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UNCERTAINTY PERCEPTION AND ENTREPRENEURIAL LEARNING IN PARTNERSHIPS

PERCEPÇÃO DE INCERTEZA E APRENDIZAGEM EMPREENDEDORA EM PARCERIAS

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Abstract

This article investigates how entrepreneurs manage uncertainty and learning in partnerships between startups and large firms. Using a qualitative longitudinal retrospective methodology, including documentary analysis and multiple case studies, it explores the processes entrepreneurs use to handle perceived uncertainty during such partnerships. The results show that entrepreneurs employ various strategies to frame uncertainty as either an opportunity or threat, identify barriers in open innovation partnerships, and learn through uncertainty management.

Keywords: Uncertainty. Learning. Entrepreneurial Decision Making. Entrepreneurship. Qualitative Research.

Resumo

Este artigo investiga como empreendedores gerenciam a incerteza e o aprendizado em parcerias entre startups e grandes empresas. Utilizando metodologia retrospectiva longitudinal qualitativa, incluindo análise documental e múltiplos estudos de caso, o estudo explora os processos que os empreendedores usam para lidar com a incerteza percebida durante tais parcerias. Os resultados mostram que os empreendedores empregam várias estratégias para enquadrar a incerteza como uma oportunidade ou ameaça, identificar barreiras em parcerias de inovação aberta, e aprender através da gestão da incerteza.

Palavras-chave: Incerteza. Aprendizagem. Tomada de Decisão Empreendedora. Empreendedorismo. Pesquisa Qualitativa.

Introduction

Entrepreneurs who decide to establish collaborations with large companies are attracted by the availability of resources, infrastructure, networks, knowledge, and market access offered by large firms. Established firms seek to integrate new technologies and innovations that can improve their competitive advantage in the market (Usman & Vanhaverbeke, 2017; Weiblen & Chesbrough, 2015). In this relationship with large enterprises, entrepreneurs are under conditions of uncertainty due to a lack of access and availability to resources and information (Packard et al., 2017; Rapp & Olbrich, 2020; Townsend et al., 2018; Klein, 2008). It means that entrepreneurs need first to develop a process of uncertainty management. It is defined as the process by which entrepreneurs deal over time with perceived information gaps, having no control or predictability over the probabilities or outcomes of certain tasks, in the course of developing their venture (Griffin & Grote, 2018; Packard & Clark, 2020). As an inherent part of the complexity and speed of business change, entrepreneurs do not have the possibility of knowing all the facts and consequences of their choices (Sarasvathy, 2001; Shepherd et al., 2015; Townsend et al., 2018). This scenario is what has captivated an important segment of academics working in the field of entrepreneurial learning processes, to understand how entrepreneurial action can be developed and how accurate decisions can be made under conditions of uncertainty (Shepherd et al., 2015).

Although the literature on uncertainty management speaks about the entrepreneurial learning process, the connections are yet incomplete. Entrepreneurial learning is concerned with how attention directs learning through the search for choices, the collection and interpretation of information, and the directing of actions as a function of achieving change to achieve market advantage (Cope, 2005; Wang & Chugh, 2014). The literature on uncertainty management focuses mainly on the types of perceived uncertainty, but not deeply enough on how experimentation is integrated into uncertainty management (Sharma et al., 2020; Walker et al., 2003). On the other hand, the literature on logics of approach in uncertainty management highlights experimentation but does not address in detail the origin and types of perceived uncertainty (Packard & Clark, 2020). Thus, it is necessary to have a more holistic and systemic framework to analyze and establish interrelations among the particularities of this type of phenomenon. In that vein, this research seeks to answer: how entrepreneurs cope with uncertainty and learning in an integrated way during partnerships between startups and large firms?

The article aims to explore the process by which entrepreneurs cope with the tensions and consequences of perceived uncertainty during partnerships between startups and large firms. To address this inquiry, a qualitative, longitudinal retrospective methodology was employed (Merriam & Tisdell, 2016). Considering the relevance of temporality in uncertainty management and learning processes, a temporal and procedural approach was defined, following the alignments proposed by Langley (1999), supported by documentary analysis and multiple case study. The results aim to understand entrepreneurs' management approach to uncertainty and learning process in startup-large firm partnerships given multiple factors and conditions.

The article presents theoretical and managerial contributions. As a theoretical contribution, we advance the discussion on entrepreneurship learning, uncertainty, and open innovation, by investigating the micro-foundations involved in entrepreneurial learning and uncertainty perception in open innovation, given multiple criteria, through theory building elaboration (Van Burg, 2020). From a managerial perspective, we indicate how entrepreneurs exploit opportunities in open innovation partnerships, facilitating the learning process and decision-making in uncertain contexts and dynamics..

