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The orchestration dynamics for creating urban innovation ecosystems: The case of Pacto Alegre

A dinâmica de orquestração para a criação de ecossistemas de inovação urbana: O caso do Pacto Alegre

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Abstract: Many cities around the world have sought to become "cities of the future," focusing on projects to create urban innovation ecosystems. Most of these projects rely on the orchestration of resources and actors to transform the local urban reality. The aim of this study is to analyze how orchestration dynamics occur for the creation of urban innovation ecosystems. A procedural approach was used to study an emblematic case in Latin America, the Pacto Alegre, the movement to turn the city of Porto Alegre (southern Brazil) into an urban innovation ecosystem. The study showed that the first dimension of orchestration that must be in action in projects to create ecosystems is the dimension of agenda setting, followed by knowledge mobility management. The dimension of coordination appears as a means to boost innovation and is followed by the dimension

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of management of the appropriability of innovation, which is related to the generation of value from the materialization of the previous dimensions. Furthermore, the study demonstrates that the role of quadruple helix actors changes over time and according to the mobilized orchestration dimension. Universities and public entities have been shown to play a prominent role in orchestration when the dimensions of agenda definition and mobilization occur. This article contributes to the literature on innovation ecosystems by demonstrating how the orchestration dynamics to create an urban innovation ecosystem happen and, for the orchestration literature, reveals the existence of a hierarchy of dimensions over time. For future studies, it is suggested to analyze the orchestration dynamics in mature ecosystems, which thus have more than one cycle.
Keywords – Orchestration; Innovation ecosystems: Urban ecosystems

Resumo: Muitas cidades ao redor do mundo têm buscado tornar-se "cidades do futuro", apostando em projetos para criar ecossistemas de inovação urbana. A maior parte desses projetos depende da orquestração de recursos e atores para transformar a realidade urbana local. O objetivo deste estudo é analisar como ocorrem as dinâmicas de orquestração na criação de ecossistemas de inovação urbana. Para isso, empregamos uma abordagem processual para estudar um caso emblemático na América Latina, o Pacto Alegre. Trata-se de um projeto desenvolvido no sul do Brasil, onde, por meio da orquestração de atores locais, foi possível gerar uma dinâmica de ecossistema na cidade de Porto Alegre. Nosso estudo demonstrou que a primeira dimensão da orquestração que deve estar ativa em projetos de criação de ecossistemas é a dimensão de definição de agenda, seguida pela Gestão da mobilidade do conhecimento. A dimensão de coordenação surge como um meio de estimular a inovação, e, por fim, a dimensão de gestão da aproveitabilidade da inovação emerge, relacionada à geração de valor a partir da materialização das dimensões anteriores. Além disso, mostramos que o papel dos atores da hélice quádrupla muda ao longo do tempo e de acordo com a dimensão de orquestração mobilizada. Universidades e entidades públicas têm demonstrado desempenhar um papel de destaque na orquestração quando ocorrem as dimensões de definição de agenda e mobilização. Este artigo contribui para a literatura sobre ecossistemas de inovação ao demonstrar como as dinâmicas de orquestração para a criação de um ecossistema de inovação urbana se desenrolam e, para a literatura de orquestração, revela a existência de uma hierarquia de dimensões ao longo do tempo. Para estudos futuros, sugerimos analisar as dinâmicas de orquestração em ecossistemas maduros, que tenham passado por mais de um ciclo.
Palavras-chave – Orquestração; Inovação de ecossistemas; Ecossistemas urbanos.

Introduction

Cities have experienced several problems such as unemployment, homelessness, traffic jams, pollution, diseases, violence, among others. This urban configuration no longer fits the value creation principles of the new economic paradigm. To overcome this crisis, the cities of the future must find suitable trajectories and become urban innovation ecosystems, also known as smart cities. These urban innovation ecosystems have specific local capacities, which ensure that knowledge flows easily in deliberate interactions and collaborations between different stakeholders to create sustainable innovation and wealth, supported by a flexible institutional framework, an integrated participatory governance model, and a functionally urban project.

Many cities around the world have sought to become "cities of the future," betting on projects to create urban innovation ecosystems. Most of these projects rely on the orchestration of resources and actors (Thomas, Faccin & Asheim, 2021; Bittencourt, Zen, Schmidt & Wegner, 2018; Mignoni, Bittencourt, da Silva & Zen, 2021) to transform the local urban reality. However, the literature addressing these experiences, although already dedicated to identifying the practices used, still lacks in terms of identifying the orchestration dimensions that are prioritized in certain phases of these projects. Another gap refers to the explanation of the patterns found in the place that allow the adoption of one practice to the detriment of another at a given moment and why these practices change over time. In this context, the question is how do the orchestration dynamics to create an urban innovation ecosystem occur?

To address the research problem, a procedural approach was used to study an emblematic case in Latin America, the Pacto Alegre. Pacto Alegre is the name of a movement involving actors from the four helixes (government, business, academia and civil society) to turn Porto Alegre (in southern Brazil) into an urban innovation ecosystem. As such, we want to understand the orchestration dynamics of the Pacto Alegre in the process of creating the ecosystem.

