



UNIVERSIDADE CATÓLICA PORTUGUESA

Human Side of Open Innovation: Review, Analysis, and Recommendations

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Management

by

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Resumo

Nos últimos anos, a inovação aberta (IA) emergiu como um campo proeminente de estudo na literatura de gestão e inovação, concentrando-se na natureza colaborativa e aberta de vários processos organizacionais. No entanto, grande parte da investigação nesse campo tem sido dominada por uma firme perspectiva tecnológica, com pouca atenção dedicada aos aspetos humanos da IA. Como tal, a presente tese visa colmatar essa lacuna de investigação através da realização de uma revisão abrangente da OI com foco no lado humano e na perspetiva (micro) individual.

O estudo envolve uma revisão sistemática de 54 artigos publicados em revistas emblemáticas de gestão, que são analisados usando técnicas de análise temática e de conteúdo. A revisão destaca a importância de fatores como confiança, comunicação, colaboração, compartilhamento de conhecimento e liderança na facilitação de práticas bem-sucedidas de IA. Além disso, enfatiza o papel crítico de fatores sociais e culturais na formação da dinâmica humana da IA.

Com base nos resultados, a tese propõe questões de investigação que visam esclarecer as dimensões humanas da IA e como estas podem ser aproveitadas para melhorar os resultados da inovação. O estudo contribui para a literatura existente, fornecendo uma compreensão mais abrangente do papel dos fatores humanos na IA e oferecendo insights que podem informar o design de estratégias eficazes de IA.

Palavras-chave: Inovação Aberta, Fatores Humanos, Revisão Sistemática da Literatura.

Número de palavras: 9528

Abstract

In recent years, open innovation (OI) has emerged as a prominent field of study within management and innovation literature, focusing on the collaborative and open nature of various organizational processes. However, much of the research in this area has been dominated by a firm and technological perspective, with limited attention paid to the human aspects of OI. As such, this thesis aims to address this research gap by conducting a comprehensive review of the OI with focus on human side and individual (micro) perspective.

The study involves a systematic review of 54 articles published in top-tier management journals, which are analysed using thematic analysis and content analysis techniques. The review highlights the importance of factors such as trust, communication, collaboration, knowledge sharing, and leadership in facilitating successful OI practices. Moreover, it underscores the critical role of social and cultural factors in shaping the human dynamics of OI.

Based on the findings, the thesis proposes research questions that aim to shed further light on the human dimensions around OI, and how they can be leveraged to enhance innovation outcomes. The study contributes to the existing literature by providing a more comprehensive understanding of the role of human factors in OI, and by providing insights that can inform the design of effective OI strategies.

Keywords: Open Innovation, Human Factors, Systematic Literature Review.

Number of words: 9528

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1. Introduction

The “human side” of open innovation (OI) represents a void that remains poorly understood (Bogers et al., 2018a). Therefore, a further investigation on how customers, managers, and employees contribute to the advancement of academic knowledge regarding innovative openness is of high necessity. Thus, this thesis will focus on reviewing literature related to human aspects of OI, exploring its interconnectedness, as well as contributing with recommendations to broaden its intersection.

The conventional wisdom regarding the origin of competitive advantage in large businesses is being challenged by OI. Namely, Chesbrough (2003) suggested that businesses significantly rely on and use outside sources of ideas to enhance competitive position and growth. Accordingly, using external ideas and technologies in their own operations while allowing internal ideas to flow out to other organizations for usage is what is referred to as OI. To put it more precisely, the “use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively” is what is meant by the term (Chesbrough, 2006, p.1). More than just utilizing stakeholders' internal and external ideas, internal and external channels to market, cutting-edge technology, and improved business prospects are included in today's definition of OI. Moreover, the human side of OI literature has outlined some psychological and social traits, such as trust and collaboration, that are essential to teach and develop individuals working in OI teams, but it hasn't yet developed a clear model for how to transmit these traits (Ahn et al., 2017; Marzi et al., 2023; Sartori et al., 2017). This provides strong evidence that a developing approach to training is more effective than a filling-gaps approach since the first one is connected to a more creative productive thinking (which combines knowledge with creative/critical thinking), while the second one is

connected to a less original reproductive thinking (which is simply a way to refine what is already known). Ultimately, exploring the future of OI and its human side will lead to new opportunities for research. Therefore, the research questions for this thesis are: *“What are the principal foundations and research areas within human side of OI domain?”* and *“What are the future research tracks regarding human side of OI domain?”*.

This study will use a systematic literature review approach and critically evaluate the body of existing literature to better understand the topic and make recommendations for future research. With this approach, the intellectual domain related to the human side of OI will be synthesised and presented in an organized way, exhibiting the familiarity of the work with a body of knowledge, and establishing credibility with various references. This systematic literature review will embrace a content analysis built on a hybrid-narrative systematic review approach, proposing a framework for future research. This way, the thesis will be able to combine the integration of “the tenets of both bibliometric and structured reviews” (Paul & Criado, 2020, p.2), and present “a more objective account of the research domain” (Vlačić et al., 2021, p.188). During the selection of the approaches of the systematic review and the methodology, it will be necessary to decide and specify search criteria to collect scientific articles and reviews, which will then allow a deep analysis. Afterwards, a bibliometric analysis will be conducted. This methodology involves the statistical analysis of scientific publications, identifying patterns of publication, citation, and collaboration within a field of study (Sweileh et al., 2014). Through this analysis, this study will uncover the most influential authors, publications, and research topics in the field of interest, providing insights into the evolution and trends of the research domain.

This thesis contributes to the literature in more than one sense. Firstly, the existing research gap in the OI field is explored from a human side perspective.

Furthermore, after addressing this gap, the need for further investigation within the domain is mentioned, suggesting diverse research questions. In general, the exploration of this topic can lead to significant results in, for example, the development of an OI model to teach and develop individuals working in OI teams, thus allowing competitive advantage in large businesses.

The thesis's structure starts with a review of literature focused on the topic, introducing the OI field and the human side within OI, and recognising the current research gap in their intersection. As for the methodology, the bibliometric analysis method was implemented with the selection, gathering, and analysis of several manuscripts. The structure continues with the results, determining pertinent conclusions following the thesis's topic. Finally, recommendations for future research are outlined, where research gaps are identified based on the results, and arranged in future research questions.

2. Evolution of the intersection among Human side and OI domains

OI challenges the traditional sources of competitive advantage in businesses. In this line, Chesbrough (2003) asserted that in the face of rapidly changing market conditions like globalisation, digitization, shorter product life cycles, or complex social and economic problems, businesses could no longer afford to only rely on their own internal ideas and capabilities. Thus, companies ought to seek inspiration from outside sources rather than attempting to create independently. By enlisting outside assistance, they were in a far better position to expand their business.

This proposal starkly contrasted conventional wisdom on innovation management, which held that corporations with substantial R&D budgets could manage all innovation initiatives internally. Even well-established companies realized their capacity for innovation was constrained in the face of shifting

market trends. Therefore, these firms would turn to a novel form of invention known as OI in order to stay profitable and relevant.

OI is an exercise in knowledge exchange, transfer, and management. Knowledge can either flow towards an organization (outside-in), away from it (inside-out), or in both directions (coupled). Hence, there are three types of approaches in OI, with the outside-in being the most common. This approach has two main focuses: the acquisition of ideas and the integration of partners into the development and implementation process. In contrast, in the inside-out approach, internal knowledge is exploited externally. Finally, in the coupled process mode, companies can simultaneously let knowledge flow in and out of their boundaries, as well as upstream (suppliers) and downstream (customers).

When it comes to the human side within OI, there are three fears that hold back corporate innovation more than others: fear of criticism, fear of uncertainty, and fear of the negative impact on one's career. These might be directly related to the team structure and how it might influence the inventions' potential in environments with a high degree of knowledge variety.

OI is significantly influenced by antecedent elements like technical innovation, human capital, and knowledge management (Latifah et al., 2022). Thus, resources like employees' knowledge, skills and abilities are a competitive advantage for the company. In light of the senior management teams' and/or entrepreneurs' favourable assessments, OI is frequently adopted by small and medium-sized businesses (SMEs) (Marzi et al., 2023). Due to the contradictory results that might follow from SMEs' openness, managers must balance the advantages of boundary-spanning against the challenges posed by knowledge transfer and inter-organizational arrangements. By looking at how decision-makers' cognitive styles interact with their perceptions of the benefits, drawbacks, and organizational opposition to openness, it is possible to

emphasise the cognitive configurations impacting OI adoption in SMEs, which build on the principles of dual-process theory.

There are two primary cognitive based decision-making approaches in management innovation, namely intuition and reason. Li et al. (2022) contend that intuition leads to better results. Given that, team intuition is related with product innovation since it can improve the speed of the development of new products and their creativity. Furthermore, Li et al. (2022) allusion rationality with cognitive appraisal associated with risk, match, and complexity. In an attempt to try to reclassify strategical decision-making and include the special value of intuition, it is intriguing to consider if intuitive decision-making approaches supported by experience and knowledge may create new-to-the-firm management innovation. Finally, the view that intuition and rationality are two poles of a continuum makes it clear that intuition and rationality are the substitution of one another. Contrarily, given that human cognition is unidimensional, Li et al. (2022) hold the view that rational and intuitive decision-making are two independent systems. Furthermore, intuitive and rational cognition work in parallel as shown in Marzi et al. (2023).

Bhimani et al. (2023) highlight the need to go beyond attitudinal tendencies and explore the cognitive dissonance reduction process to understand differences in managerial dispositions towards OI. Therefore, the authors provide targets for managerial actions in coping with OI by emphasizing behavioural responses. For instance, reasons for managerial cognitive dissonance (MCD) in OI, cognitive dissonance reduction processes that influence behavioural outcomes, and how managers can influence trajectories towards desired project goals are conceptualized. Moreover, Bhimani et al. (2023) emphasize the importance of Cognitive Integration Points (CIP), where curated cognitive strategies can influence behavioural responses during periods of organizational change towards or away from OI. One notable exclusion from the

conceptualization is the role of an organization's absorptive capacity, which enhances knowledge sharing and exploratory-exploitative capacities.

Ultimately, when it comes to the OI revolution, there are tactics and skills that organizations have been implementing over the years to succeed at OI, particularly new mindsets and skills for the workforce as a whole (Lindegaard, 2010). The main goal of innovation leaders is to find and pursue lucrative development possibilities and doing so also entails overseeing changing the company culture to foster innovation. For this reason, the human side of OI is crucial.

The variety of contributions provided to solution threads is thought to be influenced by both intrinsic and extrinsic motivations (Frey et al., 2011). While extrinsic desire for monetary compensation is often positively correlated with making minor contributions, intrinsic enjoyment is frequently associated with postings that are more substantial, and knowledge variety is frequently associated with all forms of contributions to OI projects. The interaction effects between motivation and knowledge diversity are also supported by this study, which is helpful for platform managers attempting to draw participants who may contribute significantly to innovation concerns.

As the human side of OI is still poorly understood and considering the role of employee characteristics with respect to predicting firm-level openness, Bogers et al. (2018) stated that knowledge diversity of the firm's employees is positively associated with employees' ability to identify and absorb external knowledge, which in turn contributes to increased firm-level openness—that is, firms' use of external knowledge in their pursuit of innovation. The premise that employees' educational diversity is positively correlated with firm-level openness is supported by a combination of three data sources.