Theoretical Framework

Uncertainty Perception in Entrepreneurship

The role of uncertainty as an inhibitor in entrepreneurial action has permanently been at the center of academic discussions, thus emerging two alternatives for conceptualizing it (McMullen & Shepherd, 2014). The first has focused on quantifying the uncertainty perceived by actors, to study who actually acts or does not act entrepreneurially as a function of their knowledge of uncertainty, which is shaped through perception (Emami et al., 2020). On the other hand, following the tradition of seminal works done by economists such as Joseph Schumpeter and Frank Knight in the early 20th century, the second stream is inspired by studying who decides to act or not act in an entrepreneurial way according to their willingness to bear and deal with uncertainty (McMullen & Shepherd, 2014). This choice would be determined in part due to attitudinal and motivational issues and the risk propensity of each individual (McKelvie et al., 2011). The paper follows the second stream, because although it is a field with wide investigative coverage, ontological discussions about uncertainty and its reaches as a cognitive phenomenon remain open and dynamic (McMullen & Shepherd, 2014; Packard et al., 2017; Townsend et al., 2018).

In the literature, four categories of uncertainty are observed: technical, market, organizational, and resource (Rice et al., 2002). The first of these, technical, is linked to the lack of information regarding scientific knowledge that allows for a greater determination of the technical and manufacturing specifications of the product in the transition to its implementation. The market uncertainty covers information -or lack of it- regarding the consumer profile on which the product is oriented, as well as issues related to the availability of models that allow visualizing the interaction of the product with the competition it will have in the market. Organizational type uncertainty, on the other hand, focuses on the gaps that are produced within the organizations to deal with the demands of the particularities of the most radical innovation projects. Finally, resource uncertainty deals with the information gaps related to attracting sufficient resources for the activities related to each project, including both monetary resources as well as critical skills within the firm.

The four categories compose the "uncertainty matrix" (Rice et al., 2002) that is dynamic in essence, and it is significantly influenced by the latency, and criticality of the tackled uncertainties. The latency is related to the anticipation likelihood of the determined category of uncertainty (O'Connor & Rice, 2013). The criticality concerns about the magnitude of the uncertainty perceived and how to extend could have serious implications in the near future (O'Connor & Rice, 2013). Current literature approaches this problem of uncertainty in two streams (Mansoori & Lackéus, 2020; Reymen et al., 2015). The first is composed of proposals that emphasize planning and control (Reymen, 2015). The second current is characterized by emphasizing more flexible, collaborative, and adaptive approaches in decision-making, where we find proposals on improvisation, bricolage, and effectuation (Kitching & Rouse, 2020; Sarasvathy, 2001). The two streams are large debated, but we think that is necessary approach the problem by other stream: the entrepreneurial learning.

Entrepreneurial Learning Stream

Entrepreneurial learning has positioned itself as an interface between the theoretical and empirical development of entrepreneurship and organizational learning (Cope, 2005; Wang & Chugh, 2014). There is a fruitful scientific advancement in the study of learning in entrepreneurship, both at the individual and collective level (Minniti & Bygrave, 2001; Nogueira, 2019; Wang & Chugh, 2014), with the medullary axis being to know how attention directs learning through the search for choices, the collection and interpretation of information, and the directing of actions as a function of achieving change to achieve market advantage. The three main attributes of entrepreneurial learning behaviors

(Nogueira, 2019). Proactive learning behaviors can be either forward-looking, anticipatory, or change-oriented-are related to addressing challenges related to innovation processes because they are oriented to dealing satisfactorily with change. The exploratory learning behaviors - which include exploration of new alternatives, experimentation, and discovery - cover the discovery, acquisition, and improvement of new skills and capabilities. Last but not least, the collaborative learning behaviors - which may have the character of participatory and shared with other actors - relate to the inclusion of other relevant actors in the entrepreneurial process, such as partnerships established in contexts of open innovation with large firms.

Consonant with the perspective of entrepreneurial behavior, the literature presents experiential learning in entrepreneurship. Experiential learning can be summarized as the process in which knowledge is created as a product of the transformation of experience and, therefore, requires a transformative process from a figurative representation of the experience that is continuously recreated (Kolb, 1984). The experiential learning approach can be synthesized as the process in which knowledge is created as a product of the transformation of experience, therefore it requires a transformative process from a figurative representation of the experience that is continually recreated (Kolb, 1984). It is recognized that Kolb's (1984) proposal has generated distance to be used in entrepreneurship in contexts of uncertainty and complexity, mainly for two reasons. On the one hand, learning in stressed entrepreneurs resulting from a lack of time and information does not follow the sequential thread of each stage proposed by the author (Politis, 2005), but is more flexible depending on the subject's cognitive abilities. On the other hand, experiential learning sustains that experience is available to entrepreneurs, separating the incidence of environmental and personal factors that may eventually vary the acquisition of new experiences (Markowska & Wiklund, 2020).

In this way, complementing the perspectives above, it emerges the explanations from a constructivist perspective. Considering the theory of social learning and his concept of self-efficacy (Bandura, 1995), entrepreneurial learning under uncertainty has addressed how contextual variables influence the learning process. Due to the level of perceived self-efficacy, the strategies that entrepreneurs use to face new tasks are being modeled, where greater self-efficacy, and greater inclination to experiment and develop an open-in-up mode of learning (Markowska & Wiklund, 2020). Entrepreneurs with less confidence in their abilities, prefer to learn from another way, focusing and modeling their approach to creating and implementing a solution to problems accordingly.

