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## CO-EVOLUTION OF INNOVATION ECOSYSTEMS AND HYBRID ORGANIZATIONS

### Summary

This paper explores the co-evolution of innovation ecosystems (IES) and hybrid organizations (HO), with a particular focus on the transition from linear, business-oriented models of innovation processes to network-structured IES. Based on a systematic literature review, the key mechanisms of mutual adaptation between IES and HO have been identified. By combining market-driven and mission-oriented logic, HOs leverage the structure and dynamics of IES to affirm their legitimacy within complex and rapidly changing environments. Acting as bridges between business, innovation, and platform ecosystems, they facilitate the exchange of knowledge and resources, connect the activities of diverse actors, and serve as catalysts for mutual collaboration. At the same time, IES evolve toward greater flexibility, creating conditions for the integration and support of hybrid organizations. Based on theoretical analysis, a conceptual model is proposed to illustrate the dynamic interaction between IES and HO, aiming to foster innovation and enhance sustainable socio-economic development.

**Key words:** innovation, innovation ecosystems, hybrid organizations, co-evolution.

### INTRODUCTION

In today's highly dynamic environment, the imperative to strengthen innovation capacity at all levels of the economic and social system is becoming increasingly pronounced. Innovation is recognized as a key mechanism of social adaptation to accelerated scientific, technological, economic, and environmental transformations.

Historically, models describing the path from idea generation to market valorization have evolved from linear approaches, through systemic, spiral, and open innovation models, to the concept of IES. Through collaboration among business entities, academic and research institutions,

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startups, as well as governmental and non-governmental organizations, IES networks foster the creation, transfer, and market valorization of knowledge into value-added innovations. These ecosystems are integrated institutional and resource architectures, supported by relevant policies and regulatory frameworks, enabling the translation of knowledge into sustainable innovations (Granstrand & Holgersson, 2020). Their comparative advantage lies in the ability to integrate diverse resources, competencies, and perspectives, thereby accelerating the development of inclusive and sustainable innovations with greater social and economic returns.

The development of IES does not occur in isolation but through complex interactions among companies, institutions, users, and technologies. This process is characterized by continuous knowledge circulation, experimentation, and collective learning, accompanied by the co-evolution of organizations and their environments through interaction, collaboration, and strategic rivalry. In this context, the question of the nature of co-evolution between IES and HO is of particular importance, gaining growing theoretical and practical relevance in contemporary economic conditions (Adner, 2017).

The phenomena of IES and HO constitute dynamic and adaptive structures that evolve within complex networks of collaboration and interdependence. Nevertheless, the mechanisms underlying their co-evolution, as well as the enabling and constraining factors of this process, remain insufficiently explored in the existing literature. In particular, questions regarding the social, economic, and environmental outcomes of IES–HO co-evolution remain open.

Building on these gaps, this review paper seeks to address the following research questions:

**RQ1:** What are the principal domains of overlap and the primary functions of IES and HO in their co-evolutionary process?

**RQ2:** What are the most significant long-term social and economic outcomes of IES–HO co-evolution?

The aim of this paper is to provide a robust theoretical framework for understanding IES–HO co-evolution by: a) systematizing existing knowledge and theoretical approaches, b) identifying the key mechanisms driving their mutual co-evolution, and c) outlining the implications of this process for the design of effective and sustainable innovation initiatives.

Methodologically, the study adopts a *systematic literature review* approach, encompassing: the definition of explicit source inclusion criteria, a comprehensive search of relevant scientific databases (Scopus and Web of Science), critical analysis and synthesis of theoretical models and empirical evidence, and integration of findings into a unified conceptual model of IES–HO co-evolution. Sources were selected based on their relevance to explaining IES–HO co-evolution, methodological rigor, and scholarly impact, enabling the identification of: a) the key domains of overlap and primary functions of IES and HO within the co-evolutionary process, and b) the most salient social and economic outcomes of this process.

Drawing on this analysis, a visual model was developed to depict the IES–HO co-evolutionary process, highlighting: a) the principal areas of

overlap and primary functions of IES and HO, and b) the core social and economic outcomes, considered in the context of social inclusion, digital transformation, and environmental sustainability.

This paper not only synthesizes existing knowledge but also advances both theoretical and practical understanding of IES–HO co-evolution. It contributes to the literature on innovation economics and organizational studies by conceptually bridging IES and HO frameworks through the lens of co-evolution. Further empirical research—particularly longitudinal and comparative studies—is required to validate the generalizability of the identified mechanisms. Co-evolution thus emerges not merely as an adaptive process but as a strategic framework for sustainable development, wherein market efficiency and social responsibility are mutually reinforcing.

