administrative sciences

MDPI

Article

Innovative Behavior in Startups: An Empirical Study

Marisa Leal, Carmem Leal and Rui Silva *

Department of Economy, Sociology and Management, University of Trás-os-Montes and Alto Douro, 5001-801 Vila Real, Portugal; marisautad2022@gmail.com (M.L.); cleal@utad.com (C.L.)
* Correspondence: ruisilva@utad.pt

Abstract: Considering the SECI model, which emphasizes a modern conception of knowledge management, the main objective of this study is to understand how the socialization, externalization, combination, and internalization (SECI) dimensions can influence innovative behavior within organizations. The quantitative method was adopted, carrying out a descriptive-correlational study in which 247 individuals participated. For data collection, a questionnaire was used. Their analysis was performed using SPSS software. The results show that of the four dimensions of the SECI model, only three have a positive influence on innovative behavior: externalization, combination, and internalization. This study highlights the importance that the SECI model has in understanding knowledge generated by companies/organizations, in particular, startups. It is possible to state that this model is extremely important to understand innovative behavior in startups, but also issues related to entrepreneurship, thus rendering this study into a guiding reference for companies.

Keywords: innovative behavior; startups; social capital theory; co-incubation theory; SECI model

1. Introduction

Currently, the business environment is not only dynamic but has also become increasingly competitive, and through this scenario, organizational performance has gained prominence within the scope of the implementation of measures aimed at ensuring competitiveness and sustainability (Muthuveloo et al. 2017). At the same time, innovation also emerges as an important factor in facing competitiveness, with employee knowledge management being a key strategy for organizational performance (Muthuveloo et al. 2017). Therefore, knowledge appears to be prominent today, being the key to business development, innovation, and problem-solving (Flor et al. 2022), especially because the specific knowledge of the profession and the combined experience and skills associated with and possessed by individual employees are key resources on which companies rely to differentiate their operations from those of their competitors (Guo et al. 2018).

According to Duan and Jin (2021), knowledge corresponds to a dynamic structure in which information can be stored, processed, and understood. And it is precisely the ability to create and apply new knowledge that is recognized today as one of the main sources of competitive advantage for an organization (Martín-de-Castro et al. 2008). However, it is also important to emphasize that it is not just the creation of knowledge that matters, but the transfer and sharing of knowledge are equally important. Incidentally, two major areas of organizational learning are precisely the creation and transfer of knowledge, where the SECI model emphasizes the interaction between explicit knowledge and tacit knowledge as the basis of knowledge exchange (Chatterjee et al. 2018). And for this to happen, collaboration is necessary not only between organizations, but also between organizations and university institutions, since, as Duan and Jin (2021) verified in their study, collaboration exerts a direct and indirect influence on the process of creation, as well as on the process of knowledge transfer and conversion. Similarly, Zhang and Huang (2020) recognize the importance of studying and understanding the flow and exchange of knowledge across the organizational frontier. Therefore, starting from the clear demonstration of the continuous cycle of creation

Citation: Leal, Marisa, Carmem Leal, and Rui Silva. 2023. Innovative Behavior in Startups: An Empirical Study. *Administrative Sciences* 13: 256. https://doi.org/10.3390/admsci13120256

Received: 23 October 2023
Revised: 20 November 2023
Accepted: 4 December 2023
Published: 12 December 2023

and transformation of knowledge within an organization provided by the SECI model, the authors presented a revised model of creation and conversion of knowledge which intends to provide managers with a clearer vision of the knowledge creation and sharing opportunities within and between organizations based on inter-organizational knowledge flow and open innovation principles (Zhang and Huang 2020).

In fact, given the importance that knowledge currently assumes, several theoretical models have emerged, and there is a vast body of literature that seeks to test the processes of knowledge creation (Martín-de-Castro et al. 2008). It has been more than two decades since the development of organizational knowledge creation, and several management theorists have contributed to the evolution of knowledge management (Inuzuka 2010).

In the present study, the focus is particularly on the SECI model (an acronym for socialization, externalization, combination, and internalization) which translates the process of creating organizational knowledge (Sasaki 2017). In other words, SECI, a model developed by Nonaka and Takeuchi (2008), describes the processes involved in creating and sharing knowledge within an organization through a spiral process of socialization, externalization, combination, and internalization, and the dynamic interaction between tacit knowledge and explicit knowledge (Li et al. 2009).

Because of the above, and considering the SECI model, which presents a modern conception of knowledge management with emphasis on the subjective nature and relativity of the concept of knowledge (Bartolacci et al. 2016), the main objective of this study is to understand how the socialization, externalization, combination, and internalization dimensions can influence innovative behavior within organizations.

2. Literature Review

2.1. Social Capital Theory

According to Woolcock (1998, p. 155), social capital is 'a broad term that encompasses the norms and networks that facilitate collective action for mutual benefit'. And as far as social capital theory is concerned, this perspective translates the idea that social networks, norms, and trust within a society can be considered a valuable resource, similar to physical or financial capital.

Within the scope of social capital theory, it is interesting to refer to the conceptual approaches of theorists such as Bourdieu, Coleman, and Putnam, given their important theoretical and conceptual contributions.

In Bourdieu's view, social capital consists of a capital of representation, a symbolic capital, accumulated and reproduced in various ways in social classes (Siisiainen 2000).

From Coleman's perspective, which came to integrate the social relations of other groups (Schuller et al. 2000), social capital deals with aspects of the social structure that stimulate social action (Adam and Roncevic 2003). In his approach to social capital, Coleman (1988, p. S101) highlights relationships based on loyalty and trust that can generate and fulfill expectations as useful capital resources for individuals. As Silva (2008, p. 73) explains, contrasting Bourdieu's and Coleman's perspectives on social capital, (Luiz Coradini 2010) while Bourdieu is more concerned with issues of the willingness to acquire, maintain, and transmit the social capital that generates recognition and representation, being, therefore, symbolic capital, Coleman is more interested in how social capital can become a resource in social structures, which can be used (like other forms of capital) for individuals to achieve certain goals/interests. On the other hand, both Coleman and Bourdieu underscore the intangibility of social capital, compared to other forms of capital.

Putnam (1993), because of Bourdieu's and Coleman's studies, understands that social capital comprises the characteristics of social life, such as relational networks, norms, and values, and that these characteristics allow its participants to act together and more effectively to achieve collective objectives. In this line of thought, social capital translates into the characteristics of social organizations that contribute to the formation of the community.

Social capital can take many forms, such as shared values and beliefs, strong and positive relationships, and a sense of community engagement and civic participation. And

in the field of management, social capital theory 'provides a powerful basis for understanding the creation of intellectual capital and the nature of organizational advantages, given that companies are more endowed with social capital than the market as an institutional arrangement. To build this argument, the authors are based on a wide literature, emphasizing the results of several previous empirical studies that corroborate the argument, therefore supporting themselves on positivist principles' (Nahapiet and Ghoshal 1998; cited by Melo et al. 2015, p. 156).

Theory suggests that social capital can lead to positive outcomes for individuals and communities, including better communication and cooperation, better access to resources and opportunities, and increased social and economic well-being. As Tsai and Ghoshal (1998) note, social capital encompasses several aspects of a social context, namely, social ties, trust relationships, and value systems that facilitate the actions of individuals inserted in that context.

Therefore, social capital theory highlights the value of social networks, relationships, and social structures, where social capital, a clear example of tacit knowledge, is, like financial capital, essential for the success of an organization so that individual, collective, and organizational objectives are achieved (Nishihara 2018).

Now, the focus turns to another theory that emphasizes the importance of collaboration and joint work among organizations for the creation of knowledge and the success of companies.

2.2. Co-Incubation Theory

Currently, when talking about topics such as entrepreneurship, innovation, and startups, it is inevitable not to talk about business incubators, because business incubators enable the existence of an environment particularly designed to promote and encourage innovation and entrepreneurship (Guillen and Veras 2018).

Business incubators can be defined as a tool for economic development whose main objective is to help create new businesses by providing support services (for example, assistance in developing business plans, marketing, training of promoters, raising capital, and access to various more specialized services), flexible space, shared equipment, and administrative services (Sherman and Chappell 1998).

According to Liechtenstein and Lyons (1996, p. 11), the main purpose of the business incubation process is 'to assist entrepreneurs in the formation and development of new companies to ensure their survival and success'. For this very reason, during the incubation process, the company is monitored by the incubator team, which intervenes in the sense of organizing it at the management level, with the main purpose of increasing its chances of success and presence in the market (Moreira 2002). Similarly, Aernoudt (2004) notes that the business incubation process is interactive and aims to encourage and support the creation of businesses and the development of innovative products, providing physical space, management support, access to financing, legal advice, expertise, and access to new markets. In summary, business incubators are promoters of entrepreneurship and innovation, constituting a tool for the development of new businesses and companies and, at the same time, stimulating job creation and the generation of value/wealth (Hamdani 2006) and trade academic activity (Bollingtoft and Ulhoi 2005).

Considering the above, the theory of co-incubation refers to the concept of incubating or promoting companies that are at the beginning of their activity in collaboration with other organizations. Co-incubation theory is widely used in the context of startup incubators, providing guidance, resources, and networking opportunities to help new companies get started. In this way, incubators must provide five types of services, namely: access to physical resources; administrative support; access to financial resources; business support for new companies (startups); and access to networks (Carayannis and Zedtwitz 2005).

Just as Duan and Jin (2021) recognize the importance of joint work based on collaboration between different organizations for the creation, transfer, and conversion of knowledge, the OECD—Organisation for Economic Co-Operation and Development—(OECD 2004)

also states that the rapid development of business and technology incubators across all OECD countries over the past 10 years highlights the governmental and non-governmental efforts being made to reduce the obstacles that entrepreneurs face at an early stage. And for this to happen, collaboration is necessary between organizations and even between organizations and university institutions, governmental and non-governmental organizations, insofar as, as Duan and Jin (2021) verified in their study, collaboration exerts influence, direct and indirect, on the creation process and also the transfer and conversion process of knowledge.

