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MANAGEMENT PROCESSES IN CLUSTERS AS INNOVATION ECOSYSTEMS FOR COMPETITIVENESS AND KNOWLEDGE SHARING

GIBSON MEIRA OLIVEIRA
UNIVERSIDADE ESTADUAL DA PARAÍBA (UEPB)

ANIELSON BARBOSA DA SILVA
UNIVERSIDADE FEDERAL DA PARAÍBA (UFPB)

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1 INTRODUCTION

Developing strategies to enhance competitiveness and foster knowledge sharing has become essential for organizational positioning and survival in innovation-driven and complex organizational environments. The growing need for adaptability and collaboration has led to the emergence of clusters as strategic environments that facilitate collective learning, interorganizational cooperation, and dynamic capabilities. These clusters, typically composed of companies operating in similar or related sectors within a defined geographic area, serve as innovation ecosystems that promote strategic integration and value co-creation.

Clusters create favourable conditions for continuous interaction and the exchange of competencies among organizations, strengthening collaborative practices that impact competitiveness (Zaccarelli et al., 2008; Mueller & Jungwirth, 2016; Balland, Belsomartinez & Morrison, 2015). These ecosystems unite diverse actors - such as universities, research centres, government bodies, and private companies - in an open, dynamic network where self-management and information flow beyond organizational boundaries are central (Surie, 2017; Nascimento & Lima, 2021).

This dynamic interaction fosters the development of managerial capabilities, particularly those related to Dynamic Managerial Capabilities (DMCs), including human capital, social capital, and managerial cognition (Helfat & Martin, 2015; Adner & Helfat, 2003), which are essential in highly competitive and changing markets.

This paper analyzes the contribution of management processes within a cluster network to strategic competitiveness and managerial integration. The empirical focus is the Red de Institutos Tecnológicos de la Comunitat Valenciana (REDIT), a consolidated Spanish cluster composed of 11 institutes that operate across various economic sectors and collaborate through research development and innovation (R&D&I) projects. REDIT provides a valuable context for exploring the interaction between governance, knowledge sharing, and collaborative management practices in innovation ecosystems.

Our main contributions are threefold. First, we identify key management processes that support strategic integration and innovation in a cluster setting. Second, we analyze how these processes enhance governance structures and enable knowledge sharing. Third, we offer practical insights for policymakers and managers seeking to design or improve cluster initiatives, particularly in the Brazilian context. Empirical evidence from a mature and successful cluster can contribute to extending the literature on cluster governance and interorganizational collaboration.

Unlike previous studies that primarily emphasize clusters' economic or industrial impacts, this research highlights the strategic role of collaborative management processes in enhancing competitiveness and knowledge flows within innovative ecosystems.

The remainder of this paper is structured as follows: the next section presents the theoretical framework; the methodology is described in Section 3. The findings are discussed in Section 4. Finally, it concludes with key implications and suggestions for future research.

2 THEORETICAL FRAMEWORK

Clusters can be understood as agglomerations of interrelated companies that share a geographical location and establish strategic connections with customer and supplier channels

(Porter, 1988). This structure represents a competitive approach to organizational development, as it strengthens collective capabilities and expands the market reach of participating firms.

The concept is expanded by Evgeniya, Sam, and Cinzia (2021), who define clusters as "organizations of organizations," emphasizing the managerial autonomy of the entities that comprise them and the absence of hierarchical relationships between them. This horizontal configuration stimulates a collaborative dynamic that can increase companies' competitiveness within such arrangements.

From a socioeconomic perspective, clusters play a significant role in promoting information and knowledge sharing among involved agents, thereby creating an environment conducive to innovation (Bittencourt et al., 2019). This exchange of knowledge fosters the formation of strategic partnerships, the strengthening of trust-based relationships, and the enhancement of the quality of collective investments. As a result, organizations within these clusters tend to gain competitive advantages compared to those operating in isolation (Sousa et al., 2015). Studies suggest that these companies are more likely to implement process and product innovations, even though there is no consensus on the specific mechanisms driving these outcomes (Bittencourt et al., 2019).

The value proposition of clusters is creating collective benefits derived from the combination and sharing of resources among members - resources that would otherwise be unavailable to organizations outside this arrangement (Lupova-Henry et al., 2021; Bittencourt et al., 2019). This process places collaborative activities at the centre, especially those associated with innovation, surpassing the importance of actions developed independently by each firm (Ahrne & Brunsson, 2005). Joint efforts not only expand innovation capacity but also redefine the strategic priorities of participants.

To better understand innovation processes within clusters, drawing upon the concepts of systems and organizational ecosystems is necessary. These constructs emphasize the relevance of interorganizational communication and collective learning, resulting from continuous knowledge flows among actors (Lupova-Henry et al., 2021). This exchange of experiences fosters the emergence of new methods, practices, and technologies, contributing to the evolution of organizational processes and adaptation to the external environment. Along these lines, Evgeniya, Sam, and Cinzia (2021) propose viewing clusters as meta-organizations - composed of autonomous entities maintaining structured relationships with the institutional and economic environment. This approach acknowledges the ability of clusters to shape and transform their context through strategic collective action.

