



# Schumpeter meets Teece: Proposed metrics for assessing entrepreneurial innovation and dynamic capabilities in entrepreneurial ecosystems in an emerging economy

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## ABSTRACT

Based on the dynamic capabilities framework and the concept of entrepreneurial innovation, we identify a set of metrics that can be used to assess innovation and entrepreneurial ecosystems in an emerging economy. These metrics allow us to analyze how such ecosystems develop key capabilities and how they generate economic and social value. We also assess the relationship between entrepreneurial innovation, ecosystems, and socio-economic impact.

## 1. Introduction

Joseph Schumpeter (1942) was one of the first scholars to recognize the close connection between innovation and entrepreneurship. This connection is supposed to flourish in innovation and entrepreneurial ecosystems, which have been growing rapidly around the globe. Substantial public and private investments in ecosystems have heightened interest in determining how best to design and evaluate their effectiveness. While there have been several theory-driven considerations of the connection between innovation and entrepreneurship (e.g., Autio et al., 2014; George and Prabhu, 2003; and Ejdemo and Ortqvist, 2020), these studies have not considered the role of dynamic capabilities in innovation and entrepreneurial ecosystems, within a contingency framework, and have not applied this theoretical framework to the development of metrics for evaluating the effectiveness of such ecosystems in an emerging economy.

We fill this gap by building on the ideas of two great scholars of innovation and entrepreneurship: William Baumol and David Teece. Specifically, we use two key concepts they developed, entrepreneurial innovation and dynamic capabilities, to help us understand how

innovation and entrepreneurial ecosystems evolve and how to assess their performance. The metrics we develop, based on these concepts, allow us to analyze how ecosystems develop key capabilities and how they generate economic and social value. We also assess the relationship between entrepreneurial innovation, ecosystems, and socio-economic impact and apply our analysis to innovation and entrepreneurial ecosystems in an emerging economy: Mexico. Mexico was selected for two reasons. The first is that this nation has implemented multiple entrepreneurship innovation strategies (OECD, 2016) guided by the national government (e.g., Enrique Peña Nieto administration, 2012–2018). The second reason is that Mexico is regarded as a key role model for Latin-American countries such as Chile, Colombia, Brazil, and Perú (Dixon et al., 2010; Guerrero and Link, 2021).

## 2. Entrepreneurial innovation and ecosystems promoting innovation and entrepreneurship

The concept of entrepreneurial innovation was first discussed by the late William Baumol. In his book explaining the dynamism of American capitalism, Baumol (2010) made a key distinction between “routine/

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systematic innovation” and “entrepreneurial innovation.” He asserted that routine/systematic innovation was mainly the domain of large multinational firms, such as IBM, Novartis, GE, and Intel, who may have large, traditional research labs and facilities. On the other hand, he viewed small, entrepreneurial firms, including many that emerge from universities, as key sources of radical or revolutionary breakthrough innovation. Some excellent examples of entrepreneurial innovations that were developed by small firms include the electronic calculator, alternating electric current, sound motion pictures, the turbojet engine, biotechnology, the personal computer, and Internet search engines.

While economists have traditionally focused on innovation as a key source of economic growth (Link and Siegel, 2007), Baumol asserts that entrepreneurial innovation is the most important source of improvements in economic performance. Recognizing this, many nations, regions, and states have formulated and implemented policies to induce entrepreneurial innovation in hopes of enhancing economic growth. These include efforts to build innovation and entrepreneurial ecosystems on campus and in surrounding regions of the university. Such policies include efforts to promote university-based startups (Siegel and Wright, 2007; Feldman et al., 2019), including reforming intellectual property regulations to allow faculty to launch startups, building property-based institutions to stimulate technology transfer and technology-based economic development, such as incubators/accelerators and science/technology parks, government programs to stimulate innovation and entrepreneurship, such as the Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR) program in the U.S, the U.K.’s Science Enterprise Challenge, the “Law on Innovation and Research to Promote the Creation of Innovative Technology Companies” in France (Mustar and Wright, 2010), and ProTon Europe, the European Knowledge Transfer Association, created by the European Commission, and local, regional, and national efforts to develop “technology clusters” (Kerr and Robert-Nicoud, 2020).