In conclusion, by working together, these organizations can share resources, knowledge, and experience, and also provide a more comprehensive support system. For this very reason, within the scope of the co-incubation theory, incubation refers to co-creation, where the construction of a joint sphere of interaction and mutual influence between the incubation parts is a key management activity (Eriksson and Voutilainen 2014).

2.3. SECI Model: Socialization, Externalization, Combination, and Internalization

The SECI model, also known as the 'knowledge creation process', is a framework developed by Nonaka and Takeuchi to explain how knowledge is created and shared within organizations. That is, this model assumes that knowledge creation in organizations takes place through continuous and dynamic interaction between explicit knowledge and tacit knowledge, where four modes of knowledge conversion, that is, four conversion processes are responsible for this interaction: socialization; outsourcing; combination; and internalization (Nonaka and Takeuchi 1997).

This model assumes itself as the most recognized conceptual structure to understand the knowledge generation processes in organizations, considering this as a dynamic process, in which the continuous dialogue between tacit and explicit knowledge generates new knowledge, amplifying it at different ontological levels: single; organizational; and inter-organizational (Farnese et al. 2019).

In fact, the model proposed by Nonaka and Takeuchi considers the processes that are at the origin of knowledge, based on Polanyi's (1967) classification regarding the coexistence of two types of knowledge—tacit and explicit—which are illustrated with the metaphor of the iceberg.

Considering the SECI model, knowledge is created through the permanent interaction between tacit and explicit knowledge. Tacit knowledge corresponds to knowledge based on experience and, for this reason, is difficult to articulate in written documents (Richtnér et al. 2014). For this reason, despite the difficulty in explaining what tacit knowledge is in formal language, since it is subjective knowledge, it can be defined as personal knowledge based on the individual's experience and including intangible factors such as beliefs, personal values, projects, and systems of values (Lievre and Tang 2015).

In turn, explicit knowledge can be documented and expressed (Richtnér et al. 2014), and that, in the iceberg metaphor, corresponds to the visible part. It is objective, easily and formally transmitted knowledge, expressed through grammatical propositions, mathematical expressions, technical specifications, and books (Lievre and Tang 2015).

According to Nonaka et al. (2008), knowledge emerges through the conversion of tacit knowledge into explicit knowledge, and of explicit knowledge into tacit knowledge. This is because, as the authors point out, the tacit knowledge possessed by individuals is externalized and thus transformed into explicit knowledge so that it can be shared with others and enriched by their individual points of view to become new knowledge. It is then internalized once again by a larger number of individuals as new, richer, and more subjective knowledge that becomes the basis for initiating another new cycle of knowledge creation (Nonaka et al. 2008).

The SECI model evolves along four stages, which translate into four modes of knowledge conversion that are caused by the process of changing from tacit knowledge to explicit knowledge or from explicit knowledge to tacit knowledge (Nonaka 1994): socialization; outsourcing; combination; and internalization.

The processes mentioned are characterized as a continuous cyclical process (Roque et al. 2018), where knowledge creation takes place and starts from the socialization process, undergoing a conversion, and forming a spiral (Nonaka and Takeuchi 1997), as represented in Figure 1.

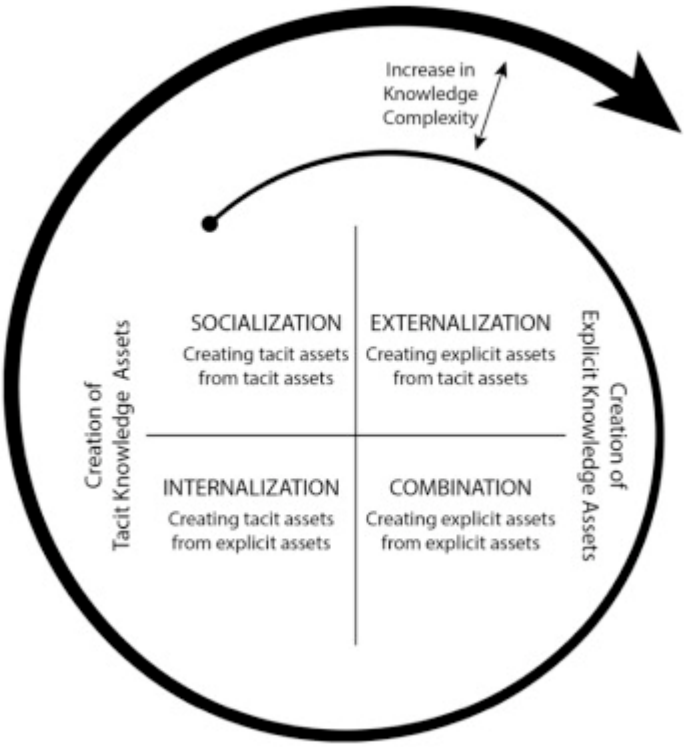

Figure 1. SECI model (Nonaka and Takeuchi 2008, p. 24).

The SECI model is extremely important for organizations, as it helps them to understand how knowledge is created and shared within the company and how it can be used to drive innovation and growth. In other words, it is helpful for startups to understand how their team can create, share, and use knowledge effectively to drive innovation and growth (Nonaka 1994; Nonaka et al. 2008) In this respect, Martínez-Martínez et al. (2015) note that socialization, externalization, combination, and internalization continue to be key processes for the creation of knowledge that allows organizations to successfully face environmental challenges. Also, Canonico et al. (2019) emphasize the fact that socialization and combination play a fundamental role in the management of knowledge in the organization.

The SECI model assumes as a premise 'that human knowledge is created and expanded through the social interaction between tacit and explicit knowledge' (Takeuchi and Nonaka 2008, p. 59). In other words, this model addresses 'the dynamic process in which explicit and tacit knowledge are transferred and transformed and promotes understanding of the dynamic nature of knowledge creation' (Roque et al. 2018, p. 4) (Table 1).

Table 1. Summary of the conversion models between tacit knowledge and explicit knowledge (Nonaka and Takeuchi 1997, p. 81).

	Tacit Knowledge	**Explicit Knowledge**
Tacit Knowledge	Socialization	Externalization
Explicit Knowledge	Internalization	Combination

The SECI model highlights socialization, externalization, combination, and internalization as stages or modes of knowledge creation (Rusland et al. 2020).

Socialization translates into the conversion mode that can be seen as the starting point for the complete process of knowledge creation, characterized by the interaction between

individuals, who communicate with each other without the need for codes or explicit forms for the message (Sampaio et al. 2014). It is the process of sharing tacit knowledge or knowledge that is difficult to put into words, through interactions and experiences with other people. This stage depicts the transformation of tacit knowledge, instigated between people, into tacit knowledge and that is why it is also known as shared knowledge, which is transformed by visualization, questions, and perception (Junior and Yu 2017). As Oliveira (2015, pp. 23–24) explains, 'sharing and creating tacit knowledge through mental models and direct experiences between individuals, is the relationship of tacit knowledge to tacit knowledge. Personal experiences that occur in an organization such as brainstorming, master-apprentice relationship, or even that 'coffee talk' are examples of socialization'. This is because, as mentioned earlier, tacit knowledge depends on the context, being complex, idiosyncratic, and ambiguous, and for this to be acquired, it is necessary to share experiences through carrying out joint activities in the socialization process, for example, the relationship between mentor and mentee (López-Sáez et al. 2010). By sharing tacit knowledge, individuals can learn from each other and develop new insights that can culminate in innovative solutions to problems, or new ideas for products or services. Socialization can also facilitate the development of consolidated relationships based on trust between individuals, which can be important to foster a culture of innovation. When individuals feel comfortable sharing their ideas and perspectives with others, they are more likely to engage in creative thinking and take risks.

Externalization corresponds to the step of the SECI model that implies transforming tacit knowledge into explicit knowledge (Wu et al. 2010); therefore, it refers to the expression of tacit knowledge and its conversion into explicit forms, for example, by preparing documents (Latino et al. 2016; Vaccaro et al. 2009). That is, through externalization, tacit knowledge is transformed into explicit knowledge through documentation or verbalization (concepts, images, and written documents), which can be shared with other group members (Farnese et al. 2019; López-Sáez et al. 2010; Sasaki 2017). However, this step depends on the need to convert tacit knowledge into explicit knowledge and the incentive to make it available to other co-workers (Hong 2011).

Combination is the third step of the SECI model and consists of the 'process that connects discrete elements of explicit knowledge to make sets of more complex and systematic explicit knowledge' (López-Sáez et al. 2010, p. 695). This concerns the creation of new explicit knowledge resulting from the fusion, categorization, reclassification, and synthesis of existing explicit knowledge (Vaccaro et al. 2009). In other words, as Astorga-Vargas et al. (2017) state, 'when different parts of the existing explicit knowledge are merged to create new explicit knowledge, the process of Combining explicit knowledge with new explicit knowledge occurs, which is stored using repositories that facilitate its access'. However, it is important to clarify that operations such as the categorization, reclassification, and synthesis of explicit knowledge are neither automatic nor instinctive, so when there is no direct reference to the creation of meaning, the combination mode only describes the process of increasing the richness of information (Acar and al-Gharaibeh 2019). Therefore, blending is a basic function by which various types of documentary knowledge can be combined to create new knowledge (Scaringella and Burtschell 2015). It reflects the process of creating new explicit knowledge network structures, where individual explicit knowledge is integrated into organizational knowledge structures and which, unlike what happens in externalization, is a social process based on the communicable property of explicit knowledge (Bratianu 2011; Na-Nan et al. 2019).

Internalization corresponds to the last step of the SECI model, referring to the incorporation of explicit knowledge into tacit knowledge (organization for the individual), reflecting the idea of 'learning by doing' (López-Sáez et al. 2010; Na-Nan et al. 2019; Oliveira 2015; Sasaki 2017). That is, internalization describes the creation of knowledge within an individual (Acar and al-Gharaibeh 2019), and it is in it that what was learned with explicit knowledge is put into practice (Astorga-Vargas et al. 2017).