Thus, there are differentiated perspectives on the behavior, the usefulness of the knowledge already acquired, and the demands of the challenges resulting from the complexity and uncertainty perceived by the entrepreneurs. The studies developed in the most recent directions consider the diversity of perspectives, and it is understood that both individuals and organizations can detect which elements are necessary to be learned, as well as to effectively assess the quality of what is being apprehended or deliberately reinforced some types of learning over others (Alvarez et al., 2018). However, the details of the process of entrepreneurs learning by uncertainty are undercover.

Based on entrepreneurial learning, we investigate the open innovation phenomena (Chesbrough & Bogers, 2014). One of the advantages that collaboration between startups and large firms generates is a synergy that makes possible imitation by competitors much more complex and less likely (Urbaniec & Zur, 2021). On the one hand, it may be that the corporation chooses to act in a way that can integrate emerging innovations through interaction with startups, aligning them with businesses already developed by the large firm (Hutter et al., 2021). From another perspective, collaboration with startups allows one to perform surveillance and detect emerging innovations that can be prospected as disruptive. Speccialy here we will analyses de collaborations between startups and corporations. Entrepreneurs decide to establish collaborations with large companies attracted by the availability of resources, infrastructure, networks, knowledge, and market access offered by large firms, while the latter seeks to integrate new technologies and innovations that can improve their competitive advantage

in the market (Chesbrough & Bogers, 2014). The entrepreneurial learning process is understood as the acquisition of information and skills (i.e., knowledge) through experience (Wang & Chung, 2014) and under context conditions of uncertainty.

Methods

We employed a qualitative, longitudinal retrospective approach (Merriam & Tisdell, 2016). Rather than aim to predict or describe attributes among a certain segment of the population, a qualitative paradigm is focused on deepening the understanding of meanings and significations created by the actors involved in a certain phenomenon. This research is designed following a theory and data-driven approach. In most qualitative studies, deduction and induction are present in qualitative study development since the researcher both generalizes from empirical observation and also connects it to prior existing theory (Gehman et al., 2018). This research process is called abduction, which "means connecting what you see in the empirical world with theoretical ideas, which are also out there and can be further developed" (Gehman et al., 2018, p. 297).

Entrepreneurial Learning Stream

Regarding our research question, connected with entrepreneurial uncertainty perception and learning, the primary data collection is structured to the following sampling strategy: a) Universe: Entrepreneurs who lead a startup and have developed inter-organizational projects with large firms. b) Unit of analysis: Founding entrepreneurs or co-founders of startups who have developed inter-organizational projects with large firms. In addition, the project must comply with these two criteria: (1) The project must have developed a product or service with some degree of radical innovation. Radical innovations mainly concern the creation and development of new businesses and technology that are highly unpredictable in terms of timing and results (Leifer et al., 2000); consubstantially, they involve an important grade of uncertainty. (2) The project must have required a significant level of co-development between both parties (i.e. startup and corporation).

As stated, in the study of processes linked to learning, it is challenging to isolate constitutive events of that phenomenon, given its fluid character within the spatiotemporal context. In response to this, secondary data from the documentary source (Langley & Abdallah, 2011) will be combined as a way of complementing possible biases of the informants regarding memorable events and synthetic information provided by the interview primary data collected. As a strategy to overcome difficulties arising from the complexity of the dynamic character of the unit of analysis in the procedural approach, the elaboration of the visual mapping (Langley, 1999) will be used. This tool allows focusing attention and analysis on anchor points to structure the data from which theory will emerge, allowing for the establishment of patterns in the process, guided by the meaning of the process given by the actors involved. Detached from this, an analytical chronology will be generated that will assist in clarifying the sequences at different levels of analysis.

For primary data collection, semi-structured interviews were used, as methodological tools that allowed us to access the personal narratives and meaning created by each actor about a particular issue or event (Hernández Sampieri et al., 2006). Interviews were conducted with new ventures' entrepreneurs and managers who act in units related to collaboration with startups. There will be three primary data sources interviews from (1) entrepreneurs, (2) large firm managers (depending on each case).

The 39 interviews were carried out, in which 14 were applied to corporation managers or open innovation institution' managers, in order to identify relevant elements for the protocol validation and also to facilitate connections with entrepreneurs. From the startup side, 19 interviews were carried out: 14 with entrepreneurs, and 5 with startup decision-makers managers. Considering the selection criteria specified above, finally, 14 interviews were considered for the analysis stage. These 14 interviews were

with entrepreneurs and startup decision-makers managers from 6 startups (Table 1).