## THE GENESIS OF INNOVATION PROCESS MODELS

In the contemporary era, innovation increasingly unfolds through open and interconnected networks of actors, known as IES, while the significance of closed organizational structures is gradually diminishing. These ecosystems bring together companies, startups, universities, research centers, investors, and public institutions, which collaboratively shape innovative solutions through both cooperation and competition. Their strength lies in the ability to integrate diverse resources, knowledge, and perspectives, thereby fostering faster, more inclusive, and more sustainable innovation development.

The evolution of innovation models reflects shifts in the understanding of how new ideas are transformed into market- and socially-relevant products, services, or processes. The earliest models of the innovation process were linear in nature, assuming a clear sequence of phases, from fundamental research, through development, to the commercialization of knowledge and inventions (Godin, 2006). These models, dominant in the mid-20th century, were based on the premise that scientific discoveries almost automatically led to technological innovations (Bush, 1945).

Over time, critiques of linear approaches paved the way for the development of systemic models of innovation, which recognize feedback loops, interactivity, and the importance of context (Kline & Rosenberg, 1986). Within evolutionary economic theory, the concept of national innovation systems emphasized that innovation is not the result of isolated actors, but rather the product of a network of interactions among firms, universities, research centers, and government institutions (Freeman, 1987; Lundvall, 1992).

The further development of innovation theory has been marked by the emergence of spiral models, beginning with the Triple Helix concept, which emphasizes the strategic interaction between universities, industry, and government in generating and disseminating innovation (Etzkowitz & Leydesdorff, 2000). Later expanded versions - Quadruple Helix and Quintuple Helix - incorporate civil society and the dimension of sustainable development (Carayannis & Campbell, 2009, 2010). These models reflect

multifaceted relationships in the capitalization of knowledge, as well as hybridization through the creation of new organizational forms that arise at the intersection of academic, business, and public spheres. Such structures imply a high capacity for mutual learning and continuous communication within a dynamic and open environment.

By the late 1990s and early 2000s, the concept of IES became a central framework for analyzing innovation processes. Adner (2006) defines an ecosystem as a network of collaborative relationships and agreements in which value is created through the collective efforts of diverse actors. Jackson (2011) highlights the institutional and organizational dimensions of ecosystems, emphasizing the complexity of relationships between universities, industry, and government. Oh et al. (2016) critically examine the IES concept, pointing to the need for balance between scientific and commercial dimensions - particularly relevant for innovation policies in transitional economies.

Within IES, innovation is no longer viewed as the exclusive result of investment in research and development, but rather as the product of interaction among actors within an institutionally supported system. In the European Union, this approach is reflected in programs such as Horizon 2020 and Horizon Europe, which promote collaboration among universities, industry, and the public sector to create pan-European innovation networks (European Commission, 2021). In the United States, the institutional framework is shaped through support from the National Science Foundation and the development of innovation clusters and technology parks (Etzkowitz & Leydesdorff, 2000).

Thus, the evolution of innovation process models - from linear, through interactive and national innovation systems, to the IES concept - demonstrates the continuous development of theoretical frameworks. Under contemporary conditions, IES represent not only a theoretical construct but also a guiding principle for public policy, aimed at building sustainable networks of actors, institutional arrangements, and instruments that enable societies to respond to the challenges of global competitiveness and sustainable development (Adner, 2017).

Parallel to the affirmation of the IES concept, HO have emerged as entities operating within these ecosystems, combining market-driven and socio-ecological logics (Battilana & Lee, 2014; Pache & Santos, 2013). Studies show that HO require specific institutional conditions, flexible governance mechanisms, and open innovation processes in order to effectively fulfill their dual mission within contemporary IES (Haigh & Hoffman, 2012).

HO, which integrate elements from the for-profit, non-profit, public, and private sectors, have proven particularly well-suited for functioning in such environments. Their ability to operate across different institutional logics enables them to connect traditionally separate sectors, fostering interdisciplinary collaboration, inclusivity, and experimentation with new governance models. While this flexibility offers numerous advantages, it simultaneously generates challenges related to organizational identity, governance, and strategic orientation.

## SUBSTANTIVE SCOPE OF THE IES CONCEPT

IES represent complex networks of interconnected actors, resources, institutions, and policies that collectively enable the creation, exchange, and application of innovations (Granstrand & Holgersson, 2020; Autio & Thomas, 2014). Unlike traditional innovation models, which focus on individual organizations and linear flows of activity, IES emphasize participant interdependence and value co-creation (Moore, 1993).