Internalization allows the conversion of the explicit knowledge of the organization into tacit knowledge at the individual and group level (Vaccaro et al. 2009), where knowledge is internalized through a process of integration into the already known knowledge structure (Bratianu 2011).

This is the fourth and final stage of the SECI model, ending the process of knowledge creation, where new knowledge is internalized and incorporated into the company's processes, products, and culture, that is, as Nonaka and Takeuchi (2008, p. 67) explain, 'when the experiences of socialization, externalization, and combination are internalized in the tacit knowledge bases of the individual, in the form of shared mental models, or know-how'. Therefore, internalization ends the cycle of learning how to learn (Sampaio et al. 2014).

Regarding the SECI model, and the internalization stage in particular, Li et al. (2018), when proposing a new model of knowledge creation called Gray SECI (G-SECI), studied the knowledge creation mechanism and the relationship between knowledge creation models and innovation performance during the development of complex product systems (CoPSs), and found that the internalization of knowledge through practice (KIP) is the key mode of knowledge creation, as well as the most important step for the high-end CoPS performance. The results obtained in this study also reveal that individual innovation performance is influenced by the internalization of knowledge through reflection and KIP and that organizational innovation performance is influenced by the combination and systematization of knowledge (Li et al. 2018).

2.4. The SECI Model and the Knowledge Creation Process

The bibliographical research to theoretically support the present study allowed us to find several investigations that rely on the SECI model to explain and understand the process of knowledge creation in several sectors.

In the case of Canonico et al. (2018), a study was carried out with the purpose of understanding, in the empirical context, how to obey (a Japanese concept that refers to obedience) is used to integrate knowledge and how its adoption fits into the SECI model. Inscribed in the automotive industry, the study by Canonico et al. (2018) reveals that, after applying the SECI model to knowledge creation, the concept of obedience includes the four processes described in the SECI (combination, externalization, combination, and internalization), demonstrating the complexity and dynamic nature of the model itself. Still, in the light of the same study, it was perceptible that socialization between internal and external staff has a positive impact and contributes to a better execution of the control process. The study concludes that the concept of obedience, even if it is underestimated in the literature on knowledge, can be an important tool in the four phases of the SECI model.

Another study, this time carried out in the agricultural sector, aimed to discover the opportunities for innovation and reconfigure the interaction dynamics of knowledge in the artisanal agricultural production of agave-mezcal in Oaxaca (Mexico), using emerging technologies based on the SECI model (Torres et al. 2019). According to the results of this study, the SECI model can be an added value, and in terms of the opportunities it highlights, the study emphasizes the need to follow the logic of digital performance; to develop a mobile application to provide greater interaction among employees, external agents, and other producers; and to create a mezcal tech-hub, thought of as a collaborative space, to promote interaction between producers and between producers and external agents.

Contreras-Medina et al. (2019), focusing on third-sector companies in Mexico, conducted a study in which they evaluated knowledge-creation activities by non-profit organizations from the perspective of their beneficiaries, using the SECI model to study ontological change. According to the results of this study, socialization was considered the most important aspect and externalization was the least important in the dynamic interaction of knowledge, suggesting an imbalance in the creation of knowledge, namely, in the conversion of tacit into explicit knowledge, which implies a problem, gap, or explicit barrier between nonprofit organizations and their beneficiaries.

Addressing the issue of organizational culture and giving us a different perspective, Rai (2011) relates organizational knowledge management to culture, noting that, of the six types of culture identified, the four processes of knowledge creation and conversion vary.

It is clear that several investigations study the application of the SECI model in the creation, transfer, and management of knowledge and frame it in different sectors and contexts. In this regard, Dutta and Kumar (2022) explored the processes by which knowledge creation occurs during the implementation of enterprise resource planning and how external consultants assist in its operation. The results obtained were clear, demonstrating that the external consultants help in the operationalization of the knowledge creation process through four activities that fall within the four dimensions of the SECI model: in terms of socialization, they help in solving problems using the knowledge they possess; at the outsourcing level, they provide support in the release of knowledge; at the level of combination, they help in activating the knowledge flow; and at the level of internalization, they help in the importation of knowledge. Rai (2011), in a study he carried out on knowledge creation processes at the project level, also observed, based on the SECI model, that these processes and knowledge dissemination routines are interconnected, namely, the socialization stage.

These studies demonstrate the importance that the SECI model has for companies and their success, and these facts support the relevance of this investigation in the study of the application of the SECI model to understand the role of innovation in startups.

3. Methodology

The methodology adopted in this investigation is quantitative, which means that it is an investigation in which facts were collected and the relationships between the variables under study were examined (Bell 1993). In this way, it is a study that uses the quantitative method and that takes the form of a descriptive-correlational study. Quantitative research is a type of scientific research that is based on the hypothetical-deductive method to study the cause–effect relationship, and knowledge extracted from the reality under study is quantifiable, allowing to establish generalizations applicable to several situations (Meirinhos and Osório 2010).

The quantitative research method is adequate, as verified for this study, to test hypotheses, make predictions, and generalize results referring to a sample of a population (universe of investigation). The data collected in this type of investigation are numerical in nature, being analyzed using statistical techniques to identify patterns, relationships, and trends. In addition, it is a descriptive-correlational investigation, as it seeks to describe the existence of relationships between the variables and how they influence each other (Fortin 1999).

We used a questionnaire-type survey with scales previously validated by the literature that allowed measuring the five dimensions of our investigation model. Combination (COMBI) was measured through nine variables resulting from previous studies (Baldé et al. 2018). Internalization (INTER) was measured using six variables that resulted from the study by Baldé et al. (2018). The socialization dimension (SOCIA) consists of seven variables that derive from the study by Baldé et al. (2018). The externalization dimension (EXTER) consists of six variables (Baldé et al. 2018). Finally, the innovative behavior dimension (INNBEH) was measured using seven variables that resulted from previous studies (Scott and Bruce 1994).

The robustness of the items was tested using exploratory factorial analysis (EFA), which allowed us to visualize the factor loadings of each item and its suitability for use in confirmatory factorial analysis (CFA) (Byrne 2010). In addition to the five measured dimensions, the respondents were also asked about their sociodemographic data. The questionnaire used was developed using the 7-point Likert Scale, ranging from (1 = Strongly Disagree) to (7 = Strongly Agree) to achieve the item reliability score values. The research model tested is shown in Figure 2.

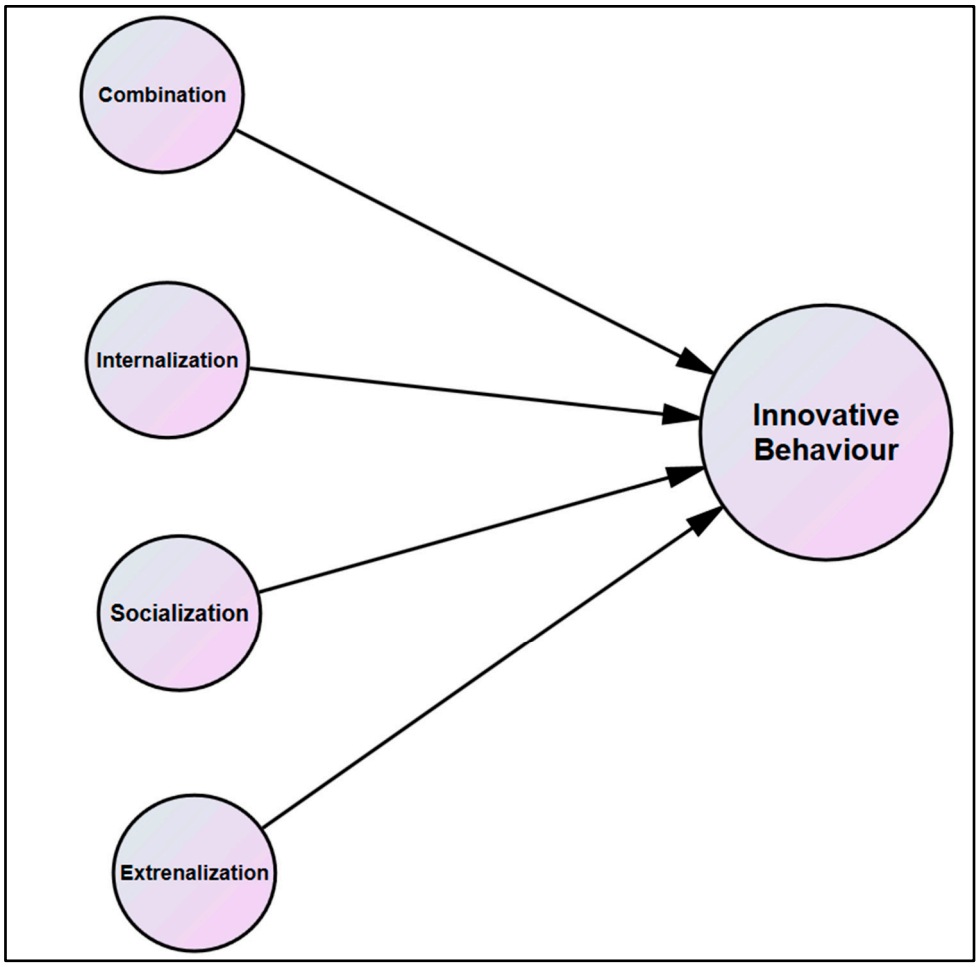

Figure 2. Research model.

To test the structural model, the following research hypotheses were defined:

Hypothesis 1 (H1): *Combination positively influences innovative behavior*.

Hypothesis 2 (H2): *Internalization positively influences innovative behavior*.

Hypothesis 3 (H3): *Socialization positively influences innovative behavior*.

Hypothesis 4 (H4): *Externalization positively influences innovative behavior*.

