FEDERAL UNIVERSITY OF CEARÁ

CONTEXTUS
REVISTA CONTEMPORÂNEA DE ECONOMIA E GESTÃO
Contextus – Contemporary Journal of Economics and Management

ISSN 1678-2089
ISSNe 2178-9258

www.periodicos.ufc.br/contextus

Orchestration of innovative networks in public policies: The Economic Clusters of Innovation Program from the Government of The State of Ceará

Orquestração de redes de inovação em políticas públicas: O Programa Clusters Econômicos de Inovação do Governo do Estado do Ceará

Orquestación de redes de innovación en políticas públicas: El Programa de Clústeres de Innovación Económica del Gobierno del Estado de Ceará

https://doi.org/10.19094/contextus.2023.81742

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ABSTRACT
This research has the objective of presenting the context of the Economic Clusters of Innovation Program (ECIP) as an orchestrating project of public innovative networks, analyzing how the Program used orchestration constructs in its relationship, constituted by different actors (Universities, Government, Researchers, Entrepreneurs and Policy-makers) that formed the public policy. For data collection, semi-structured interviews were conducted with thirty actors from local innovative ecosystems. Among the results obtained, it is concluded that the ECIP encouraged and managed interactions in a systematic and significant way among its actors, generating a great positive impact on the innovation results of the network.
Keywords: orchestration of innovative networks; innovative public policies; appropriability of innovation; stability of the network; formation of innovative clusters.

RESUMO
Esta pesquisa possui o objetivo de apresentar o contexto do Programa Clusters Econômicos de Inovação (PCEI) como um projeto orquestrador de redes de inovação pública, analisando de que forma o Programa utilizou de construtos de orquestração em sua relação, constituída por diferentes atores (Universidades, Governo, Pesquisadores, empreendedores e policy-makers) que formaram a política pública. Para a coleta de dados foram realizadas entrevistas semiestruturadas com trinta atores dos ecossistemas de inovação locais. Dentre os resultados obtidos, conclui-se que o PCEI incentivou e gerenciou interações de forma sistemática e significativa entre seus atores, gerando um grande impacto positivo nos resultados de inovação da rede.
Palavras-chave: orquestração de redes de inovação; políticas públicas de inovação; apropriabilidade da inovação; estabilidade da rede; formação de clusters de inovação.

RESUMEN
Esta investigación tiene como objetivo presentar el contexto del Programa de Clústeres de Innovación Económica (PCEI) como un proyecto orquestador de redes públicas de innovación, analizando cómo el Programa utilizó constructos de orquestación en su relación, constituidos por diferentes actores (Universidades, Gobierno, Investigadores, empresarios y políticos) que dieron forma a las políticas públicas. Para la recolección de datos, se realizaron entrevistas semiestructuradas a treinta actores de los ecosistemas locales de innovación. Entre los resultados obtenidos, se concluye que el PCEI fomentó y gestionó de manera sistemática y significativa las interacciones entre sus actores, generando un gran impacto positivo en los resultados de innovación de la red.
Palabras clave: orquestación de redes de innovación; políticas públicas de innovación; apropiabilidad de la innovación; estabilidad de la red; formación de clústeres de innovación.

Article Information
Uploaded on 28/09/2022
Final version on 17/11/2022
Accepted on 19/12/2022
Published online on 11/04/2023

Interinstitutional Scientific Committee
Editor-in-chief: Diego de Queiroz Machado
Associated Editor: Dalton Chaves Vilela Júnior
Evaluation by the double blind review system (SEER / OJS - version 3)

How to cite this article:
Cavalcante, R. F. L., Buarque, B., & Câmara, S. F. (2023). Orchestration of innovative networks in public policies: The Economic Clusters of Innovation Program from the Government of The State of Ceará. *Contextus – Contemporary Journal of Economics and Management*, 21, e81742. https://doi.org/10.19094/contextus.2023.81742

1 INTRODUCTION

The literature on orchestration of innovative networks has evolved in recent years and addressed different aspects, such as: the relationship with absorptive capacity and dynamics; network design elements; orchestration as an important factor for innovative typologies, which depend on collaboration among networked actors; and description of the characteristic of multiple orchestrators in the determinants mechanisms of open innovation, among others (Ritala, Armila & Blomqvist, 2009; Nambisan & Sawhney, 2011; Nätti, Hurmelinna-Laukkanen & Johnston, 2014; Cui et al., 2017; Reypens, Lievens & Blazevic, 2021; Linde et al., 2021; Schepis, Purchase & Butler, 2021; Andersén & Ljungkvist, 2021).

Since the work of Dhanaraj and Parkhe (2006), orchestration has come to prominence as a typology capable of describing coordination among actors in innovative networks. However, there are still few studies that point to this typology in the coordination of actors in public policies to stimulate innovation and the emergence of innovative Clusters. In Silva (2018), orchestration is discussed as a key element in stimulating the emergence of Clusters of Innovation. However, the framework used by the author does not adopt the perspective of public policy as a driver and stimulator of this process, although it points to the participation of local government as one of the actors. Thus, the work adds more centrally public policies in the process of orchestrating and stimulating innovation and regional development.

Thus, the research question that is sought in this work is: how does the orchestration of innovative networks in public policies influence the creation and development of regional innovative programs and the formation of Clusters of Innovation? And seeks as objective: to present the Economic Clusters of Innovation Program (Program of the Government of the Ceará State in the Northeast Region of Brazil) as an orchestrator project of public innovative networks. In the specific case, this study focuses on a program to stimulate regional development with the combination of identifying problems of companies belonging to Economic Clusters in different regions and proposals for innovative technological solutions to be presented by startups.

This program studied here is called Economic Clusters of Innovation - ECIP and it is developed under a perspective of creating networks that involve Government Teams, Regional Researchers (RRs), selected to participate in the process as mentors and bonds between the companies of the Clusters selected by the ECIP, the regional Universities and startups proposers of solutions. In this way, it intends to connect these different actors of the local innovative ecosystems (Universities, Regional Researchers, startups, Cluster Companies, among others) in order to promote the economic development of the regions by increasing the competitiveness of the already relevant sectors (Clusters) in the regions, at the same time stimulating their human capital potential in the search for the promotion of the knowledge economy, through the action of startups. This program was created in the State of Ceará, in the Northeast region of Brazil in 2019 and completed, in 2021, its first cycle with the participation of 23 sectors in 9 regions of the State, 41 RRs from Universities and 46 startups, proposing solutions for 30 different problems of these sectors and regions. To achieve the objective of this work, a qualitative research was carried out, with the application of interviews, with a script based on the themes addressed in the Network Orchestration literature. This method was adopted aiming to collect the perceptions of the actors participating in the network that was constituted in the ECIP, and relate them to the literature.

The paper is structured as follows: the next section discusses the theoretical insights in innovative networks, orchestration in innovative networks, public policies for innovation and the analytical framework of the research. In the third section, the design and the context of the research are presented along with the choice of the program studied. In the fourth section, based on empirical data, the results and discussions are presented, making use of the fundaments and unfoldings of the empirical evidence found. Finally, the main conclusions are presented and their implications for policy and research are discussed.

2 THEORETICAL FRAMEWORK

2.1 Innovative Networks

Innovative networks are interorganizational networks consisting of innovative organizations and other actors such as Government Entities, Universities, Research Centers and Financial Agencies interested in the development of a product, process or service (Rycroft & Kash, 2004; Silva et al., 2007; Goduscheit, 2009).

Küppers and Pyka (2002) clarify that innovative networks include the performance and interaction of people, ideas, and organizations to create new products, processes, and organizational structures that are technologically and commercially viable (Küppers & Pyka, 2002; Buganza et al, 2011; Ahrweiler & Keane, 2013), where organizations maintain their autonomy, but in the context of innovation, actors establish stable, complex and reciprocal social relationships (Duschek, 2004; Batterink et al., 2010; Cap et al., 2019). Along with this, they promote interactions in a collaborative manner and rely primarily on knowledge sharing (Grant, 1996; Dyer & Nobeoka, 2000).