The basic structure of IES consists of four key groups of actors:

- **enterprises** – from large multinational corporations to medium and small enterprises and startups,
- **academic and research institutions** – universities, research centers, and laboratories,
- **governmental and public institutions** – regulatory bodies, development and financial agencies,
- **civil society and non-governmental organizations** – including civic initiatives and social movements (Carayannis & Campbell, 2010).

This heterogeneity creates a dynamic network of interactions in which a balance is struck between competition and collaboration (Ritala et al., 2013). The ecosystem structure is often organized around a focal firm or platform that coordinates activities and sets standards for interaction (Adner, 2017; Gawer & Cusumano, 2014). The strength of IES lies in their ability to integrate diverse resources, knowledge, and perspectives, fostering more inclusive and accelerated development. Instead of hierarchical relationships, IES operate through horizontal interactions and complementarity among participants.

### Key Functions of IES include:

- generation and exchange of knowledge through collaborative networks (Powell et al., 1996),
- mobilization of resources—financial capital, human potential, and technological infrastructure (Clarysse et al., 2014),
- fostering innovation legitimacy through institutional support and regulation (Meyer & Rowan, 1977),
- integration of the social dimension of innovation through the involvement of civil society and social enterprises (Westley et al., 2011).

The most important characteristics of IES include openness, complementarity, dynamism, and horizontality. Instead of relying on closed organizational structures, actors within IES actively seek external partners, exchange resources, and co-develop innovative solutions. Such openness enables accelerated technological dynamics and institutional changes that redefine existing norms and rules. The functional efficiency of the ecosystem depends on governance mechanisms, both formal (contracts, regulations) and informal (reputation, social norms) (Williamson, 1991).

In the context of sustainable development, there is a growing integration of principles of open and social innovation (Chesbrough, 2003; Cajai-ba-Santana, 2014). In addition to economic value, this also generates social

and ecological value, making IES a suitable environment for the development of HO. Empirical research shows that inclusive and participatory IES achieve greater resilience and innovativeness (Cohen, 2006; McPhee et al., 2021). In short, IES not only promote market-oriented innovation but also enable transformation toward a sustainable and socially responsible economy, thereby creating the conditions for their co-evolution with HO.

In contemporary society, IES represent complex networks of actors, resources, and relationships that enable the generation, exchange, and application of knowledge. Although traditional focus has been placed on technological and economic aspects, the importance of organizational factors - such as social capital, organizational culture, and collaboration - is increasingly recognized, not only in shaping innovation dynamics, but also in enabling long-term sustainability and ecosystem evolution (Rabelo Neto et al., 2024).

Social capital encompasses networks of relationships, norms, and trust that facilitate effective coordination and collaboration among actors. In the context of IES, it manifests through horizontal and vertical ties, informal communication channels, and the capacity for joint problem-solving. According to Ortiz et al. (2021), intra-organizational social capital, which includes trust, shared goals, and normative frameworks, directly influences an organization's ability to absorb and apply external knowledge, thereby fostering innovation.

Organizational culture refers to the set of values, beliefs, and behaviors that shape how innovation is developed within organizations. A culture of openness, learning, and experimentation enables employees to freely express ideas, take risks, and learn from failure. Birudavolu and Nag (2018) emphasize that innovation culture is the heart of an organization's innovation capability, while strategy represents its brain. Without an embedded culture that promotes collaboration and creativity, innovation strategies remain ineffective.

## **COLLABORATION AMONG ORGANIZATIONS AND INDIVIDUALS IS ESSENTIAL FOR THE DEVELOPMENT OF IES**

It enables the exchange of resources, knowledge, and competencies, creating synergy that exceeds the capacities of individual actors. Thomas (2019) emphasizes that collaborative networks—including formal alliances and informal ties—are crucial for the development of innovation and social capital. The quality of interpersonal relationships, including empathy, trust, and shared vision, directly influences the success of joint projects and the long-term stability of the ecosystem.

IES bring together companies, startups, universities, investors, and public institutions into dynamic networks that facilitate resource exchange, accelerated innovation diffusion, and collective learning. Their efficiency depends on the degree of technological interdependence and the ability of actors to adapt to changes in knowledge and market conditions (Zhang et al., 2022).