The applied questionnaire aimed to understand the influence of the COMBI, INTER, SOCIA, and EXTER dimensions on the INNBEH dimension. Respondents were questioned at random, with members of startups responding to the survey. The questionnaire was administered by sending a link, provided by e-mail, which allowed access to a set of questions the answers to which were anonymous and voluntary. In the presentation of the questionnaire, questions related to ethics and the confidentiality of the answers were safeguarded.

The questionnaires received were screened to avoid outliers and missing data. The basic test for this removal included testing the normality, homogeneity, and linearity of the data. Of the 282 questionnaires answered, the data screening process indicated that there were 21 unusable questionnaires because of missing data, leaving the total of questionnaires with usable data at 261. Table 2 presents a summary of the sociodemographic data of the respondents who were the target of our questionnaire.

Table 2. Sociodemographic data.

Variables		Frequency	%
Gender	Male	159	60.9%
	Female	102	39.1%
Age	20–30	43	16.5%
	31–50	179	68.6%
	51–60	29	11.1%
	>60	10	3.8%
Current Position	CEO	99	37.9%
	Leader/Team Leader/Department Leader/Collaborator	80	30.6%
		66	25.3%
	Other	16	6.2%
Years of Experience	1–5 years	143	54.8%
	6–10 years	58	22.2%
	11–15 years	18	6.9%
	16–20 years	22	8.4%
	21–25 years	13	4.9%
	26–30 years	3	1.3%
	31–35 years	4	1.5%
Residential Area	North	95	36.4%
	Center	85	32.6%
	Lisbon and Tagus Valley	55	21%
	Alentejo	9	3.4%
	Algarve	7	2.8%
	Islands	10	3.8%

In the present questionnaire, a total of 261 responses were obtained, with 39.1% of the respondents being female and 60.9% male. More than half of the survey participants (68.6%) were between the ages of 31 and 50. As for the position held by the respondents in the incubators, CEOs predominate (37.9%), followed by Leader/Team Leader/Department Leader/Collaborator (30.6%) and Employees (25.3%). Regarding the years of experience in the business, there is a predominance of years of experience between 1 and 5 years (54.8%), followed by 22.2% having 6 to 10 years of experience, and finally 8.4% with between 16 and 20 years of experience. Finally, concerning the area of the country where the questionnaires were collected, it appears that most were collected in the north of the country at 36.4%, followed by the center at 32.6%, and Lisbon and the Tagus Valley at 21%. The remaining zones like Alentejo, Algarve, and Islands have residual percentage values. See Table 2.

4. Results

4.1. Exploratory Factor Analysis

The variables under study are socialization, externalization, combination, and internalization, in terms of their influence (or not) on innovative behavior.

In the first phase, using SPSS 27, the validity of the data was analyzed, and the component loading was identified through an exploratory factorial analysis (EFA). The objective of the EFA was to identify the structure of the variables that explain each of the dimensions. The factorial analysis was performed using the principal components method, with Varimax rotation, as it was the method that best explained the factor loading of each variable, as well as the proper grouping of factors. In the factorial analysis, the calculation of Cronbach's alpha (α) and the Kaiser–Meyer–Olkin measure (KMO) are the two statistical procedures most used within the EFA to examine the items underlying the structure of the components extracted from the measured variables.

According to the statistical literature, the value of the standardized KMO loading factor must be greater than 0.50, while Cronbach's alpha is recommended to be greater than 0.70 (Taber 2018). Our data obtained an adequate KMO extracted measure that stood

at the value of 0.902, which means that a principal component analysis can be performed (Bonett and Wright 2015). Bartlett's sphericity was statistically significant with $\chi^2 = 664.056$, DF = 248, $p < 0.001$. In Table 3, we can verify the factorial load of each of the 35 variables used in the questionnaire and the robustness presented by the different dimensions under study. See Table 3.

Table 3. Factorial loads and robustness tests obtained in the exploratory factorial analysis.

Items	Description	Loadings	Label	(α)
COMBI1	I participate in the development of the company's internal regulations, based on the compilation of information from different events that have occurred.	0.886	**Externalization**	0.875
COMBI2	I contribute to the internal regulations.	0.977		
COMBI3	I contribute to updates, and new editions and add information to the internal regulations.	0.977		
COMBI4	I share documents and sketches with the team.	0.465		
COMBI5	I keep the documents related to the events that occurred (including meetings).	0.257		
COMBI6	I update the documents related to the events that occurred (including meetings).	0.247		
COMBI7	I found the documents relating to the events that took place (including meetings) to be useful, accessible, and easy to use.	0.288		
COMBI8	I contribute to improving the company's IT organization by saving documents.	0.378		
COMBI9	I discuss the information in the company's database before using it.	0.429		
INTER1	My colleagues take part in team building simulations and/or exercises where you learn by doing.	0.691	**Internationalization**	0.890
INTER2	My colleagues participate in simulations and/or exercises through training sessions and reading manuals, better understanding the performance of their duties.	0.799		
INTER3	After training, simulations, and/or exercises, my colleagues have time to practice/try out what they learned.	0.821		
INTER4	My colleagues gain experience when faced with real situations and apply the knowledge acquired in training.	0.839		
INTER5	My colleagues continually repeat and improve the techniques acquired in training and, eventually, apply them automatically.	0.933		
INTER6	My co-workers work with other people/teams.	0.526		
SOCIA1	**I spend some time on:** Professional meetings.	0.395	**Socialization**	0.785
SOCIA2	**I dedicate some time to**: Mentorship/Coaching programs.	0.819		
SOCIA3	**I spend some time on: Training programs.**	0.725		
SOCIA4	I use a mentor/coach to help me at work.	0.629		
SOCIA5	I share my work experience with my coworkers.	0.470		
SOCIA6	I share knowledge and am rewarded through awards.	0.467		
SOCIA7	I usually spend some time observing and collaborating with my colleagues to understand the work better.	0.462		

Table 3. *Cont.*

Items	Description	Loadings	Label	(α)
EXTER1	There are brainstorming sessions within my team.	0.409	**Externalization**	0.868
EXTER2	After meetings, I make summaries of what happened.	0.864		
EXTER3	After training, I make summaries of what happened.	0.866		
EXTER4	I record what I have learned from the problems and the respective solutions.	0.762		
EXTER5	I use diagrams to better explain my reasoning and share it with the team.	0.771		
EXTER6	I send all the members the documents that I create within the team.	0.579		
INNBEH1	I am looking for new technologies, processes, techniques, ideas, and/or products.	0.735	**Innovative Behavior**	**0.882**
INNBEH2	I come up with creative ideas.	0.769		
INNBEH3	I promote and defend my colleagues' ideas.	0.710		
INNBEH4	I am looking for sources of funding to implement new ideas.	0.603		
INNBEH5	I secure the funding to implement new ideas.	0.650		
INNBEH6	I develop suitable plans and timeframes for implementing new ideas.	0.655		
INNBEH7	I consider myself an innovator.	0.836		

Concerning the model's convergent validity (Table 4), it was evaluated using three metrics: average variance extracted (AVE), composite reliability (CR), and Cronbach's alpha (α). All convergent validity metrics surpassed what the literature references as pertinent, in which the AVE must be greater than 0.5, the CR greater than 0.7, and α above 0.8 (Hair et al. 2010; Marôco 2010).

Table 4. Factorial loadings and robustness tests obtained in exploratory factorial analysis, excluding responses with loadings below 0.5.

Dimension	Items	Loadings	(α)
Combination	COMBI1	0.886	0.875
	COMBI2	0.977	
	COMBI3	0.977	
Internalization	INTER1	0.691	0.890
	INTER2	0.799	
	INTER3	0.821	
	INTER4	0.839	
	INTER5	0.933	
	INTER6	0.526	
Socialization	SOCIA2	0.819	0.785
	SOCIA3	0.725	
	SOCIA4	0.629	
Outsourcing	EXTER2	0.864	0.868
	EXTER3	0.866	
	EXTER4	0.762	
	EXTER5	0.771	
	EXTER6	0.579	
Innovative Behavior	INNBEH1	0.735	0.882
	INNBEH2	0.769	
	INNBEH3	0.710	
	INNBEH4	0.603	
	INNBEH5	0. 650	
	INNBEH6	0.655	
	INNBEH7	0.836	

In this sense, it can be concluded that the requirements of convergent validity and reliability were obtained. Discriminant validity was assessed by comparing the square root of the AVE of each construct and the correlation of these constructs with the others, verifying discriminant validity and acceptable reliability for the presented research model. See Table 4.

The factorial load ranged between 0.247 and 0.977, not all of which were above the threshold of 0.500 recommended by several authors (Brown 2015; Hair et al. 2010; Marôco 2010). In this sense, to estimate the final model, variables with factor loadings below 0.500 were removed. The removed variables were COMBI4, COMBI5, COMBI6, COMBI7, COMBI8, COMBI9, SOCIA1, SOCIA5, SOCIA6, SOCIA7, and EXTER1.

It should also be noted that after removing the variables, the Cronbach's alpha (α) values of the five dimensions were situated at 0.875 in the COMBI dimension, 0.890 in the INTER, 0.785 in the SOCIA, 0.868 in the EXTER, and 0.882 in the INNBEH. It should also be noted that the robustness of all variables at the same time was around Cronbach's alpha (α) 0.942. We can say that the individual dimensions have good or very good robustness and the questionnaire in general has very good robustness.

4.2. Verification of Research Hypotheses

The investigation model tested using an estimation method based on structural equations allowed us to see if there was a statistically significant cause-and-effect relationship between combination (COMBI), externalization (EXTER), internalization (INTER), socialization (SOCIA), and innovative behavior (INNBEH). The effective result of the multidimensional construction measures tested allowed the validation of three of the four previously formulated investigation hypotheses. However, the hypothesis referring to socialization (SOCIA) was not validated because it did not have statistical significance.