Thus, innovative networks give greater visibility to the manifest of globalization by facing uncertainties more quickly and with greater agility. One more factor is their ability to adapt to situations, since networks proceed not only by responding to changes, but by achieving proactivity (Rycroft & Kash, 2004). Prince et al. (2014) highlight such ideas by reiterating that network configuration enables deep connections between actors and superior responsiveness on their part.

A benefit of networks lies in the access to knowledge, technology, experiences, resources, and/or innovations that they provide that would not otherwise be available (Buganza et al., 2011; Prince et al., 2014). Furthermore, networks enable the achievement of economies of scale, allow organizational changes, enable the institutionalization of innovation and collaboration, which contributes to the competitive advantage of its participants (Balestrin, Vargas & Fayard, 2005; Silva et al., 2007; Bueno & Balestrin, 2012).

In the view of Dhanaraj and Parkhe (2006), in innovative networks, as in all other innovative projects, knowledge is the chief currency and the clarity and ease with which knowledge is shared, acquired and applied within the network, being a determining and essential factor for the success of innovation.

It can be seen that innovative networks remain of strong relevance to current economic development, including and reaching out to the public sector. Just as this theme has spread in the private sector in recent years, public institutions and their managers are also beginning to realize the possibilities arising from a structured approach to innovative networks (Toigo et al., 2021).

Alberti and Bertucci (2006) attest that governments around the world have been under permanent pressure from society to respond to the demands of citizens and the growing complexity of their environments. According to Schwella (2014), globalization, the struggle against inequality, respect for diversity, and the search for good governance and efficient public management are some of the challenges faced by governments in the 21st century that require creativity and innovative approaches.

2.2 Orchestration in innovative networks

Originating from the management literature, orchestration has been a relevant concept for understanding the development of innovative networks and ecosystems. In this sense, orchestration can be considered as the ability of an actor to influence the evolution of a business network altogether. Authors such as Dhanaraj and Parkhe (2006) and Ritala, Hurmelinna-Laukkanen and Blomqvist (2009) and Ritala, Armila and Blomqvist (2009) mention that orchestration capacity is the ability to intentionally build and manage innovative networks among companies.

According to authors such as Carayannis, Barth and Campbell (2012), Hwang and Horowitt (2012) and Durst and Poutanen (2013) the components of an innovative ecosystem include actors of all types and relationships. Authors such as Etzkowitz and Leydesdorff (2000) indicate the Triple Helix (Government, Academy, and Business) as actors in an innovative ecosystem. For Labiak (2012), the actors can be classified as public actor, knowledge actor, fomentation actor, institutional actor, innovative habitat actor, and entrepreneurial actor. Hamad et. al. (2015) propose different actors as being notable actors of an innovative ecosystem. Thus, government, business, academy/school, and community should act towards improving the quality of the development of innovative networks and ecosystems. Bittencourt, Santos and Mignon (2021) relate how innovative ecosystems benefit and use the constructs of orchestration in networks to structure policies and initiatives in this environment, especially in activities related to the acquisition and sharing of knowledge.

Klerkx and Aarts (2013) point out that the orchestration of network is necessary for its operation as, due to its complexity, several challenges and dilemmas arise that are not solved by themselves. In the same sense, Silva et al. (2007) state that the cooperation with several organizations, often heterogeneous, leads to a network configuration, represented by an organization and its flows characterized by the content of joint activities (from the identification of opportunities to R&D activities and even commercialization). With the purpose that these activities involving heterogeneous actors meet the major objective of innovating, it becomes necessary the existence of coordination mechanisms among the organizations that constitute the network.

Buganza et al. (2011) states that in networks there is a process in which the actors are a source of complementary characteristics over which the company has no hierarchical control and that enables effective collaboration practices and technology exchange. In this process, individuals who occupy a central position in scientific, technical, or market issues have a key role in the network, which can be related to the role of the network orchestrator.

According to Dhanaraj and Parkhe (2006), the central company or the orchestrator of the network is the one who has prominence and power, gained through his individual attributes and his central position in the network structure. For these same authors, the orchestrator makes use of prominence and power to act as a leader in bringing together the dispersed resources and capabilities of the network members. For Rycroft and Kash (2004), however, innovative networks are able to combine new scientific and technological capabilities and recombine old ones, without the intervention of a central controller.

Mignoni, Bittencourt, Silva, and Zen (2021) conducted a research on how a public policy program, from the actions of its different actors, executed network orchestration initiatives to achieve the objectives of engaging the participants of the regional innovative network, defining how the constructs of the orchestration area are applied in this context of a municipal innovative network. In this study, the collective initiatives and actions of engagement, collaboration, and sharing of information and knowledge are critical to the establishment of the network and the mutual gain for its participants.

In the face of these approaches, Dhanaraj and Parkhe (2006) state that there are three processes for the exercise of orchestration of innovative networks and that they are positively related to innovative output and network collaboration activities and also related to the role of the orchestrator, which are: (a) knowledge mobility, which

concerns the ease with which knowledge is shared; (b) innovation appropriability, which seeks to ensure that network members are able to capture the results generated by innovations in an equitable manner, aiming to ensure reciprocity and legitimacy in sharing the results generated; (c) network stability, which deals with the willingness of network members to maintain collaboration with each other, which is related to the dynamism of an innovative network. These processes are central to understanding the orchestration of innovative networks.

As for the result, the effects of management actions and their impact on the innovation generated by the network are verified. The verification of the results is essential for actions to be taken in order to maintain or to improve the results for the network as a whole, being necessary to see in which of the explained points it will be necessary to act again aiming the balance (Clegg et al., 2016; Dagnino et al., 2016; Perks et al., 2017; Pikkarainen et al., 2017; Thomas, Faccin & Asheim, 2020; Bittencourt, Santos & Mignoni, 2021; Mignoni et al, 2021).

The contribution of several authors allows to give the necessary support to the set of processes and specific actions, called orchestration of innovative networks, representing the managerial action necessary to orchestrate resources in the environment of the innovative network, in which a central agent, in face of its characteristics of prominence over the other members of the network, assumes the role of orchestrator to promote the development and access to network resources as proposed by Nyström et al. (2014), laying the basis for their research on the ECIP for the evolution of innovations and regional development.

2.3 Public Policies of Innovation

Due to different perspectives on innovation and public policy-making, various ways and approaches have been developed to define and categorize innovative policy. However, authors such as Edquist (2011), Audretsch and Link (2012), Bajmócy and Gébert (2014), Silva, Serio and Bezerra (2022) define innovative policy as a series of government activities in the form of plans, programs, projects or actions aimed at fomenting innovation.

Added to this, there are policy justifications based on market failures that tend to focus on structural conditions and a very limited government role (Laasonen, Kolehmainen & Sotarauta, 2020), introducing a broader and deeper view on innovative processes and failures that can slow down the innovative system as a whole (Edquist 2011; Woolthuis, Lankhuizen & Gilsing, 2005). The underlying idea is that competencies for innovation are distributed across a network of actors, such as firms, universities, intermediaries and their relationships. Thus, innovations should be understood as a complex interaction between actors, knowledge spillovers, institutions, and networks. System failure can be caused by a lack of sufficient elements in the innovative system (e.g. actors, certain types of funding, or knowledge) or a non-optimal interaction between these elements (Woolthuis, Lankhuizen & Gilsing 2005).

Borrás (2009) attempted to grasp the trends behind a broader view of an innovative policy by characterizing the developments of the 2000s as a process of (1) broadening, referring to the expansion of the scope of innovative policy, and (2) deepening, referring to the introduction of new and more sophisticated policy instruments. In a broader context, recent developments in innovative policy also reflect the replacement of traditional state-centric models of government and public administration with new ideas about the distribution of power, multi-level and multi-stakeholder governance, and New Public Management (Flanagan, Uyarra & Orange 2011).