The case is unique as it represents an emerging country, while most of the literature explores cases from developed countries, such as @22 in Barcelona, Spain (Piqué, Miralles & Berbegal-Miraben, 2019) or Israeli public policies (Frenkel, Maital, Leck & Segal, 2011; Tabansky & Israel, 2015). It is also distinguished by involving actors from the four helixes and especially because it was not conceived by the

government, which is a discredited actor, given the countless episodes of corruption experienced by Latin American citizens.

The study demonstrated that the first dimension of orchestration that must be put into action in projects to create ecosystems is the dimension of agenda definition, as actors need to have a clear common goal to mobilize them around the ecosystem. Subsequently, as the project evolves, Knowledge Mobility Management becomes important for activities around the common agenda to emerge. Coordination then appears as a means of driving innovation. From this stage, the stabilization of the network begins to emerge. Finally, the innovation appropriability management dimension is the last one to appear since it is related to the generation of value from the materialization of the previous dimensions.

Furthermore, the study shows that the role of the quadruple helix actors changes over time and according to the mobilized orchestration dimension. Universities and public entities have been shown to have a prominent role in orchestration when the agenda definition and mobilization dimensions occur.

Theoretical Foundations

Urban Innovation Ecosystems

The concept of Innovation Ecosystems gained notoriety in the management area from the studies by Adner in 2006. This field of research can be understood holistically as "a meta-organization created by heterogeneous actors to manage collaboration, coordination, complementarity, and interdependence, aiming to create value related to systemic innovation for a target audience" (Gomes et al., 2021, p.7).

The growing interest in understanding the dynamics of innovation ecosystems is not restricted to theoretical and scientific debates (Oh et al., 2018; Gomes et al., 2018; Gomes et al., 2021). All sectors of the economy emphasize the importance of innovations, and various organizations seek innovative collaborators. For example, private companies need knowledge and innovation to compete in markets; governments aim to offer higher quality services to citizens at an affordable cost. In this scenario, since the 1990s, innovation has taken on interactive characteristics, configured as a process imbricated by collaborative strategies. It is precisely this need to access resources external to organizations that has accentuated the importance of the environments in which companies, whether small or large, are inserted.

Thus, urban innovation ecosystems have gained prominence among researchers and public policymakers for their ability to generate innovation through collaboration between different actors, such as governments, industry, universities, and society (Frenkel & Maital, 2014; Adner & Kapoor, 2016). In this sense, such ecosystems can be defined as a set of interdependent actors with conflicting technical, social, economic, and political interests, but also with convergent objectives, priorities, expectations, and behaviors that cooperate and compete concurrently in a specific geographic area (Santos, Zen & Bittencourt, 2021). The collaboration between these actors results in ecosystems that contribute to the generation of jobs, wealth, and the technological development of local economies.

The dynamics involving the relationships of this set of interdependent actors—governments, industry, universities, and society—was termed the Quadruple Helix (Carayannis & Campbell, 2009). Empirical studies have demonstrated how each of the actors in the government-industry-universities-society quadriad can act as catalysts in an urban innovation ecosystem. Schwartz and Bar-El (2015) argue that governments do not always adequately perform this role, leading to a failure to achieve optimal economic growth to the detriment of both the national economy and the industry itself. In turn, Leon (2013) argues that urban innovation ecosystems can be orchestrated by universities, as they act as inducers for the development and transfer of knowledge and disruptive technologies.

It is important to highlight that the interdependence between actors also raises questions about how urban innovation ecosystems are coordinated and managed. Thus, understanding how these relationships occur and who is responsible for articulating actors to generate innovation practices in these ecosystems is essential (De Silva; Wright, 2019; Hurmelinna-Laukkanem; Nätti, 2018). In environments such as urban innovation ecosystems, where there is a great diversity of actors, managing and ensuring innovation becomes a complex task (Pikarainen et al., 2017; Reypens; Lievens & Blazevic, 2019).

Therefore, to better understand the complexity of these relationships, it is necessary to identify the ideal management and manager model (Lumineau & Oliveira, 2018; Majchrzak et al., 2015). Thus, the success of innovation networks is considered to require careful guidance and coordination, that is, orchestration (Hurmelinna-Laukkanem, Möller & Natti, 2011). With this, the relevance of approaching orchestration theory emerges, which proves to be adequate for describing the activities involved in the development, management, and coordination of urban innovation networks and ecosystems (Ritala et al., 2009).

Orchestration

There is an ongoing debate in the literature about the best collaboration models and their management in network and ecosystem contexts (Hurmelinna-Laukkanen & Natti, 2018). Managing—or orchestrating (Dhanaraj & Parkhe, 2006)—innovation ecosystems is not a new issue, but discussion of the phenomenon has been on the rise in recent years (Möller & Halinen, 2017). As a result of the complexity of those relationships, it becomes necessary to understand which is the best model of management (Lumineau & Oliveira, 2018; Majchrzak et al., 2015). Managing and guaranteeing any process of innovation is a multifaceted and complex task (Pikkarainen et al., 2017), especially in environments where there is a great number and diversity of actors, as is the case with innovation ecosystems at the city level (Reypens, Lievens & Blazevic, 2019; Gupta, Panagiotopoulos & Bowen, 2020).