In Table 5, we can observe the summary of the hypotheses tested using the best possible investigation model (we removed the variables COMBI4, COMBI5, COMBI6, COMBI7, COMBI8, COMBI9, SOCIA1, SOCIA5, SOCIA6, SOCIA7, and EXTER1 for presenting factor loadings below 0.500). The results obtained allow us to conclude that the variation that occurred is explained by the dimensions combination (COMBI) ($\beta = -0.148$, $p < 0.001$), internalization (INTER) ($\beta = 0.124$, $p < 0.001$), socialization (SOCIA) ($\beta = 0.057$, $p > 0.05$), and externalization (EXTER) ($\beta = 0.323$, $p < 0.001$), with H1, H2, and H4 validated and H3 not validated. The structural results indicate that the dimensions combination, internalization, and externalization have a statistically significant direct and positive influence on innovative behavior, validating three of the formulated research hypotheses (H1, H2, and H4). The socialization dimension was not validated because it was statistically insignificant, leading to the non-validation of one of the hypotheses (H3).

Table 5. Verification of research hypotheses.

Hypotheses	Relationship	Coefficient Regression	Standard Error	t	*p*-Value	Results
H1	COMBI → INNBEH	0.148	0.039	3.796	<0.001	Supported
H2	INTER → INNBEH	0.124	0.049	2.546	<0.001	Supported
H3	SOCIA → INNBEH	0.057	0.039	1.465	>0.05	Not Supported
H4	EXTER → INNBEH	0.323	0.051	6.387	<0.001	Supported

In Figures 3 and 4 we can see the initial investigation model before the removal of variables with factor loadings below 0.500 and the final model after removing these variables. It was found that in the dimensions combination, socialization, and externalization, some variables were removed to obtain the best possible structural model, concerning its statistical robustness.

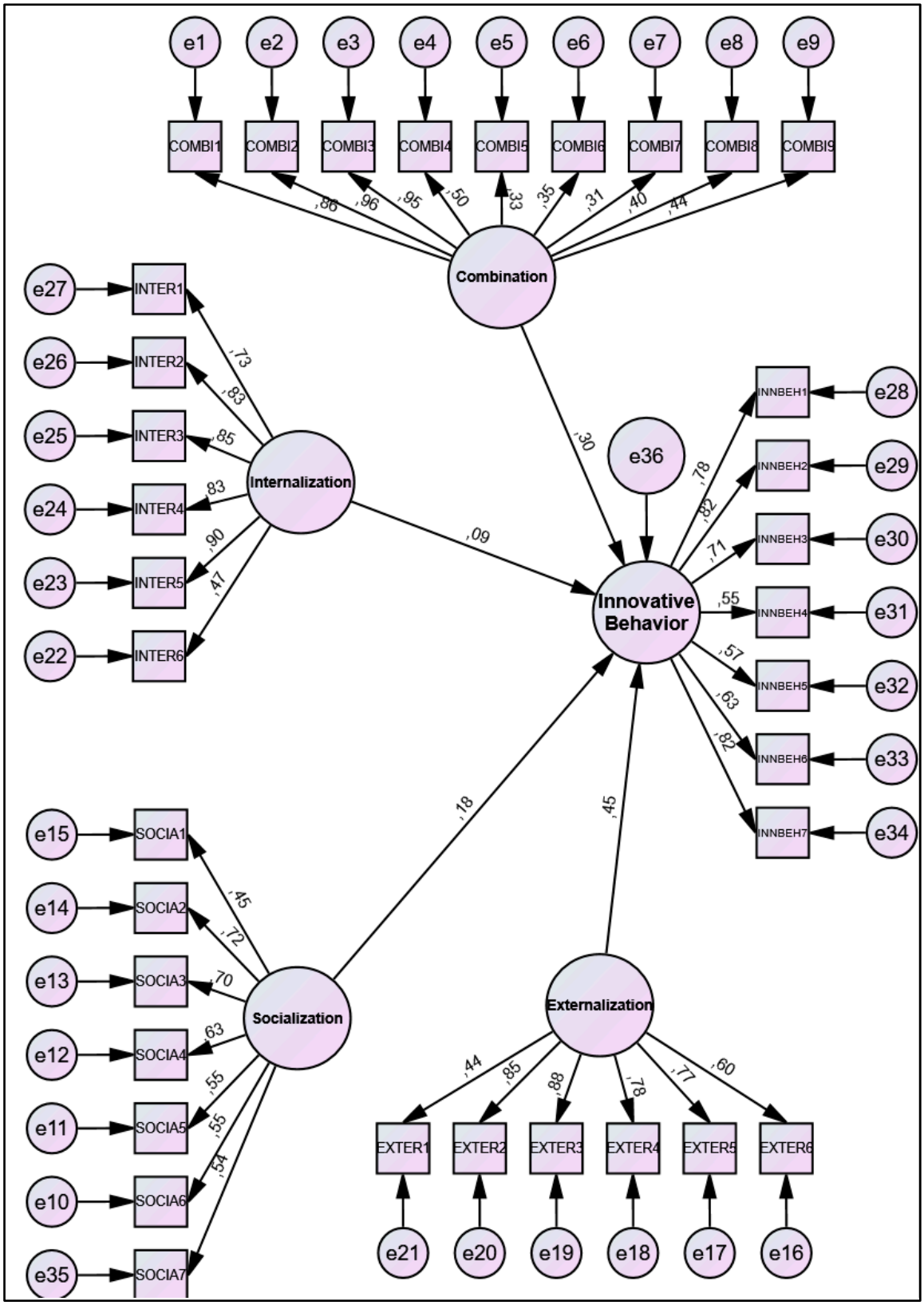

Figure 3. Initial investigation model.

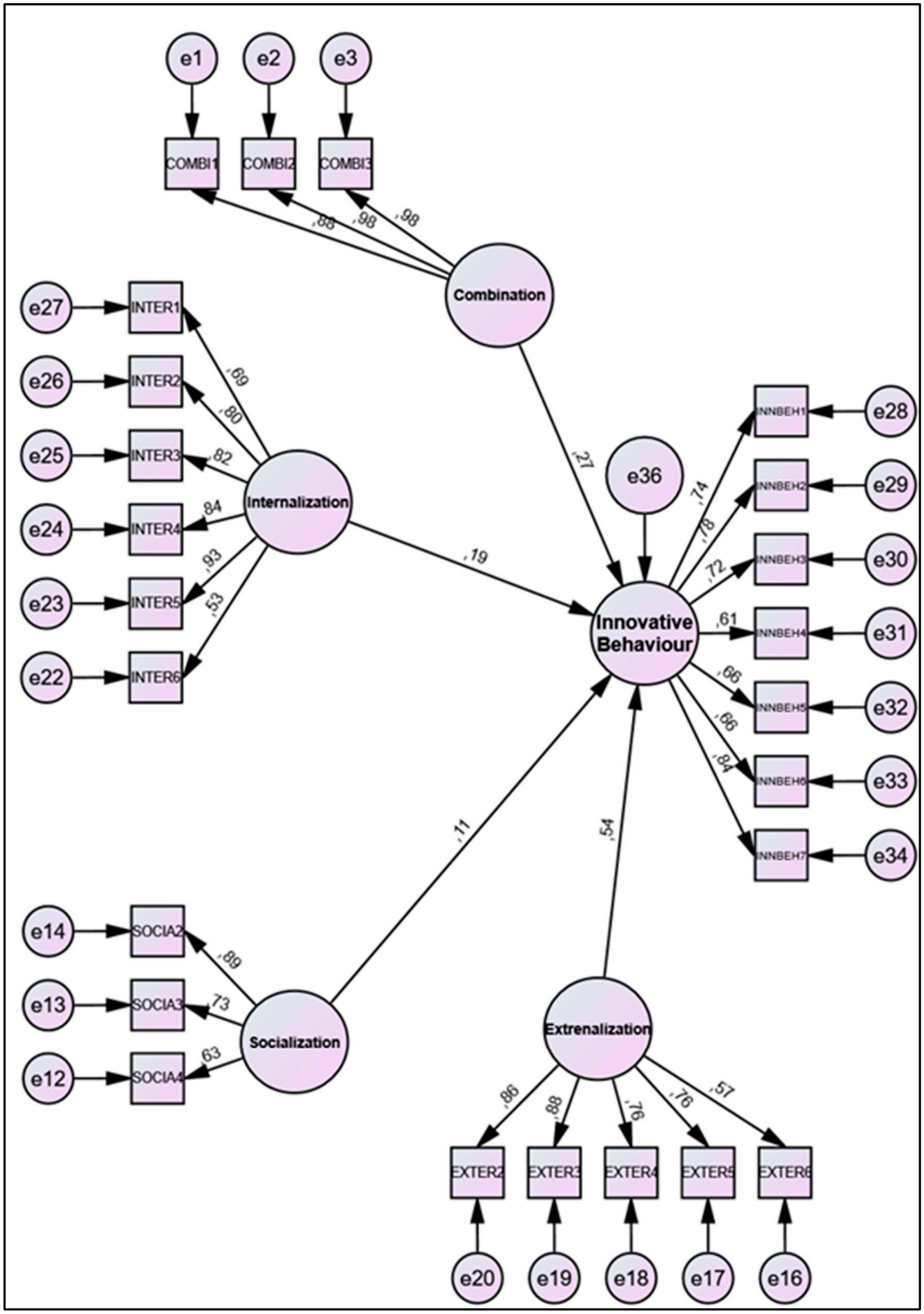

Figure 4. Final research model.

5. Discussion

This study aimed to understand the importance of innovative behavior in startups, using the SECI model to understand how the socialization, externalization, combination, and internalization dimensions can influence innovation within organizations.