In the OI management literature, it is widely acknowledged that individuals are essential to collaborative knowledge creation processes. (Chatenier et al.,

2010). Yet, the human element of OI teams is rarely explored in the literature. Therefore, there are some competencies that professionals need for working in OI teams and to cope with the challenges they face. That competence profile for OI professionals consists mainly in brokering solutions and being socially competent.

Table 1 reveals the most relevant manuscripts for this literature review, analysed in the understanding of the topic and its development. For example, researchers have focused on the managerial cognitive styles and how it influences the willingness or reluctance to adopt OI (Marzi et al., 2023), as well as ability, motivation, and opportunity (AMO)-enhancing practices and human resource management (HRM) practices (Ferrarini & Curzi, 2022). Other pertinent papers analysed are present in the Appendix 1.

Table 1 - Notable Reviews of Human side and OI domains

Studies / Author	Term of the concept	Measurement	Sample	Database	Variables	Method of Analysis	Findings or outcome
	<i>managerial cognitive styles</i>	IC was measured using the 5-item scale from Bianchi et al.; RC was measured with the 4-item scale from Bianchi et al.			intuitive-creative, rapid, unconscious, expertise-based style; rational-analytic, deductive, formal, and critical		Closer cognitive proximity enables effective communication and flow of information; it influences the willingness or reluctance to adopt OI.
Marzi et al.	<i>NIH syndrome</i>	3-item scales adapted from Burchart (2014)	managers working in SMEs	Survey Data collected via Prolific	dual-process theory (DPT) (intuitive, heuristic-based, and associative processes), and cognitive evaluation of OI-related elements (careful evaluation and assessment)	PLS-SEM and fsQCA	It negatively influences the willingness or reluctance to adopt OI.
	<i>NSH syndrome</i>	4-item scales adapted from Burchart et al., (2014)					It negatively influences the willingness or reluctance to adopt OI.
	<i>perceived benefits (PBE)</i> <i>perceived barriers (PBA)</i>	9-item scale adapted from Pappas et al. (2021) 8-item scale adapted from Pappas et al. (2021)					PBE tend to favour willingness to adopt OI. PBA tend to lessen willingness to adopt OI.

	<i>willingness to adopt OI (WA)</i>	5-item scale adapted from Pappas et al. (2021)					
Yun et al.	<i>sustainable economic growth</i>	conceptual and mathematical model of OI under inter-rationality (Zigzag Growth Theorem), causal loop model, and conceptual experiments and agent-based model (ABM)	individuals, firms, and artificial intelligence (AI) in OI systems	n.a.	the economic condition of OI or inter-rationality, and the growth pattern of economy or firm under open innovation dynamics	Agent-based model (AMB)	Causal loop modeling shows that the concept of inter-rationality adds value in terms of understanding OI dynamics. Bounded rationality of economic agents leads to the diversity in the growth of firms and the economic system. The total innovative performance increases continually when the OI in the system progresses and inter-rationality is widespread. The growth of the economic system when OI is practiced by inter-rational agents follows a zigzag pattern which is sustainable.
Ferrarini and Curzi	<i>ability, motivation, and opportunity (AMO)-enhancing practices</i> <i>HRM practices</i>	HRM practices were standardized into z-score and then additively combined into a single aggregated index	20,000 establishments at European level	European Company Survey (ECS) 2019	employee performance and innovation innovation by means of exploration activities	binary logistic regression	Companies that invest in AMO-enhancing practices not only have higher probability to innovate, but also are more inclined to collaborate with external partners. OI not only enhances the innovation capacity of the firm but also partially mediates the relationship between HRM and organizations' innovativeness.
Bogers et al.	<i>human capital</i>	openness, work history diversity, educational diversity, control variables	3392 danish firms with 40 or more employees across	large-scale double respondent survey of Danish firms	knowledge diversity of the firm's employees	n.a.	Employees' educational diversity is positively associated with firm-level openness. There is no direct association between employees' work history diversity and firm-level openness but

different
industries

and Statistics
Denmark

there is a conditional relationship based on educational background, which implies that diverse work history only has a positive impact at higher levels of educational diversity.

3. Methodology

Understanding the human side of OI calls for an in-depth literature review. This thesis combines bibliometric and content analysis approach built on a hybrid-narrative systematic review (Vlačić et al., 2021). Working with this method allowed the proposition of a future research agenda, improving the current knowledge of the interdependence between the OI field and its human side. Accordingly, the thesis's methodology combines the integration of "the tenets of both bibliometric and structured reviews" (Paul & Criado, 2020, p. 2), and presents "a more objective account of the research domain" (Vlačić et al., 2021, p. 188). Through this, the most frequent and relevant descriptors were determined in the literature related to the topic. The methodology protocol is demonstrated in Figure 1.

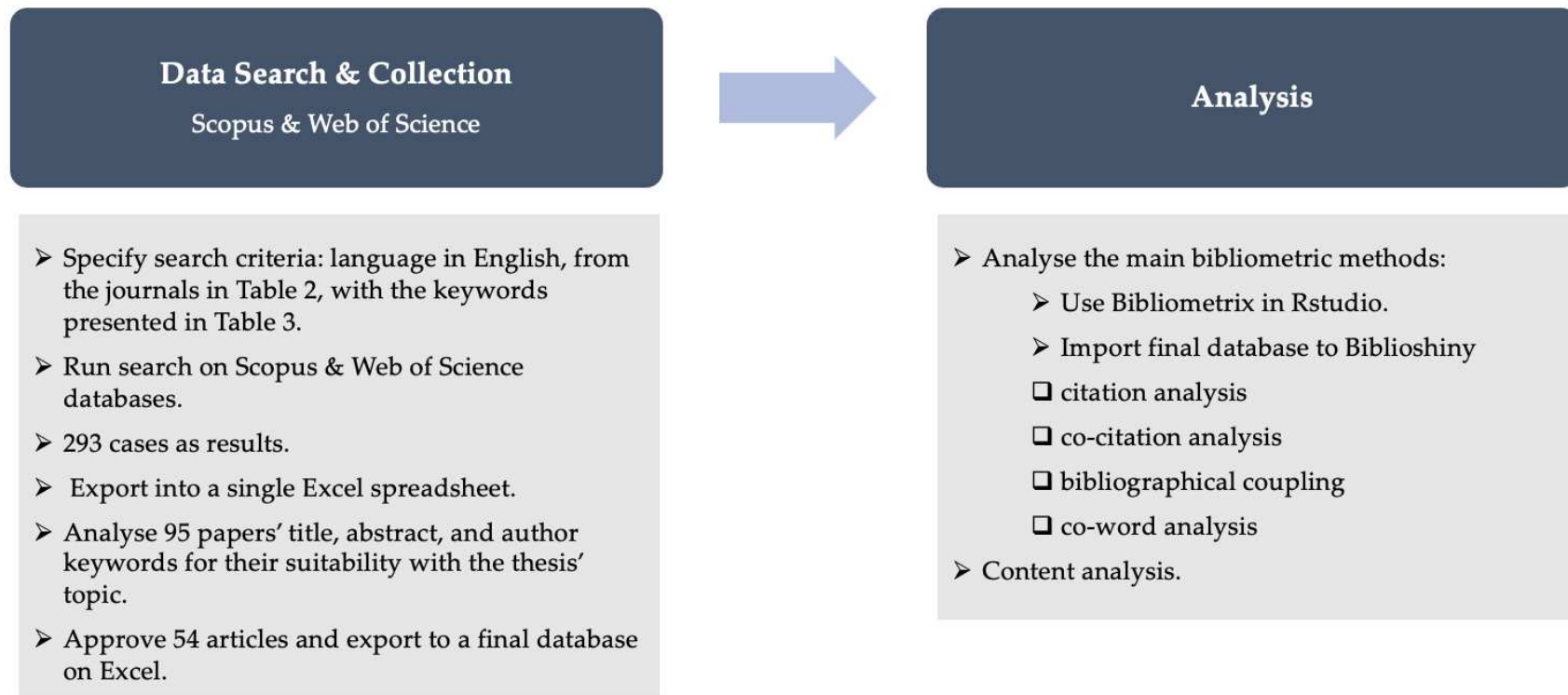


Figure 1 - Methodology Protocol

Source: own draft

3.1. Data Selection

The case selection was performed using the scientific search databases Scopus and Web of Science. To conduct this manuscript search, the following parameters were used. Papers must have been published in English, by the flagship OI journals delineated in Table 2, and containing several keywords presented in Table 3.

Journal	Ranking CABS - AJG
Research Policy	4*
Journal of Product Innovation Management	4
Industry and Innovation	3
Journal of Technology Transfer	3
R and D Management	3
Technological Forecasting and Social Change	3
Technovation	3

Table 2 – Best Ranked Journals for Data Selection

Source: Academic Journal Guide 2021 and Aria & Cuccurullo (2017)

After the selection of manuscripts using these criteria, the total number resulted in an initial database of 293 articles, from which only 95 articles were selected for data collection, considering their suitability with this study. This process was executed by analysing their respective title, abstract, and author keywords, and in some cases, the introduction chapter. After identifying relevance to the OI field and human side, the article in question was selected. Later in the end, after viewing all of them, only 54 were selected and added to a final database, on a separate Excel spreadsheet.

Concept-related	Keywords
Open Innovation	Open Innovation
	Innovative Solutions
	Differentiation
	Open Eco-innovation
	Design thinking
Human Side	Human Side
	Cognition
	Rationality
	Intuition
	Competitiveness
	Social Advancement
	Decision Making
	Managing Skills
	Human Capital

Table 3 - Keywords for Data Selection

Source: own draft – based on Obradović et al. (2021), Bogers et al. (2018), Ahn et al. (2017), Marzi et al. (2023) and Niittymies & Pajunen (2020)

The 54 articles were selected from highly recognised journals, from a specific period and with specific authors' keywords so Table 4 and Figures 2 and 3 show the number of papers from each journal, the year of publication and author's keywords, respectively.