While developing the concept of entrepreneurial innovation, Baumol articulated his famous thesis explaining its economic impact. He called this the “David-Goliath symbiosis,” referring to specialization in the free-market economy that has emerged, where small firms founded and managed by entrepreneurs focus on radical innovations, while large incumbent firms perform mainly incremental innovation, which he believes have produced “superadditive” economic impacts. Thus, such factors should be incorporated into innovation and entrepreneurial ecosystems. Some scholars of entrepreneurial ecosystems have tried to operationalize the concept of entrepreneurial innovation, focusing on three dimensions: individual, organizational, and environmental. However, there is no consensus on how to define entrepreneurial innovation (Autio et al., 2014; Guerrero and Urbano, 2019), as well as how opportunities emerge from co-creation processes among entrepreneurial innovation ecosystem actors (Schmitz et al., 2017; Cherubini-Alves et al., 2021). Another concern regarding research on ecosystems is that many studies on this topic focus on the direct effects of a reduced number of determinants.

We need to know more about bi-directional effects between entrepreneurial innovation ecosystems and ventures. An example is the ecosystems’ role in configuring dynamic organizational capabilities during the development of entrepreneurial innovations (Dixon et al., 2010; Colwell and Narayanan, 2010; Ridder, 2012; Pahnke et al., 2015; Spyropoulou et al., 2017). Finally, given the complexity of ecosystems and the lack of systematic information on these entities, empirical research has not adequately specified measures that enable us to assess the effects of ecosystems on firm performance and economic progress (Autio et al., 2014; Garud et al., 2014). Little is still known about the empirical operationalization of entrepreneurial innovation using robust and replicable metrics across different contexts (Stam, 2015; Anderson et al., 2019; Stam and van de Ven, 2019; Feldman et al., 2022). We believe that it is also possible to uncover the socio-economic outcomes/impacts generated by entrepreneurial innovations (Lowe, 1995; Kokkaniikal and Morrison, 2011; Acs et al., 2017) and some intuitive insights

effectiveness of supportive entrepreneurship innovation ecosystems (Lowe and Feldman, 2017; Bruns et al., 2017; Guerrero and Urbano, 2019; Foss et al., 2023).

### 3. Theoretical foundations

#### 3.1. Entrepreneurial innovation

According to previous studies, entrepreneurial innovation represents the convergence of creative-innovative and entrepreneurial behaviors strongly influenced by context-specific policies (tax, financial, labor, intellectual capital protections) and ecosystem agents (Cohen, 2006, p. 4). In this view, entrepreneurial innovations represented the outcomes of a small group of high-growth-oriented ventures (Von Barga et al., 2003, p. 315) or innovative outsiders (Norbäck and Persson, 2012, p. 488) that generate positive and sustainable impacts in industries, societies, and regions (Cohen, 2006, p. 1). Then, Autio et al. (2014, p. 1100) augmented previous definitions of entrepreneurial innovation by including the intersection between entrepreneurship ecosystems and innovation systems through multi-level processes, actors, and context, which determine where entrepreneurs develop disruptions of existing industries. In this regard, entrepreneurial innovation represents the emergence of business initiatives focused on innovations co-created among multiple actors in a determined space/time, resulting from a policy that fosters entrepreneurship and innovation ecosystems (Autio et al., 2014). Likewise, Guerrero and Urbano (2017, p. 295) and Malerba and McKelvey (2020, p. 518) expand the notion that entrepreneurial innovation is related to the generation of technologies or marketable innovations as a result of the collaboration among university-industrial actors.