In the estimation of the model, the socialization dimension did not prove to be statistically significant ($\beta = 0.057$, $p > 0.05$). That is, it was found that socialization does not influence innovative behavior in a statistically significant, direct, or positive way. Contrary to the results obtained in this study, Sampaio et al. (2014) found that socialization was the mode of transmission of knowledge to which the project development team attributed greater importance and that socialization is the preferred mode of knowledge capture. Similarly, Junior and Yu (2017), when studying the transformation of organizational knowledge based on the innovation process, found that in a pre-development phase, socialization stands out, revealing a greater intensity of tacit knowledge. Also, in the informal phase of the project and in the last phase (post project), socialization emerged, being important for the construction of tacit knowledge in the first case, and crucial for the learning of the organization through tacit knowledge in the second case (Junior and Yu 2017).

In fact, during the socialization stage, according to López-Sáez et al. (2010), the transfer of tacit knowledge occurs through face-to-face interaction between individuals, and it is necessary to share experiences by carrying out joint activities. However, people must be willing to identify and interact with others and to energize and sustain collaborative efforts in knowledge creation (Hong 2011). In this study, and according to the results obtained, it seems that there is still no understanding of the importance of socialization, knowledge sharing, and experience exchange for creating new knowledge.

Socialization can facilitate the development of new ideas and perspectives, allowing individuals to share their tacit knowledge and experiences with others. Thus, by sharing tacit knowledge, individuals can learn from each other and develop new insights that can culminate in innovative solutions to problems or new product or service ideas. Furthermore, the dimension of socialization can also facilitate the development of consolidated relationships based on trust between individuals, which can be important to foster a culture of innovation. When individuals are comfortable sharing their ideas and perspectives with others, they are more likely to engage in creative thinking and risk-taking.

As for the dimension of externalization, it was observed that this has a statistically significant, direct, and positive influence on innovative behavior ($\beta = 0.650$, $p < 0.001$). These results are not surprising, since, as Vaccaro et al. (2009), Latino et al. (2016), and Wu et al. (2010) point out, externalization translates into the expression of tacit knowledge and its transformation into explicit forms. Based on this idea, the impact of outsourcing on innovation and innovative behavior can be inferred. Taking into account innovative behavior, through externalization, tacit knowledge is transformed into explicit knowledge through documentation or verbalization, and this knowledge can be shared with other members of the group (Farnese et al. 2019; López-Sáez et al. 2010; Sasaki 2017). However, this step depends on the need to convert tacit knowledge into explicit knowledge and the incentive to make it available to other co-workers (Hong 2011).

The results obtained in this study are in line with what the scientific literature points out, namely, that outsourcing can facilitate the sharing and dissemination of new ideas and knowledge throughout the organization, not least because, by explicitly expressing tacit knowledge, individuals can share their insights with others and let others learn from their experiences. On the other hand, it is worth highlighting the fact that outsourcing can facilitate collaboration and innovation by making knowledge more accessible and easily shared. By documenting and communicating new ideas and knowledge, individuals and teams can build on other people's ideas to develop new products and services.

After estimating the model, we found that the combination dimension statistically significantly, directly, and positively influences innovative behavior ($\beta = 0.148$, $p < 0.001$), confirming the fact that combination is the process that links aspects of explicit knowledge (through the sharing, transfer, and integration of explicit knowledge among groups) to

originate more complex and systematic sets of explicit knowledge and, therefore, new knowledge, therefore, innovation (López-Sáez et al. 2010). The results obtained about combination and its positive influence on innovative behavior highlight what has already been confirmed by Vaccaro et al. (2009), that is, that combination refers to the creation of new explicit knowledge through merging, categorizing, reclassifying and synthesizing existing explicit knowledge. The same idea is highlighted by Astorga-Vargas et al. (2017) who refer to combination as the step in which different parts of existing explicit knowledge are merged and combined to create new explicit knowledge. However, it is necessary to keep in mind the fact that categorization, reclassification, and synthesis are not automatic and instinctive operations, and without direct reference to the creation of meaning, the combination mode only describes a process of increasing the richness of information (Acar and al-Gharaibeh 2019). This is because individuals cannot synthesize existing explicit knowledge without understanding it first (Acar and al-Gharaibeh 2019), and combination, we must not forget, is what is necessary to transmit aggregated explicit knowledge (Scaringella and Burtschell 2015).

Faced with these results, we can admit that the participants in this study recognize the important role that combination can play in promoting innovative behavior within the companies/organizations where they work. We know that the dimension of combination translates the process of synthesis and integration of knowledge from different sources into the creation of new knowledge, allowing the development of innovative solutions.

Finally, regarding the internalization dimension, it was found that it statistically significantly, directly, and positively influences innovative behavior ($\beta = 0.124$, $p < 0.001$). Thus, it appears that the individuals who participated in this study effectively draw on newly created knowledge and integrate it into their own personal knowledge base, using this new knowledge to inform actions and decisions.

Through internalization, the individual absorbs explicit knowledge and internalizes it, because this last step concerns the incorporation of explicit knowledge into tacit knowledge (organization for the individual), reflecting the idea of 'learning by doing' (López-Sáez et al. 2010; Oliveira 2015; Sasaki 2017), because internalization allows the conversion of the organization's explicit knowledge into individual and group tacit knowledge (Vaccaro et al. 2009). In addition, internalization reflects the process of obtaining new tacit knowledge from explicit knowledge combined and shared in a group or organization (Sasaki 2017), especially because knowledge is internalized through a process of integration into the already known knowledge structure. However, if necessary, internalization will generate a process of restructuring tacit knowledge (Bratianu 2011) and therefore, something new, innovation.

Regarding innovative behavior, internalization can facilitate the development of individual expertise, which can lead to the creation of innovative ideas and solutions. As individuals internalize new knowledge, they may develop new insights, perspectives, and ways of thinking that drive innovation. Furthermore, the internalization dimension can also facilitate organizational learning, as knowledge is shared and integrated into the broader collective knowledge of the organization, which encourages the development of new organizational capabilities and allows innovation to occur more readily.

As to what was seen in this study, the study by Li et al. (2018) also reveals that the performance of individual innovation is influenced by the internalization of knowledge through reflection and that the performance of organizational innovation is influenced by the combination and systematization of knowledge (Li et al. 2018).

6. Conclusions

Using the SECI model, this study analyzed the relative predominance in a sample of Portuguese startups, not only distinguishing between tacit and explicit knowledge assets, but also between the four phases of the SECI model, which include the interactive transitions between the creation of tacit and explicit knowledge. The results of this investigation allow us to affirm the importance of the SECI model for understanding innovative behavior

in Portuguese startups. Four research hypotheses were defined based on the dimensions of the model, seeking to verify their influence on innovation within organizations.

After analyzing and interpreting the statistical results obtained, the following were concluded concerning the four hypotheses:

Hypothesis 1 (H1): *Combination positively influences innovative behavior in startups*.

Hypothesis 2 (H2): *Internalization positively influences innovative behavior in startups*.

Hypothesis 3 (H3): *Socialization does not have a significant influence on innovative behavior in startups*.

Hypothesis 4 (H4): *Externalization positively influences innovative behavior in startups*.

We believe that the contribution of this study is manifold.

Firstly, this study highlights the importance that the SECI model has in understanding the knowledge generated by companies/organizations, in particular, startups; what they do with the knowledge generated by themselves and how, from the knowledge acquired and the knowledge generated, startups can generate new knowledge that can be translated into new solutions, strategies, and behaviors.

Next, we highlight the importance of the SECI model as a way to better understand where startups should focus their attention to be successful. If it is clear to entrepreneurs that the knowledge spiral starts from previously internalized experiences leading to the elaboration of business plans and processes, activities that harness and codify this internalized knowledge can be better adapted as early as possible.

On the other hand, we confirm that of the four dimensions of the SECI model, only combination, internalization, and externalization influence the innovative behavior of the Portuguese startups studied.

This means that, with regard to the externalization dimension, the results obtained demonstrate that it can facilitate the sharing and dissemination of innovative ideas and knowledge in the organization, since by exposing tacit knowledge explicitly, individuals can share their perceptions and provide opportunities for others to learn from their experiences. At the same time, evidence has revealed that outsourcing can facilitate collaboration and innovation, as it makes knowledge more accessible and easily shared. These results are supported by the literature that deals with the subject, since there are several studies that indicate that externalization allows the expression of tacit knowledge and its transformation into explicit forms.

Regarding the results obtained on combination, it is noticeable that this dimension influences innovative behavior, as it combines elements of explicit knowledge to originate new explicit knowledge. However, even if the results obtained converge with the empirical evidence found, it is important to underline that before combining aspects of explicit knowledge, it is crucial that companies understand it and realize what they are dealing with; otherwise, the dimension of combination will only allow the description of a process that generates the most important pieces of information.

Internalization was, in this study, another of the three dimensions of the SECI model in which the positive and direct influence on innovative behavior was proven. In fact, it is through this dimension that the transformation of explicit organizational knowledge into tacit knowledge possessed by the individual or the group takes place. That is, as expressed in the literature that deals with the subject, this study also reaches the conclusion that internalization allows the transformation of explicit knowledge into tacit knowledge, where the individual, or the group, integrates the newly acquired knowledge into their personal knowledge. Thus, on the one hand, the individual internalizes new knowledge, which can result in the development of new knowledge which, in turn, leads to innovation. But, on the other hand, it can also contribute to innovation at the organizational level, since, armed with new knowledge, the individual (or the group) can share their knowledge, stimulating

the development of new individual and organizational capacities and, ultimately, produce innovation in the organization.

Finally, in view of socialization, the estimation of the model made it possible to verify that this dimension does not exert a statistically significant, direct, or positive influence on innovative behavior. The results obtained are opposed to the results of several studies that reveal that socialization is the most important way of transmitting knowledge and that it is the chosen way to capture knowledge, playing an important role in the construction of tacit knowledge and in the organization's learning through tacit knowledge. In fact, socialization is a stage where the transfer of tacit knowledge takes place through direct interaction between individuals, implying, through activities carried out together, the sharing of experiences. Given the results obtained, it is concluded that there still seems to be no understanding of the importance of socialization, sharing knowledge, and exchanging experiences for creating new knowledge. Indeed, the socialization dimension can facilitate the development of new ideas and perspectives, allowing individuals to share their tacit knowledge and experiences with others. As a result of sharing tacit knowledge, individuals can learn from each other and develop new insights that, in turn, can contribute to the emergence of innovative solutions to identified problems or to new ideas for products or services. Furthermore, it is interesting to point out that socialization can also facilitate the development of solid relationships, guided by trust between individuals, which can contribute to the promotion of a culture of innovation. This is because when individuals feel comfortable sharing their ideas and perspectives with others, they are more likely to engage in creative thinking and take risks.