Innovation activities increasingly occur through interactions among organizations in different networks (Reypens, Lievens & Blazevic, 2019; Schepis, Purchase & Butler, 2021). Therefore, the success of city innovation ecosystems calls for careful direction and coordination; it calls for orchestration (Hurmelinna-Laukkanen & Natti, 2018; Gupta, Panagiotopoulos & Bowen, 2020). Thus, the orchestration approach is likely the most suitable to describe the development, management, and coordination activities of the networks (Ritala et al., 2009). Orchestration comprises a set of activities, and when an orchestrator conducts these activities in a specific manner (e.g., by exerting more or less power on other network or ecosystem members), it can be considered that the orchestrator assumes a specific role (Pikkarainen et al, 2017).

Orchestration emerges as a set of activities aimed at the development, management, and coordination of actors that are intended to create and extract value from the network (Dhanaraj & Parkhe, 2006; Ritala et al., 2009). Wind, Fung, and Fung (2008) support this definition by describing orchestration as a capability to unite several different expertises in a way that creates a harmonious value-creating system. “It is about activities that facilitate (but do not dictate) the coordination of the network for the performance of innovation outcomes” (Ritala et al. 2012, p. 325).

The orchestration model was originally defined by Dhanaraj and Parkhe as a set of deliberate, purposeful actions undertaken by a central actor to create and extract value from a network or ecosystem (Dhanaraj & Parkhe, 2006). Dhanaraj and Parkhe (2006) initiate this discussion by outlining three dimensions of such capacity: knowledge mobility, appropriability of innovation, and network stability.

Knowledge mobility refers to the sharing, acquisition, and deployment of knowledge within the ecosystem. The appropriability of innovation involves ensuring that innovators can capture the results generated by innovations; and the stability of the ecosystem pertains to the intentionality of maintaining collaboration among ecosystem members.

Hurmelinna-Laukkanen et al. (2011) expand upon the dimensions proposed by Dhanaraj and Parkhe (2006) by identifying six dimensions as the basis for the orchestration of innovation networks: setting agenda, mobilizing, stabilizing the network, creating, and transferring knowledge, coordination. By integrating the dimensions proposed by Dhanaraj and Parkhe (2006) with those proposed by Hurmelinna-Laukkanen et al. (2011), six grouped dimensions emerge (agenda definition, mobilization, knowledge mobility management, knowledge appropriability management, network stability management, and coordination). Table 1 presents these six dimensions to provide a clearer understanding of each one.

Initially, in the context of firm-level ecosystems, orchestration was understood to be performed by a hub firm (Dhanaraj & Parkhe, 2006). However, more recent studies indicate that, especially in more complex ecosystems—such as at the city level—orchestration is shared among its actors (Hurmelinna-Laukkanen & Natti, 2018; Cinelli, Ferraro & Iovanella, 2019; Gupta, Panagiotopoulos & Bowen, 2020). Furthermore, it has been recognized that depending on the stage of ecosystem development, a particular dimension of orchestration becomes more necessary (Nielsen & Gausdal, 2017; Schepis, Purchase & Butler, 2021).

In this study, the division of the life cycle of ecosystems from Mikhailov et al. (2021) was adopted, which, through a meta-synthesis, identified four stages of the life cycle: birth, growth, maturity, and renewal. The birth stage is characterized by knowledge accumulation, the implementation of knowledge-sharing mechanisms, the establishment of a culture of innovation, and the formation of a formal working group. The growth stage is distinguished by the offering of new value mechanisms to the market, the emergence of agents such as service providers and financial institutes, the implementation of management practices, and the creation of training centers that provide consultations and resources financed by public agencies. Maturity is marked by the materialization and capture of value, the establishment of standards, improvements in performance and efficiency, and the prioritization of capacity expansion in the short and medium term, with exaptation playing a vital role. The renewal stage occurs when mature ecosystems are

challenged and threatened, focusing on avoiding decline and maintaining the momentum for redevelopment, diversifying technologies, capitalizing on new growth areas, evaluating current activities, and entering a period of integration.

It is identified that there is a gap in the literature regarding orchestrator roles and orchestration dimensions according to the stage of ecosystem development (Paquin & Howard-Grenville, 2013; Schepis, Purchase & Butler, 2021). It is argued that in city-level innovation ecosystems, multiple orchestrators become necessary and that the orchestration changes as collaborative practices are implemented (Cinelli, Ferraro & Iovanella, 2019; Pikkarainen et al, 2017). Thus, this paper seeks to identify how the dimensions of orchestration are mobilized over time and what roles different actors play in the orchestration of innovation ecosystems.