Openness is one of the key characteristics of IES. Rather than relying solely on internal resources, organizations within these networks actively seek external partners to develop new products, services, and business models. According to Liu et al. (2024), IES function as platforms that connect different sectors and disciplines, fostering interdisciplinary collaboration and knowledge transfer. Such openness not only accelerates technological development but also drives institutional changes that lead to the redefinition of existing rules and normative frameworks.

As dynamic networks, IES form the foundation of the contemporary innovation landscape. Their ability to integrate diverse actors, resources, and perspectives makes them highly effective mechanisms for generating and disseminating innovation. Dynamism, openness, and the capacity for co-evolutionary adaptation enable these networks to respond to the complex challenges of today and actively shape the directions of future innovation development.

## HO: COMBINING MARKET LOGIC AND SOCIAL MISSION

HO can be defined as organizations that incorporate multiple institutional logics into their structures and processes. They represent specific organizational forms that combine market-oriented business models with a social and/or ecological mission (Battilana & Lee, 2014). Their core characteristics include:

- dual strategic orientation (simultaneous pursuit of economic and social goals),
- integration of business, innovation, and platform ecosystems,
- innovative business models (using market mechanisms to generate revenue while addressing social problems),
- multiple accountability (to investors, users, and the broader community),
- mission sustainability (preserving the social mission amid changing market and institutional conditions) (Haigh & Hoffman, 2012).

Typologies of HO are based on mission, legal form, or dominant institutional logic. The most common forms of HO include:

- social enterprises that provide socially beneficial products or services and reinvest profits into their mission,
- benefit corporations (B-Corps), legally recognized entities that integrate social and environmental goals
- cooperative models,
- hybrid non-governmental organizations that use market activities to fund their programs (Pache & Santos, 2013).

HO often act as bridges between business, innovation, and platform ecosystems, enabling the transfer of knowledge and resources (Liu et al., 2024). These organizations have proven essential for addressing complex social challenges, as they successfully adapt to diverse norms and expectations (Secinaro et al., 2019). In the contemporary context, innovation is increasingly developed through open collaboration networks rather than within closed structures.

HO, which combine diverse goals and values—most often balancing market demands with social missions—have proven particularly well-suited for operating in such environments. Their ability to function across multiple institutional frameworks allows them to connect sectors that traditionally do not collaborate, promote inclusivity, and experiment with new governance models. It is precisely this flexibility that enables HO to respond to the complex challenges of the modern socio-economic context.

The plurality of institutional logics that characterizes HO means they simultaneously respond to the demands of the market, society, and regulatory bodies. Although this multi-dimensional orientation can generate internal tensions, it also opens space for innovative solutions in governance, strategy, and organizational culture. HO often develop specific mechanisms to balance competing demands, including flexible decision-making structures, participatory governance models, and multiple success metrics, thereby contributing to the development of dynamic and inclusive innovation ecosystems.

Thanks to their combination of market mechanisms and social responsibility, HO frequently become drivers of social innovation. Their mission encompasses addressing complex challenges such as climate change and social inclusion, and their ability to rapidly adapt to technological and societal shifts enables them to outperform traditional organizational structures (Zhang et al., 2022).

HO face challenges such as mission drift, stakeholder conflicts, limited access to capital (Bugg-Levine & Emerson, 2011), and numerous regulatory barriers (Young, 2008). To overcome these obstacles, they often leverage the advantages of IES through networking and partnerships with actors across different sectors, facilitating the exchange of resources, knowledge, external ideas, and technologies (Santos et al., 2015).

## CO-EVOLUTION IN THE CONTEXT OF ENHANCING INNOVATION AND HO DEVELOPMENT

At its core, co-evolution implies that changes in one system trigger adaptations in another, leading to their mutual shaping (Kauffman, 1993). In a societal context, it is reflected in the interaction of organizations, technologies, rules, and markets (Garud & Karnøe, 2003). Within innovation theory and the study of complex organizational systems, co-evolution contributes to understanding how changes in technology, social practices, and regulation unfold through interdependent processes (Teece, 2007), emphasizing that innovation is not an isolated event but the result of simultaneous adaptations among diverse actors.

Theoretical frameworks that explain co-evolution include approaches from complex systems theory, institutional theory, and ecological metaphors. Within complex systems, development is viewed as the result of nonlinear interactions and interdependent adaptive processes. Institutional theory emphasizes the transformation of norms through the practices of actors operating within diverse logics, while the ecological metaphor treats organizations as biological entities that continuously adapt to changes in their environment.