We believe that an SECI approach can provide stakeholders in business ecosystems, including investors and policymakers, with new analysis and insights into the knowledge creation process in startups and help them assess the long-term sustainability of businesses. Concretely, this study can be a guiding reference insofar as it highlights the contribution of each of the dimensions of the SECI model in the innovative behavior of startups, helping them to understand how the knowledge created by them can be used and shared, giving rise to new knowledge.

Startups have increasingly stood out as agents of change in the business scenario; companies that often start with few resources and big ideas have the ability to develop innovative solutions to complex and often old problems. One of the main characteristics of startups is the constant search for innovation. That means always being focused on new ways to solve problems, offer new services or products, and even create new markets. This entrepreneurial mindset is essential for startups to stand out from the competition and be successful in the long term. One of the main advantages of innovation in startups is the ability to create value for customers and for the company itself. By creating unique solutions, startups can deliver differentiated customer experience, leading to increased customer loyalty and an increased market share. Another advantage of innovation is the possibility of differentiating oneself from competitors and creating new markets. By offering innovative solutions, startups can establish a leadership position in niche markets and create entry barriers for competitors. This can lead to rapid and significant company growth. However, innovation is not, by itself, a guarantee of success. For example, there are ideas that have no correspondence or applicability in the market. In addition, it is necessary to have a capable and committed team, as well as solid strategic planning to ensure that innovation is directed towards the company's business objectives.

The limitations of this study are that it only contemplates the influence of innovative behavior in startups, not considering other factors, such as organizational performance. As highlighted by Muthuveloo et al. (2017), organizational performance gained prominence in the context of the implementation of measures aimed at ensuring the competitiveness and sustainability of companies. Thus, as a proposal for future research, it is suggested to carry out studies that consider other factors, in addition to innovation, that may influence startups and that contribute to the creation of knowledge about organizational performance.

Author Contributions: Conceptualization, M.L. and R.S.; methodology, M.L., R.S. and C.L.; software, R.S.; validation, M.L., R.S. and C.L.; formal analysis, M.L.; investigation, M.L., R.S. and C.L.; resources, M.L., R.S. and C.L.; data curation, M.L.; writing—original draft preparation, M.L., R.S. and C.L.; writing—review and editing, M.L., R.S. and C.L.; visualization, M.L., R.S. and C.L.; supervision, R.S. and C.L.; project administration, M.L., R.S. and C.L.; funding acquisition, M.L., R.S. and C.L. All authors have read and agreed to the published version of the manuscript.

Funding: This research is supported by national funds, through the FCT—Portuguese Foundation for Science and Technology under the project UIDB/04011/2022 and by NECE-UBI, Research Centre for Business Sciences, Research Centre under the project UIDB/04630/2022.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data are contained within the article.

Acknowledgments: The authors gratefully acknowledge the University of Trás-os-Montes and Alto Douro and CETRAD (Centre for Transdisciplinary Development Studies) and the University of Beira Interior (NECE–UBI).

Conflicts of Interest: The authors declare no conflict of interest.

References

Acar, William, and Rami al-Gharaibeh. 2019. Internal and Consulting Information Flows in the Process of Knowledge Accumulation. *International Journal of Knowledge Management* 15: 19–36.

Adam, Frane, and Borut Roncevic. 2003. Social Capital: Recent Debates and Research Trends. *Social Science Information* 42: 155–83. [CrossRef]

Aernoudt, Rudy. 2004. Incubators: Tool for entrepreneurship? *Small Business Economics* 23: 127–35. [CrossRef]

Astorga-Vargas, Maria Angelica, Flores-Rios Brenda, Guillermo Licea-Sandoval, and Felix Gonzalez-Navarro. 2017. Explicit and tacit knowledge conversion effects, in software engineering undergraduate students. *Knowledge Management Research and Practice* 15: 336–45. [CrossRef]

Baldé, Mariama, Aristides Ferreira, and Travis Maynard. 2018. SECI driven creativity: The role of team trust and intrinsic motivation. *Journal of Knowledge Management* 22: 1688–711. [CrossRef]

Bartolacci, Chiara, Cristina Cristalli, Daniela Isidori, and Federico Niccolini. 2016. Ba virtual and inter-organizational evolution: A case study from a EU research project. *Journal of Knowledge Management* 20: 1–22. [CrossRef]

Bell, Judith. 1993. *Como realizar um projecto de investigação*. Lisboa: Gradiva.

Bollingtoft, Anne, and John Ulhoi. 2005. The networked business incubator—Leveraging entrepreneurial agency? *Journal of Business Venturing* 20: 265–90. [CrossRef]

Bonett, Douglas, and Thomas Wright. 2015. Cronbach's alpha reliability: Interval estimation, hypothesis testing, and sample size planning. *Journal of Organizational Behavior* 36: 3–15. [CrossRef]

Bratianu, Constantin. 2011. Changing Paradigm for Knowledge Metaphors from Dynamics to Thermodynamics. *Systems Research and Behavioral Science* 28: 160–69. [CrossRef]

Brown, Timothy. 2015. *Confirmatory Factor Analysis for Applied Research*. New York: Guilford Publications.

Byrne, Barbara. 2010. *Structural Equation Modeling with AMOS: Basic Concepts, Applications, and Programming (Multivariate Applications Series)*. New York: Taylor and Francis Group.

Canonico, Paolo, Ernesto Nito, Vincenza Esposito, Mario Iacono, and Stefano Consiglio. 2019. Knowledge creation in the automotive industry: Analysing obeya-oriented practices using the SECI model. *Journal of Business Research* 112: 450–57. [CrossRef]

Canonico, Paolo, Stefano Consiglio, Ernesto Nito, Vincenza Esposito, and Mario Iacono. 2018. Dealing with knowledge in a product development setting: An empirical analysis in the automotive industry. *Knowledge Management Research and Practice* 16: 126–33. [CrossRef]

Carayannis, Elias, and Maximilian von Zedtwitz. 2005. Architecting gloCal (global-local), real-virtual incubator networks (G-RVINs) as catalysts and accelerators of entrepreneurship in transitioning and developing economies: Lessons learned and best practices from current development and business incubation practices. *Technovation* 25: 95–110.

Chatterjee, Aindrilla, Arun Pereira, and Bijan Sarkar. 2018. Learning Transfer System Inventory (LTSI) and Knowledge Creation in Organizations. *The Learning Organization* 25: 305–19. [CrossRef]

Coleman, James. 1988. Social capital in the creation of human capital. *American Journal of Sociology* 94: S95–S120. [CrossRef]

Contreras-Medina, David, Elia Díaz-Nieto, María Uribe-Plaza, Nélida García, and Patricia Mendoza-García. 2019. Nonprofit Organizations in Mexico: A Preliminary Study on Knowledge Creation From the Beneficiaries' Perspectives. *Journal of Nonprofit and Public Sector Marketing* 32: 407–26. [CrossRef]

Duan, Run, and Linlin Jin. 2021. Influence of the leading role of collaboration in knowledge transfer in the regional context. *Knowledge Management Research and Practice* 20: 619–29. [CrossRef]

