



THE EFFECT OF DYNAMIC CAPABILITIES AND ENTREPRENEURIAL DECISION-MAKING ON THE ENGAGEMENT OF STARTUPS IN PUBLIC POLICIES FOR INNOVATION AND ENTREPRENEURSHIP

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Cite as – American Psychological Association (APA)

Buarque, B., Câmara, S. F., Pinto, J. G. P. & Melo, J. I. B. (2023, Jan./Apr.). The effect of dynamic capabilities and entrepreneurial decision-making on the engagement of startups in public policies for innovation and entrepreneurship. *International Journal of Innovation - IJI*, São Paulo, 11(1), 1-35, e22989.
<https://doi.org/10.5585/2023.22989>

Study objective: This research sought to understand and identify the effect of dynamic capabilities and entrepreneurial decision-making in the engagement of knowledge-intensive companies in a regional public policy to foster innovation and entrepreneurship.

Methodology / approach: To achieve this objective, forty-six questionnaires were applied to startups participating in a regional public policy to foster innovation. The results were treated through Factor Analysis and ANOVA.

Originality / Relevance: This research aims to contribute to the literature by seeking to understand how dynamic capabilities and entrepreneurial decision-making impact the engagement of knowledge-intensive companies in a regional public policy to foster innovation and entrepreneurship.

Main results: It was possible to conclude that, after participating in the regional innovation public policy, the startups with greater engagement were influenced by their levels of entrepreneurial decision-making and by their global capacity to innovate: i) Causation & Effectuation and ii) Innovative Capacity.

Theoretical-methodological contributions: The study conducts research in a program to foster innovation at the regional level, seeking to understand how dynamic capabilities impact the development of startups and companies that participated in this program.

Managerial / social contributions: These results point to the fact that startups that have further developed their entrepreneurial skills, notably in decisions related to balancing the risks of the innovative process and that focused on their general capabilities to innovate, were more engaged in the journey proposed for them by the public policy studied.

Keywords: dynamic capabilities; public innovation policies; knowledge-intensive entrepreneurship.

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O EFEITO DAS CAPACIDADES DINÂMICAS E DA TOMADA DE DECISÃO EMPREENDEDORA NO ENGAJAMENTO DE STARTUPS EM POLÍTICAS PÚBLICAS DE INOVAÇÃO E EMPREENDEDORISMO

Resumo

Objetivo do estudo: Esta pesquisa buscou compreender e identificar o efeito das capacidades dinâmicas e a tomada de decisão empreendedora no engajamento de empresas intensivas em conhecimento em uma política pública regional de fomento à inovação e ao empreendedorismo.

Metodologia / abordagem: Para o alcance deste objetivo, foram aplicados quarenta e seis questionários com *startups* participantes de uma política pública regional de fomento à inovação. Os resultados foram tratados através de Análise Fatorial e de ANOVA.

Originalidade / Relevância: Esta pesquisa busca contribuir com a literatura ao buscar compreender de que forma as capacidades dinâmicas e a tomada de decisão empreendedora impactam no engajamento de empresas intensivas em conhecimento, em uma política pública regional de fomento à inovação e empreendedorismo.

Principais resultados: Foi possível concluir que, após a participação na política pública regional de inovação, as *startups* com maior engajamento foram influenciadas pelos seus níveis de tomada de decisões empreendedoras e pelas suas capacidades globais de inovarem: i) *Causation & Effectuation* e ii) Capacidade Inovadora.

Contribuições teórico-metodológicas: O estudo realiza pesquisa em um programa de fomento à inovação a nível regional, buscando compreender como as capacidades dinâmicas impactam no desenvolvimento das *startups* e empresas que participaram desse programa.

Contribuições gerenciais / sociais: Estes resultados apontam para o fato de que as *startups* que desenvolveram mais suas habilidades empreendedoras, notadamente em decisões relacionadas ao balanceamento dos riscos do processo inovativo e que focaram em suas capacidades gerais de inovar, engajaram-se mais na jornada proposta para elas pela política pública estudada.

Palavras-chave: capacidades dinâmicas; políticas públicas de inovação; empreendedorismo intensivo em conhecimento.

EL EFECTO DE LAS CAPACIDADES DINÁMICAS Y LA TOMA DE DECISIONES EMPRENDEDORAS EN LA PARTICIPACIÓN DE STARTUPS EN POLÍTICAS PÚBLICAS DE INNOVACIÓN Y EMPRENDIMIENTO

Resumen

Objetivo del estudio: Esta investigación buscó comprender e identificar el efecto de las capacidades dinámicas y la toma de decisiones empresariales en la participación de las empresas intensivas en conocimiento en una política pública regional para fomentar la innovación y el emprendimiento.

Metodología/enfoque: Para lograr este objetivo, se aplicaron cuarenta y seis cuestionarios a startups que participan en una política pública regional de fomento de la innovación. Los resultados fueron tratados mediante Análisis Factorial y ANOVA.

Originalidad / Relevancia: Esta investigación busca contribuir a la literatura buscando comprender cómo las capacidades dinámicas y la toma de decisiones empresariales impactan en la participación de las empresas intensivas en conocimiento en una política pública regional para fomentar la innovación y el emprendimiento.

Principales resultados: Se pudo concluir que, luego de participar en la política pública de innovación regional, las startups con mayor compromiso fueron influenciadas por sus niveles de decisión empresarial y por su capacidad global para innovar: i) Causalidad y Efectuación y ii) Capacidad Innovadora.