Adner (2017) defines an ecosystem as an alignment structure composed of a multilateral set of partners who, through coordinated interaction, enable the realization of a value proposition. This conceptualization highlights the interaction among involved actors, whose collaboration is fundamental for effective mutual strengthening.

In organizational ecosystems, this structure manifests through the articulation of various agents - such as universities, research institutes, funding bodies, governments, small and medium-sized enterprises (SMEs), and large corporations - who share knowledge, resources, and capabilities for value creation. Carayannis and Campbell (2009) noted that such a collaborative environment has driven growing organizational openness, leading institutions to pursue external strategic alliances to broaden access to knowledge and practices beyond internal organizational boundaries.

From this perspective, ecosystems are composed of diverse actors who establish interdependent relationships based on shared and complementary interests. These actors engage in collaborative activities such as co-development of technologies, information sharing, and creating innovative solutions (Nascimento & Lima, 2022). The artefacts generated include tangible products and services and intangible assets such as knowledge, skills, and technologies that circulate as inputs and outputs of the system.

The literature acknowledges that ecosystems enable the creation of collective value that would unlikely emerge from a single organization acting alone (Adner, 2006). In such environments, firms operate under a simultaneously collaborative and competitive logic - coopetition - to develop new products, better meet customer demands, and foster continuous innovation cycles (Moore, 1993). This dynamic enhances the collective performance of the ecosystem. It strengthens its adaptive capacity in the face of technological and/or market changes, encouraging the emergence of disruptive innovations and new business opportunities (Valkokari et al., 2017).

Ecosystems offer fertile ground for collective learning, knowledge exchange, and experimentation with innovative production practices (da Silva, de Sá & Spinosa, 2019). These ecosystems are not limited to commercial relationships but are also structured as networks focused on creating, sharing, and applying new knowledge (Kon, 2016).

Companies' involvement in knowledge and technology transfer activities depends on the motivation of actors and the presence of cultural, institutional, and economic incentives (Arvanitis, Kubli, & Woerter, 2011; Williams & Pouder, 2019). In this context, the intersectoral partnerships of the Triple Helix - involving businesses, government, and universities - stand out as instruments for strengthening clusters (Piqué, Berbegal-Mirabent, & Etzkowitz, 2018). However, the effectiveness of these alliances is directly tied to governance mechanisms that internally organize interactions, guide behaviour, and promote collective efficiency (Bocquet & Mothe, 2010; Cassanego Júnior et al., 2019).

Clusters become organizational ecosystems when they create an environment conducive to knowledge sharing and cooperation, which includes the exchange of techniques, information, and complementary skills among members (Asheim & Isaksen, 2002; Zeng, 2008). This cooperative dynamic is a central pillar supporting the functioning of clusters, as it enables the circulation of knowledge and practices that enhance innovation and collective competitiveness. In this scenario, several authors highlight the relevance of informal social relationships in the knowledge transfer process, particularly when the cluster structure is deeply embedded in the local productive fabric (Molina-Morales, 2001; Morosini, 2004). Such relationships, rooted in trust and proximity, facilitate the flow of tacit knowledge, which is difficult to codify and transmit through formal channels.

Building relationships based on trust, legitimacy, and reciprocity emerges as a key factor for the success of cooperation strategies in interorganizational, knowledge-intensive environments. Cooperation and coordination among cluster members must be promoted through governance mechanisms designed to structure collective devices capable of internally organizing interactions, guiding member conduct, and fostering both efficiency and effectiveness at the group level (Bocquet & Mothe, 2010; Cassanego Júnior et al., 2019).

Governance plays a central role in structuring and strengthening clusters, particularly regarding access to and articulation of public policies aimed at innovation and entrepreneurship. Public policies and tax incentives are widely recognized as fundamental strategies for stimulating firms' innovative capacities and fostering the creation of new ventures (Severo et al., 2020; Marini, Da Silva & Do Nascimento, 2016). In this regard, an effective governance system within the cluster is essential for mediating dialogue with state actors, interpreting regulatory guidelines, and mobilizing public resources in a coordinated manner.

Moreover, governance serves as an integrative element among the different ecosystem actors - companies, universities, research centres, and public agencies - promoting the convergence of interests and implementing collaborative strategies for regional development. By facilitating access to funding instruments and stimulating the construction of shared agendas, governance in clusters contributes directly to consolidating a more dynamic, inclusive, and sustainable innovation ecosystem.

Such mechanisms play a strategic role in consolidating shared norms and practices, aligning interests, reducing conflicts, and strengthening collaborative capacities, all of which contribute directly to organizational performance and interorganizational learning processes.

Interorganizational learning is a dynamic process of knowledge integration between companies and their respective members, supported by continuously sharing information, experiences, and practices (Lane & Lubatkin, 1998). This process occurs through both formal and informal mechanisms. Formal learning is characterized by the intentional creation of institutional structures and channels for knowledge transfer - such as consortia, technical agreements, and R&D networks - while informal learning occurs spontaneously, often based on casual interactions and interpersonal relationships (Eiriz, Gonçalves & Areias, 2017).