Journal	Frequency	Exemplary References
R And D Management	3	Ahn et al. (2017); Xia et al. (2023); Chatenier et al. (2010)
Technological Forecasting and Social Change	3	Yun et al. (2022); Carmona-Lavado et al. (2021); Scheiner et al. (2015)
Technovation	3	Seo & Park (2022); Marzi et al. (2023); Porter & Newman (2011)
Research Policy	1	Bogers et al. (2018)

Table 4 – Most Relevant Journals

Source: own draft – based on Aria & Cuccurullo (2017)

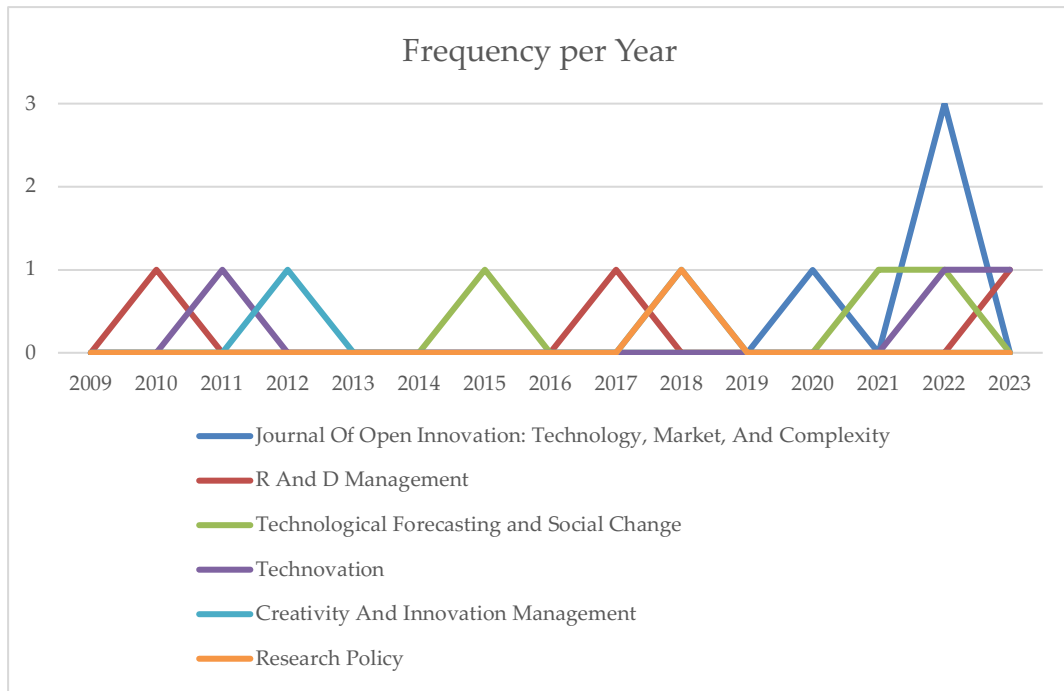


Figure 2 - Frequency per Year

Source: own draft – based on Aria & Cuccurullo (2017)

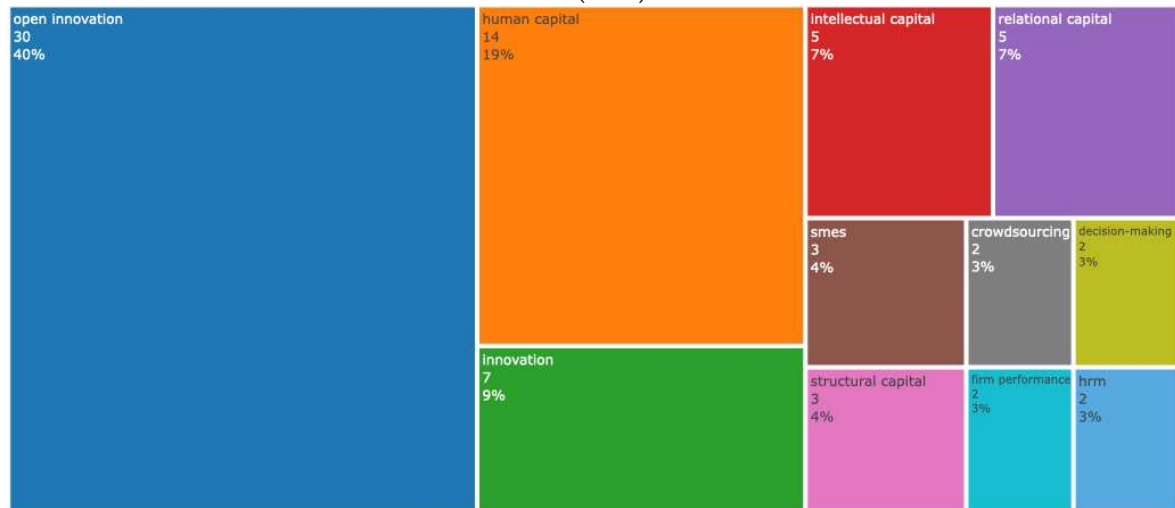


Figure 3 – Tree Map of Author's Keywords

Source: Aria & Cuccurullo (2017)

3.2. Data Collection

The final database was imported into Biblioshiny, using the package Bibliometrix in the RStudio software (Aria & Cuccurullo, 2017), where a bibliometric and partial content analysis was performed. This methodology involves the statistical analysis of scientific publications, identifying patterns of publication, citation, and collaboration within a field of study (Sweileh et al.,

2014). Vosviewer software was further used as it provides user-friendly features and aids in interpreting graphs.

Using this technique, this study uncovered the most influential authors, publications, and research topics in the field of interest, providing insights into the evolution and trends of the research domain.

3.3. Data Analysis

To analyse the data, bibliometric procedures were conducted, enabling science mapping and performance analysis. Science mapping strives to expose the structure and dynamics of scientific areas, whereas performance analysis seeks to assess the research and publication performance of individuals and institutions (Zupic & Čater, 2014).

Four primary bibliometric techniques will be used in this process (Zupic & Čater, 2014). The first three—citation analysis, co-citation analysis, and bibliographical coupling—construct influence and similarity measures using citation data. Co-word analysis identifies relationships between concepts that co-occur in document titles, keywords, or abstracts. Performing this procedure allowed the creation of illustrations of the researched field's intellectual structure.

4. Results

Building upon the adopted methodological approach, the results of the thesis are presented in the following subsections: citation analysis, co-citation analysis, bibliographical coupling, and co-word analysis.

Regarding the dataset's description, which is provided in Table 5, it contains 54 papers, published from 2009 until 2023 in 44 journals. Articles have been cited on average 25.19 times. The dataset comprised 3,896 cited references. Articles contained 215 keywords plus and 176 author's keywords. Only 3 of the 174

authors who authored the articles were single authored. The Collaboration Index is 3.28 whereas the international co-authorship is 33.33%. Consistent scientific production from the dataset is illustrated in Figure 4.

Description	Results
Timespan	2009:2023
Sources (Journals, Books, etc)	44
Documents	54
Average years from publication	5.04
Average citations per document	25.19
References	3896
Keywords Plus	215
Author's Keywords	176
Authors	174
Authors of single-authored documents	3
Single-authored documents	3
Co-authors per document	3.28
International co-authorships %	33.33

Table 5 - Dataset's Descriptive Results

Source: own draft – based on Aria & Cuccurullo (2017)

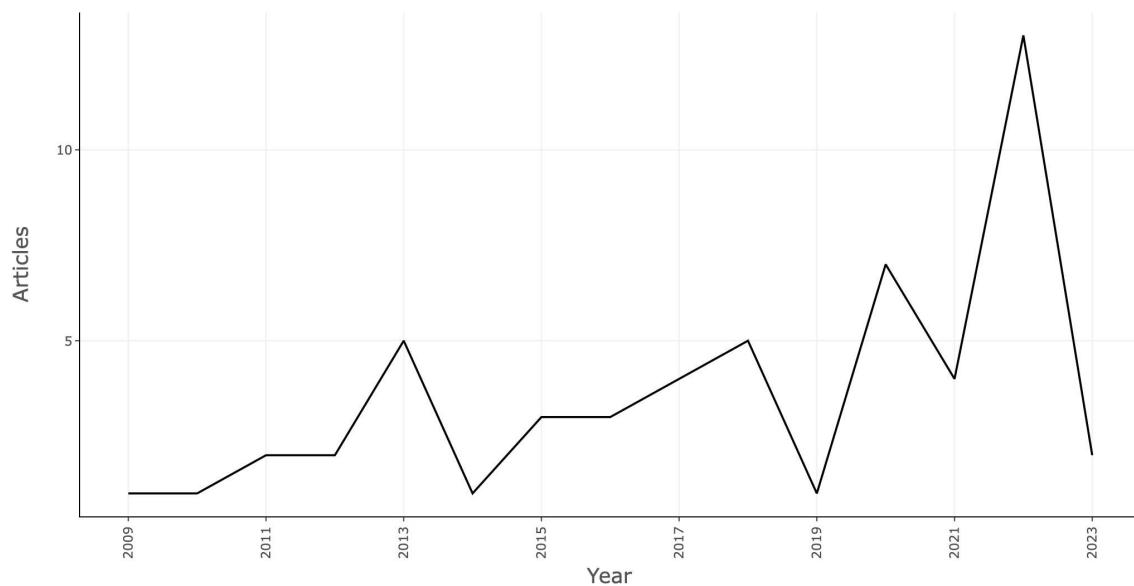


Figure 4 – Annual Scientific Production

Source: Aria & Cuccurullo (2017)

In terms of journals, 44 outlets have published the 54 papers in the dataset. Figure 5 shows the 10 most relevant journals considering the number of articles published. The Journal of Technology Transfer and Research Policy can be considered the core source according to Bradford's Law (Bradford, 1934). These

two journals are also the most cited, with 196 and 531 citations respectively, making Research Policy the more influential journal outlet in terms of citations per document.

4.1. Citation analysis

The citation analysis was performed to investigate the connections between the authors' publications in an effort to develop a deeper understanding of this research field and provide accurate knowledge to it (Kraus et al., 2014).

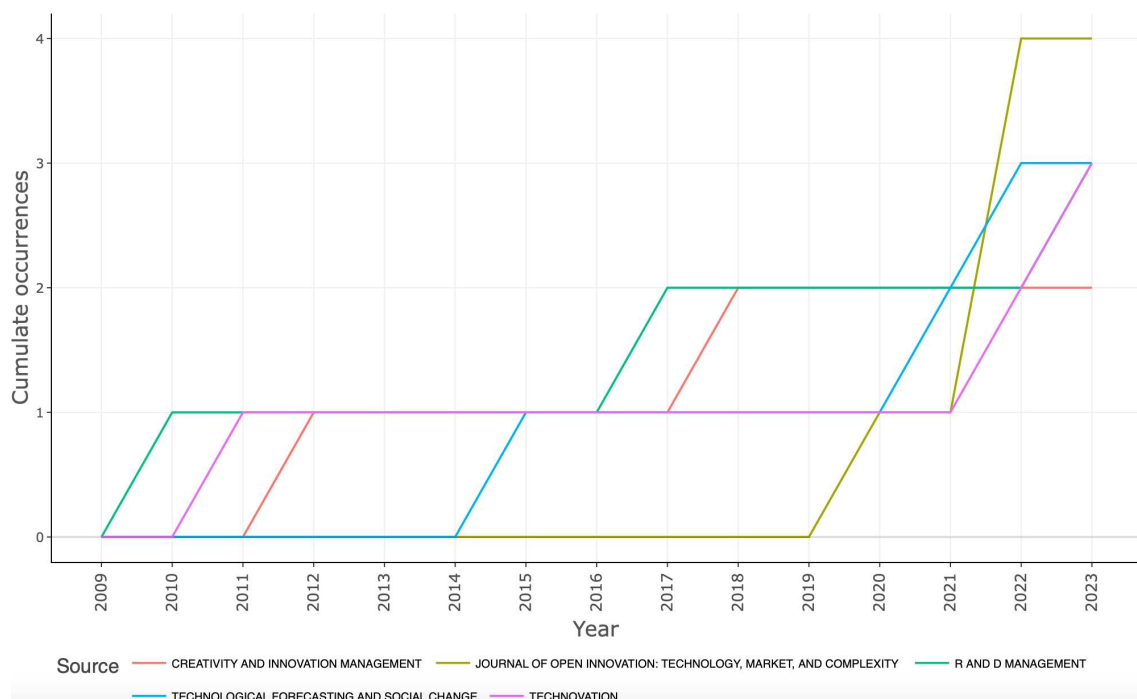


Figure 5 – Sources' Production over Time

Source: Aria & Cuccurullo (2017)

As Figure 5 shows, the number of papers published by the journals has increased gradually since 2009. The high concentration of frequently cited papers over these years could signify an overall growth in the number of authors and academic contributions and, as such, potential opportunities for citation growth. 2022 and 2023 recorded a peak in the number of published papers by the Journal of Open Innovation: Technology, Market, And Complexity, even though this journal only started publishing in 2020, which justifies increasing attention to human side of OI and reinforce necessity for this study. This could show that this

journal became highly recognised, adopting a stronger focus on OI. There may also have been a delay period for recently published articles prior to their recognition and citation within the academic community.