Aportes teórico-metodológicos: El estudio investiga en un programa de fomento de la innovación a nivel regional, buscando comprender cómo las capacidades dinámicas impactan en el desarrollo de las startups y empresas que participan en este programa.

Contribuciones gerenciales / sociales: Estos resultados apuntan al hecho de que las nuevas empresas que desarrollaron más sus habilidades empresariales, especialmente en las decisiones relacionadas con

el equilibrio de los riesgos del proceso innovador y que se centraron en sus capacidades generales para innovar, se comprometieron más en el viaje propuesto para por la política pública estudiada.

Palabras-clave: capacidades dinámicas; políticas públicas de innovación; emprendimiento intensivo en conocimiento.

1 Introduction

Startups have a high mortality rate in their first years of life, either due to issues related to financing, or regarding the insertion of their products in the market, and the management of operations (Arruda et. al., 2015; Startup Genome, 2011). Recently, there have been discussions and proposed solutions on how public policies can foster the creation and development of these companies (Giraud, Giudici, & Grilli, 2019; De Mello; De Moraes; & Fischer, 2022; Singh, 2022). Several of these studies address how the Government, through public policies, stimulates the development of new businesses and the fostering of the innovation ecosystem (Edquist, 2011; Audretsch & Link 2012; Silva, Serio & Bezerra, 2019).

More recently, efforts have been made to understand how public policies for innovation focused on regional development are important for the development of innovation ecosystems at the local level and how they impact regional economic dynamics (Stam, 2015; Cavallo; Ghezzi; & Balocco, 2019; McCann & Ortega-Argilés, 2016; Wurth, Stam, & Spigel, 2022). There are several mechanisms, pointed out in the literature, capable of influencing this dynamic and the development of regions, such as: i) formation of innovation hubs; ii) knowledge spillovers; iii) fostering technological transfer from universities to companies; and iv) stimulating the creation and maturation of knowledge-intensive companies (Da Cunha, Vilhena & Selada, 2009; Patanakul & Pinto, 2014; Gifford, Mckelvey & Saemundsson, 2021; Hope & Limberg, 2022).

Entrepreneurship policies generally focus on: i) supporting the development of new businesses by financing them through fiscal incentives or loans; ii) guiding the development of new businesses through programs in the field of business management; and iii) investing in institutions that can contribute to the development of human capital needed for knowledge-intensive entrepreneurship, such as universities and science and technology institutions (Caloghirou et al., 2015). It is important to note, however, that there is a lack of studies and technical reports that can demonstrate the level of engagement of companies participating in entrepreneurship policies, and which factors are related to this engagement.

In the case of public policies that foster the creation and development of maturity in knowledge-intensive companies, there are studies that analyze: i) the effects of financing as

grants or subsidized loans; ii) the difference between economic sectors and the specificities of public policies; iii) the development of new economic agglomerations; and iv) the influence of public policies on the competitive capabilities of the companies (O'Gorman & Kautonen, 2004; Santos, 2019; Guarasa & Fischer, 2020 Hottenrott & Richstein, 2020).

However, there is still room for studies that analyze the factors that lead these companies to engage in these public policies. The literature on dynamic capabilities can contribute to overcome this gap by shedding light on the capabilities of companies to generate competitive advantage, impacting the engagement of knowledge-intensive companies in entrepreneurship and innovation policies. This study seeks to understand and identify the effect of dynamic capabilities and entrepreneurial decision making on the engagement of knowledge-intensive companies in a regional public policy to foster innovation and entrepreneurship. To achieve this objective, questionnaires were applied to forty-six startups participating in a regional public innovation policy. Thus, this research seeks to answer the following research question: how do dynamic capabilities and entrepreneurial decision-making impact the engagement of knowledge-intensive companies during their participation in a regional public policy to foster innovation and knowledge-intensive entrepreneurship?

From the survey and the analyzed results, it was possible to conclude that, after a participation in the regional public innovation policy, the startups with higher engagement were influenced by their levels of entrepreneurial decision-making and their overall capacity to innovate.

This article is separated into five sections, including this Introduction. The second section addresses a Literature Review on dynamic capabilities, entrepreneurial decision-making (causation & effectuation) and new product development capacity, ending with the analytical framework that guides this research. The third section deals with the Methodology addressed in the research, while the fourth section presents the Results obtained. Finally, the last section is concluded by addressing the Final Considerations of the study.

2 Literature Review

2.1 Dynamic Capacities

Penrose (1959) made a significant contribution to the field of strategic management when he proposed in the Resource-Based View (RBV) that a company's capacity to differentiate itself from other companies in its industry is based on its access to scarcer resources. Hence, the RBV provided a new perspective on how to achieve competitive advantages and how firms

can maintain those advantages over time (Penrose, 1959; Barney, 1991; Nelson, 1991; Teece, Pisano & Shuen, 1997; Kraaijenbrink, Spender & Groen, 2010). The proposal is to have a look at the internal resources of organizations to suggest that companies should be analyzed as containing a set of resources, made explicit through their capacities that are heterogeneously distributed among different organizations (Penrose, 1959; Mahoney & Pandian, 1992). It is essential to register that resources are primarily endogenous. They can also be analyzed through the interaction of the company with the environment about reputation, cooperation and relationship (Barney, Ketchen & Wright, 2011).