Table 1 – Cases

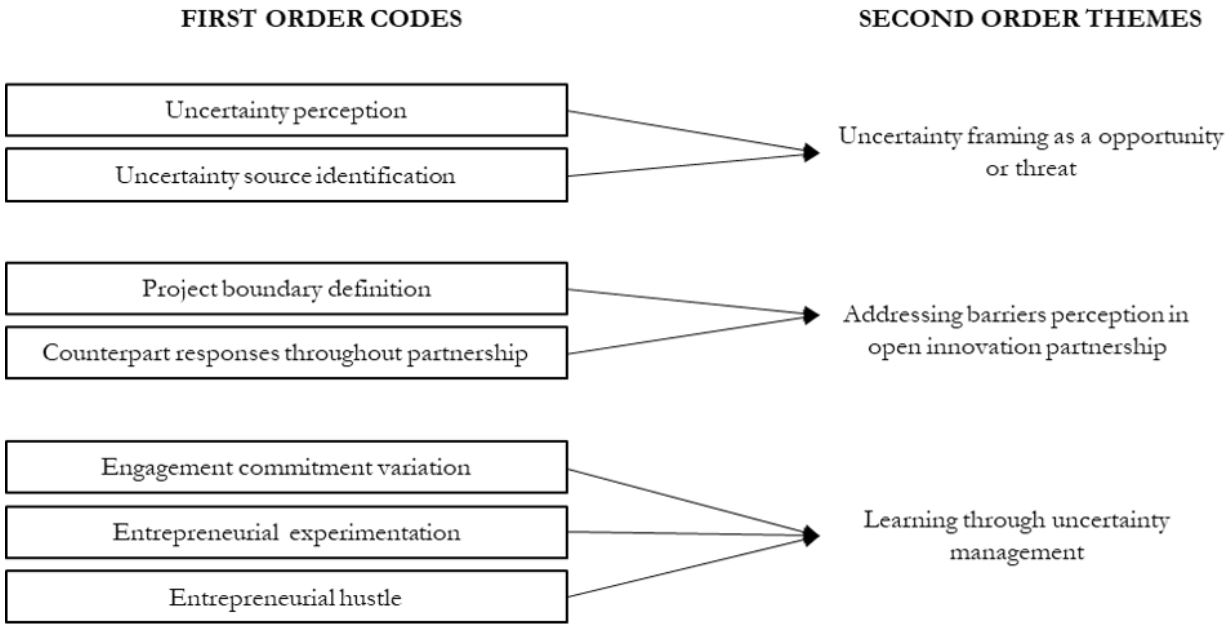
Project	Startup ID	Corporation ID	Project type	Number of interviews	Startup stage
Project 1	Gardênia	Jacarandá	Market and technical validation	2 (entrepreneur)	Growth stage
Project 2	Tulipa	Cambucá	POC	2 (manager)	Early stage
Project 3	Tulipa	Cambucá	Comercial contract - MVP	1 (manager)	Growth stage
Project 4	Amarílis	Sapuva	New product development	2 (entrepreneur)	Seed
Project 5	Azaléia	Seringueira	POC	2 (entrepreneur)	Seed
Project 6	Azaléia	Grumixama	POC	1 (entrepreneur)	Early stage
Project 7	Calêndula	Aroeira	Technical validation and prototype	2 (entrepreneur)	Seed
Project 8	Astromélia	Jacarandá	POC	2 (entrepreneur)	Seed

Source: The authors (2023)

Entrepreneurial Learning Stream

The focus of this research is to explore the learning processes of entrepreneurs in contexts of perceived uncertainty. In this research, the methodological alignments provide rigor to the analytical process by blending two methodological devices: the use of Glaser & Strauss's Grounded Theory emergent data coding (Creswell, 2014) and structured data analysis based on the Gioia Method (Gioia et al., 2013). One of the main challenges of this type of approach, honoring its process specificity, is to encompass not only a sequential description of events but also to increase the complexity in the analysis of multiple cases. As a strategy, we will incorporate the methodological recommendation of Abdallah et al.(2019), which suggests analyzing the cases in parallel using the same narrative alignments, supporting the process with illustrative data for each case. For this, timelines will be built for each project, reflecting the most relevant events of each case. Once the cases were mapped, the inductive coding process began. This process resulted in the coding tree (Figure 1). Three second-order themes emerged from the data analysis in order to explore the patterns by which entrepreneurs manage uncertainties and learning during startup and corporate partnerships: Uncertainty framing as an opportunity or threat, Learning through uncertainty management, and Alignment/misalignment in front of uncertainty management responses.

Figure 1 – Coding tree



Source: The authors (2023)

Results

This section is structured by following the three second-order themes that emerged from the data analysis, in order to explore the patterns by which entrepreneurs manage uncertainties and learning during startup and corporate partnerships.

Uncertainty Framing as an Opportunity or Threat

The uncertainty framing as an opportunity or threat, in the analyzed collaboration type between startups and large firms, is composed of two micro-foundations: uncertainty perception, and uncertainty source identification.