Table 1.
Dimensions of the Orchestration

Dimensions	Process	Definitions
Agenda Setting	Definition of network actors and their tasks	It provides the attraction of people to activities influencing the mobilization of actors and objectives.
	Agenda organization	It involves creating and communicating an agenda that directs members of the network.
Mobilization	Attraction and selection of partners for the innovation network	Refer to the attraction and selection of partners for the innovation network, including the motivators.
Network Stabilization	Maintaining collaboration between members of the network	It involves elements of culture, identity formation, values, and beliefs.
	Avoid individualism and opportunism	Prevents isolation, migration, cliques, and friction.
Knowledge Creation and Transfer	Sharing knowledge that is acquired and implemented in the network	It refers to the sharing, acquisition, and implantation of knowledge within the network between the actors involved and the combination of this specialized knowledge for co-creation.
Innovation Appropriability	Building trust	It ensures that innovators can obtain the financial results created by innovations and the stability generated by the collaboration between members of the network.
	Extraction of value created by innovations	It governs an innovator's ability to capture the profits generated by innovation.
	Promotion of procedural justice and joint ownership of assets	It reports appropriability, through instruments such as patents, copyrights, and trademarks.

Coordination	The direction of all planning and controls execution	It creates mechanisms to drive the innovation process, as well as all the resources and infrastructure necessary to generate such innovation; It guides the actors towards the same objective.

Source: Prepared by the authors based on Dhanaraj and Parke (2006); Hurmelinna-Laukkanen *et al*. (2011).

Methodology

To understand in depth how does the orchestration dynamics to create an urban innovation ecosystem happen, a single case study was developed (Yin, 2015), with a procedural approach (Langey, 1999; Langley & Abdallah, 2011), considering the six dimensions of orchestration, grouped by Dhanaraj and Parkhe (2006) and Hurmelinna-Laukkanen et al. (2011). The case chosen for study was Pacto Alegre, an innovation ecosystem in the city of Porto Alegre, in southern Brazil. The choice of case was because Pacto Alegre is a city-level innovation ecosystem, involves multiple actors and is an example of an urban innovation ecosystem in a developing country since most of the previous studies were carried out in ecosystems of developed countries. The case of Porto Alegre uses strategies from other successful cases such as Florianópolis, Barcelona and Medellín (Huerta, 2017) and aims to become an innovation network around the world. The Pacto Alegre has revealing potential, because in addition to being the case of an urban ecosystem in a developing country, orchestrated by three universities, it has gained notoriety on the national scene. According to the Connected Smart Cities ranking, it is among the 10 best cities in technology and innovation in the country and is the fifth city with the largest number of innovation initiatives (in a scenario of 656 municipalities evaluated) (Urban Systems, 2024).

Pacto Alegre was conceived by the Alliance for Innovation, a partnership between three Universities - UNISINOS, UFRGS and PUCRS -, and by the Porto Alegre City Hall, to foster the development of Porto Alegre's innovation ecosystem. The objective of the Pacto is to create conditions for the city to become a hub of innovation, investment attraction and entrepreneurship. The agreement provides for the sharing of resources and partnerships with the government and the private sector. The idea is to unite the forces of the city, of all segments, in favor of a common agenda. In addition to these actors, the ecosystem counts with financial and development institutions as sponsors, with media partners, with design partners, and

with an advisory board (comprised of five professionals considered references in different themes) composed of more than 100 companies, associations, and institutions from different areas (Pacto Alegre, 2019).

Regarding data collection techniques, primary data collection was used, with 12 interviews and participant observation, and secondary data, from documents, videos and websites. Data were collected from June 2018 to December 2021.

Regarding the interviews, the snowball strategy was used to select the key informants in the Pacto Alegre network that integrates the same members of the Alliance for Innovation, in addition to the Porto Alegre City Hall, the international consultancy and an association of companies and members of civil society movements. For the definition of the interviewees, the selection criteria was the involvement in the creation of the Pacto Alegre and also the representativeness of each of the helix: government, university, companies, and society. We interviewed those responsible for the Pacto Alegre in the government, in each of the three universities involved, the foreign external consultant hired in addition to representatives of society and companies. Therefore, 12 of the main actors involved in the articulation of the innovation ecosystem in the city were interviewed. The interview script was based on the orchestration dimensions of Table 1 and was validated by two experts in the field of orchestration of innovation ecosystems, the interviews were recorded and later transcribed in full.

Participant observation took place on two occasions, first during working meetings of the Pacto Alegre management group in May 2019 and, subsequently, from October to December 2019, totaling 15 meetings. These meetings were monitored, recorded, photographed and recorded in a field notebook.

The secondary data were 7 official documents, videos, academic research, reports, and action plans related to Pacto Alegre initiatives, such as the Alliance for Innovation Memorandum of Understanding (MoU), Porto Alegre Innovation Diagnosis Network, Preliminary focus groups for mapping the innovation network, Pacto Alegre Projects available on the Pacto Alegre Websites (https://pactoalegre.poa.br/), Alliance for Innovation main universities and Porto Alegre City Hall. The videos are available on YouTube (https://www.youtube.com/c/PactoAlegreOficial/videos).

Data analysis was carried out by the process approach, using narrative, that involves construction of a detailed story from the raw data; and visual maps with temporal scheduling, to represent the different dimensions and to show precedence, parallel processes, and the passage of time (Langley, 1999). Thus, as

pointed out by Van de Ven and Poole (1995), we adopted for this study the linear sequence pattern of phases that occur over time to produce a given result.