The co-evolution of IES and HO refers to the parallel development of these two entities, where changes in one trigger adaptations in the other (Ritala et al., 2021). This interaction is based on the exchange of resources, knowledge, and institutional practices, creating an environment that simultaneously fosters innovation and sustainability (Adner, 2017). IES evolve to incorporate the flexibility required by HO, which combine market and mission-driven logics. Such dynamic synergy enables more effective innovation management and promotes sustainable socio-economic development, while HO—especially in the early stages of opening new developmental pathways—require strong institutional support to preserve their transformative role.

The co-evolution of IES and HO can be explained through a combination of organizational theory, innovation network theory, and evolutionary perspectives on business systems. It is a process in which two or more systems develop together, with changes in one prompting adjustments in the other. When IES and HO mutually influence each other's development, a dynamic synergy emerges—HO introduce new logics and needs into IES, while IES provide resources, partners, and normative frameworks that guide their growth.

For example, a hybrid startup in the field of renewable energy may stimulate the innovation ecosystem to develop new regulations, investment models, and supply chains. At the same time, the IES provides access to capital, partnerships, and institutional support. This reciprocal interaction accelerates innovation processes while enhancing the adaptability of hybrid organizations to ongoing technological changes in the environment.

The co-evolution of IES and HO implies mutually conditioned development, where changes in one system affect the behavior and capabilities of the other. HO often serve as bridges between business, innovation, and platform ecosystems, enabling the transfer of knowledge, technology, and institutional norms. Such interaction leads to new forms of collaboration, the redefinition of organizational identities, and institutional innovation (Liu et al., 2024).

Organizations that combine diverse institutional logics become key actors within these ecosystems. Their ability to balance competing goals and values allows them to connect sectors that traditionally do not collaborate. According to Secinaro et al. (2019), HO develop specific governance mechanisms, flexible decision-making structures, participatory management models, and multiple success metrics, which enable them to respond to complex social, ecological, and economic challenges.

Thanks to their ability to integrate diverse goals and values, HO have become key actors in networks that contribute to the development of more inclusive, adaptive, and sustainable IES. By combining profit-driven, social, public, and private interests, these organizations are increasingly becoming integral components of innovation ecosystems. Their operational flexibility enables rapid adaptation to change and successful connection of sectors that have traditionally operated in isolation.

In the process of co-evolution, IES and HO mutually shape one another: ecosystems provide the framework for collaboration, while HO

introduce adaptability and innovative governance models. According to Zhang et al. (2022), the success of IES depends on the degree of technological interdependence and the ability of actors to adapt to changes in knowledge and market conditions. The dynamism of IES stems from continuous information exchange, experimentation, and collective learning, which enables swift and effective responses to external challenges and emerging opportunities.

In this context, the co-evolution of IES and HO is not merely a parallel development, but a process in which both phenomena are simultaneously transformed, shaping new patterns of collaboration and innovation. HO adapt to the governance structures of IES while maintaining a dual strategic logic—aligning market objectives with the pursuit of a social mission.

## DISCUSSION

The development of IES does not follow a linear trajectory, but rather unfolds through co-evolution—a process in which actors simultaneously adapt and transform. Each innovation alters interaction patterns within the IES, creating a need for new forms of coordination, governance, and evaluation. In this context, HO, which combine diverse institutional logics, occupy a central role. Their ability to connect sectors that traditionally operate separately and to rapidly adapt to change makes them key actors in the evolution of IES (Secinaro et al., 2019).

The development of IES requires a holistic approach that encompasses not only technical and economic factors but also organizational dimensions. Social capital, organizational culture, and collaboration are essential components that enable dynamic, inclusive, and sustainable development. One of the core advantages of HO is their capacity to adapt to changes in the institutional environment. Within IES, where rules are constantly evolving, HO function as bridges between sectors and disciplines, accelerating knowledge transfer, fostering collaboration, and enabling experimentation with new value models (Liu et al., 2024).

The strong growth of IES has contributed to the affirmation of HO, primarily due to their role in managing interactions among economic actors from different institutional spheres. Such interactions are crucial for the creation, transfer, and commercial valorization of knowledge and innovation (Hasche et al., 2020). IES based on systemic, helix, and virtual innovation models have significantly advanced the development of HO, which combine characteristics and functions from various institutional domains to enhance innovation at both national and regional levels (Champeño & Etzkowitz, 2017).

This dynamic emerges from the synergistic interplay of key actors within IES. For example, academic research transitions into startups; startups attract investors; corporations acquire or implement their solutions; and the state shapes the regulatory framework that enables these processes. The ultimate goal is to accelerate innovation and convert knowledge and ideas into market value.