During entrepreneurs' daily life, the decision-making process is capital to be able to judge and identify which goals and investments are feasible, and what kind of strategies should be taken in order to improve understanding of how to capture value more efficiently. In entrepreneurship, the core of the decision process is made in a condition of uncertainty perception. Innovation projects with a more radical nature have, intrinsically, difficulties in clearly defining the paths to be followed in order to achieve project success. In this way here, we define uncertainty perception as a cognitive perspective, where the lack of information makes it impossible for decision-makers to know neither the possible outcomes nor the probability of occurring when a decision is made (Alvarez et al., 2018).

For example, uncertainty could emerge from the venture of implementing a new category of product in a market. The entrepreneur of startup Amarilis (project 4) founded the firm in 2020. Since then, they have been working on developing technologies for food with functional ingredients for companies. Nowadays, there are developing technologies related to the development and elaboration of vegetal

functional foods, adding probiotics. In the United States market, we can label that we want vegetable yogurt. In Chile, this concept cannot be used because we use food based on probiotic food, for example, within a commercial brand that also refers to what it is, yogurt, but we cannot declare that it is a yogurt like in the United States. Then the product that would be sold as yogurt can not be sold as a yogurt. Consequently, the partnership with the main corporation would be made in another industry than expected. It awakened a situation where decision-makers can't know the future of the product in the market.

Not only is the perception of uncertainty affected but also the source of uncertainty is not clear. See that in the startup report above, what was initially an opportunity (new probiotic food such as yogurt) quickly became a threat of making the company's sales unfeasible (due to not being able to place the product in the yogurt category). The source did not come from a technological source but from a regulatory source

The entrepreneur of Project 8 also reports this change in the perception of uncertainty coming from an uncertainty source.

> It was something super strange, but just like us, we tested it (the sensors) and nothing happened. Nothing, but nothing (was wrong with the sensors). That was rare. It was very rare. So there we started to ask and we found that was it (problems with the company's electronic connection). On the second or third day, it went off (the sensor that measured the vibrations). In fact, strange things happened. We couldn't enter the system (which recorded the temperature and vibrations of the machines) and that was rare. And then, suddenly, we started to ask if there were cuts of light. And of course, there we said (the collaborators): there were many light cuts. (Mike, entrepreneur project 8)

The technology developed in the laboratory was treated as a solution to take advantage of a significant market opportunity. However, the difficulties of implementing the production process in the local infrastructure increased the perception of threat in the face of uncertainty. It means that the path of innovation raises new uncertainty sources in the startup trajectory. Innovation projects with a more radical nature have, intrinsically, difficulties in clearly defining the paths to be followed in order to achieve project success. See the situation of Project 7.

> So it is very difficult and all the information that is handled is not there in the IT area, it is not in the MEL servers, it is in different parts and different software. Then we realized that, for us to work with the data, we had to order the data. And we lost a lot of time, -we didn't waste a lot of time-, but we took up a lot of time, in the first phase of the project, which is ordering the data: ordering the data in such a way that I could use it. (Peter, Project 7)

Then the microfoundations of uncertainty perception and uncertainty source identification promote in the entrepreneur an uncertainty frame of opportunity and thereat when establishing a partnership with corporations

Addressing Barriers Perception in Open Innovation Partnerships

Besides uncertainty perception, the partnerships with corporations are circumscribed by barriers perceptions from project boundary definition, counterpart responses throughout the partnership, and engagement commitment variation.

The first barrier is the project boundary definition. The lack of sufficient internal capabilities within large companies to understand the development of products or processes with a significant degree of innovation generates problems in defining the scope and limitations in delimiting the scope of the project. Negotiations between both parties during the project, without compromising its viability, can be significantly influenced by unmitigated uncertainties. An example of this is what happened in Project 4, where a vegan probiotic drink was developed, but with the important challenge of not including preservatives. This project had as its principal counterpart a leading company in the field of fruit exports, where although they had a consolidated R&D area, the lack of technical skills within the large

company's team permanently made it difficult to clearly define the scope of the project.

> But the last one had to do precisely with the topic of preservatives, which would make the supply chain much more difficult. What was the main difficulty that came out? We finally thought that the proposal that we made with them was: ok, better to avoid that there are problems here of microbiological growth, what could mean the decrease or the partial or complete loss of the load of yogurt... Finally, the answer was returned to us after a couple of days, after reviewing this initial proposal, and we were told that it was not, because the truth is that they did not want to absorb this production process and preferred to outsource it. (Jordan, entrepreneur Project 4)

The identification of uncertainty and the decision to mitigate it or not can generate significant difficulties in understanding between the parties, which, as evidenced in Project 4, created situations where the possibility of unilaterally closing the project was contemplated. Competencies within an organization are a critical resource for stability during the execution of more radical innovation projects.