Results and Discussion

According to Dhanaraj and Parkhe (2006) and Hurmelinna-Laukkanen et al. (2011), six dimensions can be considered: agenda definition, mobilization, knowledge mobility management, innovation appropriability management, network stability management, and coordination. These six dimensions were analyzed over time, resulting in five linear phases. It is important to note here that it is assumed the orchestration dimensions vary over time, depending on the life cycle stage of the innovation ecosystem. Based on Mikhailov et al. (2021), it was adopted that the ecosystem has a life cycle of four stages: birth, growth, maturity, and renewal. Thus, after constructing the narrative that follows, it is understood that the analysis conducted on the Pacto Alegre essentially comprises the first stage of the ecosystem's life cycle, birth. The first phase, called “Mobilization of actors,” occurred from April 2018 to February 2019. The second phase, called “Coordination,” took place from April to November 2018.

Phase 1 - The Pacto Alegre is born: April to November 2018

On April 9, 2018, marked the starting point for what would become the Pacto Alegre. Three leading universities in the state of Rio Grande do Sul—the University of Vale do Rio dos Sinos (UNISINOS), the Pontifical Catholic University of Rio Grande do Sul (PUCRS), and the Federal University of Rio Grande do Sul (UFRGS)—the first one public and the other two private, created the Alliance for Innovation. The signing of the protocol of intentions by the three institutions took place at the UFRGS Rectory. This Alliance was intended to foster the innovation ecosystem of Porto Alegre (MoU Alliance for Innovation, 2018).

On this occasion, the three institutions, through the protocol of intentions, organized an agenda and began to build a network and determine tasks for the different actors. It was agreed that the three universities would jointly develop a methodology to map the innovation ecosystem. Professors and undergraduate and graduate students in administration from these institutions began to meet to, first, establish the dimensions of the ecosystem that would be mapped, namely: Talents and Knowledge,

Financial, Structural, Institutional-Legal, and Interaction and Quality of Life. With these dimensions defined, they began to collect statistical data from Porto Alegre and other capitals (for comparison purposes).

On June 4, 2018, the universities hosted an event at the Unisinos theater, where the city's statistical data were presented within the context of the five dimensions and examples of innovation from other cities, such as Florianópolis and Barcelona, were discussed to serve as inspiration. More than 600 people from various sectors participated in this event, including representatives from companies, universities, public authorities, and civil society.

In the months following the event, a series of workshops was conducted by members of the three universities involved in the Alliance for Innovation. The objective was to map the main challenges facing the city and to identify potential projects for the Pacto Alegre. A total of 135 people participated in these workshops, including representatives from companies, public authorities, educational institutions, and civil society. The same five dimensions used for secondary data collection guided the data gathering along the four helices, employing Design Thinking methodologies and the Personas tool (fictional characters that represent profiles of real people). From this process, materials were prepared that served as the basis for diagnosing the city and defining the macro challenges that would guide the actions of the Pacto Alegre from March 2019.

On November 21, 2018, the official signing ceremony of the Pacto Alegre took place at the Cultural Center of UFRGS. This initiative was born from the collaboration between the Alliance for Innovation, the Municipality of Porto Alegre, and representative entities of the capital. The purpose of creating the Pacto Alegre centers on enhancing high-impact actions aimed at the city's development. This objective involves creating a network that strengthens connections to transform the city into an environment where quality of life and career growth can coexist. The Pacto Alegre aims to foster a more innovative city with increased knowledge generation, social cohesion, investor appeal, improved infrastructure, opportunities for entrepreneurs, cultural richness, cleanliness, and above all, a higher quality of life for its citizens, ultimately evolving into a world-class innovation ecosystem (Pacto Alegre, 2019).

In this first phase, it was evident that orchestration was led primarily by the three universities, even though public authorities provided occasional support, initially in a supportive role. The universities first collaborated to establish an agenda that would direct actors from the four helices toward the common goal

of transforming the city into a hub of innovation, investment attraction, and entrepreneurship. The subsequent challenge was to mobilize actors from the four helices to not only participate in the workshops but also commit to the city's transformation. Thus, two dimensions of orchestration stood out in this phase: agenda setting and mobilization.

The signing of the Pacto Alegre marked the conclusion of this first phase and initiated the next phase, which spanned from November 2018 to December 2019.

Phase 2 - Fostering the Pacto Alegre: November 2018 to February 2020

Thus, the development of the Pacto Alegre symbolized the materialization of an identity for the movement aimed at transforming the city into an innovation ecosystem. At this stage, it was crucial to work toward stabilizing the network, meaning mobilizing and aligning various actors around a common objective. The effort focused on creating a movement that fostered collaboration among actors.

The signing of the Pacto Alegre not only marked the involvement of actors from the four helices as protagonists of the initiative but was also characterized by the hiring of external consultant Josep Piqué, who was responsible for the development of Distrito 22@ in Barcelona, one of the exemplary international innovation ecosystems. Piqué brought his expertise and methodology for fostering innovation ecosystems to the Pacto. This initiated a period of knowledge creation and transfer among the various actors within the network.