In the context of clusters, promoting interorganizational learning requires an institutional environment that encourages cooperation and the development of bonds among various actors. As Colet and Mozzato (2018) argue, the cluster environment needs to be structured to foster frequent and trust-based interactions, as these conditions enable effective knowledge exchange between organizations. Thus, strengthening interorganizational relationships becomes a critical condition for firms to learn from one another (Oliveira & Silva, 2022), enhance their technical and strategic capabilities, and advance together toward innovation and sustainable competitiveness.

While traditionally associated with control and decision-making, the potential of governance as a strategic resource can transcend this role in cooperative arrangements by facilitating collective learning and the development of capabilities through shared mechanisms (Anand et al., 2020). In this way, governance becomes a strategy that enhances competitive advantage through collaboration and mutual learning among cluster participants.

3 METHODOLOGY

This study adopted a **qualitative and exploratory** approach, structured as a **single case study**, as proposed by Sampieri, Collado, and Lucio (2006). The objective was to analyze the contribution of management processes within a cluster network to strategic competitiveness and managerial integration among organizations. The selected case was the *Red de Institutos Tecnológicos de la Comunitat Valenciana* (REDIT), a social organization coordinating 11 technological institutes operating across various productive sectors. This multisectoral articulation, combined with a broad network of affiliated companies, positions REDIT as one of the most prominent technological clusters in national and international arenas, headquartered in the Valencian Community, Spain.

REDIT was established over five decades ago to support the modernization of the Spanish industry, especially in response to the realization that products from the Valencian Community had low, competitive performance in international markets. Since then, the cluster has expanded its scope and now includes 11 technological centres specializing in footwear, leather, metalworking, wood, toys, and children's products. These centres collaborate closely with companies of various sizes, promoting technical-scientific linkages and fostering technological innovation. Currently, REDIT holds more than 169 active patents, not including those held exclusively by its affiliated companies. Its governance structure consists of a General Director and a technical team of five professionals responsible for strategic areas such as analysis and studies, technical support, control, and institutional communication.

The selection of research participants was based on accessibility criteria, involving six professionals directly engaged in REDIT's governance. Interviews were conducted with three board members, the General Director, and two specialists responsible for analysis, studies, and institutional communication. This range of roles among the interviewees was intended to

provide a broad and qualified perspective on the cluster's internal management and articulation mechanisms.

Choosing REDIT as the research object provided a unique opportunity to explore the dynamics of innovation and governance processes in a well-established technological cluster in depth. The contributions of the interviewees revealed significant practices and strategies related to interorganizational coordination, highlighting the role of management in creating an environment conducive to innovation.

Data was collected through individual interviews, a technique widely recommended in qualitative research for capturing participants' perceptions, experiences, and attributed meanings (Bauer & Aarts, 2002). A semi-structured interview guide was designed based on analytical categories previously defined from the theoretical framework presented in Table 1. The questions were carefully formulated to explore the core theoretical dimensions of the investigation while maintaining flexibility to delve deeper depending on participants' responses

Table 1 – Interview Dimensions and Categories

OBJECTIVE	DIMENSION	PREDEFINED CATEGORIES
Analyze the contribution of management processes within a cluster network to strategic competitiveness and managerial integration among organizations.	Interorganizational integration and competitiveness (Bocquet & Mothe, 2010; Adner, 2017; Piqué, Berbegal-Mirabent & Etzkowitz, 2018; Cassanego Júnior et al., 2019; Bittencourt et al., 2019; Nascimento & Lima, 2022)	Structure, Integration, Knowledge sharing, Collaboration.
	Role of governance and relations among business, government, and academia (Carayannis & Campbell, 2009; Marini, Da Silva & Do Nascimento, 2016; Piqué, Berbegal-Mirabent & Etzkowitz, 2018; Severo et al., 2020)	Companies, Government, Universities, Society.
	Mechanisms for knowledge sharing (Lane & Lubatkin, 1998; Eiriz, Gonçalves & Areias, 2017; Colet & Mozzato, 2018)	Formal, Informal

Source: Developed by the authors, 2025

The interview guide followed a structure aligned with the established analytical dimensions, allowing for systematic data collection while remaining open to the emergence of new categories during the interviews. The interviews were in-person in June 2024, following a pre-established ethical and procedural protocol. This protocol included an initial greeting, a formal request for recording consent, a presentation of the interview script (with space for follow-up questions), and a closing thank-you and farewell. All interviews were recorded with the participant's consent, totalling 5 hours and 12 minutes of empirical material.

One of the criteria for participant selection - in addition to accessibility - was their **direct involvement in REDIT's governance and management processes**. The richness of the information obtained was notable, mainly due to the technical and strategic expertise of the professionals interviewed, whose experiences substantially contributed to the research's analytical objectives. After completing the fieldwork, all interviews were **fully transcribed**, preserving the original content to ensure a rigorous and systematic data analysis.