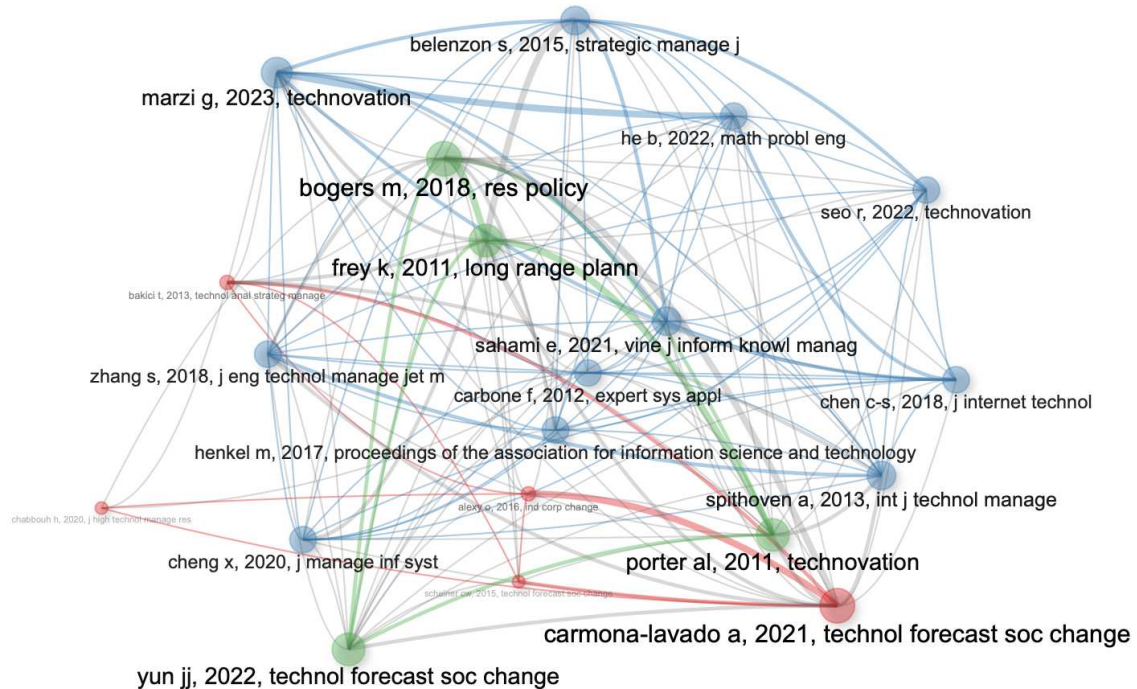


Figure 6 – Citation Analysis- Authors' Network
Source: Aria & Cuccurullo (2017)

Furthermore, as shown in Figures 6 and 7, the most influential publications on the human side and OI domains include Frey et al. (2011) manuscript “Whom should firms attract to open innovation platforms? The role of knowledge diversity and motivation” which was cited from 203 papers. This paper explores the role of knowledge diversity and motivation in attracting individuals to participate in OI platforms, enhancing the importance of diverse expertise and intrinsic motivation. By examining the role of these factors, the authors contribute to the understanding of how firms can effectively engage individuals in OI processes.

The significant impact of this paper in this field of research can be seen in several ways. Firstly, it advances valuable theoretical understanding in terms of knowledge diversity and motivation, helping researchers and practitioners gain a deeper understanding of the factors that drive successful engagement in OI

platforms. Secondly, the practical implications for firms implementing OI strategies. By recognizing the importance of attracting individuals with diverse knowledge backgrounds and strong motivation, organizations can design their OI platforms and strategies to attract the right participants. This can lead to improved outcomes and increased innovation potential. Finally, Frey et al. (2011) prompt scholars to delve deeper into understanding the mechanisms through which knowledge diversity and motivation influence OI outcomes. Additionally, it encourages exploration of other relevant factors that play a role in the human side of OI, stimulating further inquiry and investigation.

With 179 citations, Bogers et al. (2018) is the second-most cited publication in this field of research due to the strong link to Frey et al. (2011) paper. It focuses on the role of employee diversity in promoting firm-level openness in OI processes and it emphasizes the significance of diverse perspectives, skills, and backgrounds in driving innovation and knowledge sharing.

Conducive in understanding the human factors and dynamics involved in this field, both competencies required for professionals working in OI teams (such as communication, collaboration, and adaptability) and CEO characteristics (such as risk-taking propensity and knowledge breadth) play a role in driving successful OI initiatives (Chatenier et al., 2010; Ahn et al., 2017).

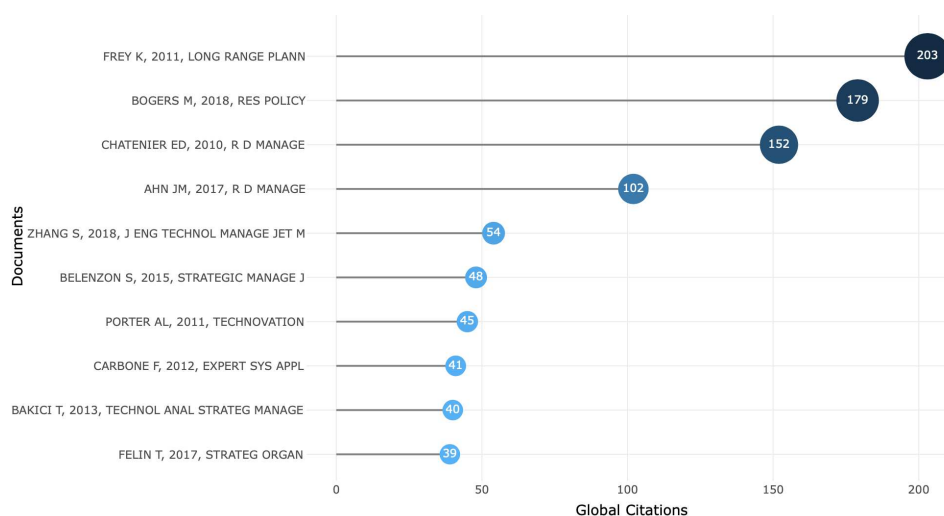


Figure 7 – Most Global Cited Documents
Source: Aria & Cuccurullo (2017)

4.2. Co-citation analysis

Co-citation analysis creates metrics of similarity between documents using co-citation counts. The basic premise behind co-citation analysis is that two items are more likely to have linked content if they are mentioned together frequently (Zupic & Čater, 2014). Circle size shows the number of citations, line thickness indicates co-citation strength, cluster identifies associated group, and links and proximity reveal co-citation correlation. Thus, as Figure 8 illustrates, the human side of OI co-citation network fashioned three clusters.

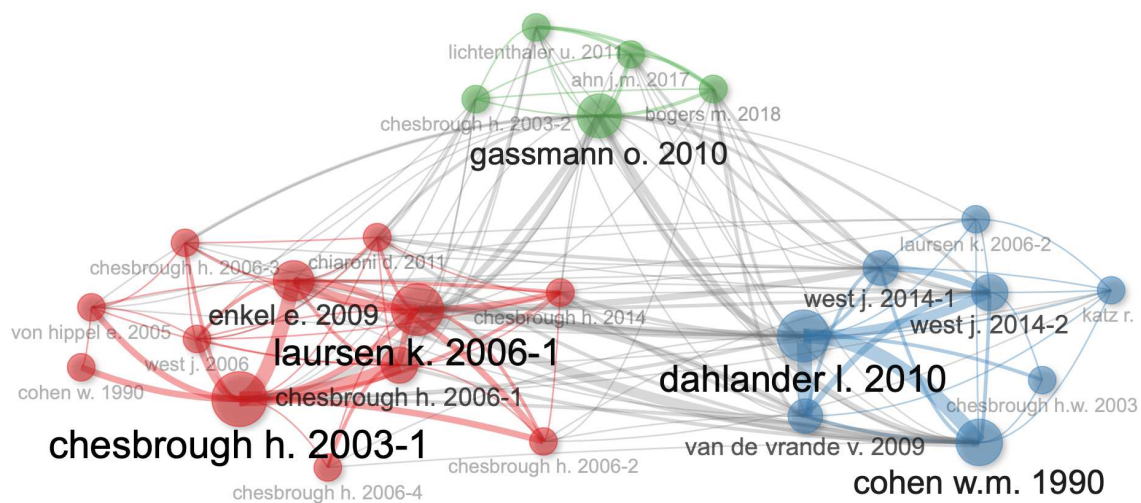


Figure 8 – Co-citation Network
Source: Aria & Cuccurullo (2017)

4.2.1. Innovation Process and Knowledge

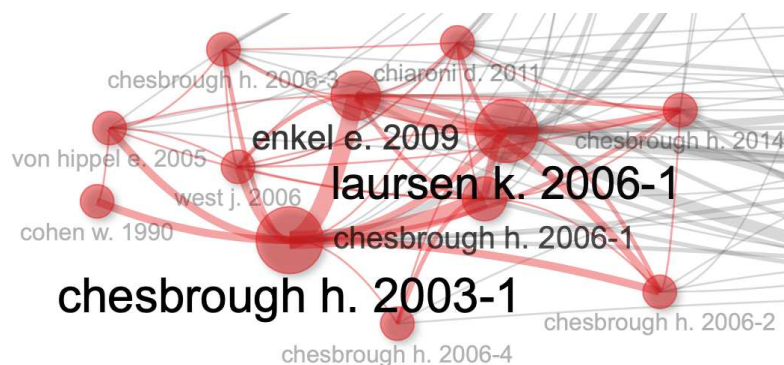


Figure 9 – Red Cluster: Innovation Process and Knowledge
Source: Aria & Cuccurullo (2017)

OI is not just a process driven by technology and strategies, as it heavily relies on the human side of organizations. The success and effectiveness of implementing OI practices depend on understanding the role of individuals,

organizational openness, knowledge exchange, and learning (Chesbrough, 2003,2006,2014; Laursen & Salter, 2006; Enkel et al., 2009; Chiaroni et al., 2011; Von Hippel, 2005; Cohen & Levinthal, 1990; H. Chesbrough et al., 2008).

Chesbrough (2003) establishes OI as a new paradigm for industrial innovation, emphasizing the importance of external knowledge sourcing, collaboration, and leveraging external technology in achieving innovation success. Chesbrough (2006) delves into the shift from closed innovation to OI models and similarly highlights the importance of human-centered factors, such as external knowledge flows, partnerships, and intellectual property management, in fostering OI practices.