On February 26, 2019, at UMove.me, the diagnosis of Porto Alegre—resulting from the workshops—was presented. March 26, 2019, marked the consolidation of the Board of the Pacto Alegre, a forum designed to agree on the main challenges and ideas capable of transforming Porto Alegre, thus ensuring the traction of projects. This network includes financial and development institutions as sponsors, media and design partners, an advisory board (composed of five professionals recognized as experts in various themes), and comprises over 100 companies, associations, and institutions from diverse sectors (Pacto Alegre, 2019). Additionally, six macro-challenges were defined as priorities for the Pacto: talent, urban transformation, business environment, city image, quality of life, and modernization of public administration. From this foundation, 24 projects were proposed to address the identified challenges. Each project was "sponsored" by a group of actors responsible for transforming ideas into actions throughout 2019.

This phase culminated on December 3, 2019, with an event at Nau Live Spaces, where the progress of the 1st cycle of the Pacto Alegre project was presented to the citizens of Porto Alegre. It was an opportunity to showcase the advancements of each project and outline the steps planned for the following year. Following this event, on December 5, more than 80 entities that make up the Board met at Unisinos to evaluate this first year of the Pacto Alegre. As a result, five new projects were proposed to be integrated into the initiative for the upcoming year, and three of the initial 24 projects were either discontinued or merged with others. The degree of evolution and engagement in the first cycle was crucial in the Board's evaluation.

Thus, this phase was fundamentally marked by three orchestration dimensions: network stability, knowledge creation and transfer, and coordination. The establishment of the Board, the identification of macro-challenges, and the proposal of projects created mechanisms to stimulate the innovation process, mobilize resources, and align actors toward a common objective. In other words, through these projects, it was possible to identify the activities to be developed within the city's innovation ecosystem and to mobilize actors to bring them to fruition. This phase was also characterized by collaborative orchestration among the actors of the four helices.

Phase 3 - Covid-19 and new directions for the Pacto Alegre: March to August 2020

In March 2020, specifically on the 16th, which marked the beginning of isolation due to the Covid-19 pandemic, the in-person activities of the Pacto Alegre management committee were suspended. The pandemic brought about changes as social isolation, individual challenges, information overload, and new communication demands influenced the mobilization of knowledge. At the onset of the pandemic, members of the Pacto were focused on understanding the unfolding situation and the implications for the initiative. Initially, activities and projects were suspended, and the network of actors established through the Pacto was mobilized to gather scarce supplies, such as masks and alcohol gel, for distribution to hospitals. It became a time to reassess priorities due to the pandemic. There was a shift toward mobilizing the knowledge of actors to create solutions to emerging challenges. Among the main practices carried out were hackathons and festivals featuring lectures and workshops (POA, 2020), promoted by universities and civil society, respectively. It is also important to note the continuity of the Pacto Alegre website, though with reduced content available.

Throughout the year, following the initial phase of the pandemic, the mobilization around projects gradually resumed, with adaptations to a remote meeting routine. Some projects were paused while others emerged in response to ecosystem demands. Notable examples include Supera, a support platform for small businesses involving the government, universities, and professional associations, and Brothers in Arms, a civil society movement for fundraising for hospital supplies. In this context, it became evident that exchanges and interactions among actors were essential for reassessing projects and setting priorities.

On May 19, 2020, the Executive Board met virtually to assess the new challenges imposed by the crisis, with over 130 participants. Collective actions were identified to help mitigate the negative effects caused by the pandemic. Mayor Marchezan recommended monthly meetings of the Executive Board to enhance group integration and increase the responsibility of joint decisions, aiming to overcome the crisis with greater assertiveness and reduced harm to society. In this phase, the orchestration dimensions of knowledge creation and transfer, as well as network stability, were particularly prominent. The pandemic introduced a new common goal for the Pacto: to minimize the effects of Covid-19. The network built around the Pacto demonstrated its capacity to maintain collaboration toward these new objectives. During this phase, both the municipal government and the universities played a leading role in ensuring network stability.

Phase 4 - New normal: August 2020 to December 2021

With the return of face-to-face activities and advances in pandemic control, it became necessary to revisit the objectives of the Pacto and assess the results achieved. Meetings were held with the board to present the status of the projects and the impacts they had generated. It was found that 9 projects were completed and had generated value. This assessment indicated that the Pacto had already contributed innovations and made progress in the development of the Porto Alegre ecosystem.

At this stage, for example, a team composed of students and professors from the Alliance for Innovation, which had previously developed an innovative solution for companies in the post-Covid period to replace masks, was awarded second place in a global competition during the IXL Innovation Olympics. Along with realizing the extraction of value created by innovations, as in-person activities resumed and the pandemic's repercussions became clearer, the role of innovation during the pandemic also came under discussion—both actions already taken and planning for future ones. On August 21, 2020,

Decree 20,704 regulated the Innovation Fund and established its Management Committee, creating the Fund for Innovation and Technology of Porto Alegre.