In addition to the interviews, **documentary analysis** was conducted using materials available on REDIT's official website, including annual reports from the past 20 years, the knowledge map, brochures, bulletins, and freely accessible books.

The data analysis process followed Bardin's (2016) guidelines for content analysis, a widely used technique in qualitative research for its ability to identify relevant categories and meanings systematically. The analysis was conducted in three phases, as proposed by the author. In the first phase, pre-analysis, a floating reading of the interview transcripts was performed to identify the most representative excerpts aligned with the research question. The second phase, material exploration, involved identifying three central thematic categories: interorganizational integration and competitiveness, governance and institutional articulation, and mechanisms for knowledge sharing. Data were organized by category, facilitating the identification of recurring patterns in the participants' statements. Finally, in the third phase, results treatment and interpretation, the meanings attributed by participants to REDIT's management processes were examined. This phase also enabled the articulation of findings with the theoretical framework presented in this study.

4 RESULTS

The results presented in sequence are organized into three central categories identified in the literature: inter-organizational integration and competitiveness, relational governance, and knowledge-sharing mechanisms. Each of these dimensions is examined as a management process that, in an articulated manner, contributes directly to strengthening strategic capabilities and the competitiveness of the studied cluster. This structure allows the interpretation of the findings not as isolated phenomena but as systematized managerial practices that underpin the collective performance of the ecosystem created by REDIT.

4.1 Managerial Processes for Interorganizational Integration and Competitiveness

Implementing productive clusters has the fundamental purpose of enhancing the competitiveness of companies operating within a specific sector or territory, fostering collective strategies that enable better positioning in response to market dynamics (Bittencourt et al., 2019). In this context, the creation of the *Red de Institutos Tecnológicos de la Comunitat Valenciana* (REDIT) represents a strategic approach aimed at reconfiguring the competitiveness of the regional industry within the international arena. This initiative aims to strengthen the innovative and technological capacity of companies affiliated with the institutes, promoting interorganizational integration and increasing their visibility on the global stage. This strategic orientation was confirmed by the statement of one of the interviewees, who emphasized the deliberate intent behind the establishment of REDIT:

> [...] lo cierto es que las empresas de la Comunidad Valenciana veían cómo sus productos no pasaban la frontera. [...] Vamos a crear una infraestructura común, con un equipamiento común que pueda garantizar la calidad de nuestro producto. [...] en la década de los 80, fue cuando la chanita valenciana, el gobierno regional pensó y si estos dos modelos están funcionando, uno en Alicante y el otro en Castellón, vamos a hacer lo mismo para los clústeres industriales más importantes de la comunidad agroalimentario, textil, juguete, plástico, madera, metal." (Interviewed 1)

REDIT emerges as an alternative strategy to enhance the industrial sector's competitiveness in the Valencian Community by promoting the sharing of productive structures and knowledge to strengthen products in the international market. REDIT is responsible for integrating 11 technological centres, each specializing in different economic segments. These centres operate in a complementary manner in research, development, and innovation (R&D&I) activities, establishing a collaborative ecosystem that fosters the generation and dissemination of technical and scientific knowledge.

By promoting interaction among the institutes and encouraging the sharing of technologies, practices, and competencies, REDIT has positioned itself as a platform for interorganizational innovation. It contributes to strengthening the technological capabilities of affiliated companies and, consequently, to raising the level of systemic competitiveness in the region, as illustrated in the following interview excerpts:

> “[...] por ejemplo, AINIA, que es el Centro Tecnológico Agroalimentario, se ha dado cuenta de que ellos trabajan con tecnologías para el sector agro, pero también pueden trabajar en Farma, en cosmética, en Biotech. Son centros tecnológicos que han ido evolucionando con los tiempos y que sus tecnologías se han ido adaptando a otros sectores industriales que también son importantes en la Comunidad Valenciana o a los que se le puede dar soporte” (Interviewed 1)

> "a priori eran 11 sectores diferenciados, la propia evolución de la tecnología y la aplicación de la tecnología junto con la evolución de los sectores, no hay sectores verticales, hay absolutamente transversalidad, horizontalidad y donde la aplicación de por ejemplo, en construcción, no hay un centro de la construcción, pero es que los 11 centros abordan la construcción desde la perspectiva complementaria de la energía, de las TICs, de la aplicación del plástico, del metal sobre la construcción." (Interviewed 3)

The integration process among the 11 technological centres affiliated with REDIT constitutes a fundamental strategic resource for strengthening collective innovation capabilities. This institutional articulation fosters the exchange of technical and scientific knowledge among the centres, expanding the scope and effectiveness of the solutions developed solutions that can be applied transversally across the various productive sectors served by the network. The underlying logic of this collaborative arrangement aligns with the concept of innovation ecosystems proposed by Adner (2017), in which value creation does not stem solely from the isolated actions of a single agent but rather from the coordination and alignment of multiple actors whose contributions are interdependent and complementary.