The human aspect of OI is emphasized by examining the relationship between organizational openness, knowledge acquisition, and innovation outcomes and the importance of human interactions and knowledge exchange in driving successful OI processes is highlighted (Laursen and Salter, 2006).

Enkel, Gassmann, and Chesbrough (2009) explore the phenomenon of open R&D and OI, investigating the role of human interactions, knowledge sharing, and collaboration in facilitating OI practices. It is emphasized the importance of creating an OI culture within organizations and building networks to access external knowledge and expertise.

Chiaroni (2011) focuses on the OI journey and how firms dynamically implement the emerging innovation management paradigm. The research highlights the role of individuals, organizational learning, and knowledge integration in successful OI, highlighting the importance of human-centered factors, such as leadership, motivation, and learning capabilities, in driving effective OI practices.

Chesbrough (2014) explores future trends and challenges, including the need for cultural transformation, leadership, and collaborative capabilities. It

highlights the role of individuals and organizations in embracing openness and adapting to evolving innovation practices.

In the context of the evolving phenomenon of user innovation, Von Hippel (2005) emphasizes the role of users as innovators and the importance of human-centred factors, such as user involvement, co-creation, and user feedback, in driving innovation, outlining the potential for OI to tap into user insights and expertise. Next, Cohen (1990) introduces the concept of absorptive capacity, providing a new perspective on learning and innovation, underlining the role of individuals and organizations in acquiring, assimilating, and utilizing external knowledge for innovation. Ultimately, West (2006) emphasises the importance of human interactions, collaboration, and knowledge exchange in advancing successful OI practises in his discussion of the demand for interdisciplinary research.

4.2.2. Support to Innovation

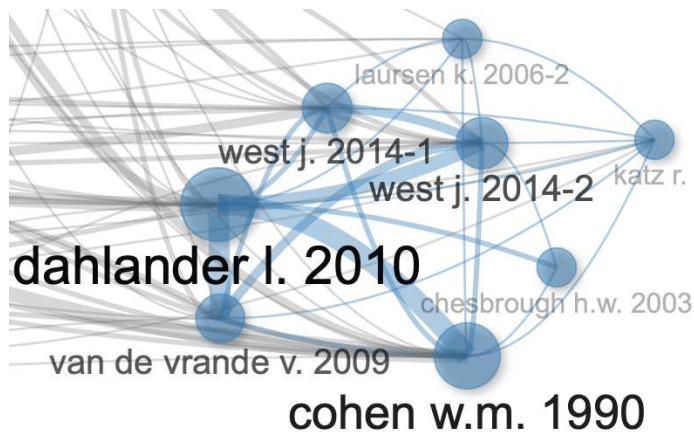


Figure 10 – Blue Cluster: Support to Innovation
Source: Aria & Cuccurullo (2017)

Furthermore, it is crucial to have a solid awareness of all the components that help understanding and managing various aspects related to individuals and organizations in this context. Articles within blue cluster (Dahlander & Gann, 2010; Cohen & Levinthal, 1990; West & Bogers, 2014; H. W. Chesbrough, 2003; Vrande et al., 2009; Laursen & Salter, 2006) collectively emphasize the importance

of openness, collaboration, and the utilization of external sources of innovation in driving successful innovation processes within organizations.

In addition to highlighting the importance of human interactions, collaboration, and knowledge exchange in driving successful OI practises, the human factor is highlighted by addressing the role of individuals in seeking and integrating external knowledge for innovation purposes (Chesbrough, 2003; Cohen, 1990; West, 2014; Laursen and Salter, 2006; Dahlander, 2010).

Dahlander, L. (2010) explores the degree of openness in innovation processes. It delves into the various dimensions of openness, including the degree of collaboration with external partners, the involvement of users and communities, and the sharing of intellectual property, emphasizing the importance of understanding the different levels and forms of openness in innovation and providing insights into the challenges and opportunities associated with openness. Further, West (2014) highlights the importance of human-driven processes in accessing and incorporating external ideas and technologies.

The recognition of the challenges and opportunities associated with OI, considering the context of SMEs and the need for tailored management approaches are accentuated by Van de Vrande (2009), emphasizing human aspects such as the motivations of individuals within these organizations.

Laursen and Salter (2006) explore the relationship between organizational openness, knowledge acquisition, and innovation outcomes within UK manufacturing firms. It explores how firms can leverage external knowledge sources, such as collaboration with customers, suppliers, and research institutions, to enhance their innovation outcomes. Thus, empirical evidence on the positive impact of openness on innovation performance is provided. Moreover, mechanisms through which openness influences firm-level innovation are outlined.

4.2.3. The roles of CEO and employees in fostering an environment conducive to OI



Figure 11 – Green Cluster: The roles of CEO and employees in fostering an environment conducive to OI

Source: Aria & Cuccurullo (2017)

The human side of OI is a crucial aspect that influences the success and effectiveness of implementing OI practices within organizations. Understanding the fit between OI modes and CEO characteristics, embracing employee diversity, and exploring the role of individuals and their interactions are essential for successful implementation Ahn et al., 2017; Bogers et al., 2018b); Chesbrough, 2003; Gassmann et al., 2010; Lichtenthaler, 2011).

Ahn (2017) focuses on understanding the human side of openness by examining the fit between OI modes and CEO characteristics. The research emphasizes the role of CEOs in creating an organizational climate conducive to OI. The study highlights the importance of CEO characteristics, such as leadership style, risk tolerance, and mindset, in shaping the openness of the organization and its ability to leverage external knowledge and collaborations.

Similarly, Gassman (2010) emphasizes the human aspect of OI, including the need for trust, transparency, and effective communication in fostering successful open innovation practices. The future of OI is also discussed, focusing on emerging trends and challenges in the field. It is crucial to manage OI ecosystems, intellectual property rights, and collaborative networks.

Bogers (2018) explores the role of employee diversity in firm-level openness. The research highlights that diverse teams comprising individuals with different

backgrounds, perspectives, and expertise contribute to enhanced openness and innovation within organizations. It emphasizes the value of inclusive work environments that foster the exchange of knowledge and ideas, enabling organizations to tap into a broader range of insights and expertise.

As approaches for acquiring external technologies, collaborative strategies, and knowledge transfer are investigated, OI is acknowledged as a new imperative for creating and profiting from technology (Chesbrough, 2003; Lichtenthaler, 2011).

4.3. Bibliographic coupling

According to Boyack & Klavans (2010), bibliographic coupling provides further information about the research domain by measuring the number of references that two papers have in common. In short, two articles are more closely related when their bibliographies overlap one another (Zupic & Čater, 2014).

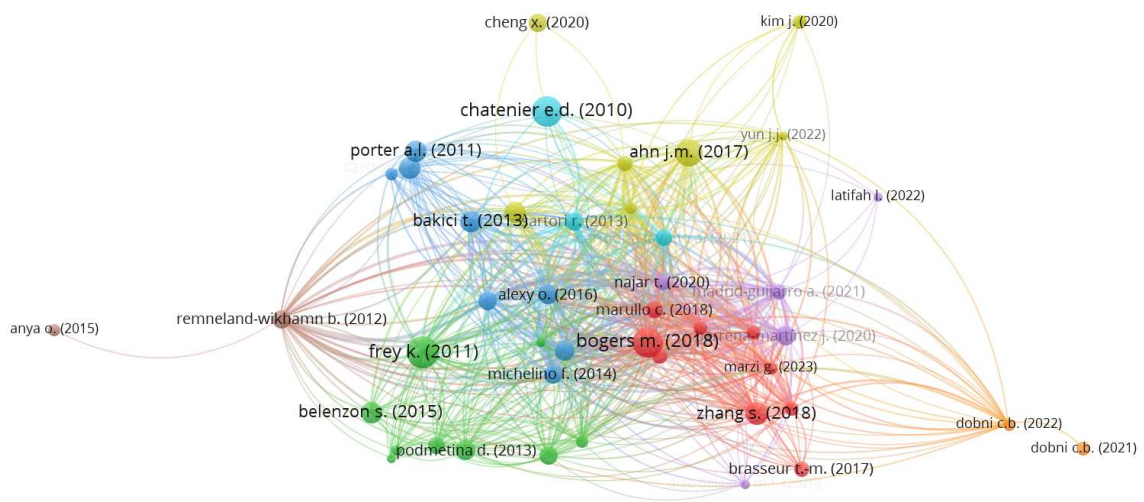


Figure 12 – Bibliographic Coupling Network

Source: Vosviewer

As represented in Figure 12, three emerging funded studies on the human side of OI field are made up of highly referenced authors of the bibliographic coupling (Bogers et al., 2018; Alexy et al., 2016; Ahn et al., 2017). Although papers like Matricano et al. (2022), Belenzon & Schankerman (2015), and Frey et al. (2011)

have less impact, they are similarly centred, thus they are to be considered. Then, a quote network is put through main path analysis to examine the direction of bibliographic coupling, and the articles by Bogers et al. (2018) and Alexy et al. (2016) can be recognised as additions to the field's emerging knowledge. Scholars might acquire a better understanding of the impact the human side has in firms' openness and contribute to its behavioural theory through OI by combining these two articles.

OI is not solely a technological or structural phenomenon but is heavily influenced by the individuals involved, their behaviors, aspirations, and capabilities (Bogers et al., 2018; Alexy et al., 2016).

Alexy et al. (2016) and Frey et al. (2011) argue that individuals' aspirations, such as the desire for recognition, learning, or making a societal impact, when aligned with the objectives of OI initiatives, will bring enhanced outcomes. Organizations should also embrace employee diversity, create an inclusive culture, and provide platforms for knowledge sharing and collaboration (Bogers et al., 2018).

Furthermore, attracting individuals with diverse knowledge and expertise to OI platforms enhance the quality and effectiveness of innovation outcomes (Belenzon & Schankerman, 2015; Frey et al., 2011).

Regarding the human expertise and intellectual capital, Matricano et al. (2022) and Belenzon & Schankerman (2015) explore that intellectual resources within organizations contribute to the success of OI processes by facilitating knowledge sharing and collaboration. When individuals with different areas of expertise come together, they can share their knowledge, exchange ideas, and collaborate on projects. This cross-pollination of knowledge and expertise leads to the generation of new ideas, insights, and innovative solutions, providing firms with valuable inputs, problem-solving abilities, and domain-specific knowledge that can enhance the quality and novelty of innovations. OI endeavours benefit from

the utilization of intellectual capital - intangible assets within an organization, including patents, copyrights, trademarks, and tacit knowledge possessed by employees - within organizations. Intellectual property and proprietary knowledge can be shared and leveraged through collaborative efforts, enabling participants to build upon existing knowledge and create value-added innovations. Additionally, intellectual resources contribute to the learning and continuous improvement aspects of OI and also play a role in accessing external networks and resources in OI.

According to Ahn et al. (2017), the alignment between different OI approaches and the characteristics of CEOs can have an impact on the success of OI initiatives within firms. When there is alignment between the CEO's characteristics and the chosen OI approach, the likelihood of successful implementation and outcomes increases. CEO characteristics such as leadership style, risk-taking propensity, networking skills, and change management abilities shape the fit between OI modes and organizational objectives, influence the strategic direction, foster a supportive culture, enable effective networking, and drive organizational adaptation.