Furthermore, the counterpart responses throughout the partnership are other situations that could create barriers. Tensions are evident when changes are trying to be implemented in organizations where there are beliefs related to previous experiences working with startups. End users' expectations about the usability of the proposed solution can form resistance to commitment to the success of the project. Limiting beliefs related to the usefulness of the tool can create friction that eventually jeopardizes the success of the project. The lack of knowledge about more disruptive technologies presents itself as a fertile space to turn a lack of technical knowledge into a threat to the exercise of tasks in the workday of end users. This type of situation is illustrated in Project 5, where the informant Roger (founder of the startup Azaleia) had to invest efforts in constantly confronting negative criticisms about the implementation of a platform for locating construction works, which was not only technologically feasible but also adjusted to current legal regulations.

> No, the other way around. We already offered without these contacts from the beginning. So, like this, I told them the following: Look, do you know that the address of the work is this, do you have the phone number publicly on the platform? No, it doesn't. You need to hit the work and try to sell in the field. But selling in the field didn't make sense to them) the collaborators said) (Roger, entrepreneur Project 5)

In the case of Project 5, was carried out within the scope of an open innovation contest, where the startup Azaleia developed a POC in a set of Seringueira franchise stores, a company focused on the sale of construction materials for small works. Although the focal point within the large company was the owner of the set of stores, the uncertainties of resources derived from the implementation of the solution constituted inputs that would lead to the decision to pivot in the startup's business model, modifying the segmentation of customers and the strategy of delivering value through the platform.

Finally, the engagement commitment variation. Startups that establish partnerships with large companies often face difficulties of different natures, therefore managing the expectations between each of the parties is essential to achieve the objectives of the joint venture, as well as to improve their business model by pursuing scalability. Corporations, in turn, are often trapped by their intrinsic complexity in order to be willing to permeate their borders and allow the entry of new solutions to the different pain points of the company. One of the scenarios that can arise, for example, is a mismatch between the inherent need for resources of startups, with the rigidity and organizational inertia of corporations, which constitutes a source of uncertainty when reaching the different stages of planning, execution, and joint project control. A good example can be seen in Project 1, between the startup Gardenia and the corporation Jacarandá. Gardenia is a biotech specializing in the production and scalability of microorganisms, while the company Jacarandá is one of the most important players in the production and sale of meat products.

> And I also told them, well, really, if I get a validation and I get an enzyme that's optimized for me, that's patent. Then there is also the moment when the company assesses how much the company is worth. We, the convertible bonds, in the convertible bonds contract, will put a cap, a very high cap value of the company, because there is a

> probability that we already have the patent right. (Joana, entrepreneur Project 1)

The initial approaches between the two parties were promising to establish ambitious objectives in the prospection of joint projects, but when it came to realizing and formalizing the commitments made, the corporation's organizational rigidity surprised the entrepreneurs and had ramifications in the level of commitment to the partnership already established.

In this way, uncertainty learning faces the barriers of project boundary definition, counterpart responses throughout the partnership, and engagement commitment variation.

Learning Through Uncertainty Management

The last category is learning through management, which happens by uncertainty management through experimentation and entrepreneurial hustle.

In partnership with corporations, learning starts with applying uncertainty management through experimentation. Entrepreneurs must face significant challenges to improve their business model by incorporating new knowledge. In innovation project management, decision-makers must constantly define which approaches will be defined in order to cope with the lack of information in the context of project execution. The experimentation happens through trial and error. It treats about learning incorporation through searching for new information, concomitant to adjusting the activities and scope to fit with that.

For example, Project 3 was an initiative executed by Tulipa startup, which was a commercial contract related to a collaborative picking system development using ARM technology, having as a client a transnational corporation from packing transportation. Here, due to the corporate bureaucracy institutions, they had important difficulties establishing and maintaining the scope of the project: critical information was not available to access even for corporate managers.

> So, the employee needs to receive this information. We made the project and the contract was signed with a cell phone as the device. So we did the development using an Android platform. OK. However, when we went to do it after the contract was signed . . . the international team put a limitation on us. They said: you cannot use a cell phone in this operation, it is not a device that meets the company's information security standards. For almost all of the clients we had, in this first wave of projects last year, almost all of them, we had to redefine the scope in the IT area . . . to be able to define the technology to be used, which device to use. Because it is, in fact, something very on the edge, on the frontier of development. (Denver, entrepreneur Project 3)

Facing this situation, the decision-makers decided to start testing hypotheses related to the technological issues of the project.

However, the learning happens through entrepreneurial hustle, too. Identifying the uncertainty nature is significantly important to determine the ways in which the decision-makers are able to cope with it and mitigate the effects of this lack of information. Entrepreneurs need to act under conditions of uncertainty and resource constraints, sometimes they elaborate urgent, unorthodox actions for addressing threats and take advantage of potential opportunities. In this regard, Mike (Astromélia startup co-founder) identified that financial autonomy was a key issue in front of collaboration projects with large firms. As a response, he decided to create an alternative by which he could be able to mitigate uncertainties within the project, as well as not compromising future earnings related to the partnership. Even when this path had lying as a component, he decided to follow that alternative in front of the contingency.