In this sense, integrating technological centres fosters a favourable environment for co-creating solutions, enhancing inter-organizational collaboration and optimizing resources based on shared interests. As Nascimento and Lima (2022) highlight, this collaborative arrangement stimulates joint innovation-oriented activities, reinforcing collective dynamics and generating benefits for the ecosystem in which they operate. Thus, the coordinated action among the institutes goes beyond mere technical cooperation, constituting a structured regional development strategy based on knowledge sharing, complementary capabilities, and the generation of collaborative projects, as illustrated in the interview excerpts below:

> "lo que hacemos es desarrollar proyectos estratégicos que responden a objetivos estratégicos del gobierno de España y debemos de hacerlos en consorcio entre varios centros tecnológicos de diferentes comunidades autónomas, con lo cual ahí se fomenta también el carácter relacional con el resto de regiones españolas." (Interviewed 1)

> "En segundo lugar, desarrollar proyectos colaborativos donde los centros asumen ante retos que cuando fueron concebidos no existían. Ex.: centro tecnológico aeroespacial o de la aeronáutica, Reddit Mobility, Reddit Ecohabitat, REDIT Ventures (vehículo de inversión donde están presentes los 11 centros tecnológicos).” (Interviewed 3)

REDIT plays a strategic role as a mechanism of cohesion and coordination among the technological centres that comprise it, acting directly in mediating and developing collaborative projects. These projects are made possible by integrating knowledge, expertise, and specific technologies from each centre, thereby enhancing the capacity to generate innovative solutions

with greater impact and in shorter timeframes. This synergy among the technical institutes constitutes a significant competitive advantage, as it increases the efficiency of innovation processes and accelerates the development cycle of new products and services.

This integration is closely tied to the role of governance within the cluster context. More than simply mediating relationships among firms, the governance system assumes the function of articulating and structuring interinstitutional connections beyond the ecosystem's internal boundaries, fostering linkages with universities, governmental agencies, and other actors. This perspective aligns with the studies of Bocquet and Mothe (2010), Piqué, Berbegal-Mirabent, and Etzkowitz (2018), and Cassanego Júnior et al. (2019), who emphasize the importance of governance in clusters as a key element for strengthening collaborative relationships and aligning diverse interests around common goals related to innovation, technological development, and regional competitiveness.

4.2 Governance as a coordinating management mechanism between industry, government, and academia

The integration promoted by REDIT is not limited to the relationships established among the technological centres within its structure. As a governance mechanism, it plays a broader coordinating role by fostering strategic connections with a wide range of institutional actors that extend beyond the network of institutes and companies, encompassing the development of partnerships with universities and governmental bodies.

This capacity for articulation aligns with the logic of the Triple Helix model, as formulated by Etzkowitz and Leydesdorff, in which innovation emerges from the interaction among universities, industry, and government. As highlighted by the interviewees in this study, REDIT operates as a relational platform that facilitates the flow of knowledge, resources, and capabilities among these various actors:

> "los centros tecnológicos ayudaron a las empresas en sus necesidades más de certificación y normativa, pues se convirtieron en el laboratorio de iDi de estas empresas de una forma natural [...] y también los centros tecnológicos jugaron un papel muy importante con la universidad porque actuaban de catalizador, de conector entre un conocimiento de excelencia que existía en las universidades, pero que era muy difícil de asimilar por un tejido productivo, principalmente Pyme." (Interviewed 5)

> "La parte pública es muy importante tanto para nosotros como asociación como para los centros, para poder estar por delante de esas necesidades de las empresas, tener las mejores instalaciones que la empresa no podría pagar, tener observatorios para ir viendo cómo se van desenvolviendo otros mercados internacionales, otras propuestas que van saliendo, y todo eso se hace con dinero público." (Interviewed 2)

> "A ver, nosotros colaboramos mucho con la universidad, tenemos cátedras, tenemos masters, tenemos cursos de especialización, tenemos un montón de colaboraciones con académicos y con investigadores en proyectos. Trabajamos muchísimo con la UPV, muchísimo [...] Eso lo hicimos desde REDIT, en coordinación. REDIT coordinaba el trabajo de ese proyecto con cuatro o cinco centros de red." (Interviewed 1)

REDIT's capacity to establish connections with entities external to the cluster - such as universities, government agencies, and research institutions - highlights its role as a central agent in building a competitive and innovative ecosystem. This role aligns with the propositions of Piqué, Berbegal-Mirabent, and Etzkowitz (2018), who argue that integration among different

institutional spheres is essential for generating and disseminating knowledge and strengthening regional innovation capabilities.

These connections foster knowledge exchange among the involved actors and expand access to strategic resources such as public innovation policies, government subsidies, and scientific knowledge produced within universities. By enabling the circulation of these inputs, REDIT consolidates itself as a relational structure that combines the realms of science, technology, and the market, playing an essential role in the innovation dynamic and the practical implementation of the Triple Helix model.