In addition, there have been other prevailing concepts regarding innovative systems, such as regional (Cooke, Uranga & Etxebarria, 1997), innovative ecosystems (Clusters) (Porter, 1998), entrepreneurship and business (Stam, 2015), built regional advantage (Asheim, Boschma & Cooke 2011), among others, enabling an expressive impact on the innovative policies implemented, especially in developing countries like Brazil.

The approach that relates innovative systems with public policies suggests that policies should somehow be adjusted or customized according to the region or industries to which they are directed. In particular, Asheim, Boschma, and Cooke (2011) introduced a sound framework that emphasizes the importance of a region's related variety and differentiated knowledge bases in establishing effective innovative policies. The authors argue that innovative policies and practices vary not only across countries and regions, but also depending on their past paths, resources, and policy-making styles. In addition, policies should be based on the identification of regional and sector-specific knowledge bases and institutions (Sotarauta & Kosonen, 2013).

It also adds the growth of interest in addressing socio-economic-technological challenges through innovative policies and transforming entire systems of innovation, production, and consumption. Translated into policy rationales, the emphasis is on mission-oriented policies that require the public sector not only to decrease private sector risk, but also to lead the direct creation of new technological opportunities and market settings. The recent policy debate on innovation-led smart growth is seen as requiring long-term strategic investments and public policies that aim to create and shape markets rather than just fix markets or systems (Mazzucato, 2016, p. 140).

In this perspective, Patanakul and Pinto (2014) recommend that the government should have an innovative policy portfolio and in this way, the authors institute some relevant environmental conditions and factors to be evaluated when formulating the innovative policy portfolio. These are: i) a favorable business environment; ii) infrastructure and business platforms; iii) investment in scientific research; iv) quality workforce; v) a rigorous and focused innovative policy.

2.4 Analytical Framework of the Research

Therefore, the construction of the orchestration analysis framework was elaborated, based on the collaborative and network process present in public innovation. It was used, due to the scarcity of works with the theme orchestration of innovation in the public sector, literature of orchestration in innovation in a generic way, mainly linked to the innovation of companies (Ritala, Armila & Blomqvist, 2009; Nambisan & Sawhney, 2011; Bittencourt et al, 2018; Silva, 2018; Milwood & Roehl, 2018; Faccin, Wegner & Balestrin, 2020; Schepis, Purchase & Butler, 2021, Bittencourt et al, 2022).

Taking into consideration the literature reviewed and based on the previous frameworks of Sørensen and Torfing (2011) and Milwood and Roehl (2018) a theoretical analytical framework was proposed for this work, as indicated in Figure 1 and added the Public Policy typologies of Chen, Walker and Sawhney (2020), as a way to build more tangibility to the empirical analyses arising from the empirical use of the proposed framework.

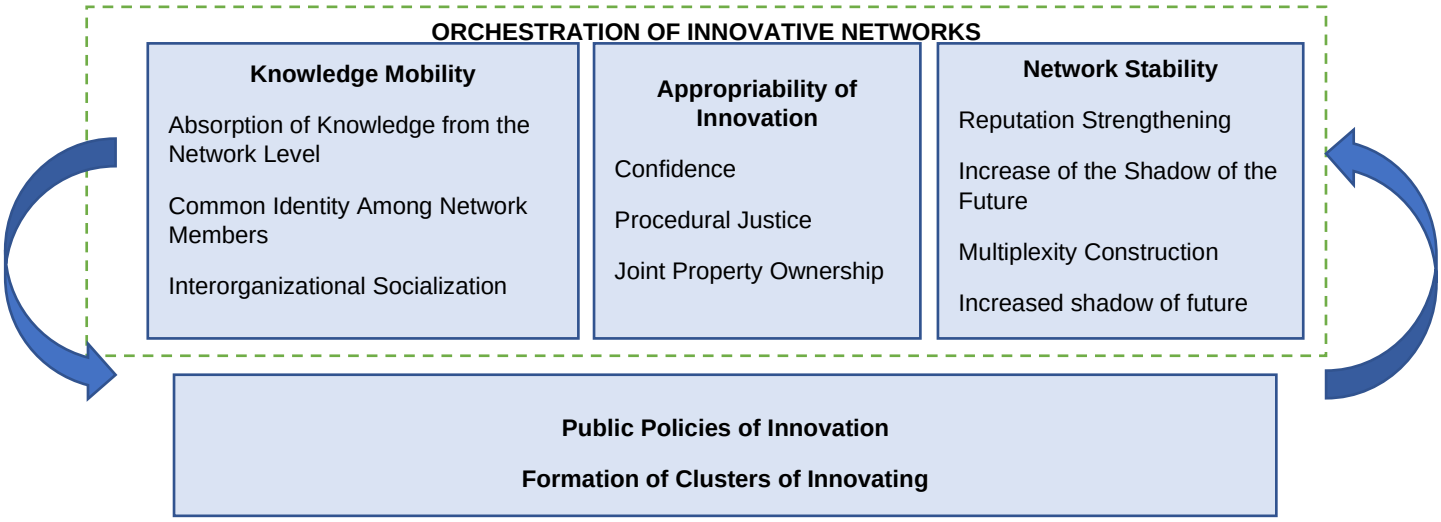

Figure 1. Proposed analytical theoretical framework
Source: Adapted from Sørensen and Torfing (2011).

Basically the framework is based on a simple logic, based on two types of antecedents: i) the first type are those related to the conditions for the public innovation policies to occur (collaborative process between managers, technicians, academy, citizens, public management decision, facilitators and barriers in the institutional, organizational and cultural spheres) and ii) the second type are elements that ensure the possibility of the orchestration of innovative network (knowledge mobility, appropriability of innovation and network stability).

These precedents are capable of enabling or promoting, preventing and/or even disrupting the studied phenomenon that interlinks orchestration of a public innovative network.

3 RESEARCH DESIGN

3.1 Research Context

Considering the scarcity of research addressing the issue of orchestration of public innovative networks, it was decided to conduct a research with a basic qualitative, descriptive and exploratory approach (Cooper & Schindler, 2003) as the most appropriate to provide a better understanding of the studied phenomenon and its constituent variables, according to proposed analytical theoretical framework (Sekaran, 2003).

This research has an abductive approach (Adam, 2008), using a single case of study research strategy and substantiated by documentary research and fieldwork, enhancing the understanding of a little-researched phenomenon, requiring an understanding of the details of its constituent elements, which could be lost if performed by quantitative research based on aggregate variables (George & Bennett, 2005; Yin, 2005; Hashimov, 2015).

Data collection procedures occurred through the use of research instruments, which in this paper were represented by primary and secondary data, publications, national and international surveys, semi-structured interviews (Mann, 1992) and, direct observation (Patton, 2002). The data were analyzed using content and narrative analysis techniques (Freitas & Janissek, 2000), to extract the perceptions of the interviewees about the themes addressed.

Data collection occurred during the months of February and March of 2022, and the main method used was semi-structured, in-depth interviews via videoconference, with an average duration of forty-five minutes, with a total of thirty (30) interviewees, as shown in Table 1. The interviews were recorded for later transcription and analysis, as authorized at the time of the interview by all respondents.

Twenty members of the group called the Central Core of the ECIP were interviewed, represented by technicians and analysts from various institutions, and 10 RRs from the ECIP.