An important observation is that the capacity to adapt to the market is more critical for the development of new companies than the adaptation of technology, showing that, in the initial stages, the most important thing is for that new companies to analyze and adapt their resources according to the market. Thus, these companies need to adjust their technological developments to the expectations and demands from the market, on one hand by the consumer and on the other by the differentials to their competitors (Boccardelli & Magnusson, 2006). In this process, the absorptive and network capacities are relevant so that the adjustment is made by capturing the right signals.

In this sense, this article focuses on the Absorptive Capacities and Network Capacities in their relationship with the final capacity to innovate, considering that these capacities are crucial for the development of the knowledge-intensive companies (KICs) in early stages of maturity and that the public policies can be a favorable environment for these relationships and development (Boccardelli & Magnusson, 2006). So, the present research studies these relationships in the environment of innovation promotion provided by policies focused on this matter.

The association of networks in the KICs (knowledge-intensive companies) and in startups is necessary because this is how the members gain experience in commercializing a product in a new sector. In some cases, participants lack market experience (Soetanto & Van Geenhuizen, 2015; Huynh et al., 2017). Therefore, the association in networks is essential, especially in the first years, a phase in which this type of company needs to establish partnerships for the development of products and technology transfer (Boccardelli & Magnusson, 2006).

In this sense, network capacity is a construct that measures the capacity of the members of these companies to build, maintain and develop good relationships with different actors, such as partners, competitors, suppliers, among other important actors in the field of technology

transfer (Sousa-Ginel, Franco-Leal & Camelo-Ordaz, 2017), as well as their capacity to convert this particular product/technology into a marketable product/service. However, as highlighted by Buarque et al. (2020), industrial managers need to be acquainted with local innovation initiatives aimed at their sector, which often take place through public policy initiatives.

Absorptive capacities, according to Cohen and Levinthal (1990), can be defined as the capacities a company has to perceive, assimilate and apply new and external information for business purposes. Furthermore, in their seminal article on absorptive capacities, the authors argue that exploiting external knowledge is crucial for innovative capacities. Therefore, they maintain that prior knowledge, manifested in skills and knowledge, enables the recognition, assimilation, and application of valuable information for business purposes. These processes occur at an individual level, with employees, and at an organizational level, within and across different sectors (Cohen & Levinthal, 1990).

Innovation Capacities are essential for the development of products, processes and projects of new companies (Breznik & Hisrich, 2014; Camisón & Villar-López, 2014). Therefore, this is an essential capacity for the knowledge-intensive companies (Malerba & McKelvey, 2020). Furthermore, as Câmara and Brasil (2015) argue, the company's innovation capacity can benefit from public policies that support the sector's technological development.

Moreover, in the context of innovation generation, the strategic and operational directions that range from the ideation stage to technology transfers to the market are mutually influenced by the decision-making processes of the actors who coordinate these stages. This way, the entrepreneur acting in knowledge-intensive companies needs to make decisions that guarantee the sustainability of his innovations in the market, thus, concepts such as causation and effectuation can be adopted (Sarasvathy, 2001).

2.2 Entrepreneurial Decision-Making – Causation & Effectuation

The theoretical concepts wrapped in the dominant paradigms addressing the causation & effectuation relationship argue for the grounding of distinct, but not exclusive, theoretical principles in the applicabilities of these models in different organizational contexts (Sarasvathy, 2001; Read & Sarasvathy, 2005; Read et al., 2009; Lemos., 2016; Furterer, Schmidt & Heidenreich, 2017).

The existence of the *causation type* decision model is based on the idea of broad predictability and management control to ensure the maximization in reducing risks and uncertainties in the innovation process (Sarasvathy, 2001; Ahuvia & Bilgin, 2011). From this

logic of analysis, the model advocates the development of methodological actions that lead the direction of the different variables in order to control the results and the effects produced throughout the innovative process, so as to ensure the desired results (Sarasvathy, 2001; Read & Sarasvathy, 2005; Chandler et al., 2011).

The decision model entitled *effectuation* is based on the premise that all events and variables involved in the innovation process cannot be fully controlled, considering that the adaptability to risk is an inherent factor in innovative processes (Sarasvathy, 2001; Tasic & Andreassi, 2008). Thus, the innovative trajectory of organizations is influenced by economic and behavioral aspects represented respectively by the political-economic scenario experienced by organizations, as well as their ideologies and purposes (Buchanan & Vanberg, 1991; Sarasvathy, 2001; Sarasvathy & Dew, 2005; Lemos, 2016).

The behavior of the *effectuation type* is based on the operationalization of strategic actions oriented to the means of the innovation processes (Berends et al., 2014). For this strategy, it is considered a priority to size and calculate the resources that can be spent on the innovation trajectory, besides focusing on the development and strengthening of strategic partnerships in order to mitigate some present risks in the trajectory (Dew et al., 2008).

Furthermore, this paradigm is based on the idea that organizational decision-making behaviors are defined by their situations of risks and probabilities of uncertainty. So, the actions should be directed to the predictability and quantification of their losses, besides intentional efforts for strategic expansion of their gains, not focusing on the continuous management of tasks (Sarasvathy & Dew, 2005). In this way, with its transversal and dynamic character, *effectuation* tends to stimulate the capitalization of contingencies and unpredictability (Sarasvathy, 2001; Sarasvathy & Dew, 2005a).

From the need to understand the behavior of the actors involved in the innovative processes of the organizations, the concepts of *causation and effectuation* are an important theoretical element, acting as two relevant behavioral logics for analyses involving the production of new products and entrepreneurial actions arising from these innovations (Fischer, 2012; Berends, et al., 2014; Furtterer, Schmidt & Heidenreich, 2017).