4.4. Co-word analysis

Co-word analysis is a content analysis method that makes use of the relationships between words in documents to provide a conceptual framework for the domain (Zupic & Čater, 2014). The method's underlying assumption is that when words appear together frequently in documents, it indicates that the concepts they represent are tightly related. The result is a network of themes and their relationships, which captures a field's conceptual space. Since the unit of analysis is a concept rather than a document, author, or journal, co-word analysis can be used on document titles, keywords, abstracts, or entire texts (Aria & Cuccurullo, 2017). In this case, the unit of analysis selected was keywords plus.

Formerly, a thematic map of the field's keywords plus was developed, as Figure 13 shows, revealing the emerging themes and trends in the human side of OI.

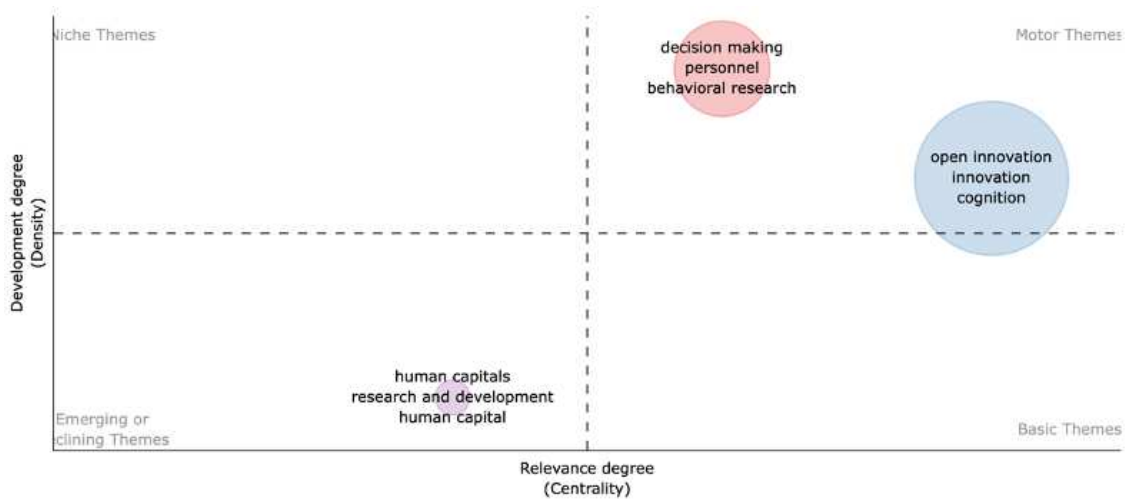


Figure 13 – Thematic Map

Source: Aria & Cuccurullo (2017)

Motor themes are concentrated in the top right quadrant due to their significant centrality and density. As a result, Decision Making, Personnel, and Behavioural Research as well as Open Innovation, Innovation and Cognition are strategic topics and are likely to be researched methodically over time. Although the last cluster has a higher frequency and relevance in the human side and OI domains, the first one has a higher development degree.

Contrarily, emerging or declining themes are located in the bottom left quadrant. Therefore, topics like Human Capital and R&D are emerging which suggests that OI may face new challenges regarding the human side domain.

Cognitive biases and mental models of the cognitive dimensions of top management teams (TMTs) (Li et al., 2022) and cognitive factors such as knowledge transfer and entrepreneurial orientation (Caputo et al., 2022) influence decision-making processes. Also, the organizational context, such as the socio-political factors in a management innovation context (Li et al., 2022) and resource constraints and transfer of academic knowledge into entrepreneurial activities in an academic spinoff context (Caputo et al., 2022) impact decision-making.

By focusing on individuals' attitudes, role perspectives, and locus of activity within the context of OI, Jun & Kim (2022) contributes to behavioural research. Understanding how individuals think, perceive their roles, and engage in specific activities that drive OI processes is crucial to gain insights into their receptiveness, acceptance, and support for OI initiatives within organizations. This behavioural perspective provides valuable insights for organizations seeking to foster a culture of OI and effectively leverage the knowledge and expertise of their personnel, enabling the identification of individuals who possess favourable attitudes, align with specific role perspectives, and engage in activities that promote OI within the organization.

Firms can access a broader range of knowledge, leverage external expertise, share risks and costs, and accelerate their innovation processes by embracing openness. OI reflects a shift towards a more collaborative and networked approach to innovation, recognizing the value of external knowledge and the benefits of partnerships and collaborations in driving successful innovation outcomes (Dahlander & Gann, 2010).

When it comes to exploring cognition and its implications for entrepreneurial behaviour and decision-making, cognitive processes, such as perception, attention, memory, decision-making, and cognitive biases, are essential in shaping individuals' behaviour and decision-making related to OI (Alves & Yang, 2022; Marzi et al., 2023b). The interplay of cognitive configurations such as risk perception, cognitive biases, cognitive diversity, and absorptive capacity can either facilitate or hinder the adoption of OI approaches in SMEs (Marzi et al., 2023b).

Human capital in open R&D is a critical driver of OI, encompassing the knowledge, skills, and capabilities of individuals from both internal and external sources. The ability to attract, develop, and retain talented individuals with diverse backgrounds and expertise is essential for driving R&D activities,

generating innovative ideas, and effectively collaborating with external partners (Enkel et al., 2009; Podmetina et al., 2013).

Additionally, establishing supportive human resource practices, such as talent management, recruitment, training, and collaboration initiatives, as well as fostering organizational structures that encourage openness, trust, and knowledge exchange is vital for creating an environment conducive to OI (Podmetina et al., 2013).

5. Future Research

This section covers the roadmap suggested for future development in the field of OI from a human side perspective. This analysis revealed three potential directions for further research, which are shown in Figure 14.

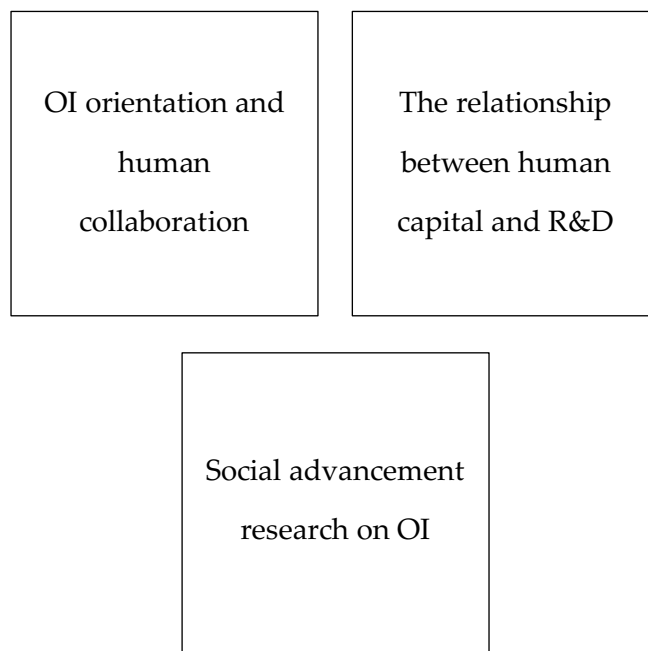


Figure 34 – Future Research Agenda
Source: own draft

OI practices can vary across different cultural and organizational contexts (West et al., 2014). There is a need for more research that examines how cultural factors, such as values, norms, and communication patterns, influence the adoption and effectiveness of OI. For instance, future research avenues on the

impact of the human side of OI on large businesses should consider how organizational culture influences the adoption and implementation of OI practices in large businesses. Moreover, in order to contribute to organizational learning and capability development in OI, an investigation on how large businesses can develop organizational learning capabilities to effectively leverage OI for competitive advantage should be conducted.

While OI has gained significant attention in research, there is still a need for a deeper understanding of the human aspects of OI processes. Although external knowledge and the benefits of partnerships and collaborations in driving successful innovation outcomes are already recognized in the OI literature (Dahlander & Gann, 2010), understanding how decision-makers combine and balance open and closed innovation strategies can shed light on the human side of OI.

Regarding OI orientation and human collaboration, future research avenues could deepen the understanding of the role of OI orientation in shaping human collaboration within the OI context. The existing literature explores the interplay between organizational practices, individual factors, and contextual influences (Podmetina et al., 2013; Von Hippel, 2005). However, to uncover the mechanisms through which OI orientation influences collaboration outcomes and contributes to innovation and organizational success, the relationship between OI orientation, human collaboration, and organizational outcomes, such as productivity, profitability, and market success should be examined.

Although human capital composition and its impact on R&D outcomes have already been considered in the literature as a critical driver of OI (Enkel et al., 2009; Podmetina et al., 2013), the interplay between individual-level human capital characteristics (e.g., education, experience, creativity) and team-level dynamics in driving R&D performance and innovation success hasn't yet been studied, hence future research avenues regarding the relationship between

human capital and R&D should extend this matter. Investigate the effectiveness of talent management strategies, including knowledge sharing, career development, and retention programs, in fostering R&D capabilities and encouraging innovation within organizations should also be considered when it comes to the influence of HRM practices on R&D. Finally, strategies for developing and nurturing human capital capabilities in R&D, including continuous learning, training programs, and knowledge management practices should be explored.

Concerning the future research avenues on social advancement research on OI, and since this is poorly addressed in the literature, there should be a social impact assessment of OI initiatives. Thus, its methodologies and metrics should be investigated, considering dimensions such as social inclusion, sustainability, well-being, and community development. Subsequently, the role of OI in addressing societal challenges, including poverty alleviation, healthcare improvement, education accessibility, and environmental sustainability should be examined. Afterwards, the mechanisms through which OI can facilitate social advancement and contribute to social change should be explored, considering factors such as collaboration, knowledge sharing, and co-creation with stakeholders.

Given the dynamic nature of the human side and OI domains, it is crucial to identify potential study directions that can further our understanding of the subject. Table 6 lists relevant questions for future research in this field.

Future Research Trends	Research Questions
OI orientation and human collaboration	<p>How does the alignment between individuals' attitudes and values towards OI and their collaborative behaviours influence the effectiveness of OI processes?</p> <p>What are the individual and organizational factors that facilitate or hinder effective human collaboration in OI initiatives?</p> <p>How can organizations foster a culture of collaboration and knowledge sharing among employees to enhance OI outcomes?</p>
The relationship between human capital and R&D	<p>How does the composition and diversity of human capital within organizations influence their R&D capabilities in the context of OI?</p> <p>What are the mechanisms through which human capital contributes to the generation and absorption of knowledge in OI processes?</p> <p>How can organizations effectively manage and leverage their human capital to enhance R&D outcomes in OI collaborations consistently?</p>
Social advancement research on OI	<p>What are the social and psychological barriers that hinder individuals from actively contributing their knowledge and expertise to OI processes focused on social advancement, and how can these barriers be overcome?</p> <p>How can OI platforms and digital technologies be designed and utilized to facilitate social collaboration, knowledge sharing, and co-creation among diverse stakeholders for the purpose of social advancement?</p> <p>What are the best practices and strategies for engaging external stakeholders, such as NGOs, social enterprises, and community organizations, in OI initiatives that address societal challenges and promote social progress?</p>

Table 6 – Future Research Trends and Research Questions

Source: own draft

6. Conclusion

This thesis was started with the intention of investigating the research gap in the OI field, where the human perspective still receives very little attention from academics, and, from this, developing a roadmap for further research within the domain. The aim of this study is to encourage authors to investigate the subject further to narrow this knowledge gap, providing important knowledge advancements and improving traditional theoretical models in these domains.

The research field of the human side of OI is an emerging area that has gained prominence in understanding the role of human factors in driving successful OI practices within organizations. OI is a paradigm that recognizes the value of external knowledge and collaboration in driving innovation and competitiveness. It emphasizes the importance of human interactions, knowledge sharing, and collaboration across organizational boundaries to foster creativity and enhance innovation outcomes (Chesbrough, 2003; Cohen, 1990; West, 2014; Laursen and Salter, 2006; Dahlander, 2010).

The existing literature offers valuable insights into the human side of OI by examining various aspects such as organizational culture, leadership, teamwork, knowledge sharing, and collaboration. Key contributions in this field include Chesbrough's (2003) seminal work on OI, which emphasizes the need for organizations to adopt a more open and collaborative approach to innovation by leveraging external knowledge sources and engaging with external partners. Furthermore, the work of West & Gallagher (2006) highlights the critical role of human interactions and social networks in facilitating OI processes and generating innovative ideas.

This thesis concludes that the human side of OI is influenced by organizational culture, leadership, and the mindset of individuals towards collaboration, knowledge sharing, and risk-taking. Organizations that foster a culture of openness, trust, and collaboration are more likely to successfully implement open innovation practices and gain a competitive advantage. Human capital, including the skills, knowledge, and attitudes of individuals within organizations, plays a crucial role in driving OI success.

Moving forward, there are several areas that require further investigation. Research should explore the relationship between OI orientation and human collaboration to uncover the mechanisms through which OI orientation influences collaboration outcomes and contributes to innovation and

organizational success. Furthermore, understanding the impact of OI on the individuals involved, such as employees' motivation, job satisfaction, and career development, is an area that requires attention, hence the future research avenues regarding the relationship between human capital and R&D. Studying the impact of collaboration, knowledge sharing, and co-creation with stakeholders mechanisms on OI outcomes can provide valuable insights on future research avenues regarding social advancement research on OI. Additionally, examining how cultural factors influence employee attitudes, behaviours, and the willingness to engage in OI practices can provide valuable insights for organizations seeking to enhance their competitive advantage through OI.

It is important to acknowledge the limitations of this thesis that fall under the limitations of bibliometric research which stem from the subjective nature of human judgment, the characteristics of the database utilized, and the criteria employed for data curation. Therefore, caution should be exercised when applying these findings to different organizational contexts and industries.

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Appendixes

Appendix 1 – Other Notable References from the Literature Review

Studies / Author	Term of the concept	Measurement	Sample	Database	Variables	Method of Analysis	Findings or outcome
R. Seo and J.-H. Park	<i>inbound open innovation</i>	dyadic measurement approach	ventures and small technology-intensive firms in high-tech industries	Ministry of SMEs and Startups Korea	technological and business performance	Confirmatory Factor Analysis (CFA)	The formation of external innovation networks to open up the firms' internal innovation processes is a viable strategy to cope with challenges, although few firms enjoy greater returns from inbound OI.
	<i>interorganizational learning (IOL)</i>	IOL measurement scale	external innovation networks of ventures with external parties-R&D alliances		exploitative and exploratory learning practices		Ventures adopting IOL in their inbound open innovation initiatives show higher performance than those lacking IOL practices. IOL practices determine the firms' learning ability to benefit from inbound open innovation for performance improvement.

Studies / Author	Term of the concept	Measurement	Sample	Database	Variables	Method of Analysis	Findings or outcome
	<i>entrepreneurial orientation (EO)</i>	managerial discipline			innovativeness, proactiveness, and risk-taking		EO contributes to firm growth, competitive advantage, and innovation performance- firms with a higher EO show a stronger tendency to leverage external innovation networks to fill knowledge gaps in pursuing emerging opportunities. Ventures manifesting EO in inbound OI can cultivate a fertile ground that legitimizes their increased returns on IOL. Combinations of IOL practices with EO result in varying extents to which each learning practice is relatively more beneficial for the technological or business performance of inbound OI.
Alves, J. and Yang, W.	<i>cognitive mechanisms</i>	antecedent variables and influencing factors of entrepreneurship competence	entrepreneurs	interview method/content analysis method and questionnaire survey/data analysis	entrepreneurship competence, cognitive flexibility, entrepreneurial self-efficacy, and optimism	combination of qualitative and quantitative research	SEM analysis further shows that cognitive flexibility has a positive direct effect on entrepreneurial self-efficacy; entrepreneurial self-efficacy has a positive direct effect on entrepreneurship competence; cognitive flexibility has a positive direct effect on entrepreneurship competence; cognitive flexibility has a positive indirect effect on entrepreneurship competence through entrepreneurial self-efficacy; optimism moderates the relationship between cognitive flexibility and entrepreneurship competence.

Studies / Author	Term of the concept	Measurement	Sample	Database	Variables	Method of Analysis	Findings or outcome
Engelsberger et al.	<i>relational leadership</i>	examination of the process through which teams utilize multicultural skills to support the development of relational leadership and knowledge sourcing and sharing (KSS)	20 employees, middle and senior managers with multicultural experiences, in various open innovation environments	interview method/ category theme analysis	individual interaction and relationship building	qualitative research methodological approach	Social exchange relationships among team members and knowledge exchange partners are enhanced by the use of multicultural skills and support the development of relational leadership to facilitate KSS and ultimately OI. The decision for participants to collaborate and source and share knowledge is motivated by individual reward (such as establishing network or long-lasting contacts), skill acquisition (such as learning or personal growth in decision-making) and a sense of reciprocity and drive for group gain. It is encouraged greater HR manager support for relational leadership and the development and use of multicultural skills to promote KSS.
V. Gupta and L. Rubalcaba	<i>multicultural skills</i> <i>global entrepreneurship</i>	entrepreneurial support provided by libraries in globalising the business operations of a Spanish start-up across the US market	Spanish start-up	practical experiences drawn from one consulting project	libraries, entrepreneurs, and their start-ups		Entrepreneurial libraries have great potential to foster innovation in start-ups in normal as well as turbulent times thus they can be a source of rich market information, helping start-ups to make rational business decisions.

Studies / Author	Term of the concept	Measurement	Sample	Database	Variables	Method of Analysis	Findings or outcome
Jun, Y. and Kim, K.	<i>attitude</i>	OI attitude measurement scale (roles of transfer, absorption, and brokerage)	134 individuals in domestic and multi-national corporations	Korean Management Association	COOIAA	deductive process that identifies organizational OI attitude constructs with an inductive framework development process	An organization's attitude toward interactive OI activities among OI stakeholders can reveal its degree of capability. Collective individual OI attitude status can strengthen the potential of intentions to act upon OI activities at the organizational level by articulating categories of the requisite behavioral reflections for executing OI.
He et al.	<i>organizational distance</i>	it measures the geographical proximity of enterprises in high-tech industrial clusters employing organizational distance	industrial clusters	National Social Science Foundation of China	innovative performance	evolutionary game theory and duopoly model	The export-oriented open innovation model is more appropriate for the innovation of high-tech industry clusters. There is a significant relationship between organizational distance and the R&D spillovers of businesses. Increased patent fees can encourage industry clusters to adopt an open innovation model with an outward orientation if they are located in close proximity to each other. Geographical proximity encourages enterprises to adopt open innovation export strategies.

Studies / Author	Term of the concept	Measurement	Sample	Database	Variables	Method of Analysis	Findings or outcome
Xia et al.	strategic leadership CEO overconfidence top management team (TMT)	Chinese listed companies	multiple industries	IncoPat, Orbis Intellectual Property, CSMAR	n.a.	M&A data of the firm	Overconfident CEOs favor market and organization-oriented OI over technology-oriented OI, and TMT governance can moderate such relationship, that is, as the level of TMT governance increases, the preference of overconfident CEOs for market and organization-oriented OI will be weakened, avoiding the negative effect of excessive adoption of such activities on firm performance.
Yun, J. J. and Zhao X.	business model innovation	rectangular compass concept model	17 business model patents	DGIST	over-shooting of modern business models, expanding the bottom of modern business models, cultivating the forward neighborhood of modern business models, and cultivating the backward neighborhood of modern business model	social experiments applying the rectangular compass	Through different types of OI, different styles of business model innovation can be achieved. Continuous OI is the trigger of business model innovation dynamics.

Studies / Author	Term of the concept	Measurement	Sample	Database	Variables	Method of Analysis	Findings or outcome
Cheng et al.	<i>open innovation crowdsourcing</i>		100 user generated ideas	OpenIDEO	OI		Germane cognitive load positively correlates with idea convergence quality, satisfaction with process, and satisfaction with outcome.
	<i>cognitive load</i>	Cognitive Load Theory (CLT)			mental and cognitive effort	laboratory experiment	Intrinsic cognitive load is negatively associated with satisfaction with process and satisfaction with outcome, while extraneous cognitive load negatively correlates only with satisfaction with outcome.
Bello-Pintado, A. and Bianchi, C.	<i>skill-driven recruitment</i>	different knowledge search strategies for innovation	Latin American country	Uruguayan Innovation Survey	technical and social skills	PLS- SEM	The estimation results using pooled panel data and panel data techniques confirm that the adoption of open search strategies for innovation demands the recruitment of new employees with higher technical and social skills. Technical skills are more likely to be demanded than social skills. The effects observed are higher when the firms use intensively knowledge and information sources.
Edelbroek et al.	<i>perceived quality of the OI process</i>	adapted from Hoch's (2013)	173 respondents from multiple different departments and industries	online questionnaire	n.a.		No significant positive relationship was found between how employees perceive their leader to be transactional and the quality of the OI process.

Studies / Author	Term of the concept	Measurement	Sample	Database	Variables	Method of Analysis	Findings or outcome
	<i>perceived transactional leadership</i>	Personal Reward and Material Reward scales					The non-significant direct relationship between employees' perceptions of transactional leadership and the perceived quality of the OI process can be explained by the fact that contingent reward is dependent on a leader's or organization's access to resources.
	<i>perceived transformational leadership</i>	performance expectations, vision, idealism, inspirational communication, and intellectual stimulation	n.a.	n.a.	n.a.	n.a.	Perceived transformational leadership behaviour have a significant positive relationship with employees' perceptions of the quality of the OI process.
	<i>work engagement</i>	vigour, dedication, and absorption					
Á. González-Moreno et al.	<i>open eco-innovation</i>	input measures, direct output, and indirect impact	279 food firms in Spain	ad hoc survey	breadth and the depth of the firm's knowledge network and the firm's propensity to develop different types of eco-innovations	n.a.	Ordination difficulties and bounded rationality explain an inverted U shape in the relationship of breadth of external knowledge sources and the propensity to eco-innovate both in product and process eco-innovations. It is important to rely on deep, frequent, and intense relationships with stakeholders in order to create the required atmosphere to foster fluent knowledge sharing among partners specially to develop eco- process innovations, but a learning effect appears.