Table 1
Interviews with actors in the innovative ecosystem of the State of Ceará

Ecosystem actors	Position	Institution
INT1	Regional Researcher from Tourism Cluster of the Greater Fortaleza 1	State University of Ceará - Uece
INT2	Pro-Rector of Extension	Federal Institute of Ceará - IFCE
INT3	Regional Researcher from Renewable Energy Cluster of the Greater Fortaleza 3	Federal Institute of Ceará - IFCE
INT4	Former Director of the Technology Center and Coordinator of Platform 2050: a long-term vision for Ceará	Federal University of Ceará - UFC
INT5	Director of the Technology Center	Federal University of Ceará - UFC
INT6	Pro-Rector of Learning	Federal Institute of Ceará - IFCE
INT7	Regional Researcher from the Health Cluster of Sobral's Sertão	Federal Institute of Ceará - IFCE
INT8	President	Nucleus of Technology and Industrial Quality of Ceará (Nutec)
INT9	Director of Entrepreneurship and Business	Nucleus of Technology and Industrial Quality of Ceará (Nutec)
INT10	Regional Researcher from the Infrastructure and Logistics Cluster of the Greater Fortaleza 3	CDL Faculty
INT11	Regional Researcher from Renewable Energy Cluster of the Greater Fortaleza 3	Federal Institute of Ceará – IFCE
INT12	Regional Researcher from the Jaguaribe Valley Agribusiness Cluster	Federal Institute of Ceará - IFCE
INT13	Executive Secretary for Trade, Service and Innovation	Secretary of Economic Development and Labor (Sedet)
INT14	Executive Secretary of Labor and Entrepreneurship	Secretary of Economic Development and Labor (Sedet)
INT15	President	Company of Information Technology of Ceará – Etice
INT16	Manager of the Innovation HUB	Bank of the Northeast of Brazil – BNB
INT17	Director	Senac Ceará Faculty
INT18	Regional Researcher from the East Coast Agribusiness Cluster	Federal Institute of Ceará – IFCE
INT19	Regional Researcher from Tourism Cluster of the Greater Fortaleza 1	University of Fortaleza – Unifor
INT20	President	State University of Ceará Foundation – Funece
INT21	Director	National Service of Industrial Learning (Senai Ceará)
INT22	Manager of the Northeast Regional Department (DRNE)	Financier of Studies and Projects – Finep
INT23	Regional Researcher from the ICT Cluster of the Greater Fortaleza 1	State University of Ceará – Uece
INT24	Special Advisor of the Innovation Board	Federation of Industries of the State of Ceará – Fiec
INT25	Regional Researcher from the Crateús's Sertão Trade Cluster	Federal University of Ceará – UFC
INT26	Coordinator	Technology Business Development Space (EDETEC) of the University of Fortaleza – Unifor
INT27	Director of Business Support	Agency of Economic Development of the State of Ceará - Adece
INT28	Technology and Innovation Manager	National Service of Industrial Learning - Senai Ceará
INT29	Coordinator	CriarCe Hard - Secretary of Science, Technology and Higher Education – Secitece
INT30	Research Project Manager	University of Fortaleza – Unifor

Source: Elaborated by the authors.

Once data collection and transcription of the recorded audios were concluded, we moved on to the analytical exploration phase of these data, using the triangulation of sources method (Alves-Mazzotti & Gewandsznajder, 1999), with the help of the New NVivo software. The data were analyzed by means of thematic content analysis techniques based on the predetermined categories and emerging from the interpretations, in addition to the narrative analysis. Thus, 3 analytical categories were grouped, divided into 3 subcategories respectively. The data analysis occurred by crossing the data collected through the documentary survey; the record of the observations, through structured observation, describing precise information about the fact in question, as well as the guidance of Bardin (2009), related to the analysis of the content and transcript of the interviews.

After developing the theoretical structure of analysis with the framework proposal, the next step was to promote its applicability. In view of this, the application was carried out in Ceará, a state in the Brazilian Northeast region. This state has about 9,240,580 in estimated population, distributed in 148,894.442 km², in 184 municipalities of, with an HDI of 0.682 and with monthly household income per capita of R$ 1,028.00 (IBGE, 2010, 2020, 2021a, 2021b; IPECE, 2020). The State of Ceará in the Innovation Index of the Brazilian States (FIEC, 2021) shows that in 2021, this state 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.

3.2 The Economic Clusters of Innovation Program (ECIP)

The objectives of the ECIP are to strengthen regional economic and social development, generate greater competitiveness of the regions by increasing the productivity of the activities with the greatest potential, create a new economy based on innovative ventures in the region, promote the wealth of the region with better income distribution, increase the wealth of the state with better distribution among the regions, and retain and attract talent trained in the region by offering high quality opportunities, driving entrepreneurs who have innovative ideas to solve the main problems of competitiveness in the existing economic conglomerates in Ceará.

The ECIP sought to select innovative enterprise projects that could receive support for technological innovation through the awarding of innovation grants to entrepreneurs belonging to the projects' teams/startups. The innovative enterprise projects were directed towards the problems identified in the sectors and regions (Clusters) established as priorities throughout Ceará. Altogether, there were 23 Clusters in the areas of Agribusiness, Tourism, Commerce, Civil Construction, Education, Renewable Energies, Mining and Metalworking, Health, ICT, Infrastructure and Logistics, and the Wood Industry.

The ECIP is coordinated, monitored and supervised by a central team from the Government of the State of Ceará, counting with the participation of 41 RRs from the respective Clusters, selected by the ECIP. These researchers promote the transfer of knowledge between science and technology institutions (STIs) in their region and the productive sectors; the entrepreneurial construction of innovative technological solutions; and the realization of projects that can contribute to the development of these programs and generate impact on science, technology and innovation in the Clusters where their actions will be implemented. In this way, the choice was made for its network approach characteristics and for the action of a policy to stimulate innovation through the creation of innovative Clusters.

4 ANALYSIS AND DISCUSSION OF RESULTS

In this section the network formed in the course of the ECIP implementation is characterized, as well as the ECIP initiatives which underpinned the set of specific processes and tasks called orchestration of innovative networks. Thus, the three key processes for the orchestration exercise are presented below: management of knowledge mobility, management of innovation appropriability, and management of network stability. For each of these processes there are actions that must be performed (Dhanaraj & Parkhe, 2006; Ritala et al., 2013; Hurmelinna-Laukkanen, Müller & Nätti, 2011).

4.1 The ECIP Network

Next, to better contextualize the results of this article, the base network formed in the ECIP is characterized, which includes the 46 startups and 41 academic Regional Researchers participating in the innovation incentive program, as shown in Figure 2. The Regional Researchers are shown in the center and in red color (numbers 1 - 43). The startups are represented by the color blue (numbers 44 - 89).

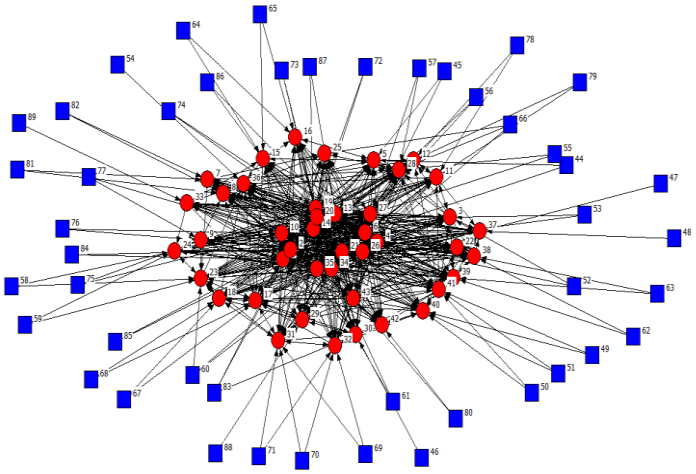

Figura 2. Map of the ECIP base network.
Source: Elaborated by the authors.

