasado |