Academic Community Perceptions of Open Innovation: An Exploratory Study

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Abstract This study seeks to assess the academic community's knowledge and perception of open innovation. While the so-called "closed innovation" is rooted in the discourse of future managers, open innovation, being a relatively recent paradigm, may be an unknown form of innovation and therefore its potential is underused. What is the perception of open innovation among students and faculty at a private Portuguese university? The technical procedure was based on a survey, and 64 responses were obtained (the population corresponds to 3666 people). It was shown that the theme of open innovation, despite being recognized in the academic world, is still little known in the community. Although Portugal is a country of meager funds for innovation, which should lead to a greater focus on open innovation, this may not be happening due to the lack of trust in strangers that exists culturally in Portugal, and that may be currently hindering open innovation partnerships. Finally, in order to identify possible relationships between gender and perceptions regarding open innovation, we applied the chi-square test of independence (X^2) in relation to gender. This exploratory study verified the existence of gender equality regarding the variables analyzed on open innovation.

Keywords Academic community · Open innovation · Perceptions · Higher education

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1 Introduction

We live in an increasingly global and dynamic world, where ever-shorter innovation cycles and lower R&D costs are required [1]. Given the characteristics of technologies, the existence of complexity, and the need to respond to market needs [2], as well as due to scarce resources [3], the open innovation strategy is emerging, recognizing that not all good ideas derive from within the organization and that not all can be commercialized internally [4]. In this context, open innovation has progressively asserted itself as an approach to master innovation, allowing to save and solve the time and money problems of the innovation process, contributing to the maintaining of competitive advantage [5]. Companies that do not focus on an open innovation strategy will ultimately fail as rising development costs, as well as shorter product life cycles, make it increasingly difficult to justify investments in innovation [1, 6].

In 1977, von Hippel [7] presented for the first time a form of innovation stating that ideas could come from outside the organization, but concretely from the so-called lead users.

Albeit the concept was later popularized with the work of Chesbrough, Vanhaverbeke [8], which defines open innovation (OI) as "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 (…) is a paradigm that assumes that firms can and should use external ideas as well as internal ideas (…) combine internal and external ideas into architectures and systems. Assumes that internal ideas can also be taken to market through external channels, outside the current businesses of the firm, to generate additional value. Open innovation suggests that valuable ideas can come from inside or outside the company and can go to market from inside or outside the company as well."

Open innovation proposes a democratic innovation process, given its influence on the acquisition of transferring capacities, resources, and technologies between the various organizations, allowing organizations of different sizes to compete against each other [9]. The knowledge of the inventive process becomes endless, not distinguishing a small organization from a bigger one, a young one from a mature one, a technologically advanced one from a more primitive one. This democratization of knowledge, i.e., the possibility of access for all, is the most remarkable feature of this contemporary innovation strategy. The motivation to understand how this innovation paradigm is rooted in the culture of academia encouraged the investigation of this study. The main objective of this study is to investigate the knowledge of an academic community about the type of contemporary innovation, open innovation, and more specifically to understand the degree of perception and importance that students linked to the areas of management (future managers and agents of change) attribute to open innovation.

A literature review is presented in the following section. Section 3 identifies the methodology of the work carried out; Sect. 4 presents the main results and main conclusions; Sect. 5 discusses the results, and, finally, Sect. 6 presents the main conclusions of the work and suggests future research tracks.

2 Literature Review

When performing the search in Scopus for publications, whose title contained the word "Open Innovation," 3161 documents were obtained. Restricting the search to the type of document "article," published in the English language and thematic "Management," "Business," and "Accounting," 1121 articles were obtained. Continuing the search, with the aim of obtaining a more specific sample to the theme under analysis, the search was refined based on the same filters, but now with the specificity for articles that encompassed "Open Innovation" and "perception" in the title. Based on these criteria, seven articles were gathered (Fig. 1).

In this sample, the oldest article is from 2010 and the most recent from 2022. Table 1 summarizes the research results, presenting the main contributions and focus of the articles analyzed.

By analyzing Table 1, we can see that the analysis of perceptions regarding the business world continues to dominate current scientific studies [12, 13, 15, 16], and there is a pathway to understand and explore the academic community's knowledge of open innovation. Previous studies can be divided on the basis of perceptions about open innovation: focus on employees' perceptions [12, 13], corporate perception [15], managers' perceptions [16], academic perception of knowledge

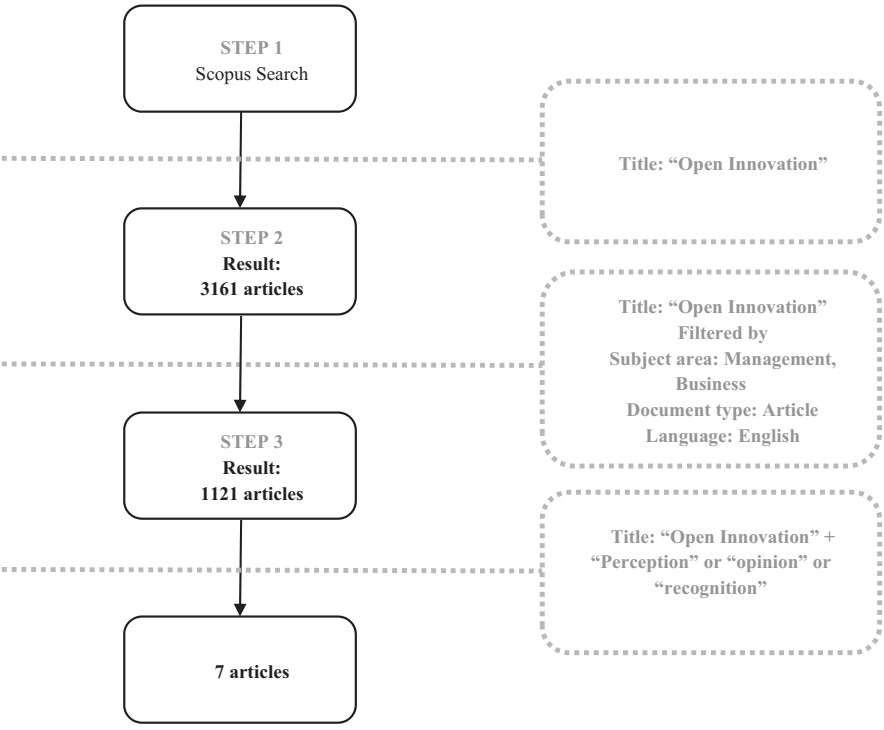

Fig. 1 Research protocol

Table 1 Analysis of Scopus articles based on the search for the title "Open Innovation" and "perception"

Title	Author	Focus of perception	Key findings
Strategic management of the Malaga brand through open innovation: tourists and residents' perception	[10]	Tourists and residents' perception	The results allow us to identify that the Malaga brand is being built and managed based on the cultural projection of the city, in which the ratings of tourists and residents serve as a basis for improving the management of Malaga as a tourist destination. Public entities that wish to transform their value creation and service delivery in a sustainable way should maintain a productive relationship with other public authorities and other external parties; exchange knowledge, skills, and experiences easily and securely with others to improve internal processes and deliver services to citizens and engage with citizens and other stakeholders to co-create new services
Higher education response in the time of coronavirus: perceptions of teachers and students, and open innovation	[11]	Teachers' and students' perceptions	The main objective of this work was to analyze how universities have managed the flow of knowledge during the pandemic situation. The results obtained showed that the absence of presence did not generate an increase in contact between teachers and students. Teachers and students showed a preference for the face-to-face method but recognize the potential of digital media
The intensity of organizational change and the perception of organizational innovativeness; with discussion on open innovation	[12]	Employee perceptions	This study assessed the relationship between investment in human resources (HR) and employees' perceptions of innovation. It sought to determine how the intensity of organizational change affects the relationship between HR investment and employees' perceptions of organizational innovation
Perceptions of open innovation at CERN: an explorative study	[13]	Employee perceptions	This study was designed to assess the perception of innovation, of employees of intergovernmental research institutes The study assessed how intergovernmental research institutes, specifically CERN, establish innovation as a driving force, mainly through internal and external openness. It was shown that most recognize the positive impact of open innovation

(continued)

Table 1 (continued)

Title	Author	Focus of perception	Key findings
What does open innovation mean? Business versus academic perceptions	[14]	Perception of the academic and business world	This paper compared the perceptions of innovation that exist academically and through business. The study showed that there are differences in the interpretation of open innovation between companies of different sizes. The results provide evidence of the issue of contextual ambiguity and dualism surrounding the OI concept
Mapping the perception and reality of open innovation	[15]	Companies' perceptions	This study assessed companies' perceptions of their degree of openness. As a result of the study, it was validated that companies' perceptions of their own openness differ from their actual situation and furthermore, each company has a different view on open innovation
Open innovation in secondary software firms: an exploration of managers' perceptions of open source software	[16]	Perceptions of managers	This paper examines how managers' perceptions of the benefits and drawbacks of open source software (OSS) affected the decision to adopt an open source policy in their companies The study reveals how perceptions about the business and technical benefits and disadvantages of OSS influenced the technological, organizational, environmental, and individual factors considered in the adoption process

management [11] and mixed academic and business perception studies [14], and focus on the perceptions of tourists and residents [10].

While also focusing on the perceptions of teachers and students, the article by Tejedor, Cervi [11] focuses on the perception of knowledge management in the context of the Covid-19 pandemic and not on knowledge about open innovation specifically. Only the article from Teplov, Albats [14] reflects an analysis on the perception of academics while continuing to focus mostly on the business world. This study has shown that there is a difference in the interpretation of open innovation, corroborating one of the results of the study of Dabrowska, Fiegenbaum [15].

3 Methodology

The main objective of this work is to assess the academic community's perception of open innovation and how it is rooted/familiarized in future professionals in society. This study is based on the adoption of a quantitative technical methodology through the elaboration of a questionnaire carried out on the GoogleForms platform.

The questionnaire is divided into closed response questions, open response (short), as well as encompassing questions structured in a Likert scale classification. Data processing was carried out using the Microsoft Excel tool.

This research is exploratory, with a convenience sampling focused on the population of a private Portuguese University, given the ease of access to the population and for covering a diversity of respondents that justifies the relevance of this study. The population of this university is represented by 3666 people. Students' limited knowledge (or not) about one of the most promising forms of innovation is important to know the potential that open innovation may have in the near future, as well as to understand what can be improved to share its potential.

The questionnaire was conducted on the GoogleForms platform and disseminated by the course coordinators of this private university via the e-learning platform Moodle. This form was shared by the academic community on June 2, 2021, and was open for responses until June 13, 2021. Sociodemographic information was gathered on the knowledge of open innovation, what is the biggest benefit, biggest drawback, and key partner they perceive in a process of open innovation, ending with the evaluation of the importance of innovation and more specifically open innovation. In total, 64 responses were obtained.

4 Results

The survey was addressed to the population of a private Portuguese university, and 64 answers were obtained. The questionnaire was answered by 62 students and 2 lecturers, with the majority of respondents belonging to the 18–25 age group (70.3%) and attending a degree course in management (53.1%). As regards representation by district, there was a predominance of responses from residents in the districts of Porto (78.1%) and Aveiro (17.2%).

With regard to knowledge about open innovation, 60.9% of the respondents are familiar with the topic, but 46.9% of those polled do not know any of the open innovation practices (inbound, outbound, or coupled), which shows that this type of innovation is still an unknown topic in the academic world.

Questions regarding the perception of the open innovation theme were also addressed, namely, asking about the perceived benefits and drawbacks, as well as the partners that they recognize as being most important in the adoption of this innovation paradigm. As far as benefits are concerned, 25% of respondents perceive as the main advantage the fostering of creativity and 15.6% the reduction of the time to find an innovation.

On the other hand, the majority of the respondents perceive as main drawbacks the leakage of information (31.3%) and the possibility of stealing the idea (23.4%). When asked about the key partner to promote open innovation (Fig. 2), respondents point to R&D centers (42.2%), followed by competitors (32.8%) and customers/consumers (18.8%).

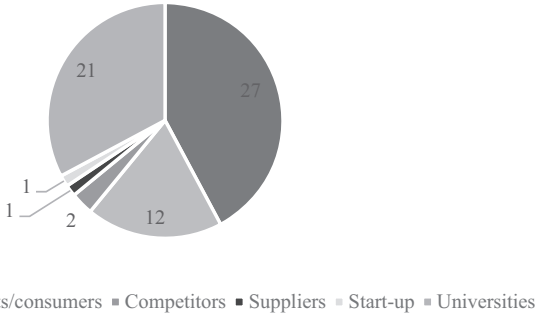

Fig. 2 Which partner do you consider most important in an open innovation process?

Fig. 3 Word cloud on open innovation

Regarding the word that respondents most identify with open innovation, the highlight goes to openness and sharing, followed by collaboration, and ideas and creativity. Figure 3 summarizes the words listed by respondents.

In order to identify possible relationships between gender and perceptions regarding open innovation, the chi-square test of independence was applied (X^2), in relation to gender.

With this purpose, four chi-square tests were performed, more specifically the association between the gender of the respondents and (1) Have you ever heard about open innovation (or open innovation)? ($X^2 = 0.18166073$); (2) Which partner do you consider most important in an open innovation process? ($X^2 = 3.837002828$); (3) What degree of importance do you attach to closed innovation (innovation carried out only within the organization)? ($X^2 = 0.000069827$); (4) How important do you consider open innovation to be? ($X^2 = 0.048092177$). All tests demonstrated independence in the relationship between gender and perception regarding the questions asked (variables studied). The contingency tables and the respective statistical tests for the remaining tests revealed that in terms of gender no pattern emerges in relation to the questions asked to the respondents. Tables 2, 3, 4, and 5 show clear examples where the percentages of men and women show similar patterns, indicating independence between the variables under study.

Table 2 Have you ever heard of open innovation?

	No	%	Yes	%	Total
Female	15	42.86	20	57.14	35
Male	10	34.48	19	65.52	29
Total	25		39		64

With regard to the questions in Tables 4 and 5, it should be noted that the data were grouped from a quantitative classification (scale of 1–7) to a qualitative classification, where low importance was attributed to classifications below 4 (including 4) and high importance was attributed to classifications above 5 (including 5).

It should be noted that for the chi-square calculation, in cases where the tables were formed in a two-by-two matrix (cases of Tables 2, 4, and 5), Yates's correction was applied due to the contingency tables being small, with only one degree of freedom. Table 6 shows the chi-square calculations in the case of relating gender with knowledge on the topic of open innovation.

Cronbach's alpha was calculated to validate the internal consistency and reliability of the questionnaire. The literature is not unanimous in defining a Cronbach's alpha that validates the reliability of the data, varying as to the minimum limit beyond which the questionnaire may be considered to have consistency. Davis [17] and Nunnally [18] report that a value above 0.5 may be considered acceptable under certain conditions (Table 7).

$$\alpha = \frac{k}{k-1} \times \left(1 - \frac{\sum \sigma^2}{\sigma T^2} \right) \tag{1}$$

where k represents the number of questions, σ^2 the variance, and σT^2 the variance of totals.

In this study, a Cronbach's α of 0.58 was obtained, which validates the consistency and reliability of the questionnaire.

The margin of error obtained taking into account the size of the population and the sample is ±10%.

5 Discussion

This section is dedicated to the reflection on the results obtained, and it is the result of the analysis of this study, as well as of the existing literature on the subject under study. We seek to indicate suggestions so that the community may rethink new contents that may be the object of study by the academic community.

Table 3 Which partner do you consider most important in an open innovation process?

	R&D centers	%	Customers	%	Competitors	%	Suppliers	%	Startup	%	Universities	Total
Female	13	37.14	8	22.86	1	2.86	0	0.00	0	0.00	13	35
Male	14	48.28	4	13.79	1	3.45	1	3.45	1	3.45	8	29
Total	27		12		2		1		1		21	64

Table 4 On a scale of 1–7, how important is closed innovation (innovation carried out only within the organization)?

	1–4 – low	%	5–7 – high	%	Total
Female	12	34.29	23	65.71	35
Male	9	31.03	20	68.97	29
Total	21		43		64

Table 5 On a scale of 1–7, how important is open innovation?

	1–4 – low	%	5–7 – high	%	Total
Female	3	8.57	32	91.43	35
Male	2	6.90	27	93.10	29
Total	5		59		64

Table 6 Chi-square calculation – Have you ever heard of open innovation?

O	E	O-E	IO-EI-0.5	$(IO-EI-0.5)^2$	$((IO-EI-0.5)^2)/E$
15	13.671875	1.328125	0.828125	0.685791016	0.050160714
20	21.328125	−1.328125	0.828125	0.685791016	0.032154304
10	11.328125	−1.328125	0.828125	0.685791016	0.060538793
19	17.671875	1.328125	0.828125	0.685791016	0.038806919
					0.18166073

Table 7 Recommended reliability levels for Cronbach's α

Author	Condition	Recommended Cronbach's α
Davis [17]	Forecast for groups of 25–50 individuals	Above 0.5
	Forecast for groups of more than 50 individuals	Below 0.5
Nunnally [18]	Preliminary research	0.5–0.6

From Peterson [19]

5.1 Open Innovation Knowledge

Starting by highlighting one of the strong points and that reinforces the robustness of this study, 65% of the respondents have a degree in management or economics, being students familiar with management and innovation.

This section is dedicated to the reflection on the results obtained and is the result of the analysis of this study, as well as of the existing literature on the subject under analysis, seeking to indicate suggestions so that the community may rethink new contents that may be the object of study by the academic community. However, one of the interesting and surprising results of this study is that 50% of these students do not know the practices of open innovation, which will allow us to conclude that open innovation is not a subject addressed in the academic environment, nor possibly in society in general, so there is a potential for this subject to be introduced in future courses of economics or management. Future decision-makers/managers

need to know about this type of innovation because the success of companies, and in turn of nations, will depend on the degree of competitiveness that managers stimulate in the business environment. Studies show that the adoption of an open innovation practice has a positive correlation with the performance of an organization Future decision-makers/managers need to know about this type of innovation because the success of companies, and in turn of nations, will depend on the degree of competitiveness that managers stimulate in the business environment [20–22].

5.2 Protection of Innovation

One of the results of this study indicates that more than 50% of the respondents' fear/perceive that open innovation may lead to the theft of ideas and information leakage from the organization. These results are associated with studies that relate the adoption of open innovation practices (coupled, inbound, or outbound) with the degree of innovation protection. According to Freel and Robson [23], the extent of cooperation for innovation and networking, i.e., the choice of OI strategy, is strongly related to the type of ownership strategy chosen, with firms that emphasize informal and strategic methods of protection recording higher rates of coupled and inbound open innovation. As a result of the fear of imitation when exploiting technology externally, a defensive strategy is associated with superior OI outbound performance, although a collaborative strategy is preferable in terms of overall innovation performance [24].

5.3 Creativity Phenomenon

The fostering of creativity presents itself as a great potential of the adoption of OI. About 25% of the respondents mentioned that this is the great advantage of OI and that it allows for the promotion of the creative process. This perception reinforces the results of studies that relate the typology of innovation with the OI. For Hecker and Ganter [25], companies that want process innovations should choose to obtain knowledge through the market by hiring specialized consultants or new workers. If the objective is to innovate by launching new products, they should use a strategy based on collaboration [26].

5.4 Key Partners

One of the important points in the creation of innovation networks is that in order to maintain high levels of performance and a sustainable competitive advantage, companies must maintain a balance in the search for innovation between the exploration

of external knowledge and the exploitation of internal knowledge [27]. The study showed that approximately 43% of the respondents favor R&D centers as key partners, followed by competitors and consumers, and allied to this, respondents relate OI to sharing and collaboration. This co-creation of knowledge is validated by previous works, emerging as the great idiosyncrasy and potential of open innovation. In their paper, Su, Lin [28] state that co-created technological knowledge is more exploratory and pioneering and has shorter technology cycle times than exclusively non-co-created knowledge.