Associated to this base network, other researchers and actors of the regional ecosystems of the state of Ceará are joined, in addition to the so-called Central Core of the Innovation Ecosystem, which consists of technical representatives and analysts of various institutions of high representation in the state, such as the Secretary of Economic Development and Labor (Sedet), Secretary of Science, Technology and Higher Education (Secitece), and its Digital Corridors Program, Agency of Economic Development of the State of Ceará (Adece), Chief Scientist Program of the Ceará Foundation for the Support of Scientific and Technological Development (Funcap), Secretary of Education of Ceará (Seduc), Federation of Commerce of Goods, Services and Tourism of the State of Ceará (Fecomércio) Federation of Industries of the State of Ceará (FIEC), Brazilian Service of Support to Micro and Small Companies of the State of Ceará (Sebrae - Ceará), National Service for Industrial Learning (Senai), National Service for Commercial Learning (Senac), Commerce Social Service (Sesc), Institute for Economic Research and Strategy of Ceará (Ipece), Center for Industrial Technology and Quality of Ceará (Nutec) private entity Iracema Digital, Federal University of Ceará (UFC), State University of Ceará (UECE), Federal Institute of Education, Science and Technology of Ceará (IFCE), University of Fortaleza (UNIFOR), Financier of Studies and Projects (FINEP), Brazilian Company for Industrial Research and Innovation (EMBRAPII), Bank of Northeast of Brazil (BNB), among others. One can notice, from the network analysis, that the connections are intense in the ECIP, with a network of some

density, which occurs in a preliminary way with the role played by the RRs, a key element in the strategies implemented by the program. These actors connect among themselves through a series of joint actions, from partnership workshops to the co-development of startups.

Analyzing the dynamics of the ECIP network, evidenced in Figure 2 and validating the arguments of Asheim, Smith & Oughton (2011), innovation is the result of several actors. Therefore, it is necessary to cooperate. There are several ways for different institutions to cooperate. In such a way that, when performed by different organizations, with their respective actors, generally heterogeneous, cooperation can configure an innovative network (Silva et al., 2007).

As observed in the ECIP, innovation occurred as a result of different actors with distinct knowledge that brought them together in a complementary way. The program's network, with the links created between companies, organizations, institutions, academy, among others, favored interactions in a collaborative way, especially in the sharing of knowledge.

4.2 Mobility of Knowledge

The first process that dealt with knowledge mobility was reinforced in the ECIP through knowledge absorption at the network level, common identity among network members, and also through interorganizational socialization with the promotion carried out by the program with the RRs and participating startups.

4.2.1 Absorption of Knowledge at the Network Level

The specific function referred to as the absorption of knowledge at the network level was considered as the ability of each organization to acquire, assimilate, transform, and optimally exploit new and external knowledge (Dhanaraj & Parkhe, 2006). Initially, the first discussions concerning the ECIP took place with the Core Group. This knowledge was shared among the participants and, in the discussions held, assimilated and explored, provided the necessary learning for the development of solutions to the problems identified in nine regions of Ceará focusing on local issues, which composed the ECIP. These assertions demonstrated agreement with the reports described below:

> [...] Idea of working together among the Triple Helix, being fundamental the participation of all actors in relation to the Economic Clusters of Innovation Program, demonstrating the importance of relying on various actors of society, in this plural and disparate performance. (INT13).

> [...] The convergence of actions involving the various actors that have taken this leadership, being the Government, the academy and the companies, being co-responsible for all this, avoiding the loss of efforts, being an intelligent way to start a collaborative work together. (INT14).

Similarly, after the launch of the ECIP, the selected RRs were introduced to the program's objectives, structures, and target audience. Structures were put in place for RRs to begin interacting. An online platform was created allowing internal team members to communicate, disseminate information, and store team and participant documents.

Additionally, interactions took place through several virtual ECIP communication channels such as invitation letters, institutional websites, e-mails, *Instagram*, *WhatsApp* and *Telegram* groups, face-to-face and virtual meetings between the stakeholder representations that were part of the ECIP and that were more linked to the planning and control of the ECIP's execution, and the *Slack* communication platform that, together, allowed participants to have more knowledge about what would be happening, as well as conditions to share their ideas.

Considering this view, it was necessary to corroborate with Fang et al. (2013), when they state that the mechanisms of knowledge governance performed an essential function in the synthesis and application of knowledge transfer between organizations, of which the success in its achievement did not depend solely on the absorption of external knowledge, but also on the integration of external and internal knowledge, as was seen in the actions that comprised the ECIP.

4.2.2 Common Identity among Network Members

The engagement of the network members for their participation and sharing of valid knowledge was obtained through the exercise of a specific task aimed at creating a common identity among network members from the conduction of joint actions. For example, after the moment of evaluation by the Central Core, the choice of Clusters was prioritized in each region according to economic and education indicators. Besides this, the potential of each region to become a reference in a certain sector was considered. After the whole process of prioritization of the Clusters, it was also validated in each region by representatives of the regional innovation ecosystems, comprising the regional actors that integrated the Central Core institutions in the regions, the academy, and the secretaries of economic development and municipal science and technology. As can be seen in the following excerpts:

> [...] This integration and joint effort strengthen the innovative ecosystem of Ceará. Our goal is to align the potentialities with the opportunities of the 21st century. (INT14).

> [...] The clear practical exercise of the action of the Triple Helix, that was very clear, it brought many people together, this is an important benefit, the integration of various actors in the innovation and development system, with this we have a neural network of so many people and it is a shared win-win, strengthening of the local economy, possibility of generating scalable solutions, generating new products and new businesses, because one thing is interlacing and helping [...] (INT21).

Aiming at the engagement of the network members for their participation and the sharing of valuable knowledge, a common identity among the network components was created through the role of the Regional Researcher (RR), who had as one of the attributions to act as a connection, keeping constant communication between the ECIP Coordination and the Teams/Startups that, by having practical validation, composed the cognitive identity of individuals and groups, valuing their knowledge and potential to collaborate.

In this way, Companies, Universities, Government, Regional Researchers, and Teams/Startups acted together to solve a problem that impacted the economic competitiveness of their region, promoting engagement around a relevant cause in which network members sought a way to flow their actions and ideas, sharing values and practices collectively through their participation in the ECIP. Through these organizations, for example, the RRs, who are experts in the area and on the topic, accompanied the entire process, analyzing and guiding the development of solutions with the teams/startups.

As evidenced in the research reports and, legitimizing the authors Dhanaraj and Parkhe (2006), Ritala et al. (2013) and Hurmelinna-Laukkanen, Müller and Nätti, (2011), the identity in common with network members is, in turn, no less important, since such factor creates the logic of trust and good faith considerable for the network flow. Furthermore, socialization should be used to increase the mobility of knowledge. Whether formal or informal, the orchestrator should encourage socialization through training, lectures, workshops, forums, mentoring, events, and other communication channels. Therefore, the ways in which the network exposes itself and how its members define it need to be in sync. In addition, the members of the network have to identify with it, understanding common goals and other characteristics.

4.2.3 Interorganizational Socialization

In addition, the ECIP participants collaborated and proved to promote interorganizational socialization by creating formal and informal bonds as a result of their participation in the ECIP and the access to and sharing of information with others existing in a process of socialization that crossed the boundaries of the network itself. Thus, the links were formed based on their objectives, when the partners to be involved were defined in view of the competencies or resources they possessed and were willing to contribute to the network. Following this line of reasoning, Goduscheit (2009) states that an innovative network is a type of interorganizational network focused on the development of a product, process, service, or other. The creation of this type of bond is highlighted by the interviewee:

> [...] So it has been a good relationship, both for the Program, for the actors of the Program, for the organization with us, the Researchers, and also we have been able to flow well with the startups. I think this has favored some mishaps that happen that we can get around [...] in relation to our field, we managed to mobilize, we did a very strong campaign of dissemination at the time, we managed to formalize startups in our field in order to compete. So, we consider this very positive, in relation to the idea of movement, of startup [...] (INT7).

As it became evident in the research reports, the evaluation of the interviewees regarding the perception of the ECIP dynamics, which occurred among the actors involved, such as Regional Researchers, Startups, Universities, Companies to be benefited and Institutions in general, was positive. The interviewees highlighted the relevance of the ECIP, which involved the union between these diverse actors, and the satisfactory effects obtained with its implementation, which enabled the positive results of the ECIP.