Studies / Author	Term of the concept	Measurement	Sample	Database	Variables	Method of Analysis	Findings or outcome
Robbins, P.	<i>design thinking</i>	creativity and intuition of a designer	Graphic Studio Dublin (GSD)	n.a.	problem definition insights and empathy, iterative approach, abductive reasoning, an ethnographic approach, brainstorming and ideation, prototyping techniques, co creation and learning launch, pilot, and field experiments	exploratory, descriptive and explanatory	Through this creative combination of developing new markets; developing better, more targeted marketing; getting new exhibition spaces; forging new partnerships, stretching across conventional disciplinary boundaries, little by little, the sales grew by over 100%.
	<i>art thinking</i>						Art thinking allowed GSD not simply to plot a path from Point A to a more desirable Point B, but to collaboratively imagine or invent the ideal destination and to put in field enough imaginative initiatives to get there. It is highly appropriate to pilot art thinking in the visual arts.

Studies / Author	Term of the concept	Measurement	Sample	Database	Variables	Method of Analysis	Findings or outcome
Lavrynenko et al.	<i>managing skills for open innovation</i>	job advertisements content analysis and in-depth interviews with chiefs of research and development companies	chiefs of R&D organizations and American, British and Russian biotech companies	American, British and Russian job search engines	skillsets in biotechnology	quantitative and qualitative methods	Skills composition required in biotechnology does not vary significantly among selected countries as the market becomes increasingly globalized in terms of not only technology used but also personnel hired. Companies stress more on hard and digital skills, while soft skills appear to be a “must have without saying”. The mismatch between skills presented in the advertisements and articulated in the interviews has been found as employers tend to demonstrate innovation friendly company culture for possible applicants.
Ahn et al.	<i>diversity of OI modes</i> <i>CEO characteristics</i>	7-point Likert scale	306 manufacturing SMEs	Korean Small and Medium Business Administration (SMBA)	direction of knowledge flow and dominant core changes attitude towards OI, EO, patience, education, and experience	extrapolation method	CEOs’ positive attitude, entrepreneurial orientation (EO), patience and education can play important roles in facilitating OI in SMEs. The effects of CEO characteristics on OI adoption are differently configured according to the nature of each OI mode. OI must be understood as a wide innovation spectrum, and, to increase opportunities for successful OI adoption, CEOs have to attempt to compensate for characteristics they may lack by recruiting appropriate complementary top managements.

Studies / Author	Term of the concept	Measurement	Sample	Database	Variables	Method of Analysis	Findings or outcome
Felin et al.	<i>crowd-related practices/more open organizational forms</i>	the functions, forms, and failures of sociality	firms	n.a.	crowdsourcing, crowdfunding, open innovation, user innovation, peer and community production, innovation contests, and user innovation	qualitative method	Attention on sociality suggests significant empirical opportunities for future work. The innovation and organization literatures are at a critical juncture, and that future research and practice on innovation will necessarily need to be distinct from the past.
	<i>theories of the firm and crowds</i>				special issue papers		
Ettlinger, N.	<i>corporate crowdsourcing</i>		firms	literatures in business, the field of human computation, and media studies together with economic geography and social theory	decentralization, intellectual diversity, and specialization	qualitative method	The new regime has opened astounding avenues of profitability for firms. Digitized resistance strategies need to reach no less than the global crowd.
	<i>new exploitation rationalities</i>	n.a.			innovative and non-innovative activity; wageless work; JIT labor; precarization; informalization; fungibility; and invisibility		While the identification, contextualization, and explanation of the new regime is a necessary component to grasping new realities, specifying of the range of rationalities of governance also is strategically germane to hopeful possibilities.

Studies / Author	Term of the concept	Measurement	Sample	Database	Variables	Method of Analysis	Findings or outcome
Mann, C.	<i>sustainable policies on biodiversity offsets and banking</i>	Challenging Futures approach, biodiversity conservation approaches, Constructive Technology Assessment (CTA) approach	workshop participants	future scenarios for biodiversity offsets and banking	design, functions, and implications	n.a.	Although the design of biodiversity offset approaches and valuation methods is predominantly framed in functional and methodological terms, it is almost always linked to more fundamental philosophies, worldviews, and different rationalities concerning how to see, use, and value nature. A quick resolution of open issues and challenges in the design and use of biodiversity offset schemes may not be possible or even desirable. The political nature of most controversies on how to conceptualize, organize, and implement biodiversity offsets suggests that there is no objectively right or wrong design decision to be made.

Studies / Author	Term of the concept	Measurement	Sample	Database	Variables	Method of Analysis	Findings or outcome
C.W. Scheiner et al.	<i>thinking patterns</i>	technological scanning process/ technology identification and evaluation process (TIE), cognition and prototype models	38 R&D executives and innovation managers	semi-structured interviews	general cognitive and intuitive abilities	Kolmogorov –Smirnov-test and a Pearson test of correlation	Technological gatekeepers possess specific cognitive prototype models and thinking patterns, which exert an influence on identification and evaluation of technologies and that the number of features a thinking pattern contains is correlated with the number of years spent in a position in the organization as technological gatekeeper. There is a discrepancy between the individual and the organization - while it is perceived on an individual level as a valuable tool, it is seen by technological gatekeepers as inappropriate on an organizational level.
	<i>gut feeling</i>						Gut feeling is not always acknowledged or communicated within the organization in the technology identification and evaluation.

Studies / Author	Term of the concept	Measurement	Sample	Database	Variables	Method of Analysis	Findings or outcome
Obinna Anya et al.	<i>discovery practice in big data science</i>	simulation system	enterprises	onsite observation of data scientists as they perform their work in the Lab's open collaborative environment, in-context and follow-up interviews, and meta-analysis of the literature on data science	crowd-sourced data, open innovation, and collaborative analytics	Agent-based model (AMB) Gaia methodology	The likelihood of new discovery increases with increase in data re-use. The increase in new discovery cases is higher when agents exchange knowledge across groups versus only within groups.
Wikhamn, B.R. and Knights, D.	<i>masculinity</i>	implementation work of open innovation in practice	large multinational corporation	qualitative empirical data (interviews and documents) are derived from a 4 year longitudinal research project on open and distributed innovation processes in the automotive industry	prescribed classical management ideals, auditing, and bureaucratisation	exploratory single case study approach	Masculine discourses are reproduced rather than challenged by OI. The preoccupation with control and conquest tends to silence alternative (feminine) discourses which could otherwise enrich the radical and creative features of the open innovation paradigm.

Studies / Author	Term of the concept	Measurement	Sample	Database	Variables	Method of Analysis	Findings or outcome
	<i>open innovation paradigm</i>				"openness", "collaboration", "creativity" and "intuition"		It is difficult for managers to incorporate alternative (feminine) discourses when acting within a strong masculine hegemony as the potential disruptive force in the open innovation paradigm tends to be watered down when appropriated by classical managerial ideals. When masculine norms govern the company setting, OI paradigm aspects tend to be either marginalised or appropriated and transformed in ways that ensure they are compatible with discourses and practices of masculinity.
Bakici et al.	<i>public open innovation (POI) intermediaries</i>	role in the innovation process of local governments	participation of POI intermediaries and local governments in Finland, Germany, the Netherlands and Spain	primary data, such as case studies and surveys, and secondary data, such as online research, analysis of organisational websites and reports, scientific journals and validation by key informants	role of public intermediaries in the innovation processes	exploratory multi case study approach	Certain public or private companies act as a bridge – POI intermediary – across the large cognitive distances between city halls and a network of organisations, while orchestrating the collaboration of actors and executing innovation projects.

Studies / Author	Term of the concept	Measurement	Sample	Database	Variables	Method of Analysis	Findings or outcome
Remneland-Wikhamn, B. and Knights, D.	<i>Transaction cost economics (TCE)</i>	application to innovation practices	Volvo Group	Volvo Group	n.a.	exploratory single case study approach	TEC has a limited descriptive power and potentially does normative damage to open innovation practice. An overemphasis on calculative reduction of transaction costs together with a focus on governance and rationality leave little space for an innovative climate, thus diverting attention away from the creative potential of transactions. The self-fulfilling prophecy character of subscribing to the assumptions of TCE is not merely limit but actually undermine innovation.
Carbone et al.	<i>3.0 framework</i>	knowledge exploitation semantic application architecture	a large corporate environment like Bankinter, a financial institution, Telefonica I+D, an international telecommunication firm and Repsol, a major oil company in Spain	a large corporate environment like Bankinter, a financial institution, Telefonica I+D, an international telecommunication firm and Repsol, a major oil company in Spain	collaborative tools	exploratory multi case study approach	The basic pillars of the knowledge network are formal description of people, processes and contents underlying any of the applications; to cover it it is also necessary to build a conceptual semantic layer fed from business and external information sources. When it comes to the impact of collaborative technology (Web 2.0 like) and knowledge technology (Semantic Web like) in the innovation process at its first stages collaboration increased, and the evaluation process is perceived as more effective.

Studies / Author	Term of the concept	Measurement	Sample	Database	Variables	Method of Analysis	Findings or outcome
Frey et al.	<i>motivation</i>	six-point Likert scale			intrinsic or extrinsic		Extrinsic and intrinsic motivations affect the number of different types of contributions to solution threads.
	<i>intrinsic enjoyment</i>	3-item scale	individuals participating in innovation projects broadcast on the Internet	Atizo	experience of performing activities (playful, interesting, challenging or exciting)	PLS	While extrinsic desire for monetary rewards tends to be positively related to the making of non-substantial contributions, intrinsic enjoyment tends to breed more substantial postings, and knowledge diversity facilitates all types of contributions to open innovation projects.
	<i>knowledge diversity</i>	computing the number of different vocational areas participants listed					The most valuable contributors are those who combine high levels of intrinsic enjoyment in contributing with a cognitive base fed from diverse knowledge domains.
L. Porter, N.C. Newman	<i>mining external R&D</i>	5-stage framework	organization	Georgia Tech KISTI	the literature review, research profiling, tech mining, structured knowledge discovery, literature-based discovery (LBD)	n.a.	Technology management has developed a culture that relies more on intuition than on evidence. Changing that culture and implementing effective technical intelligence capabilities is worth the effort. An organization's interest in CTI leans toward the immediate.

Studies / Author	Term of the concept	Measurement	Sample	Database	Variables	Method of Analysis	Findings or outcome
Chatenier et al.	<i>competencies in OI teams</i>	competence profile constructed based on the identified tasks and challenges and selected competence lists, consisting of four clusters, 13 competences, and 34 competencies	OI professionals	explorative interviews and focus group discussions	new knowledge generation, trust build and low reciprocal commitment	qualitative method	The competence profile adds a new perspective to the field of OI management by focusing on how individuals involved in OI teams can enhance OI success. Brokering solutions and being socially competent is crucial for OI professionals.
Karakas, F. and Kavas, M.	<i>service-learning</i>	service-learning 2.0 model	management instructors	service-learning projects	connectivity, creativity, community, and complexity	qualitative method	Service-learning 2.0 can be used to develop students' twenty-first century thinking skills through applied community engagement projects, namely: interactivity and interconnectedness, innovation and insight, and inspiration and intuition, integrative and interdisciplinary thinking.