5.5 The Importance of Innovation

The results of this study show that over 60% of the respondents attribute high importance to closed innovation and over 90% to OI, which contributes to validate the relevance of studying the perception that academics and future policymakers have about OI. Already in the last century, Solow [29] emphasized the importance of the physical accumulation of capital and of technological progress as forces for economic growth. This driving force is commonly called innovation and is the force that explains the progress of nations and the competitiveness of companies.

In today's constantly changing world, the winner is whoever is best prepared and whoever can absorb the most information. We are in the "Age of Knowledge," and only those who possess the dynamic capabilities that enable them to permanently leverage competitive advantage will survive [30, 31].

These results allow us to validate that the academic community is familiar with the importance of innovating, attributing high importance to this competitive factor in organizations.

5.6 Economic and Cultural Factors

Portugal, being a low-wage country [32], a lover of low-cost products/services (see the success, in Portugal, of companies such as IKEA and McDonald's), and with scarce funds available for innovation – in a country little oriented toward performance and high standards [33] –should embrace more open innovation as it is more economical than traditional closed innovation [34]. However, this study found that open innovation is not getting the prominence it deserves and that would be expected in Portugal. This may be happening due to the lack of trust in strangers that exists, culturally, in Portugal, and that may be hindering open innovation partnerships today. Culture appears to be a fundamental element in the development of nations and economies [35]; its influence shows and explains why development happens – or not [35]. "Cultural heritage provides the artifactual structure – beliefs, institutions, tools, instruments, technology – which not only plays an essential role in

shaping the immediate choices of players in a society but also provides us with clues to the dynamic success or failure of societies through time" [35].

6 Conclusions

The world is increasingly volatile, and companies are increasingly global and more interdependent. Borders no longer transform companies into hard cores; they are now more a source of knowledge for organizations. Today's society is a global network where knowledge flows, is absorbed, and transformed at an immeasurable speed, namely, to and from the company.

6.1 Contributions to Theory

The literature on the perception of the academic community on the subject of open innovation is scarce, focusing mainly on the business world. This chapter seeks to initiate a debate on the understanding of the academic community's knowledge about this contemporary paradigm of innovation, contributing to the exploration of knowledge on this topic.

6.2 Managerial Contributions

This study sought to analyze the literature on the perception of open innovation, subsequently analyzing the knowledge of the subject in academia. We verified that despite the high importance attributed to OI and the high benefits perceived, the theme is still an unknown subject in the university environment and may prove to be harmful in the country's entrepreneurial future with the neglect of the application of this practice in the business world. Thus, the introduction of curricular units or seminars in management or economics courses is suggested, which could expose the potentialities of this new paradigm.

Finally, through the chi-square test, no statistically significant results were found in the relationship between gender and knowledge of open innovation, indicating gender equality in the perception of this new paradigm. This study could serve as a basis for further in-depth studies with larger and more representative samples of a given population (this study analyzed approximately 2% of the total population of this university).

6.3 Limitations

One of the limitations of the study stems from the size of the sample obtained since only 2% of the population of this private university was analyzed.

Another limitation of this study stems from the analysis being restricted to students' perception, being scarce in terms of teachers' perception.

The results are only representative of one Portuguese private university and do not represent the entire academic population in Portugal.

6.4 Suggestions for Future Research

As lines for future research, it is suggested to extend the sample to other universities, enlarging not only the number of respondents but also the universe of analysis, allowing the results of this study to be compared with those obtained in other universities.

In future studies, the results obtained in private and public universities could be studied, ascertaining the degree of perception between different universities, and if different, the reasons for this divergence of perception.

A further clue for future research stems from the very limitation of the sample, where student results predominate. Hence, in future studies, the perception of the teaching community on this issue should be sought.

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