In the analysis of the statements, when asked about the perception of the ECIP's practice in identifying the problems of the companies in the regions where the ECIP worked, to induce the solutions of the Teams/Startups, the articulation of demands, as a result of the practice of such identification, was positive, in the perception of the interviewees, due to the management of what the network actors had to offer and what these same actors had as a demand. The offers and demands were products, services, knowledge, technologies, among others. It was then up to the ECIP orchestrators to manage these needs by adding value to the network, starting from the mapping of local and regional demands.

Several of the interviewees (INT7, INT10, INT13, INT14, INT23) talked about the mapping of problems, and this was pointed out as a central factor for the articulation and assertiveness of the proposed solution, as well as the internalization of the ECIP. The method used to identify the problems was seen as beneficial by the interviewees, as it allowed a complete and precise identification, in a sectored way, economically, as well as by regions. The result was a better visualization and resolution of the problems, allowing a complete and precise identification of solutions in nine regions of Ceará, focusing on local problems.

4.3 Appropriability of Innovation

The second process that dealt with the appropriability of innovation was ensured in the ECIP by promoting confidence, procedural justice, and joint property ownership.

4.3.1 Confidence

The function of promoting confidence among the participants began with the definition of a common agenda built from the coordination that was in charge of the ECIP, conducted by promoting successive interactions, knowledge sharing and joint problem solving since they were in permanent contact with each other, both in specific actions and on a daily basis, according to the demands made. This context generated confidence from repeated interactions, reciprocity in actions and in joint problem solving, which consequently provided a high proximity

among all, providing direction and guidance to the members of the Program. In the ECIP, all members had autonomy to suggest and carry out activities. The only restriction was that there was an open agreement about what was to be done and the purpose of the activity, and to ensure that they were available for it. Due to these efforts, confidence began to develop among the participants. This assertion demonstrated agreement with the report, described below:

> [...] We do not have a lot of problems with communication startups, because they are usually students that create a vision of respect with us, they are always ready, but we notice that during the first month you have to break a little bit of the distancing atmosphere. Then you start interacting, so I think this is something that has to happen, and we have in the Cluster a good dialog, they listen to us when we tell them that we are late and that we have to guide them in a certain way, they do it, they run after us. So we have a good, interesting relationship. At the level that even amazes me when we have different people that we do not know (INT12).

Validating the arguments of Silva et al. (2007), Dhanaraj and Parkhe (2006), Hurmelinna-Laukkanen, Müller and Nätti (2011) and Klerkx and Aarts (2013), it was found that the interactions between the actors organized in networks were strongly based on confidence, not on hierarchical and/or market relations. The formation of the network also decreased the uncertainty and complexity of the innovation process due to the environment considered reliable among its actors, which reduced the chances of opportunistic behavior among them. In this sense, Balestrin et al. (2005) and Silva et al. (2007) have taught that in an environment permeated by confidence among the actors, companies can delegate more tasks to third parties and devote efforts to key activities of their interest, reducing the complexity of their activities.

From the same point of view, the formalization of the relations was built through the term of commitment, the term of granting and acceptance of the innovation scholarship and the work plan of the scholarship recipients, and the existing formal documents, besides the agreement referring to the ECIP, came from external partnerships, contracts or responses to edicts of accountability of execution and descriptive reports of deliveries. Facing some new actions and demands, especially those paid, the option to establish contracts and agreements became a valid possibility and, in some cases, necessary because of the demands from partners, especially when it involved the transfer of resources and their distribution among those involved.

Some sanctions for violations of confidence were foreseen, but only in relation to the discontinuation of Funcap research grants to RRs and Teams/Startups. After analysis by the ECIP Coordination, those who suffered the sanction were informed of the decision. Except for the penalty regarding the discontinuation of research grants, the ECIP had no clear, predetermined type of sanction for violations of conduct.

4.3.2 Procedural Justice

The responsibility to promote procedural justice among the participants came from the necessary openness in decision making, allowing it to be coherent and fair, regardless of the results and, with this, it had an impact on the engagement and willingness to contribute new ideas, as observed by the interviewees:

> [...] For me, there was a course that I think changed what we were doing, which was the course that they talked a little more about prototyping, the approach was great, go on testing, testing, don't leave it to test only at the end. And we ended up using this approach a lot, testing, so it changed the way we developed the product. I would say that was the main course, apart from that, the main way I think so far was the accompaniments we had, they were very good. There is the accompaniment just to know how the current stage is, giving tips, for example, and then super cool ideas come up, for me this accompaniment was very nice. (INT1).

> [...] We have had an accompaniment, a very strong attention, we are never left with unanswered questions. We don't remain without an answer. Many trainings have been given [...] we pass this on to our startups all the time (INT7).

In this case, for example, the ECIP had tools that made it possible to implement monitoring channels for the collective, as well as participation in decision-making. Training, lectures, workshops, forums, mentoring, events, social networks, files, tasks, milestones, spreadsheets, and calendar were useful tools in terms of the daily monitoring of the ECIP members. From the point of view of collaboration, the tools voting, suggestion and collaborative texts were the most effective. Reinforcing the arguments of Khanna, Gulati and Nohria (1998) and Kim and Mauborgne (1998), the collaborative work of the ECIP has ensured the openness and transparency necessary for the decision-making processes to be taken as fair, regardless of the results. Examples are the acceptance or not of ideas for implementation and new functionality in the ECIP.

The ECIP promoted procedural justice with the objective of ensuring voluntary cooperation and the contribution of relevant ideas in finding solutions to common problems within the ECIP. To this objective, it sought to conduct the decision-making process in a fair manner, regardless of the results, by aggregating and producing multiple knowledge, where the ECIP members could exercise local governance. In the trainings, workshops, and seminars, the members established mutual conversations, opposing decisions based on justified arguments, related to the characteristic that they used because they experienced the reality and still managed to preserve the decision history, making possible the constancy of the process, through the mutual register and control of the decisions taken.

The ECIP orchestrators monitored the procedural justice process, making sure that the outcomes and milestones of the ECIP were enacted as accorded in the Agreement, the Work Plan and the Public Call Notice. To do

this, it was trusted in consensus that the orchestrators checked and monitored the objective, activities, obligations, achievement of goals and milestones, agreements, reports, expected results, among others, discussing the progress of the collaboration, so that specific actions could be taken if necessary.

4.3.3 Joint Property Ownership

In the analysis of the statements, the concepts of Dhanaraj and Parkhe (2006) and Grant and Baden-Fuller (2004) were also confirmed. For the authors, the task aimed at maintaining joint ownership that occurred through the sharing, combination and cocreation of knowledge generated by all stakeholders, once the ECIP, by providing the active participation of all in generating innovations for their needs, also developed their capacities to learn to innovate, to generate new knowledge and to create a process of empowerment of members. Such insight is brought out by the interviewee:

> [...] This program has a very important component that is the condition for success based on the integration, on the articulation, on the development of all those who are protagonists. So, this strong appeal regarding the issue of innovation is on everyone's agenda and it is also already known the issue of innovation as a tool to increase performance, to advance in terms of competitiveness, to reach the market, to reposition the business facing challenges that are increasingly growing, complex, the companies are already admitting that innovation is a *sine qua non* condition for competitive positioning in this market [. ...] so this Program brings along alternatives for some issues that previous initiatives also fell by the wayside because of this. First was the question of understanding the Cluster of Innovation, knowing the territory where it is operating, recognizing the vocations of each region, and from this well outlined scenario, interpreting locally with several agents which are the crucial issues to be addressed and from there with this interlocution among all stakeholders, you can build an agenda with more alignment for the resolution of issues, you don't just comply with a public policy because you have the resources, because it is important, but no, you already have a wider vision in the measure that you visualize what the greatest potential is, what the main activity sectors are, what the main problems are and how to build them, this is a very important point of this Program. (INT8).

However, it is important to note the perception regarding the continuity and future of the ECIP; taking this view into consideration, interviewees highlighted the importance of the ECIP being uninterrupted. This concern was about the alternation of elected power groups, which could interfere with the future execution of the program.