2.3 Development and Creativity of New Products

The complex process of generating new products in the marketing ambit involves several influencing actors in the different phases and dimensions present in this trajectory. In this context, there is the leading presence of the Triple Helix (Etzkowitz & Leydesdorff, 2000),

formed by the academy, which represents the production of scientific knowledge that is the basis of the innovation process, the Government with the incentive policies for the production of innovations that serve the socioeconomic demands, and the companies that lead the actions of monetization and commercialization of technologies and products developed (Cóser et al., 2018).

Regarding the role of the academy, it integrates to the traditional role of the university - referring to teaching, generation and dissemination of knowledge and innovations - the duty to align research to the demands of the society, manifesting an approach between universities, companies and government, in which the latter operates as a determinant in stimulating the creation of transferable technologies (Miller, Mcadam & Mcadam, 2014).

In the governmental sphere, it is known that the development of public policies to encourage science, technology, and innovation, at the national level, drives the creation of interaction environments between the academy and the market, through the generation of overlapping relationships between these actors (Cóser et al., 2018), expanding the capacity to generate new products. In the circumstance of companies' performance, it is known that their actions of investments in new products and marketable technologies are directly linked to the investments directed towards obtaining scientific knowledge and their technological capacity (Deeds, Decarolis & Coombs, 2000).

2.4 Analytical Framework of the Research

The framework of the research is presented in Figure 1, which shows the constructs and hypotheses proposed by the study. In this framework, it is sought to list variables that can determine the level of startups engagement and their teams in public programs to stimulate innovation. In this case, it is established three groups of variables that can, with their levels of initiation to the receipt of benefits, influence the engagement of teams in the Program, namely: i) Dynamic Capacities (Creativity and Development of New Products, Absorptive and Network Capacities); ii) Entrepreneurial Behaviors (decision-making of the *causation & effectuation* type); and iii) Innovativeness (Innovation Capacity, such as organizational practices for production/generation of goods and knowledge).

In this way, it is considered that when a startup team already has some capacity for creativity and development of new products, for absorbing knowledge and networking, and acts in an entrepreneurial way, and adopts practices that generate innovative capacity, it may understand more clearly the process or journey proposed by the Incentive Program and engage in it in a more intense way, promoting a more effective impact of the Program on technological

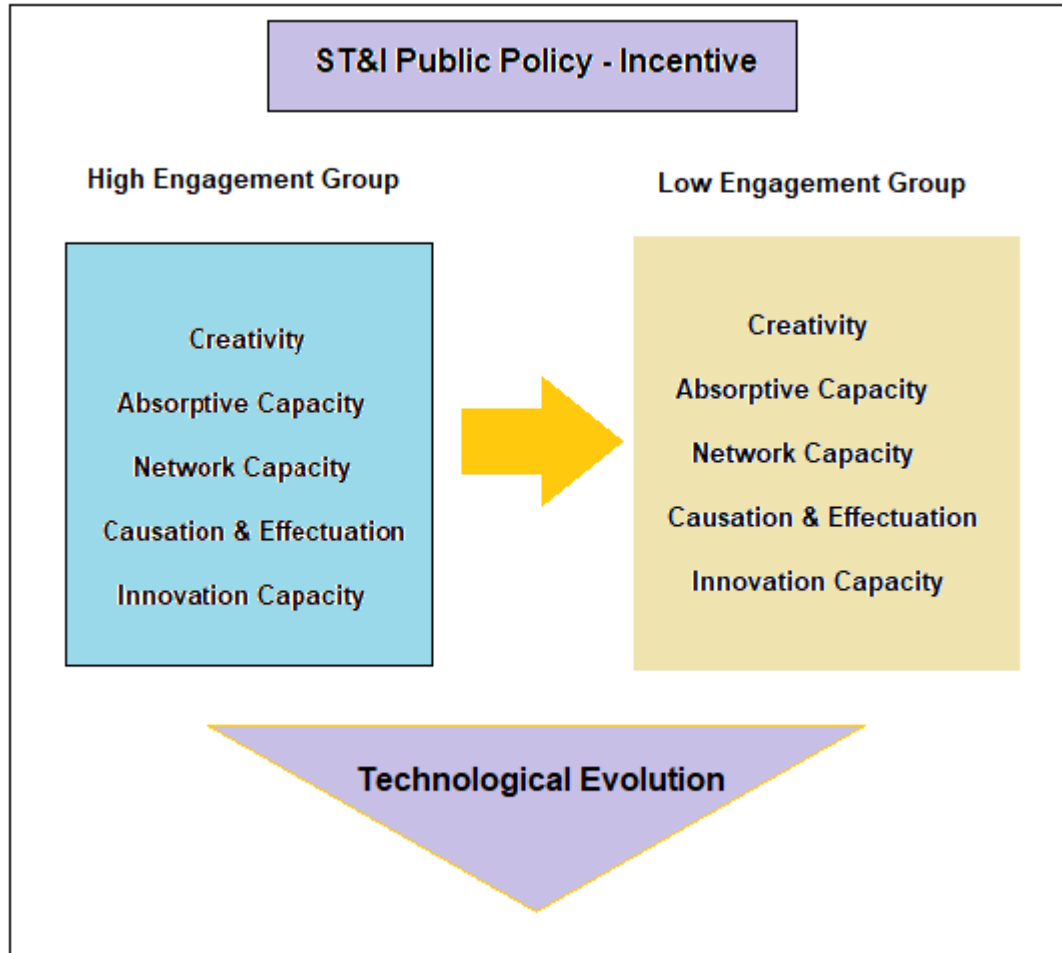
evolution (maturation towards the market) and on the success of these companies/teams.