Within the framework of the Triple Helix, particularly regarding government actors, REDIT maintains a partnership with the public sector in a manner that preserves the network's managerial autonomy, as emphasized by one of the interviewees:

> "hay un miembro o dos del gobierno regional, porque entendemos que aunque somos independientes, tenemos que caminar al lado de la administración pública para la generación de políticas industriales que sirvan a la Pyme y que no sea una cosa, un deseo político que se pierda en la teoría y no llegue nunca a materializarse." (Interviewed 1)

The relationship with the government has enabled the development of public policies that directly benefit the companies involved in the cluster. This finding is consistent with the discussions presented by Severo et al. (2020) and Marini, Da Silva, and Do Nascimento (2016), who emphasize how such partnerships support the development of small and medium-sized enterprises (SMEs) while also facilitating access to improved infrastructure, as highlighted by one of the interviewees:

> "La parte pública es muy importante tanto para nosotros como asociación como para los centros, para poder estar por delante de esas necesidades de las empresas, tener las mejores instalaciones que la empresa no podría pagar, tener observatorios para ir viendo cómo se van desenvolviendo otros mercados internacionales, otras propuestas que van saliendo, y todo eso se hace con dinero público." (Interviewed 2)

Beyond public policies for fostering innovation, the institutional relationship established between REDIT and the government is strategic for strengthening the ecosystem. This articulation enables access to support structures and public financial resources, which are decisive in assisting the companies linked to the cluster. The availability of public capital, combined with technical and institutional support, allows companies to develop new products, incorporate emerging technologies, and respond more efficiently to the demands of national and international markets.

The relationship between REDIT and the government constitutes a two-way channel. While it expands innovation opportunities for the productive sector, it also contributes to implementing more effective public policies aligned with the concrete demands of the territory. Thus, cluster governance performs a crucial mediating function, promoting integration between public and private interests (Severo et al., 2020) and consolidating a robust and competitive innovation ecosystem.

Another way to consolidate the innovation ecosystem, making it even more competitive, relates to the model's second helix, which is a direct relationship with educational institutions, specifically universities. Engagement with these actors allows the environment to develop projects that are directly applied within companies, as reported by the interviewees:

> "Hacemos un centro que tenga director científico, que venga avanzando en cierto modo por la colaboración que podamos tener con la universidad, pero que todos

> nuestros desarrollos del departamento de químicas puedan llegar a las empresas cerámicas para mejorar la calidad de sus baldosas" (Interviewed 1)

> "Y lo que hacen es traducirlo y nos utilizan a los departamentos universitarios como fuentes de conocimiento. No sólo aquí en el caso del plástico, del Instituto Tecnológico del Plástico, de Aimplast, tienen una cátedra aquí pagada, con lo cual financian un máster, laformación, financian. Entonces la ventaja de REDIT es que ocupa una posición intermedia entre departamentos universitarios, empresa y administración. La triple hélice tuya es." (Interviewed 6)

The articulation between REDIT and higher education institutions represents one of the central pillars in consolidating an ecosystem oriented towards the practical application of knowledge and fostering the pursuit of external alliances (Carayannis & Campbell, 2009). Cooperation with universities enables the development of innovations directly incorporated into the production routines of companies linked to the cluster, aiming to improve product and process quality based on academic institutions' scientific and technological potential. This interaction values knowledge and technology transfer, bridging academic output and the demands of the productive sector.

In this context, REDIT establishes strategic relationships with universities and research centres as a beneficiary of generated knowledge and an active agent in professional training and qualification. The network frequently facilitates funding for technical training and higher education programs, as well as occupying institutional spaces within the universities, which fosters integration between teaching, research, and practical application. This partnership generates a reciprocal relationship: while REDIT gains direct access to cutting-edge technical-scientific knowledge, universities find in the cluster companies a productive field for applying their research and training professionals aligned with market needs.

This cooperation strengthens the technological centres and academic institutions (Piqué, Berbegal-Mirabent, & Etzkowitz, 2018), promoting more qualified technological solutions and stimulating the formation of highly specialized human capital. Thus, the relationship between REDIT and universities constitutes a strategic axis for regional development and innovation, highlighting the importance of integration between the productive and academic sectors in building long-term competitive advantages.

Finally, within the integrative perspective that characterizes REDIT's operations, the interface that its governance establishes with society also stands out. This socio-relational dimension, although sometimes less emphasized in analyses of technological clusters, proves essential for consolidating a genuinely inclusive and socially committed innovation ecosystem, developing inclusive actions through specific initiatives, as cited by the interviewee:

> "También tenemos impacto, también buscamos llegar a la sociedad a través de muchas formas. Tenemos iniciativas muy interesantes, como por ejemplo la plataforma Inspiradoras, que es una plataforma donde se le da voz, luz, taquírafos a las mujeres innovadoras en cualquier ámbito. No solamente el tecnológico, rural, educativo, artístico." (Interviewed 1)

As one of the interviewees reported, this relationship materializes through actions and projects aimed at addressing community needs, promoting territorial development, and contributing to collective welfare. In this sense, governance mediates market interests and social aspirations, reinforcing REDIT's role as an agent of socioeconomic transformation. This positioning underscores the importance of understanding clusters not only as productive arrangements but as complex structures encompassing multiple dimensions - economic, institutional, and social - whose legitimacy largely depends on their capacity to generate public

value, promote development, and facilitate continuous knowledge sharing both at formal and informal levels, as revealed in the following section.