On January 7, 2021, after Sebastião Melo assumed office as the mayor of Porto Alegre, the Pacto projects were presented to the new municipal leaders, who committed to advancing the initiative. On April 6, 2021, the coordination of Pacto Alegre, along with the universities that form the Alliance for Innovation, met with Mayor Sebastião Melo, the vice mayor, and municipal secretaries to define the creation of an executive committee responsible for determining the priority projects for 2021.

On September 2, 2021, the fifth Executive Board meeting took place at the Plaza Hub. The 105 entities comprising the board met in a hybrid format to review project progress and deliberate on the inclusion of seven new initiatives. Eleven projects were considered completed, with another 15 classified as "in progress" and 11 as "awaiting resumption." One project was on hold, awaiting leadership. At the end of the review, the seven new project proposals were presented and were widely accepted by the Board.

At this stage, an essential dimension in the orchestration of ecosystems and networks of innovation was identified: the appropriability of innovation. It is necessary for the articulations generated between the actors and the ecosystem resources to create value for its members. Thus, as the movements carried out generate innovations, an appropriability of innovation is recognized. The next topic discusses the results found.

Visual Map and Discussion

As previously mentioned, the Pacto is an innovation ecosystem still under development (Mikhailov et al., 2021). Although in the last phase some value offerings were observed from the initial innovations generated, the period from April 2018 to September 2021 was fundamentally marked by knowledge accumulation, the implementation of knowledge-sharing mechanisms, cultural innovation initiatives, and the establishment of a formal working group.

The data collected and outlined in the narrative enabled the establishment of a timeline illustrating the hierarchy of orchestration dimensions throughout the trajectory of the innovation ecosystem in its initial development cycle. Figure 1 displays the six orchestration dimensions according to their mobilization across the four phases of the ecosystem creation cycle, alongside the key events that characterized each phase.

Figure 1 shows the six dimensions of orchestration according to their mobilization in the four phases of the ecosystem creation cycle, along with the main events that characterized each phase. At the start of an innovation ecosystem, the agenda-setting and mobilization dimensions are the most necessary, as it is essential that a clear common goal is defined and that the actors are mobilized around this goal. However, the case of Pacto Alegre showed that, before collaborative orchestration can take place between the actors of the quadruple helix (universities, government, civil society and companies), some actors need to take on the role of leading and promoting the initiative. In this sense, the universities played a crucial role, creating a shared agenda and articulating the actors involved.

This initial mobilization illustrates one of the main challenges facing urban innovation ecosystems: the complexity of engaging the different players around a common purpose. Articulating these actors, who have different interests, expectations and priorities, is a challenging task, especially in the early stages of the ecosystem's life cycle. In the case of Pacto Alegre, the universities took the lead in establishing a shared objective, demonstrating the importance of clear and articulate leadership to overcome barriers and align efforts towards the development of the ecosystem.

As the ecosystem's birth cycle progresses, new dimensions of orchestration gain relevance, notably Knowledge Mobility Management and Coordination. After setting an agenda and mobilizing actors around it, knowledge mobilization becomes essential to perform the activities required to achieve the common objective. At this stage—marked by phase two in this case—the stability of the network formed in the previous phase became evident, along with the creation of a mechanism to drive the innovation process, enabling the traction of Pacto projects. At this point, orchestration began to be shared among the different actors of the quadruple helix.

However, the evolution of the orchestration dimensions throughout the ecosystem's life cycle also presents significant challenges. While dimensions such as agenda setting and mobilization are crucial in the early stages, dimensions such as network stabilization and appropriability management become more relevant in advanced stages. This transition requires flexibility in orchestration practices in order to meet the specific needs of each stage of the cycle.

Furthermore, managing the appropriability of innovation emerges as a critical barrier at later stages. Ensuring that the results of innovations benefit the members of the ecosystem and generate tangible value requires clear mechanisms for capturing and distributing value. Thus, the success of the ecosystem

depends on adaptive orchestration practices that balance cooperation and competition, promoting the generation of sustainable value throughout the life cycle.