Hence, based on this logic, it is possible to list the hypotheses of the research:

- **H1:** In the context of a participation in a ST&I public policy, the *Creativity and Development of New Products Capacity* is higher in the group of companies that most engaged in the public policy (Etzkowitz & Leydesdorff, 2000; Miller, Macdam & Macdam, 2014; Cóser et al., 2018; Buarque et al., 2020).
- **H2:** In the context of a participation in a ST&I public policy, the *Absorptive Capacity* is higher in the group of companies that most engaged in the public policy (Cohen & Levinthal, 1990; Poudier & St. John, 1996).
- **H3:** In the context of a participation in a ST&I public policy, the *Network Capacity* is higher in the group of companies that most engaged in the public policy (Boccardelli & Magnusson, 2006, Buarque, et al., 2020).
- **H4:** In the context of a participation in a ST&I public policy, the entrepreneurial decision-making (*Causation & Effectuation*) is higher in the group of companies that most engaged in the public policy (Buchanan & Vanberg, 1991; Sarasvathy, 2001, 2005; Fischer, 2012; Berends, et. al., 2014; Lemos, 2016; Furrterer, Schmidt & Heidenreich, 2017).
- **H5:** In the context of a participation in a ST&I public policy, the *Innovation Capacity* is higher in the group of companies that most engaged in the public policy (Breznik & Hirisch, 2014; Camisón & Villar-López, 2014; Câmara & Brasil, 2015; Malerba & Mckelvey, 2020).

Figure 1

Analytical Framework of the Research



Source: Developed by the authors.

3. Methodology

3.1 Empirical Corpus of the Research

After developing the theoretical structure of the analysis with the framework proposal, the next step was to promote its applicability. In light of this, the application was carried out in the State of Ceará, located in the Brazilian Northeast region. This state has about 9,240,580 in estimated population, distributed in 148,894.442 km², in 184 municipalities, with a HDI of 0.682 and with monthly household income per capita of R\$ 1,028.00 (IBGE, 2010, 2020, 2021; IPECE, 2020). The State of Ceará, in the Innovation Index of the Brazilian States (FIEC, 2021) currently ranks 11th in the general index, ranking 9th in capabilities and taking the 14th position

in results. It is 2nd among the Northeastern states, behind only Pernambuco (10th), with São Paulo in first place.

In a specific way, the public policy studied in this research was the Economic Clusters of Innovation Program (ECIP), promoted by the Government of the State of Ceará involving some of its Secretariats and Departments and a coordination team formed by technicians from these different Government spaces, including the participation of the Chief Scientist of Innovation of the State Government. The objectives of the ECIP are: i) to strengthen regional economic and social development; ii) to generate greater competitiveness of the regions by increasing the productivity of the activities with the greatest potential; iii) to create a new economy based on innovative entrepreneurship in the region; iv) to increase the wealth of the region with better income distribution; v) to increase the wealth of the state with better distribution among the regions and vi) to retain and attract talent trained in the region by offering high quality opportunities, boosting entrepreneurs who have innovative ideas to solve the main problems of competitiveness in the existing economic conglomerates in Ceará.

In this way, the choice was made for its characteristics of fostering knowledge-intensive companies and for the action of a policy to stimulate innovation through the creation of innovation clusters. The Economic Clusters of Innovation Program offered scholarships as a stimulus for entrepreneurs to engage in the activities developed. In addition, a journey was also offered to develop solutions and improve business proposals with a set of activities that were developed by the KICs, as shown in Chart 1.

Chart 1

Activities of the Journey of Stimulus to the KICs and its relation with the constructs of the study

Constructs that relate to the ECIP journey	Activities of the Journey of Stimulus to the KICs of the Program
Dynamic Capacities <i>Causation & Effectuation</i>	Capacity building in: Business modeling (accounting, branding, business model validation, pitch preparation) Corporate Agreement Product Roadmap Product design Prototype Demoday Preparation
Dynamic Capacities	Workshops in: Corporate Governance Agile Methodologies Sales Funnel and KPIs Finances and Pricing
Dynamic Capacities <i>Causation & Effectuation</i>	Mentoring with Market Mentors Connection with the Innovation Ecosystem Follow-up for Business Evolution Fundraising Opportunities

Source: Developed by the authors.

3.2 Data Collection

For the data collection of the research, questionnaires were applied to all companies participating in the Program, in a total of forty-six, between the months of January and March of 2022. The application was made with entrepreneurs, managers and technicians of the projects, who received questionnaires, via electronic forms accessed by links sent by e-mail. The questionnaire, applied during the companies' participation in the public policy, was prepared based on intrinsic variables to the dimensions of the constructs addressed in the theoretical framework. To this end, the scale, the structure and the order of the questions and the layout were defined according to scales already used by several seminal authors in the field of knowledge-intensive entrepreneurship. Five-point *Likert* scales were applied to the questions.

Therefore, the variables that make up the research instrument were developed as from the confluence of theoretical aspects raised in the literature associated with the theme of the knowledge-intensive companies. Scales consolidated in the literature were applied to the following constructs: i) Dynamic Capabilities, including the dimensions creativity and development of new products, absorptive capacity and network capacity; ii) Entrepreneurial Behavior, including the two decision making processes - causation and effectuation; and iii)

Innovativeness, which includes innovative capacity. The variable of engagement in public policy was obtained through the frequency and assiduity of the companies' participation in the actions, events, initiatives and programming of the ECIP.