Based on these arguments, entrepreneurial innovation inspires innovative entrepreneurs who are sensing/seizing new ideas to offer worthwhile ventures (Baumol, 2010) that directly or indirectly generate positive externalities/spillovers in society (Audretsch and Lehmann, 2005; Audretsch and Keilbach, 2007; Acs et al., 2009). In this study, entrepreneurial innovations are understood as entrepreneurial opportunities focused on innovations discovered by entrepreneurs or intrapreneurs due to co-creation with ecosystem actors that are (directly/indirectly) producing societal impacts.

#### 3.2. An ecosystem view for promoting entrepreneurial innovations

Inspired by the metaphor of “abiotic community, its physical environment, and all the interactions possible in the complex of living and non-living components” (Moore, 1993, p. 249), theoretical analysis of ecosystems has focused on studying a community of hierarchically independent, yet interdependent heterogeneous participants who collectively generate an ecosystem output (Thomas and Autio, 2020). The ecosystems perspective has become popular in the fields of innovation and entrepreneurship in recent decades.

The notion of *innovation ecosystems* as a community that interacts with multiple economic and social actors emerged a century ago from the analysis of industrial districts (Marshall, 1890), innovation systems (Lundvall, 1992), and clusters (Porter, 1998). More concretely, over the last three decades, the innovation ecosystem has been adopted as a dynamic, network, and policy view of a multitude of actors’ interactions in the innovation process in different geographical scenarios (e.g., local, regional, or national) as an explanation of their economic performance (Tsvetkova et al., 2020). In this view, innovation ecosystems participants collectively generate innovation outputs to generate value-added to a defined audience (Thomas and Autio, 2020). In this respect, Autio et al. (2014) argued that innovation ecosystems emphasize complex relations (cooperation, communication) among actors that embed a narrow nature of innovation that ignores agency issues, dynamic processes, and softer forms of innovations (e.g., organizational and business model innovations).

In contrast, the notion of *entrepreneurial ecosystems* was translated in management studies by Moore (1993) to understand relationships and interactions among suppliers, investors, and customers. Isenberg (2010) used this terminology to highlight different pillars (e.g., policy, market, finance, culture, human capital, and supports) that facilitate creating and scaling new ventures. Then, Mason and Brown (2014, p. 5) defined the entrepreneurial ecosystem as a set of interconnected entrepreneurial actors, organizations, institutions, and processes that formally/informally coalesce to connect, mediate, and govern the performance local entrepreneurial environment. Afterward, Stam (2015) extended the understanding of ecosystems pillars by debating their aggregated outputs (e.g., entrepreneurial activity) and aggregated outcomes (e.g., value creation). Likewise, several authors theorized and exemplified entrepreneurial ecosystems' pillars (Spigel and Harrison, 2018; Stam and van de Ven, 2019), their responsibility with high-growth entrepreneurship's persistence (Stam, 2015; Spigel, 2017), and their regional impacts (Vedula and Fitza, 2019; Vedula and Kim, 2019; Wurth et al., 2021). In sum, entrepreneurial ecosystems participate in the start-up and scale-up of ventures that can compete through innovative business models (Thomas and Autio, 2020).

Both innovation and entrepreneurial ecosystem perspectives are rooted in parallel robust theoretical foundations, share methodological tools, and address closely related issues, including their impacts on social and economic development (Tsvetkova et al., 2020). Indeed, both perspectives have been critiqued regarding the limited insights about conceptualization, drivers of change, inter-dependency, evolutionary dynamics, diversity, and impacts (Autio et al., 2014; Mack and Mayer, 2016; Alvedalen and Boschma, 2017; Brown and Mason, 2017; Guerrero et al., 2021). Despite the theoretical similarities or differences (see Table 1), it has surprised the literature's disconnection on innovation systems and entrepreneurial ecosystems (La Rovere et al., 2020; Autio et al., 2014). Based on this assumption, this study proposes metrics to understand better the determinants and impacts of entrepreneurial innovations in a particular (emerging) economy ecosystem.