Dutta, Subhasish, and Ajith Kumar. 2022. Knowledge creation and external consultants during ERP implementation an interpretive study. *Business Process Management Journal* 28: 113–30. [CrossRef]
Eriksson, Paivi, and Juha Voutilainen. 2014. Incubation as co-creation: Case study of proactive technology business development. *International Journal of Entrepreneurship and Innovation Management* 18: 382–96. [CrossRef]
Farnese, Maria, Barbara Barbieri, Antonio Chirumbolo, and Gerardo Patriotta. 2019. Managing Knowledge in Organizations: A Nonaka's SECI Model Operationalization. *Frontiers in psychology* 10: 2730. [CrossRef]
Flor, Irina, Maria Sarabia, Fernando Crescente, and Maria Del Val. 2022. Inner Knowledge: A New Approach Building Upon Innovation. *International Journal of Innovation and Technology Management* 19: 2140006. [CrossRef]
Fortin, Marie-Fabienne. 1999. *O processo de investigação—Da concepção à realização*. Camarate: Lusociência-edições técnicas e científicas, Lda.
Guillen, Rebeca, and Manoel Veras. 2018. Processo de incubação de empresas de base tecnológica à luz da gestão de projetos: Um estudo de casos múltiplos. *Revista de Gestão e Secretariado* 9: 126–57. [CrossRef]
Guo, Ying, Pavlina Jasovska, Hussain Rammal, and Elizabeth Rose. 2018. Global mobility of professionals and the transfer of tacit knowledge in multinational service firms. *Journal of Knowledge Management* 24: 553–67. [CrossRef]
Hair, Joseph, Bernard Black, Barry Babin, Rolph Anderson, and Robert Tatham. 2010. *Multivariate Data Analysis (Upper Sadd)*. New York: Pearson Prentice Hall.
Hamdani, Daood. 2006. Conceptualizing and Measuring Business Incubation. (SIEID Working Paper). Available online: https://www150.statcan.gc.ca/n1/en/pub/88f0006x/88f0006x2006006-eng.pdf?st=w37g3ICM (accessed on 10 October 2022).
Hong, Jacky. 2011. Glocalizing Nonaka's knowledge creation model: Issues and challenges. *Management Learning* 43: 199–215. [CrossRef]
Inuzuka, Atsushi. 2010. Management by the cognitive range: A perspetictive on knowledge management. *International Journal of Technology Management* 49: 384–400. [CrossRef]
Junior, Wilian, and Abrahan Yu. 2017. As transformacões do conhecimento no processo de inovac¸ão: Um estudo multicasos no desenvolvimento da tecnologia flex fuel no Brasi. *REGE—Revista de Gestão* 24: 256–67. [CrossRef]
Latino, Maria, Angelo Corello, Ilaria Carpone, Danilo Martino, and Antonella Trifoglio. 2016. Lesson Learned and Best Practice Management: A Tool to Support the Enterprise. *Knowledge and Process Management* 23: 230–44. [CrossRef]
Li, Min, Huimin Liu, and Jing Zhou. 2018. G-SECI model-based knowledge creation for CoPS innovation: The role of grey knowledge. *Journal of Knowledge Management* 22: 887–911. [CrossRef]
Li, Yong-Hui, Jing-Wen Huang, and Ming-Tien Tsai. 2009. Entrepreneurial orientation and firm performance: The role of knowledge creation process. *Industrial Marketing Management* 38: 440–49. [CrossRef]
Liechtenstein, Greg, and Thomas Lyons. 1996. *Incubating New Enterprises: A Guide to Successful Practices*. Queenstown: The Aspen Institute.
Lievre, Pascal, and Jing Tang. 2015. SECI and inter-organizational and intercultural knowledge transfer: A case-study of controversies around a project of co-operation between France and China in the health sector. *Journal of Knowledge Management* 19: 1069–86. [CrossRef]
López-Sáez, Pedro, José Navas.López, Gregorio Martín-de-Castro, and Jorge Cruz-González. 2010. External knowledge acquisition processes in knowledge-intensive clusters. *Journal of Knowledge Management* 14: 690–707. [CrossRef]
Luiz Coradini, Odaci. 2010. The divergences between Bourdieu's and Coleman's notions of social capital and their epistemological limits. *Social Science Information* 49: 563–83. [CrossRef]
Marôco, João. 2010. *Structural Equation Analysis: Theoretical Fundamentals, Software and Applications*. Lisboa: Report.
Martín-de-Castro, Gregorio, Pedro López-Sáez, and José Navas-López. 2008. Processes of knowledge creation in knowledge-intensive firms: Empirical evidence from Boston's Route 128 and Spain. *Technovation* 28: 222–30. [CrossRef]
Martínez-Martínez, Aurora, Juan-Gabriel Cegarra-Navarro, and A. Garcia-Perez. 2015. Environmental knowledge management: A long-term enabler of tourism development. *Tourism Management* 50: 281–91. [CrossRef]
Meirinhos, Manuel, and António Osório. 2010. O estudo de caso como estratégia de investigação em educação. *EDUSER: Revista de Educação* 2: 49–65.
Melo, Paulo, Helder Regis, and Hans Bellen. 2015. Princípios epistemológicos da teoria do capital social na área da administração. *Cadernos EBAPE.BR* 13: 136–64. [CrossRef]
Moreira, José. 2002. Modelo de gestão para incubação de empresas orientado a capital de risco. Dissertação de mestrado, Programa de Pós-graduação em Engenharia de Produção da Universidade Federal de Santa Catarina, Florianópolis, Brazil.
Muthuveloo, Rajendran, Narendran Shanmugam, and Aí Teoh. 2017. The impact of tacit knowledge management on organizational performance: Evidence from Malaysia. *Asia Pacific Management Review* 22: 192–201. [CrossRef]
Nahapiet, Janine, and Sumantra Ghoshal. 1998. Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review* 23: 242–66. [CrossRef]
Na-Nan, Khahan, Salitta Saribut, and Ekkasit Sanamthong. 2019. Mediating effects of perceived environment support and knowledge sharing between self-efficacy and job performance of SME employees. *Industrial and Commercial Training* 51: 342–59. [CrossRef]
Nishihara, Ayano. 2018. Creating knowledge and promoting innovation in logistics services with "personal-touch": A case of Yamato transport. *Knowledge Management Research and Practice* 16: 1–10. [CrossRef]
Nonaka, Ikujiro. 1994. A dynamic theory of organizational knowledge creation. *Organization Science* 5: 14–37. [CrossRef]

Nonaka, Ikujiro, and Hirotaka Takeuchi. 1997. *Criação de Conhecimento na Empresa: Como as Empresas Japonesas Geram a Dinâmica da Inovação*. Amsterdam: Elsevier.
Nonaka, Ikujiro, and Hirotaka Takeuchi. 2008. *Gestão do conhecimento*. Porto Alegre: Bookman.
Nonaka, Ikujiro, Ryoko Toyama, and Tou Hirata. 2008. *Managing Flow: A Process Theory of the Knowledge-Based Firm*. New York: Palgrave Macmillan.
OECD. 2004. Networks, partnerships, clusters and intellectual property rights: Opportunities and challenges for innovative smes in a global economy. In *2nd OECD Conference of Ministers Responsible for Small and Medium-Sized Enterprises (SMEs)*. Istambul: Organisation for Economic Co-Operation and Development.
Oliveira, Tiago. 2015. Gestão do conhecimento: Analisando o modelo seci na cooperativa certaja de taquari/rs. Dissertação de mestrado, Centro Universitário UNIVATES, Lajeado, Brazil.
Polanyi, Michael. 1967. *A Dimensão Tácita*. New York: Anchor Books.
Putnam, Robert. 1993. The prosperous community: Social capital and public life. *The American Prospect* 13: 35–42.
Rai, Ranjana. 2011. Knowledge management and organizational culture: A theoretical integrative framework. *Journal of Knowledge Management* 15: 779–801. [CrossRef]
Richtnér, Anders, Pär Åhlström, and Keith Goffin. 2014. "Squeezing RandD": A study of organizational slack and knowledge creation in NPD, using the SECI model. *Journal of Product Innovation Management* 31: 1268–90.
Roque, Gabriela Rocha, Isabela Nardi da Silva, Simone Meister Sommer Bilessimo, Juarez Bento da Silva, João Bosco da Mota Alves, and Gustavo R. Alves. 2018. Construção do modelo seci no projeto visir+: Um estudo de caso das práticas e iniciativas de compartilhamento de conhecimento interorganizacional. Available online: https://recipp.ipp.pt/bitstream/10400.22/13446/1/COM_GustavoAlves_2018_1.pdf (accessed on 10 October 2022).
Rusland, Shaftdean Lufty, Noor Ismawati Jaafar, and Bambang Sumintono. 2020. Evaluating knowledge creation processes in the Royal Malaysian Navy (RMN) fleet: Personnel conceptualization, participation and differences. *Cogent Business and Management* 7: 1785106. [CrossRef]
Sampaio, Renelson Ribeiro, Francisco Uchoa Passos, and Victor Assis. 2014. Compartilhando conhecimento em projeto automotivo: O ecosport da ford do Brasil. *RAE-Revista de Administração de Empresas* 54: 414–28. [CrossRef]
Sasaki, Yasuo. 2017. A note on systems intelligence in knowledge management. *The Learning Organization* 24: 1–11. [CrossRef]
Scaringella, Laurent, and Francois Burtschell. 2015. The challenges of radical innovation in Iran: Knowledge transfer and absorptive capacity highlights—Evidence from a joint venture in the construction sector. *Technological Forecasting and Social Change* 122: 151–69. [CrossRef]
Schuller, Tom, Baron Stephen, and Field John. 2000. Social capital: A review and critique. *Social Capital: Critical Perspectives* 50: 1–38.
Scott, Susanne G., and Reginald A. Bruce. 1994. Determinantes do comportamento inovador: Um modelo de caminho da inovação individual no local de trabalho. *Academy of Management Journal* 37: 580–607. [CrossRef]
Sherman, Hugh, and David S. Chappell. 1998. Methodological challenges in evaluating business incubator outcomes. *Economic Development Quarterly* 12: 313–21. [CrossRef]
Siisiainen, Martii. 2000. Two Concepts of Social Capital: Boudieu vs. Putnam. Paper presented at the ISTR Fourth International Conference: The Third Sector: For What and for Whom? Dublin, Ireland, July 5–8.
Silva, Sandra Sofia Brito da. 2008. Capital Humano e Capital Social: Construir Capacidades para o Desenvolvimento dos Territórios. Dissertação de mestrado, Faculdade de Letras da Universidade de Lisboa, Lisboa, Portugal.
Taber, Keith S. 2018. The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Educatio* 48: 1273–96. [CrossRef]
Takeuchi, Hirotaka, and Ikujiro Nonaka. 2008. *Criação e Dialética do Conhecimento*. Porto Alegre: Bookman.
Torres, Columba Lisset Flores, Luís Alberto Olvera-Vargas, Julia Sánchez Gómez, and David Israel Contreras-Medina. 2019. Discovering innovation opportunities based on SECI model: Reconfiguring knowledge dynamics of the agricultural artisan production of agave-mezcal, using emerging technologies. *Journal of Knowledge Management* 25: 336–59. [CrossRef]
Tsai, Wenpir, and Sumantra Ghoshal. 1998. Social capital and value creation: The role of intrafirm networks. *The Academy of Management Journal* 41: 464–76. [CrossRef]
Vaccaro, Antonino, Francisco Veloso, and Stefano Brusoni. 2009. The impact of virtual technologies on knowledge-based processes: An empirical study. *Research Policy* 38: 1278–87. [CrossRef]
Woolcock, Michael. 1998. Capital social e desenvolvimento econômico: Em direção a uma síntese teórica e estrutura política. *Teoria e Sociedade* 27: 151–208.
Wu, Yue, Dai Senoo, and Rémy Magnier-Watanabe. 2010. Diagnosis for organizational knowledge creation: An ontological shift SECI model. *Journal of Knowledge Management* 14: 791–810. [CrossRef]
Zhang, Zheyu, and Fang Huang. 2020. An extended SECI model to incorporate inter-organisational knowledge flows and open innovation. *International Journal of Knowledge Management Studie* 11: 408–19. [CrossRef]