In the context of co-evolution with IES, HO not only adapt organizationally to existing institutional frameworks and network structures, but also actively contribute to their transformation—particularly toward sustainability and inclusivity—through innovative practices. HO represent unique structures that combine elements of the private, public, and nonprofit sectors, balancing profit orientation with the pursuit of social or ecological impact. Through innovative business models, they develop sustainable approaches to addressing societal challenges. Their ability to consolidate resources and foster cross-sector partnerships enables rapid responsiveness to sustainability demands and structural transformations in contemporary society (Carayannis et al., 2023). This role is especially prominent in IES focused on the development and application of new technological solutions.

The co-evolution of IES and HO signifies a simultaneous and mutually conditioned development of these entities, wherein their structures, strategies, and roles continuously adapt to environmental changes. Rather than evolving independently, IES and HO shape one another, creating a dynamic balance between institutional stability and organizational agility. IES provide a stable framework for collaboration, while HO contribute adaptability and responsiveness to the complex challenges of modern society.

HO—such as public-private partnerships and university-industry centers—are increasingly becoming key actors within IES. Their ability to connect academia, industry, and government helps reduce conflict and facilitates the transfer of knowledge and innovation (Champenois & Etzkowitz, 2017). In addition to balancing conflicting interests, HO must manage diverse stakeholder expectations (Mair et al., 2015). While academic institutions aim to generate knowledge and advance scientific understanding, economic actors prioritize rapid market valorization of products and services. The role of HO is to effectively communicate and coordinate these needs, enabling mutually beneficial collaboration. In doing so, they become indispensable actors in creating environments that foster cooperation and build trust among IES participants (Hasche et al., 2020).

By combining different institutional logics—profit orientation and social mission, public and private goals—HO are particularly important within IES because they:

- function as bridges between business, government, and civil society,
- rapidly adapt to changes within IES,
- include marginalized groups and alternative value models.

The complex dynamics of knowledge capitalization are manifested through the emergence of new forms of collaboration at the intersection of academia, business, and the public sector. These points of intersection materialize through institutions and projects born of cross-sectoral cooperation, requiring the capacity for mutual learning and effective communication within dynamic and open environments. Examples of such hybrid structures include centers of excellence, technology parks, incubators, and open platforms for information exchange.

Thanks to their unique position at the crossroads of institutional spheres, HO have become a central subject of research in the literature on IES (Hasche et al., 2020). As mediators, they facilitate the processes of knowledge creation and innovation. Their interaction with diverse actors can result in outcomes ranging from job creation to the promotion of interdisciplinary collaboration. HO may take various forms—from technology transfer centers and university-industry research hubs to intellectual property management offices that link research outputs with market needs.

Innovation intermediaries, acting as brokers within the ecosystem, provide a wide range of support services for innovation. Public-private partnerships stand out in particular, as do joint development and management initiatives for innovation projects between governmental and private entities (Hodge & Greve, 2017).

The primary role of HO within the increasingly complex structure of IES is to align stakeholder interests, facilitate the smooth transfer of knowledge and innovation, and enable more efficient resource sharing. HO possess the ability to mediate conflicts among participants whose interests may differ or even oppose one another (Aarikka-Stenroos & Ritala, 2017). Such conflicts often arise from the need to ensure the free circulation of knowledge while simultaneously protecting intellectual property rights.

Beyond balancing conflicting interests, HO must also manage the diverse expectations of stakeholders (Mair et al., 2015). While academic institutions aim to generate knowledge and advance scientific understanding, the business sector prioritizes rapid market valorization of products and services. The task of HO is to effectively communicate and coordinate these needs, enabling mutually beneficial collaboration. In doing so, they become indispensable actors in creating an environment that fosters cooperation and builds trust among participants in the innovation ecosystem (Hasche et al., 2020).

Within IES, HO function like glue—connecting the activities of diverse actors while simultaneously acting as catalysts for their mutual interactions. Actors, resources, and actions together form a context that enables value creation, which emerges through the combination of efforts and assets from various entities working toward a shared goal (Santos et al., 2015). Although the goals and expectations of involved actors may be aligned or divergent, it is precisely through the integration of resources and activities that outcomes are achieved which could not be realized through isolated efforts (Hasche et al., 2020).