4.3 Knowledge management: Formal and informal mechanisms within the cluster

Knowledge sharing among the various actors within a cluster can occur through different forms of interaction mediated by formal and informal mechanisms. Among the formal channels, collaborative projects, technical-scientific events, training workshops, and other structured initiatives stand out, all aimed at fostering integration among ecosystem participants. These practices promote the circulation of competencies, technologies, and innovations, thereby enhancing the reach and effectiveness of collective development efforts.

> "Sí, bueno, a ver, nosotros hacemos muchos eventos y en esos eventos se produce mucho networking. Eso es verdad. Por ejemplo, ahora mismo están, bueno, mañana y pasados, el Mitec en Madrid, que lo organiza la Federación Nacional de Centros, allí se desplazan un par de compañeras mías y mi jefe, y ahí están todos los directores de todos los centros, con jefes de proyectos y tal, y ahí hay networking." (Interviewed 1)

> "Todo eso también nos hace que los eventos que hacemos, que son un gran Congreso al Año, el Reddit Summit. Sí, hacemos un congreso que ahí sí que traemos a personas, a valencianos normalmente, que están liderando proyectos muy importantes de innovación por todo el mundo, los traemos aquí y nos los cuentan." (Interviewed 2)

> "Todo nuestro plan de actividades, jornadas, seminarios, está abierto a todos los públicos, empresas, universidades, políticos. Cuando, por ejemplo, mañana es 18, el miércoles 19 lanzamos una jornada que es foro de consejeros y traemos al director general del CDT a participar en una ponencia. Y es una jornada en la que van a políticos de gobierno valenciano, alcaldes, miembros de los centros tecnológicos, empresarios." (Interviewed 3)

The participants' statements reveal that REDIT adopts a structured strategy of promoting events to foster integration among the various actors within the ecosystem. The organization of congresses, seminars, and thematic forums is one of the main formal mechanisms for encouraging knowledge sharing and building relationship networks. These events provide a space for disseminating experiences and best practices while reinforcing the local community's institutional and identity ties with international trends in science, technology, and innovation. Such initiatives reinforce REDIT's role as a platform for interinstitutional articulation and as a public space for the collective construction of knowledge, fostering social capital, institutional legitimacy, and connections between science, policy, and the productive sector.

In this context, and consistent with the observations of Colet and Mozzato (2018), the cluster plays a facilitative role in enabling exchanges and creating favourable conditions for building relationship networks that transcend organizational boundaries. Spatial proximity, combined with the density of interactions, contributes to an environment conducive to mutual learning and the co-creation of innovative solutions, strengthening social capital and the competitive capacity of the actors involved. Thus, knowledge sharing is not limited to information transfer but instead constitutes a continuous process of collective construction that sustains the ecosystem's innovative dynamics.

Informal knowledge-sharing processes represent an essential dimension of cluster dynamics and are strongly supported by the geographic proximity among actors. This territorial closeness facilitates the development of interpersonal ties, the emergence of informal social networks, and the spontaneous flow of knowledge elements that, although not institutionalized, play a fundamental role in fostering innovation and collective learning.

In this regard, cluster governance performs a strategic function by acting as a mediator and promoter of environments conducive to these informal interactions. Through creating meeting spaces, promoting mutual trust, and encouraging a collaborative culture, governance helps ensure that communication among diverse agents flows organically, even outside formal structures. As noted in the following interview excerpts, several informal actions - such as sharing coffee, having lunch at a local restaurant within the cluster territory, or participating in a physical activity emerge as opportunities to strengthen ties among actors operating within the cluster environment.

> "[...] te vas a comer al restaurante de aquí arriba y de repente yo quedo para comer con técnicos de aquí, que me oye, Arantxa, te vienes a comer? Vale, pues mira, y de vaso hablamos. Pues yo quedo con los técnicos con los que tengo que hablar de cosas, quedo pues para tomar un café, para comer, para almorzar." (Interviewed 1)

> "Café de los jueves. Y el Café de los jueves es un café a primera hora virtual, donde, sin un orden del día establecido, los directores se conectan, yo me conecto y hablamos del día a día o de alguna cuestión que nos ha ido surgiendo, alguna iniciativa o alguna duda. Es decir, está muy bien el trabajo formal y planificado, pero es muy importante los espacios de interacción de las personas." (Interviewed 3)

> "Aquí a mediodía mucha gente sale a correr y son momentos de ocio saludable, muy alineados con el propósito del IBV (acho importante colocar por extenso o nome do instituto). Y donde se producen otro tipo de relaciones. Pues entre el primer extremo y el otro hay otras dinámicas donde también procuramos que se generen equipos mixtos para hacer cosas, para solventar algún reto o para mejorar algún proceso." (Interviewed 4)

The spatial dynamics of clusters foster the emergence of informal relationships that play a significant role in knowledge-sharing processes and collective learning, confirming the findings of Eiriz, Gonçalves, and Areias (2017). These connections are not established through formal or institutionalized mechanisms but arise spontaneously from daily interactions and the physical proximity among the various actors that compose the ecosystem. In this way, territory ceases to be merely a geographical space. Instead, it performs a relational function, promoting social interactions that contribute to circulating information, ideas, and practices.