> We decided to propose a free pilotage. They asked us why. We decided: we preferred to say that we had the money. And it is because after these companies, as they are part of your development… for the negotiation they will use everything that has already contributed to the project to your solution to reduce the cost of the solution for them and for us and it is not profitable. Because they are all used for the final negotiation… Yes, because they are evidently like that. In an intelligent way we have added it as co-creators, but in an intelligent way, not to say it

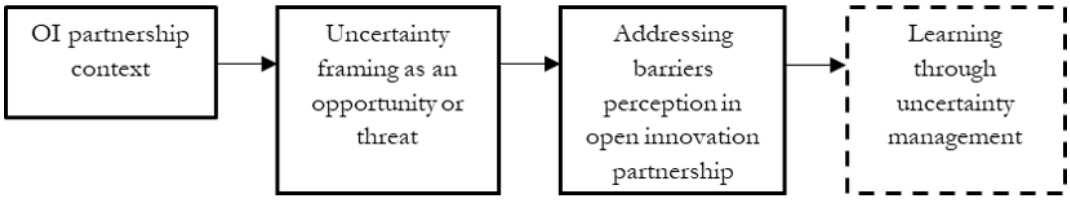
> explicitly . . . we have asked questions. But for example, sometimes you have a very big question. (y les dices): but only to validate, is this like that? (someone responds to you) Yes, of course. Oh yeah. And thanks. It could be something very important for you. But we manage it (before them) as if it were trivial. (Mike, Project 8)

This example highlights how an entrepreneur found a way to increase the possibility of achieving better conditions in future negotiations. This action, as he assumes, is not necessarily a common way to acquire valuable information and knowledge from de corporation, in order to cope with technical uncertainties. They realize that this is an "intelligent way" to be cautious in front of a potential interest conflict when the project is finished. In sum, experimentation and entrepreneurial hustle combine to allow uncertainty learning.

Discussion

The article aimed to explore the process by which entrepreneurs cope with the tensions and consequences of perceived uncertainty during partnerships between startups and large firms. The findings synthesized in our final framework of uncertainty learning (see Figure 2) show that is composed of three stages: uncertainty frame, barriers perception, and learning process. It shows that entrepreneurs, in the context of the development and execution of more radical innovation projects and with a high component of co-creation between both parties, face varied situations in which they must face challenges related to uncertainties originating from different dimensions, understanding uncertainty as the impossibility of predicting the potential results of a certain action. Considering that an important factor in the development of the startup -as a company in constant change- is the learning process, in the way in which the entrepreneurs will gradually improve their business model.

Figure 2 – Entrepreneurial learning through coping with uncertainty



Source: The authors (2023)

In the first place, the uncertainty framing as an opportunity or threat is related to the cognitive process by which the entrepreneur identifies the impossibility for decision makers to know neither the possible outcomes nor the probability of occurring when a decision is made (Alvarez et al, 2018). In other words, uncertainty perception phenomenon. This finding is linked to the cognitive perspective of entrepreneurial action under uncertainty (Packard & et al., 2017; Griffin & Grote, 2018; Emami et al., 2020), where entrepreneurs select thoughts and knowledge available at the time of having to make decisions (Shackle, 1961 cited in Packard, Clark & Klein, 2017). After this cognitive process, in the context of an open innovation partnership, the entrepreneur needs to identify the source of uncertainty (i.e. technological, resources, organizational, or related to the market) (Rice et al., 2008). In this way, the agent begins to decide whether, in a context of opportunity or threat uncertainty, it is or is not mitigable (Packard & Clark, 2020), depending on how critical the uncertainty is for the development of the project, access to information, and the individual preferences of the decision maker.

The opportunity and threat frame of uncertainty predisposes the entrepreneur to move forward or not in the partnership. At this stage, the perception of the barriers to open innovation. This perception is conditioned by whether or not the project boundaries are defined. As well as the engagement commitment of the corporations in the partnership. It is not something trivial, as action plans that

reflect a plausible degree of certainty often do not correlate with the trajectories of innovation projects with a more radical component (Rice, 2008). In innovation projects with a significant degree of uncertainty, they face challenges from different sources, which compromise counterpart responses. These problems can be derived from gaps in scientific or technological knowledge of the implemented solution, little clarity, and understanding of customer needs and their ability to appropriate technology, or an organizational culture that is resistant to commitment to innovation. In this way, this uncertain set of definitions of the project limit, the response, and the engagement of the counterpart form the perception of barriers in the uncertainty management process of startup entrepreneurs.