Interactions among actors actively shape the trajectory of knowledge creation and its commercial valorization through innovation over time. These interactions link current challenges with the experiences of past collaborations, while attitudes and decisions are influenced by previously established relationships and expectations of future engagements (Hasche et al., 2020). Value creation within IES is a key area of research, as it explains how collaboration among actors from different institutional spheres leads to economic, social, and environmental benefits. Contemporary studies aim to identify the mechanisms and processes that enable the emergence and amplification of such value

in complex innovation projects involving multiple helix system participants (Linton, 2024).

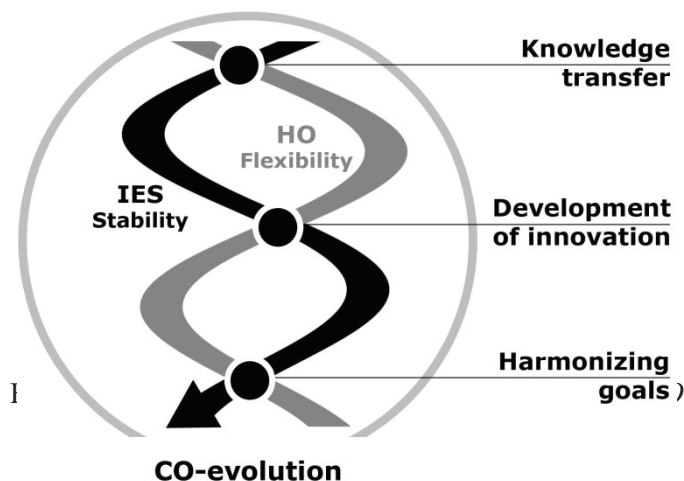
The adaptability of HO allows them to act as catalysts for change, particularly in the realm of emerging technologies. Functioning as interactive nodes where the interests, contributions, and expectations of academia, industry, and government intersect, HO play an increasingly prominent role in knowledge capitalization and the shaping of IES.

To integrate HO, IES adjust their governance mechanisms, legal frameworks, and network structures, providing access to resources and institutional legitimacy (Autio & Thomas, 2020). HO contribute new types of resources to IES—such as social capital, community trust, and mission-driven focus—while IES offer infrastructure, funding, and technological expertise (Cai et al., 2020). The business models of HO promote broader adoption of sustainable and inclusive strategies, while IES stimulate technological and organizational innovations that further advance the mission of hybrid organizations (Ansari et al., 2013).

IES legitimize HO through institutional support and inclusion in key networks, while the presence of HO enhances the social responsibility and reputation of the ecosystems themselves (Snihur & Tarzijan, 2018). Digital platforms and open innovation facilitate more efficient actor connectivity, with HO occupying a particularly important position. The growing demand for sustainable solutions, along with pressure from consumers, investors, and communities for socially responsible practices, has become a significant catalyst for the co-evolution of IES and HO. Equally important is the culture of collaboration, built on a well-developed network of trust among participants (Granstrand & Holgersson, 2020).

Co-evolution between IES and HO can be understood as a dynamic balance between institutional stability and organizational flexibility. IES provide the framework for collaboration, while HO contribute the capacity for rapid response to market, societal, and regulatory changes. Their mutual adaptation leads to the transformation of strategies, structures, and roles, shaping new patterns of interaction and coordination.

Despite its potential, co-evolution faces several limitations: power asymmetries among actors, conflicts between institutional logics, and network fragmentation—all of which require strategic management and coordination. Dominant actors often prioritize market goals at the expense of social ones, while a lack of coordination can reduce the effectiveness of collective action (Kapoor & Lee, 2013). Therefore, effective innovation policy must combine flexibility with clearly defined mechanisms of collaboration to enable the coexistence of diverse organizational forms and foster synergy between institutional stability and organizational innovativeness. Figure 1 presents an original model of the co-evolution of IES and HO, which synthesizes the answers to the research questions posed in the introductory section of the paper.



Source: Authors

The visual metaphor of the co-evolution of IES and HO is depicted through two spirals. The left spiral (IES) features an arrow indicating the direction of institutional development—a structured progression through regulations, networks, and infrastructure. The right spiral (HO), without an arrow, symbolizes flexibility, non-linearity, and multidirectional adaptability. An outer circle encompasses both spirals, representing the framework of IES-HO co-evolution. IES provide institutional stability, while HO contribute flexibility and a social mission. Their interaction enables: Knowledge transfer, Development of Innovation, and Harmonizing goals. The meaning of these intersections is presented in Table 1.