3.3 Data Analysis

Once the questionnaires were returned, the data collected underwent treatment that occurred through statistical procedures, using two computing tools: Microsoft Excel and IBM SPSS Statistics (Cooper & Schindler, 2014), which supported the operationalization of the Factorial Analysis and Analysis of Variance practiced (Hair et al., 2009; Corrar, Paulo & Dias, 2007). How the last two mentioned techniques were carried out is described below.

3.3.1 Exploratory Factorial Analysis (EFA)

In this study, based on the EFA technique, it was sought the grouping of observed variables (present in the questions of the collected questionnaire) in the constructs of the proposed analytical framework (Figure 1). It was examined the correlation of 75 original variables of 10 measurement scales built from 05 conceptual domain dimensions of the 03 studied constructs, as shown in Chart 2 - which links these attributes.

Chart 2

Characteristic composition of the items of the scales by construct

Constructs	Conceptual Dimensions / Literature	Measurement Scales	Questions (obs. var.)
Dynamic Capacities	Creativity and Development of New Products (CDNP) Rindfleisch & Moorman (2001), adapted from Moorman & Miner (1998)	New Products and Creativity	7
	Absorptive Capacity (AC) Flatten et al. (2011)	Potential Absorptive Capacity	10
		Performed Absorptive Capacity	8
	Network Capacity (NC) Walter, Auer & Ritter (2006)	Coordination	6
		Relational Abilities	4
		Knowledge of Partners	4
Entrepreneurial Behavior	<i>Causation</i> Chandler et. al. (2011); Sarasvathy (2001)	<i>Causation-type</i> Entrepreneurial Decision Making	7
	<i>Effectuation</i> Chandler et. al. (2011); Sarasvathy (2001)	<i>Effectuation-type</i> Entrepreneurial Decision Making	13
Engagement in Public Policy	Startups Engagement (SE) Scale proposed by the authors, considering the frequency and deliveries of the teams in the activities of the proposed journey by the Public Policy (Chart 1)	Frequency of participation and deliveries made in percentage of the requested total for startups	1

Source: Developed by the authors.

3.3.2 Analysis of Variance

As is well known, the analysis of variance - ANOVA model is widely applied in research to compare multiple groups. The popular *f*-test in ANOVA extends Student's *t*-test in a scenario that seeks to compare averages between two or more groups defined by two or more factors (Hair et al., 2009; Field, 2018). Hair et al. (2009) explain that the ANOVA basically involves the comparison of two autonomous estimates of the variance for the dependent variable. The first represents the overall variability of the observations within the groups; and the second

reflects the differences between treatment groups on the dependent variable - assuming as null hypothesis the inexistence of treatment effects, in short, identical averages.

This research focuses on determining the differences in the averages between the treatment groups in terms of the dependent variable - assuming as null hypothesis equal averages and seeks to reject the null hypothesis in order to find evidence that attests the existence of different treatment effects, in other words, different averages. To this end, the appropriate calculation measure is the f -statistic, whose interpretation was based on significance less than 0.10, corresponding to a critical f -value greater than 3.84 (Hair et al., 2009). Parametric modifications were applied under behaviors of non-normality and heterogeneity of variance to ensure greater reliability of the ANOVAs results: before, the bootstrapping procedure to correct likely deviations of normality in the distribution of samples and discrepancies between group sizes (Haukoos & Lewis, 2005); and after, when needed, the Welch bootstrap f -test, instead of the classical f -test, to correct the heterogeneity of variance (Blanca et al., 2018; Delacre et al., 2019).

3.3.2.1 ANOVA Model

The estimated ANOVA model considered as dependent variable the Startups Engagement in Public Policy (SE) and as factors related to the independent variables: Causation & Effectuation (CE), Innovative Capacity (IC), Creativity and Development of New Products (CDNP), Absorptive Capacity (AC) and Network Capacity (NC). See Equation 1 described:

$$SE = CE + IC + CDNP + AC + NC \quad (\text{eq.1})$$

Each factor (independent variables) was grouped into two levels - high or low. For this, it was used as a parameter of factor division the average statistical measure. The criterion was established as follows: if greater than the average, it assumes value 1 (high level); otherwise, it assumes value 2 (low level).

In this way, the hypotheses proposed by the analytical framework (Figure 1) will be falsified one by one using the ANOVAs in which it is assumed that there is a difference in the average of the engagement in the policy (SE) between the groups of startups divided by the average (plus and minus) of each of the independent variables (CE; IC; CDNP; AC; NC). The following represents, as an example, the form of testing the Hypothesis which is repeated for the other hypotheses, considering for each one the groups formed by the respective independent variable.

- H1: $SE_{11} \neq SE_{12}$, as being:

SE_{11} = average of the *Startups Engagement* group above the CDNP median

SE_{12} = average of the *Startups Engagement* group below the CDNP median

4. Results

4.1 Factorial Analysis

The results show that all samples of original variables have a satisfactory size for performing factorial analysis [$KMO > 0,8$], with the exception of the sample associated with the construct Creativity and Development of New Products, which presents an unsatisfactory size; but feasible to perform factorial analysis [$KMO < 0,8; > 0,6$] (Bezerra, 2007). Furthermore, the results show that there is a correlation between the original variables that make up the sample of each construct [$p < 0,05$]. This permits the reduction of the original set of variables into a smaller number of factors that can explain part of the variability of the total data of the analyzed construct, as shown in Table 1.