The presence of informal environments - such as cafés, restaurants, and shared leisure or sports areas - is an important support for the constructihttps://revistas.usp.br/raion of local social networks and interorganizational learning processes. These spaces strengthen interpersonal ties and foster the exchange of experiences among professionals from different organizations. As highlighted by interorganizational learning studies (Lane & Lubatkin, 1998), such informal interactions act as catalysts for mutual learning processes, facilitating the diffusion of tacit knowledge and the identification of collaboration opportunities that would be unlikely to emerge in strictly formal contexts (Oliveira & Silva, 2022).

5 CONCLUSIONS

Based on the analysis of the case of the Red de Institutos Tecnológicos de la Comunitat Valenciana (REDIT), it can be concluded that clusters operate as strategic environments for organizational integration, capable of fostering innovation, competitiveness, and regional development through structured interorganizational management processes. These processes include governance practices that enhance institutional articulation, knowledge management and collective and interorganizational learning, which operate synergistically to strengthen the strategic capabilities of the participating organizations. Table 2 below presents a summary of the main findings of this study:

Table 2 – Consolidation of findings, processes and characterization

PROCESSES	CHARACTERIZATION
Interorganizational integration and competitiveness	Integrating REDIT's 11 technological centres strengthens collective innovation capacity and enables the development of technological solutions that can be applied transversally across multiple sectors. This coordinated action enhances resource utilization, broadens the scope of competencies, and generates shared value, directly contributing to regional competitiveness.
Governance and institutional Articulation	REDIT's governance functions as a strategic mediator among companies, universities, and government, fostering institutional alignment and building bridges between scientific knowledge and the needs of the productive sector. This articulation facilitates access to public policies, financial resources, and infrastructure, consolidating the cluster as an innovation ecosystem with high legitimacy and autonomy.
Knowledge sharing mechanisms	REDIT employs formal (events, projects, seminars) and informal (everyday interactions, local social networks) knowledge-sharing mechanisms that strengthen social capital and promote interorganizational learning. Territorial proximity encourages the flow of tacit knowledge and the spontaneous emergence of collaborative solutions—elements essential to continuous innovation.

Source: Developed by the authors, 2025

These findings reveal that REDIT is an innovation ecosystem that adopts collaborative practices, enabling coordination among technological centres, companies, universities, and governmental agencies. By identifying and analyzing these processes, it becomes clear that the cluster not only promotes the circulation of knowledge and technologies but also strengthens the dynamic managerial capabilities embedded in the relationships among participating actors, fostering integration and enhancing the overall competitiveness of the ecosystem.

Governance emerges as a central dimension of these processes, mediating interactions, aligning interests, and ensuring the fluidity of interinstitutional relations. In turn, both formal and informal mechanisms of knowledge sharing stimulate interorganizational learning and, consequently, continuous innovation. The REDIT case illustrates how clusters, when guided by integrated management processes, can generate collective value, enhance regional competitiveness, and promote a sustainable innovation culture.

The findings of this study provide valuable insights for formulating public policies and institutional strategies aimed at developing clusters in local and national contexts. REDIT's experience demonstrates that strengthening governance, fostering multisectoral interactions, and investing in formal and informal learning and knowledge-sharing environments are key elements for consolidating sustainable innovation ecosystems. For public managers and business leaders, the study highlights that the success of a cluster depends not only on infrastructure and economic incentives but also on management practices that promote trust, cooperation, and continuous learning. Such practices can be replicated or adapted in other regions seeking to promote territorial competitiveness through collaborative innovation.

Despite its theoretical and empirical contributions, this research presents some limitations that must be acknowledged. It is based on a single case study focused on REDIT's experience in Spain, which may limit the generalizability of the findings to other geographic and institutional contexts. Moreover, participant selection was based on accessibility criteria, which, although ensuring technical qualification, may have excluded complementary perspectives from other ecosystem actors. Additionally, the quantitative phase of the study could not be conducted, which restricts the capacity for a more objective analysis of the innovation ecosystem and its perceived contribution by institute managers.

As for suggestions for future research, it is recommended to deepen studies on the impact of different governance and management models in clusters from diverse sectors and territorial contexts. Furthermore, a study exploring how REDIT's lessons could be adapted and

applied to the Brazilian context - considering its institutional, economic, and cultural specificities - would be of great relevance. Comparative studies between different governance and management models are also encouraged, particularly in countries with distinct institutional characteristics. Adopting mixed methods and including diverse actor profiles could enrich future investigations, broadening the understanding of the effectiveness of management processes in collaborative and innovative ecosystems.

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