**Table 1. Points of Intersection (Synergies) Between IES and HO**

| <i>Position on the Spiral</i> | <i>Point of Synergy</i>   | <i>Meaning</i>                                                   |
|-------------------------------|---------------------------|------------------------------------------------------------------|
| First intersection            | Knowledge transfer        | Exchange of knowledge, technology, and resources between sectors |
| Middle intersection           | Development of Innovation | Joint creation of new solutions and business models              |
| Lower intersection            | Harmonizing goals         | Balancing market and social interests                            |

Source: Authors

Co-evolution shapes not only organizations but also transforms society as a whole. It enables sustainable development, digital transformation, accelerated diffusion of innovation, and the strengthening of cross-sector trust. Potential indicators of success for these outcomes are presented in Table 2.

Table 2. Co-evolution Outcomes of IES and HO with Success Indicators

| Co-evolution Outcome             | Description                                                                              | Success Indicators                                                                                                                      |
|----------------------------------|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Sustainable development          | Integration of ecological, economic, and social factors through joint evaluations        | Number of implemented green policies<br>Reduction in CO <sub>2</sub> emissions<br>Community participation in decision-making            |
| Digital transformation           | Synergy between technological innovation and human needs in system evaluation            | Degree of process automation<br>Number of digitized services<br>User satisfaction with digital solutions                                |
| Accelerated innovation diffusion | Faster adoption and spread of innovations thanks to feedback from both systems           | Time from idea to implementation<br>Number of new products/services per year<br>Participation in innovation networks                    |
| Strengthening stakeholder trust  | Transparency and mutual understanding through a mix of objective and subjective insights | Level of mutual trust (survey-based)<br>Number of partnerships and collaborations<br>Process transparency and information accessibility |

Source: Authors

The co-evolution between IES and HO can be understood as a dynamic balance between institutional stability and organizational flexibility. IES provide the framework for collaboration, while HO contribute the capacity for rapid response to market, social, and regulatory changes.

CONCLUSION

Co-evolution of IES and HO represents an exceptionally important driver for enhancing the innovation capacities of companies and countries. While IES provide a stable framework for collaboration and exchange, HO introduce flexibility, social responsibility, and the ability to deliver competent responses to complex challenges. The co-evolution of IES and HO shapes not only the ways in which processes of knowledge creation, transfer, and commercial valorization are improved and economic and non-economic goals are aligned, but also serves as a mechanism through which society transforms toward sustainable development.

Research findings confirm that the most significant areas of overlap and primary functions of IES and HO are observed through the lens of co-evolution. IES provide the institutional framework, collaboration

networks, regulations and policies, as well as the necessary technological infrastructure. On their part, HO contribute a social mission, flexible business models, and multi-dimensional accountability throughout the co-evolution process. HO adapt to governance structures within IES while maintaining a dual strategic logic—aligning market objectives with the realization of their social mission. It can be said that HO act as bridges between the business sector, innovation, and platform ecosystems, enabling the transfer of knowledge and resources.

Co-evolution connects the activities of various stakeholders, acting as a catalyst for their mutual interactions and resulting in synergistic effects. Faster adoption and diffusion of innovations are achieved thanks to feedback from both systems, through the stimulation of innovation, acceleration of sustainable solution dissemination, and affirmation of HO as legitimate actors within IES.

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## SUKOEVOLUCIJA INOVACIONIH EKOSISTEMA I HIBRIDNIH ORGANIZACIJA

### Rezime

Ovaj rad istražuje sukoevoluciju inovacionih ekosistema (IES) i hibridnih organizacija (HO), sa posebnim fokusom na prelazak sa linearnih, poslovno orijentisanih modela inovacionih procesa ka mrežno strukturiranim IES. Na osnovu sistematskog pregleda literature, identifikovani su ključni mehanizmi uzajamne adaptacije između IES i HO. Kombinujući tržišno vođenu i misijom usmerenu logiku, HO koriste strukturu i dinamiku IES kako bi potvrdile svoj legitimitet u složenim i brzo promenljivim okruženjima. Delujući kao mostovi između poslovnih, inovacionih i platformskih ekosistema, one olakšavaju razmenu znanja i resursa, povezuju aktivnosti različitih aktera i deluju kao katalizatori međusobne saradnje. Istovremeno, IES evoluiraju ka većoj fleksibilnosti, stvarajući uslove za integraciju i podršku hibridnim organizacijama. Na osnovu teorijske analize, predložen je konceptualni model koji prikazuje dinamičku interakciju između IES i HO, sa ciljem podsticanja inovacija i unapređenja održivoog socio-ekonomskog razvoja.

**Ključne reči:** inovacije, inovacioni ekosistemi, hibridne organizacije, koevolucija.