Table 1

Tests of Adequacy of Sample Size and Presence of Correlation between Original Variables

Construct	Sample Size (no. of original variables)	KMO Measure	Bartlett's Statistical Significance
Creativity and Development of New Products (CDNP)	7	0,664	0,000
Absorptive Capacity (AC)	18	0,833	0,000
Network Capacity (NC)	14	0,847	0,000
Causation & Effectuation (CE)	20	0,854	0,000
Innovative Capacity (IC)	16	0,802	0,000

Source: Developed by the authors.

Subsequently, a first analysis was performed with factor extraction using the Main Components method with varimax orthogonal rotation of the factors, considering factor

loadings in the range of 0.30 to 0.40. The objective of this first arrangement was to find the number of factors extracted with the total self-values greater than 1.0, which can explain - in percentage terms - the value of variance of the total data of the related construct.

Continuing, a second factor analysis was performed. Now with factor extraction using the Main Axis Factorization method with varimax orthogonal rotation, continuing to consider factor loadings with the same range as the previous analysis. The idea of working with two options of arrangements was to increase the possibilities of analysis regarding the extraction of factors and regarding the total variance explained, seeking the most theoretically adequate configuration for the study, as shown in Table 2.

Table 2

Variance Explained by Extraction Methods

Construct	Number of Factors	Elevated Self-Values	Cumulative Variance (%) - Main Components	Cumulative Variance (%) - Main Axis Factorization
Creativity and Development of New Products (CDNP)	1	3,109	37,70	31,17
	2	1,171	61,14	50,42
Absorptive Capacity (AC)	1	9,566	26,31	24,93
	2	1,835	49,57	46,72
	3	1,624	72,36	67,66
Network Capacity (NC)	1	8,183	35,99	34,91
	2	1,218	67,15	62,38
Causation & Effectuation (CE)	1	11,692	27,05	26,26
	2	1,527	54,08	51,42
	3	1,191	72,04	67,80
Innovative Capacity (IC)	1	7,927	25,41	20,40
	2	1,538	44,01	37,58
	3	1,210	59,51	52,23
	4	1,097	73,57	64,86

Source: Developed by the authors.

In this sense, it was observed from the results presented in Table 2 that the best alternative arrangement was the one that used the Main Components method, because it presented the best cumulative percentage of data variability explanation per construct. As for the factor extraction analysis, both methods extracted the same number of factors for each construct.

4.2 Bootstrapping and ANOVA

Based on the results shown in Table 3, it was found that the Startup Engagement in Public Policy variable presents a non-normal data distribution [$Z(47)=0,229$; $P<0,05$].

Table 3

Distribution Tests of Sample Normality

Dependent Variable	Kolmogorov-Smirnov		
	Statistics	gl	Sig.
Startup Engagement in Public Policy (SE)	0,229	47	0,000

Source: Developed by the authors.

To correct for the normality deviation, bootstrapping was performed with a standard resampling number of 1000, confidence interval at the 95% level, with accelerated defect correction. In addition, to ensure greater reliability of the ANOVA results, variance equivalence verification was performed using Levene's test, which has a requirement of [$P>0.05$].

The results returned that the data for the Startup Engagement in Public Policy variable, when related to most factors, do not show relatively equal variability, namely [$L(1, 45)=12.493$; $P<0.05$]; [$L(1, 45)=8.994$; $P<0.05$]; [$L(1, 45)=4.538$; $P<0.05$]. For these relations, whose variances are heterogeneous, the application of Welch's correction method was required. For the two other relations with homogeneous variances, the ANOVA was performed without requesting any correction method: [$L(1, 45)=3.418$; $P>0.05$]; and [$L(1, 45)=3.632$; $P>0.05$]. From the data in Table 4, it is observed that only the variables Causation & Effectuation and Innovative Capacity, showed significant differences in their averages, when compared to the Startup Engagement in Public Policy variable.

Table 4

ANOVAs: f Test and f Welch Bootstrap Test

Dependent Variable	Factor	Statistics	Correction Method	gl 1	gl 2	Sig.
Startup Engagement in Public Policy	H1 – Creativity and Development of New Products (CDNP)	0,071	Welch	1	44,916	0,791
	H2 – Absorptive Capacity (AC)	1,476	–	1	45	0,231
	H3 – Network Capacity (NC)	0,036	–	1	45	0,850
	H4 – Causation & Effectuation (CE)	3,974	Welch	1	25,456	0,057
	H5 – Innovative Capacity (IC)	6,164	Welch	1	33,898	0,018

Source: Developed by the authors.

The study initially compared the averages of the groups of the Causation & Effectuation variable with the objective of verifying the existence or not of a different effect of the groups on the Startup Engagement in Public Policy variable. It was found through ANOVA with Welch correction that, on average, the values belonging to the two groups that make up the independent variable are different when related to the dependent variable: [Welch $F(1, 25.456)=3.974$; $P<0.10$].

In this sense, hypothesis H4 is accepted. This allows the inference that, although causation & effectuation possess distinct theoretical foundations, these models are not mutually exclusive and follow the company during its path in decision making (Sarasvathy, 2001; Read & Sarasvathy, 2005; Read et al, 2009; Lemos, 2016; Furtterer, Schmidt & Heidenreich, 2017), as a dynamic, at one moment one has a posture more adherent to the principles of causation, with more control and risk aversion, to know, when the planning of the entrepreneurship begins, with the business plan, strategic planning and other management tools that imply the control of actions during (Sarasvathy, 2001; Read & Sarasvathy, 2005; Chandler et al., 2011; Ahuvia & Bilgin, 2011; Lemos, 2016).