It can be verified through the interviewees' answers, the perception of the generation of value of the innovations that were and will be generated by the ECIP, among them the appropriation of innovation, perceived by the interviewees as prosperous, bringing positive results with improvement in the local economic environment, retaining and developing regional labor, qualifying them, resulting in a positive cycle of promotion and appropriation of innovation in the region.

4.4 Stability of the Network

The third process that conditioned the stability of the network occurred supported by specific tasks aimed at strengthening and at reputation, increasing the shadow of the future, and building multiplexity in the innovative network within the ECIP.

4.4.1 Reputation Strengthening

Thus, from a constant perception of the effective meaning of the ECIP for each member involved, the network's reputation has been strengthened. The greater the appropriation of meaning, the greater the sense of network stability and the generation of significant reliability effects. Members were encouraged in the ECIP to find self-responsibility and autonomy in what they did. The ECIP regularly tried to question the lines of work, among them, about who were the members who felt ownership of the business in order to identify who was effectively committed, what they termed as reference members in a particular team/startup. This initiative was better understood from the interviewees' statements:

> [...] I believe that the Program is very accessible when it, right in the first workshop, put a partnership agreement between the members. It made them have a certain security in the formalization of the startups done right at the beginning, I think this somehow dissolved any fear that the startups had with their own members, including the RRs because there it was already very clear the role of the RRs required and also among the members with this partnership agreement (INT11).

> [...] There is a growth of confidence in the Program, with those involved, of dialogue, solidifying the Program and the participants, along with the intelligence and technical capacity that the people from Ceará have (INT20).

On the other hand, some interviewees presented a contradictory view regarding its reputation, even though it is a Program supported by the State Government, by stating that the ECIP showed a certain instability due to its dependence or fragility upon changes in the economic and political scenarios, according to the following explanations:

> [...] We need to get a little out of this only resource of the State, the Municipality, the Federation, also work with investment, we can't dismiss, the State needs to expand the investment of this value, but also expand partnerships that foment this [...]. (INT6).

> [...] It is a permanent concern, since administrations change. But we bet on what was thought in the Projects like *Fortaleza 2040*, *Ceará 2050*, *Ceará Veloz*, and in the State's governance, with a reference that helps in this future work. (INT14).

Collaboration has presented itself as an intrinsic behavior as a way of operating the ECIP. So, members have felt this dynamic, in their own time, and have begun to develop a clearer relationship within the network. The ECIP

sought reputation strengthening, which ensured its legitimacy and signaled the reliability of its actions, allowing the attraction of partners and their effective engagement.

Considering this view, and corroborating with Dhanaraj and Parkhe (2006), the orchestrator can improve the stability of the network by highlighting its reputation, since for new and emerging companies it is interesting to be linked to a recognized institution. Moreover, the good reputation of the orchestrator inhibits the breaking of ties in the network and encourages the creation of new ties.

4.4.2 Increase of the Shadow of the Future

As for increasing the shadow of the future, and as discussed by Ritala et al. (2013), this specific task occurred through the creation of links between future benefits and present actions that were connected by the causes and the possibilities that the actions could generate transformations. Thus, all interested parties began to direct their attention to an intended future, as observed in the interviewees' statements:

> [...] I believe that something very nice will come out by virtue of the Program, in this area of innovation, you see that they really have a fundament, they know what they are doing, but there are still problems to be solved, because for many RRs this is a new thing, so until you insert everyone in this need it will take a while [. ...] The Researcher is the most focused group and the people from the State, from Sedet, also have the approach of making us work in the medium to long term [...] With maturity everyone learns, you are planting the seed in several places. (INT3).

> [...] The biggest benefit of the Economic Clusters of Innovation Program is the employment chain, employment socializes people, generating opportunity efficiently and effectively. (INT15).

> [...] The great benefit of the Program is to be an aggregator, besides the resource, Sedet is an aggregator, it has input with the industries, it has input with the Academy and it is the Government. The Programs that can work as great aggregators, with these multiple actors, within the same Program, makes the Program gain a robustness that most will not have even if they have money. Sometimes having a lot of money alone is not enough, it is necessary that the ecosystem is also involved, because sometimes money alone does not make a startup get off the ground. The Program as an aggregator of multiple partners, it starts to generate a force that no other will have. And the Government has this capacity, this characteristic, it has no ego, it has no equity. The Government has in its hands a force that the University will not have and that the industry will not have. (INT29).

4.4.3 Multiplexity Construction

It was found that, according to Kenis and Knoke (2002) and Shipov and Li (2012), the multiplexity construction was manifested by its working dynamics that allowed the existence of two or more types of relationships occurring at the same time. At the ECIP, such dynamics manifested themselves through the approaches made between the RRs, the teams/startups and the ECIP, and also between Programs. This dynamic is highlighted by the interviewees:

> [...] I will mention two relations that were made during the Program, one with the Regional Researcher from the Agribusiness Cluster of *Vale do Jaguaribe*, we had a superficial knowledge, and the Program brought us closer. So, in the initial phase, this Regional Researcher helped me to have contacts for dissemination, we got closer, and we created a channel that is now established, and we have treated each other as friends, and this is the first point, then I had contact with the Regional Researcher from the Mining and Metal-Mechanics Cluster of the *Vale do Jaguaribe* region. We left with a stronger approach, but we exchanged messages and had an approach that I believe can generate a lot, and so, the Program provided that, this contact that I believe that if it were in person, our meetings, in fact, we would be at a higher level. There are startups, for example, like the one linked to the Researcher from the Tourism Cluster of the Greater Fortaleza 1 region, that I am getting closer to the startup [...] (INT10).

> [...] Promoting the consolidation of relations, without the Cluster of Innovation Program, for example, I doubt that half of the people mobilized would have the initiative to participate in a public hearing, for example, so it is a level of approximation to the formulation of public policy, which is, in my opinion, unprecedented. The Cluster has this goal, which is to make companies and universities feel encouraged to talk to the Secretariat, and to nurture and promote this relationship. This is an indirect product, but the relationships that the Program is generating from the Clusters are perhaps as promising and long lasting as any result in terms of public policy that may arise from it. The Program has established a level of interlocution that I think will be a challenge for its continuity and for it to be better than it already is. (INT22).

In terms of promoting two or more types of relationships at the same time, the function aimed at building multiplexity was conducted through activities which were organized on two levels: strategic and operational.

Still at the strategic level, three actions were executed within the ECIP:

a) management of the Program;

b) evaluation and dissemination of the Program results;

c) attracting institutional, political and financial support for the program. The three activities directly influenced the set of individual actions.

Another significant dimension referred to the self-management resulting from the work conducted in the ECIP due to the empowerment of members and their direct involvement with the issues that were worked on in favor of the Territory.

As Dhanaraj and Parkhe (2006) point out, the orchestrator can improve the stability of the network by encouraging the occurrence of two or more types of simultaneous relationships in the network (network multiplexity) in order to increase the relationships and their depth, with greater understanding between the actors, which leads to greater stability, therefore, as evidenced in

the research reports and, legitimizing the authors, this statement occurred in the ECIP in an evident way.

However, when considering the contextual narratives about the ECIP and the innovations and other complementary activities to its development, it was reinforced that the program, even if it defines itself as an ecosystem in many of its communications, is a public innovation network. The analysis of the statements also confirmed the concepts of Leminen and Westerlund (2012), Leminem (2013) and Nyström et al., (2014), of how it is possible to rescue from its practices the connection between people for the construction of innovation thinking directed at facing substantial challenges.

In fact, the ECIP asserted itself as a public innovative network. In this network, the interested parties collaborated with each other to develop innovations. The dynamics of the ECIP have helped in driving a category of open innovation which has helped in the cocreation of innovative initiatives based on the creative coming together of science and technology in events which have taken place through interactions between the members or have been performed by them on the various occasions of argumentation of ideas.