Having formed the perception of uncertainty and barriers, the entrepreneur moves towards learning management. The learning through uncertainty management shows that entrepreneurial learning addresses the skills relevant to the successful ideation, creation, management, and operation of a business (Wang & Chugh, 2014). Open innovation partnerships constitute the variety of contexts by which learning can take place (Haneberg, 2019) through entrepreneurial experimentation and hustle. As was shown in the projects analyzed in the past section, for some decision makers, lack of knowledge is understood as a way to try different pathways in order to achieve the success of the project (experimentation). Depending on the startup's maturity level, a perceived uncertainty within the project may be assumed as an opportunity for gaining experience and knowledge that may tax to improve their business model (hustle)

Our framework illustrates how the perception of uncertainties of entrepreneurs is shown in different dimensions, but also addresses cognitive and, at the same time, behavioral aspects. A critical element for the growth of startups is the incorporation of knowledge that allows them to improve the way they deliver, capture, and create value. However, in contexts of open innovation partnerships, complexity increases when there are differences between counterparts regarding the level of collaboration or cooperation in the project, or excessive control over the decisions made in the project, openness in knowledge sharing, expectations about technology, and as possible future actions together, among others.

Final Considerations

This article contributes to the current literature on two key aspects: the systematization of entrepreneurial action under uncertainty, and the enhancement of the cognitive perspective on uncertainty in entrepreneurship.

Firstly, the article provides a comprehensive systematization of entrepreneurial action under uncertainty, particularly in the context of startup-corporation partnerships. Prior research has explored how entrepreneurs make decisions and take action in uncertain environments (Alvarez et al., 2018; Townsend et al., 2018; Shepherd et al., 2015), but often treated these processes in isolation. Our study advances the field by presenting an integrated model that illustrates the interaction between uncertainty framing, barrier perception, and learning processes. This model builds on and extends previous work on entrepreneurial decision-making (Packard & Clark, 2020; Reymen et al., 2015) by specifically examining how entrepreneurs navigate the complexities of open innovation partnerships.

The framework we propose demonstrates how entrepreneurs frame uncertainty as either an opportunity or threat, identify and address barriers in open innovation partnerships, and engage in learning through uncertainty management. This approach provides a more nuanced understanding of entrepreneurial action under uncertainty than previous models. For instance, while Rice et al. (2002) identified four categories of uncertainty, our study shows how these categories interact and evolve throughout the partnership process. Furthermore, our findings extend beyond the dichotomy of planning-based versus flexible approaches to uncertainty management (Mansoori & Lackéus, 2020) by illustrating how entrepreneurs dynamically combine different strategies based on their evolving

perceptions and experiences.

Secondly, the article enhances the cognitive perspective on uncertainty in entrepreneurship. Previous work has examined how entrepreneurs perceive and interpret uncertainty (Packard et al., 2017; Griffin & Grote, 2018; Emami et al., 2020), but often treated it as a relatively static phenomenon. We highlight the dynamic nature of uncertainty perception, showing how entrepreneurs continuously reframe uncertainty as either an opportunity or threat based on their experiences and learning. This aligns with and extends the work of McKelvie et al. (2011) on the unpacking of the uncertainty construct in entrepreneurial action.

The results reveal how entrepreneurs identify and categorize different sources of uncertainty, contributing to a more nuanced understanding of the cognitive processes involved. This builds on the work of O'Connor and Rice (2013) on uncertainty associated with radical innovation, extending it to the specific context of startup-corporation partnerships. Our findings suggest that entrepreneurs' cognitive processes for managing uncertainty are not fixed but adapt based on the specific challenges and opportunities presented by these partnerships. It sheds light on the role of entrepreneurial learning (Wang & Chugh, 2014; Cope, 2005) in shaping uncertainty perceptions and responses. We show how learning processes interact with uncertainty management in the context of open innovation partnerships.

From a practical standpoint, this research offers insights into open innovation partnerships between startups and large corporations. We observe the challenges and opportunities of such collaborations (Weiblen & Chesbrough, 2015; Usman & Vanhaverbeke, 2017), but these studies provided limited guidance on how entrepreneurs can effectively navigate uncertainty in these contexts. Our findings suggest practical strategies for entrepreneurs to manage uncertainty, such as actively framing uncertainties, identifying potential barriers, and leveraging learning opportunities through experimentation and entrepreneurial hustle.

These insights can help entrepreneurs better prepare for and adapt to the challenges of collaborating with large firms, potentially improving the success rates of open innovation initiatives. For instance, our article highlights the importance of entrepreneurs developing strategies to frame uncertainty as an opportunity, even in the face of challenges. It also emphasizes the value of experiential learning and adaptive approaches in managing uncertainty, which aligns with but extends beyond the concepts of effectuation (Sarasvathy, 2001) in entrepreneurship. Finally, our findings have implications for how large corporations approach partnerships with startups. By understanding the uncertainty management processes of entrepreneurs, corporations can create more supportive environments for these partnerships, potentially leading to more successful collaborations.

Future research could build on the framework suggested here and explore how these processes evolve over time and across different types of partnerships or industry contexts. In addition, researchers could investigate how the balance between opportunity and threat framing shifts throughout the partnership lifecycle and how this impacts entrepreneurial decision-making and outcomes. Also, future research could explore the factors influencing these cognitive processes, such as individual differences, prior experiences, or contextual variables. Additional efforts could also investigate how entrepreneurs' cognitive approaches to uncertainty evolve over time and how this evolution impacts the success of their ventures and partnerships.

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