At other times, the company becomes more adherent to the principles of effectuation, with less risk aversion, as in the process of the development of an innovative product, when one

does not have control of all the variables, mainly, in the sharing of knowledge with external partners, essential, for the development of the product (Sarasvathy, 2001; Sarasvathy & Dew, 2005; Tasic & Andreassi, 2008; Dew et al., 2008; Berends et al., 2014).

Thus, the dynamics between causation & effectuation processes have an impact on the innovative trajectory of the organizations that, in turn, have their purposes and ideologies, internal values, influenced by political and economic variables, which may, at a given moment, promote greater adherence to the sector's public policies (Buchanan & Vanberg, 1991; Sarasvathy, 2001; 2005 & Lemos, 2016).

Next, it was proceeded the verification between the Innovative Capacity variable and the Startup Engagement in Public Policy variable. The result of the ANOVA, using Welch's method, showed that the independent variable is significant. Its groups cause different effects on the dependent variable: [Welch $F(1, 33.898)=6.164$; $P<0.05$].

In this way, the hypothesis H5 is accepted. It is possible to infer that the Innovative Capacity of the company relates in a mutual way with the external environment during the path of innovation generation, in its ideation processes until the technology transfer in the market (Breznik & Hisrich, 2014; Camisón & Villar-López, 2014), this can influence the way these companies relate to the public policies of the sector. In the search for benefits for the development of their products, they may become more engaged in certain policies to support innovation (Câmara & Brasil, 2015).

The other variables (Creativity and Development of New Products, Absorptive Capacity and Network Capacity) did not show to be statistically significant in the context studied. However, these are artifacts that, as discussed in the literature, have a great impact on the development of the knowledge-intensive companies (KICs), although this study has shown that these variables do not influence the engagement of these companies in the public policy studied. Table 3 summarizes the final results of the hypotheses tested.

Table 3

Hypotheses Results

Hypothesis	Related Theory	Result
H1: The capacity of developing new products influences the KICs' engagement in public policy.	(Etzkowitz & Leydesdorff, 2000; Miller, Macdam & Macdam, 2014; Cóser et al., 2018; Buarque et al., 2020).	Rejected
H2: Absorptive Capacity influences the KICs' engagement in public policy.	(Cohen & Levinthal, 1990; Pouder & St John, 1996).	Rejected
H3: Network Capacity influences the KICs' engagement in public policy.	(Boccardelli & Magnusson, 2006, Buarque et al., 2020).	Rejected
H4: Causation & Effectuation influence the KICs' engagement in public policy.	(Buchanan & Vanberg.,1991; Sarasvathy, 2001, 2005; Fischer, 2012; Berends et. al., 2014; Lemos, 2016; Furterer, Schmidt & Heidenreich, 2017).	Accepted
H5: Innovative Capacity influences the KICs' engagement in public policy.	(Breznik & Hirsch, 2014; Camisón & Villar-López, 2014; Câmara & Brasil, 2015; Malerba & Mckelvey, 2020).	Accepted

Source: Developed by the authors.

5 Final Considerations

This article aimed to understand how dynamic capabilities, entrepreneurial behavior, and innovativeness impact the engagement of knowledge-intensive companies during their participation in a regional public policy to foster innovation and entrepreneurship. From the efforts of data collection and analysis, it was possible to achieve the proposed objective, through the application of techniques that allowed the evaluation of the proposed hypotheses.

It was possible to conclude that, after participating in the support Program, the startups with higher engagement did not depend on the capacities: i) network capacity; ii) absorptive capacity and iii) their creative attitudes and development of new products. However, these companies that presented higher innovative activities, when finishing the journey of the analyzed Program, were influenced by their final levels of the entrepreneurial behaviors of their global capacity to innovate: i) Causation & Effectuation and ii) Innovative Capacity.

This result points to the fact that the startups that developed their entrepreneurial skills better, notably in decisions related to balancing the risks of the innovation process, and that focused on their general capabilities to innovate engaged more in the journey proposed for them

by the public policy studied. This may reveal that even though the other capabilities studied are pointed out by the literature as relevant, the startups studied do not seem to perceive or take advantage of the journey in this sense. This may also reveal a behavioral issue or a deficiency of the journey in creating this interest from those who develop these capabilities that were not relevant to the engagement.

As limitations of the study, it is possible to mention that the research was conducted with a cross-sectional approach, in the last moments of the companies' participation in the public policy. It is possible to apply the same scale of study with companies after a certain period of completion of the Program's activities, in order to measure how these companies were impacted over time by the ECIP. It is also recommended that qualitative studies be carried out on the Program, aiming to collect more in-depth perceptions about the constructs treated here, and providing an opportunity for further analysis of the relations between these constructs.

Authors' contributions

Contribution	Buarque, B.	Câmara, S. F.	Pinto, J. G. P.	Melo, J. I. B.
Contextualization	X	X		X
Methodology	X	X	X	X
Software	X	X	X	X
Validation	X	X	X	X
Formal analysis	X	X	X	X
Investigation	X	X	X	
Resources	X	X		
Data curation	X	X	X	X
Original	X	X		
Revision and editing	X	X	X	
Viewing	X	X	X	X
Supervision	X	X		
Project management	X	X		
Obtaining funding	X	X		

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