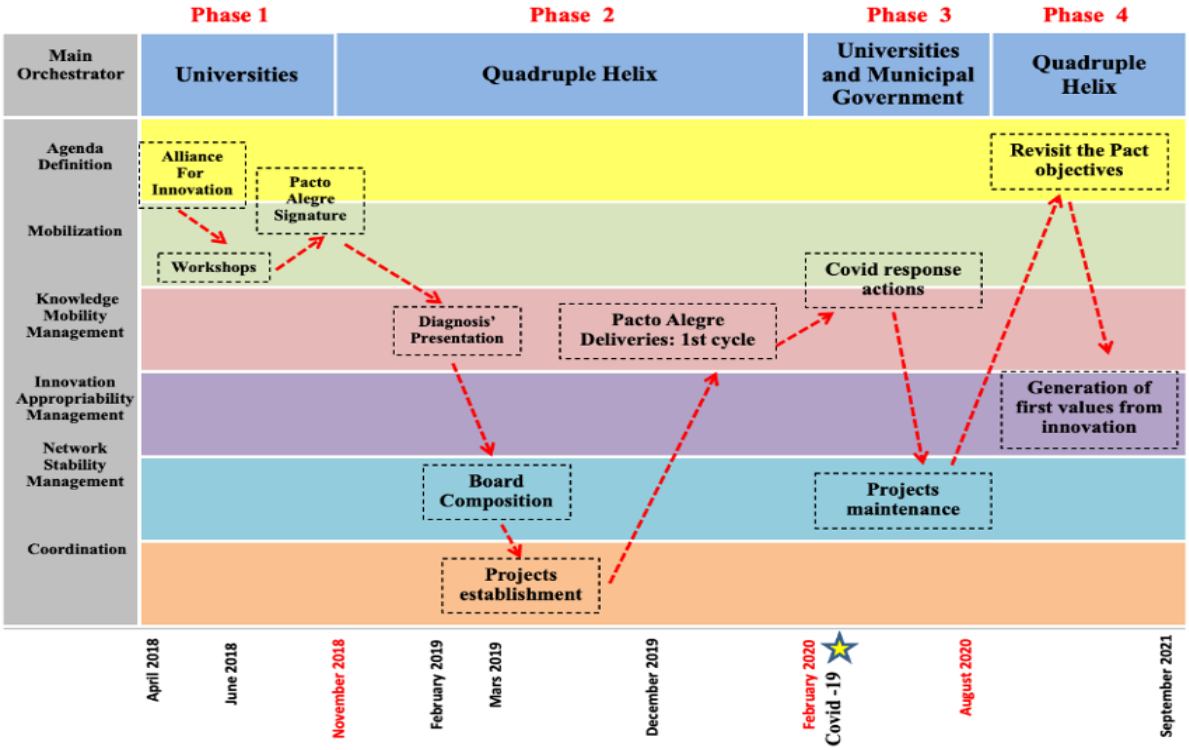

Figure 1. Chronological order of orchestration dimensions
Source: Prepared by the authors based on Pacto Alegre (2019).

The trajectory of the ecosystem revealed that an externality—in this case, Covid-19 during phase three — was able to alter part of the Pacto's agenda. The pandemic has shown that, in crisis situations, universities and public entities play a prominent role in orchestration. These crises highlight the need for resilient networks, capable of reorganizing the agenda and maintaining collaboration in times of adversity. Although the Pact's agenda was slightly modified, the network formed in the previous stages was strengthened and proved fundamental in generating value from innovation in the final phase.

Another important challenge highlighted by the pandemic is related to managing the diversity of interests among the actors in the quadruple helix, who have different technical, economic, social and political objectives. This dynamic requires orchestration that balances cooperation and competition,

ensuring alignment and avoiding the dispersion of efforts. Finally, when the crisis stabilized and regular projects and activities could be resumed, the quadruple helix actors once again played a collective role in orchestration, reinforcing the importance of collaborative and adaptive practices for the success of the ecosystem.

This means that urban managers and planners must prioritize articulating leaders, such as universities and governments, in order to structure networks, mobilize resources and promote integration between the actors of the four propellers. Resilient and flexible planning, with mechanisms for rapid adaptation and shared governance, is essential for dealing with crises and changing priorities. Multi-sector cooperation, through initiatives such as hackathons and workshops, should engage actors in solving challenges. Knowledge management and transfer, supported by technological tools, facilitate integration. Continuous monitoring ensures strategic alignment and impact. Finally, the focus should be on generating sustainable value, with projects that improve quality of life, promote social cohesion and economic development, ensuring an equitable distribution of benefits.

Final Considerations

To address the question of how orchestration dynamics operate to create an urban innovation ecosystem, an in-depth case study was conducted using a procedural approach. The selected case was Pacto Alegre, an urban innovation ecosystem located in southern Brazil.

Among the main findings is the identification of a hierarchy among the orchestration dimensions over time. Specifically, at the beginning of the first cycle of an innovation ecosystem, the dimensions of agenda setting and actor mobilization are essential. Once these are established, Knowledge Mobility Management becomes important, enabling activities around the common agenda to emerge. Coordination then functions as a driver of innovation. Following this, network stabilization begins, becoming crucial in crisis situations to reorganize the ecosystem's agenda. Finally, the innovation appropriability management dimension appears as the last phase, as it is connected to value generation from the realization of the previous dimensions.

Furthermore, the findings demonstrate that the roles of the quadruple helix actors change over time and according to the orchestration dimension being mobilized. Universities and public entities play a prominent role in orchestration during the agenda-setting and mobilization phases.

This article contributes to the literature on innovation ecosystems by demonstrating how orchestration dynamics operate to create an urban innovation ecosystem, as well as revealing, in the context of orchestration literature, the existence of a hierarchy of dimensions that evolve over time. From a practical point of view, the pandemic has highlighted the importance of resilient networks and collaborative practices in crisis scenarios, emphasizing the need for flexibility and continuous cooperation. For urban managers and planners, these lessons offer valuable insights, reinforcing the importance of integrating leadership, adaptability and collaboration into strategies for the successful development of urban innovation ecosystems.

Finally, the procedural approach enables a deeper understanding of the dynamics within innovation ecosystems. For future studies, it is suggested to analyze orchestration dynamics in mature ecosystems, which have undergone more than one cycle.

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