It was found that, based on the results of the interviewees' data and the positive results observed by the ECIP, the respondents reinforced the need for its continuity, because it is a way to guarantee economic and social emancipation for regional development. The guarantee of continuity would be the transformation of the ECIP into a State public policy, where alternations and interests of managers generate fewer negative effects on its execution.

4.5 Discussion of results

The results indicate that evidence of the orchestration constructs was found in the ECIP. As a regional public policy to foment innovation that sought to promote entrepreneurship and innovation in the state of Ceará, the Program fulfilled its role in encouraging collaboration among different actors of the ecosystem, such as researchers, representing universities, managers of institutions, and policy makers.

In relation to the Mobility of Knowledge, it was possible to note, in the context of the Program, that the flow of knowledge occurred through initiatives established by the Program to stimulate interaction among the participants. In its beginning, for example, there was great interaction between universities and institutions with the objective of listing the main opportunities and obstacles to be worked on in the different economic sectors of the state. And throughout the Program, information and knowledge were shared through virtual platforms, in the course of capacity building and training workshops for Program participants (startups and technology proposing teams).

Regarding the Appropriability of Innovation in the context of the Program, it was observed that the relationships of confidence, provided through the interaction among the Program participants, were fundamental to provide the feeling of belonging to the Program and the benefits generated from it. The strong interaction between the Regional Researchers, experts in their fields, and the startups being mentored was fundamental for the development of these startups and the maturing of the team members. Furthermore, it was also evident that the workshops provided to the participating teams provided an understanding about the sharing of benefits generated from the participation in the Program. This understanding was also achieved through training and mentoring workshops, focusing on Intellectual Property.

Finally, regarding the Stability of Network of the ECIP, it was evidenced that belonging to the Program and the assignment of activities and responsibility were important to generate effects of reliability, autonomy, and stability for the program network. The startups and the participating teams had defined activities and goals to be achieved during their involvement, such as performance in the trainings, development and delivery of proof of concept of their technologies, among others. Moreover, the construction of a long-term vision for the benefits of the Program for the economic sectors and its participants was an important strategy to generate engagement in the execution of activities and, thus, provide greater stability for the Program and better results from the public policy.

5 FINAL CONSIDERATIONS

The objective of this research was to present the Economic Clusters of Innovation Program (a program of the State Government of Ceará in the Northeast Region of Brazil) as a project that orchestrates public innovative networks. The objective was achieved, considering that it was possible, through data collection, through interviews and subsequent content analysis, to show that the ECIP outlined strategies and carried out actions aimed at establishing an environment of collaboration, and of sharing information and knowledge. These actions and strategies were possible to be carried out because the ECIP's public policy orchestrated a network of collaboration among different actors that make up the innovation ecosystem of Ceará, and that were crucial to establish the network that made possible the execution of this public policy.

As evidenced in the research reports and, legitimizing the theory (Dhanaraj & Parkhe, 2006; Ritala, Hurmelinna-Laukkanen & Blomqvist, 2009; Ritala, Armila & Blomqvist, 2009) regarding the orchestration of innovative networks in public policy, it was confirmed that in the ECIP it is possible to identify the structure and evolution of innovative activities that required a flexible and adaptable performance of organizations that collaborated to achieve common results (Spena, Tregua & Bifulco, 2017).

The innovative network of the Program was constituted from the social and institutional activity of building relationships among its actors, being the main elements of innovation networks (Gulati, 1995), promoting the creation of value (Gulati, 2007; Spena, Tregua & Bifulco, 2017). Legitimizing authors Tidd, Bessant and Pavitt (2003),

the ECIP network can be considered a set of positions or knots, occupied by individuals, companies, business units, universities, governments, customers or other agents, and linkages and/or interactions between these knots.

The conception of innovative networks has been establishing itself as a factor for successful economic development and innovative achievement. The construction of knowledge performed in a collaborative way has been a dominant and promising way to make a high quality output (Lee & Bozeman, 2005). In this sense, public innovation policies to support the formation of innovative networks can contribute to improving the economic and technological competitiveness of a sector or even a country (Koschatzky, 2001).

What can be seen from this statement is the significance of the development of public policies to facilitate networks, indicating the relevance and efficiency of structuring networks to foment innovations in economic development. In this sense, it was found that the Economic Clusters of Innovation Program acted and exercised the role of an innovative network orchestrator. Such conclusion, based on the results of this study, comes from the finding that the ECIP can still be characterized as an innovative network, due to the actual diversity of actors, as described in the works of Silva et al. (2007) and Rycroft and Kash (2004).

Analyzing the dynamics of the network, it can be affirmed that the ECIP has promoted a formulation of public policy for innovation, providing as a benefit the active participation of the Triple Helix, in synergy with a large number of diverse local and regional actors. The concentration of the relationships developed generated a level of dialogue, making companies and universities feel encouraged to talk to the government, making this relationship sustained and fomented. Even though it was an indirect product, however, the relationships that the Program generated from the ECIP were as promising and enduring as any public policy outcome that will emerge from it.

Such alliance allowed to give the necessary support to the set of processes and specific actions, representing the necessary entrepreneurial action to orchestrate resources in the environment of the innovative network, playing an important role in this process, represented by a continuous approach, through which it was illustrated how the Triple Helix can absorb and transform Programs in its practice, from public policies for innovation, promoting among many actions the stimulus to regional development, with the combination of identification of priority sectors and problems of companies belonging to economic clusters of innovation in different regions of the state of Ceará and proposals for innovative technological solutions to be presented by startups.

Furthermore, the results of this study suggest that the ECIP has encouraged and managed interactions in a systematic and meaningful way among its actors, generating a major positive impact on the innovation output of the network. It was possible to recognize the three interactions related to the three processes for exercising innovation network orchestration and that are positively related to an innovative output. First, the appropriability of innovation positively impacting on knowledge mobility. Second the appropriability positively impacting the stability of the network. And third, the stability of the network positively impacting the appropriability of innovation, as is expected of a network orchestrator (Dhanaraj & Parkhe, 2006). These processes were central to understanding the orchestration of innovative networks, enabling the management of the innovative network constituted around the ECIP for the development of innovations.

As main contributions of the research to the area, this work provides an integrated view of the existing literature in the field related to the orchestration of innovative networks in public policies, by contributing to a better understanding of the functioning of networks and the current needs of the organizations that operate in them. Furthermore, this work contributes to future studies and possible mappings of innovative networks, which can contribute to real improvements in the functioning of these networks.

This research has some limitations, namely: difficulty in getting a response from the 42 Central Nucleus components and 41 Regional Researchers regarding the scheduling and possibility of interviewing them and the understanding of the ECIP data that also comes from the data collected as part of this study, which is sufficient for a comprehensive assessment over a longer period, but cannot capture the full complexity and range of activities within such a large network.

As a suggestion for future investigations in this field of study, it is suggested the realization of empirical studies that seek to evidence the operationalization of the processes and the specific actions of the orchestration of innovative networks or even as a starting point for the identification of existing gaps and possible processes that have been barely mapped by the literature, such as the evolution of the network and the Program over time, using larger samples, with different types of startups, as well as teams/startups not classified with the Program, may be essential to confirm the research results, and add knowledge to the findings. Furthermore, it is also recommended the execution of studies that can measure and investigate the technological evolution of companies, startups and technologies participating in the Program, in order to evaluate how the ECIP public policy influenced the technological evolution and the management maturity of the organizations participating in the Program.

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FACULDADE DE ECONOMIA, ADMINISTRAÇÃO ATUÁRIA E CONTABILIDADE

CONTEXTUS
CONTEMPORARY JOURNAL OF ECONOMICS AND MANAGEMENT.
ISSN 1678-2089
ISSNe 2178-9258
1. Economics, Administration and Accounting - Journal
2. Federal University of Ceará. Faculty of Economics, Administration, Actuaries and Accounting

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