## 4. Hypothesis

### 4.1. Measuring the determinants of entrepreneurial innovation

#### 4.1.1. Dynamic capabilities

It is well established that innovation requires resources and capabilities and the ability to respond to market forces (Crossan and Apaydin, 2010; Delmas, 2002; Zhou et al., 2005). Entrepreneurial innovations require ordinary resources/capabilities, as well as specific competencies that determine the organization's ability to integrate, build, and reconfigure internal/external resources/competencies to address/shape the changing business environments (Teece, 2007, 2010; Teece et al., 1997, 2016).<sup>1</sup> Of course, the dynamic capabilities framework builds on Schumpeterian ideas, since the authors noted that "Our approach is especially relevant in a Schumpeterian world of innovation-based competition, price/performance rivalry, increasing returns, and the 'creative destruction' of existing competences." (Teece et al., 1997, p. 509). Dynamic capabilities are strategically useful in the identification of new entrepreneurial innovation opportunities (*sensing*), mobilization of resources to address an entrepreneurial innovation

opportunity, and capturing its value (*seizing*) as well as its renewal strategies (*transforming*) (Teece, 2012: 1396).

The strategic management literature has recognized the relevance of dynamic capabilities in developing new products, creating innovations (Ridder, 2012), technological change (Archibugi and Coco, 2004, 2005), and ecosystem leadership (Foss et al., 2023). In emerging economies, organizations encounter unusually radical/incremental innovation processes influenced by the lack of resources/capabilities and internal routines/processes that facilitate/retard organizational change (Dixon et al., 2010). Indeed, the lack of resources/capabilities (human, financial, technological) represents one of the main reasons for ventures in emerging economies to participate in collaborative agreements, as well as to access to subsidies/incentives/support programs (see Guerrero and Link, 2021). These effects have taken on greater importance in recent years, given that policymakers have instituted and expanded many government initiatives to foster competitiveness via entrepreneurship and innovation (García-Quevedo, 2004; Takalo and Tanayama, 2010; Cano-Kollmann et al., 2017).

There is inconclusive evidence on the effectiveness of such governmental measures (Edler and Georghiou, 2007; Oliver and Holzinger, 2008; Dimos and Pugh, 2016). We also have limited evidence on how ecosystems contribute to innovative and entrepreneurial activity (Wurth et al., 2021). However, we do know that technology/knowledge transfer enables partners to leverage capabilities and enhance performance (Zahra and Nambisan, 2011). Based on this finding, innovation and entrepreneurial ecosystems could influence the development and configuration of *dynamic capabilities* (*sensing, seizing, and transforming*), which are strongly related to the development of entrepreneurial innovations (Dunning and Lundan, 2010; Arndt et al., 2017; Autio et al., 2014; Guerrero and Urbano, 2019) as follows:

The *first dynamic capability is sensing*, representing the discovery/creation of an opportunity to assess current or latent customer needs (Teece, 2007; Castiaux, 2012). Therefore, organizations can recognize innovative and entrepreneurial opportunities during external scanning and recognize new emerging opportunities integrated into internal innovative and entrepreneurial processes (Ridder, 2012). At the organizational level, employees' capabilities are essential in identifying entrepreneurial and innovative opportunities. Corporate entrepreneurship literature has evidenced that employees with specific entrepreneurial capabilities (experiences, networks, and skills) lead and stimulate proactive, innovative, and risk-oriented organizational strategies (Guerrero and Peña-Legazkue, 2013, 2018).

A potential source for identifying/creating opportunities in emerging economies is the scanning and monitoring of governmental support programs in priority socio-economic areas and sectors (Guerrero et al., 2019b; Guerrero and Link, 2021). In the Mexican context, evidence suggests that government programs designed to stimulate knowledge transfer, innovation, and entrepreneurship in key strategic industries, such as food, energy, electronics, automotive, health, and logistics, constitute a key source of opportunity for entrepreneurial innovation (Dutrénit et al., 2010; Santiago et al., 2016; Guerrero and Urbano, 2017). Santiago et al., 2016 also show that firms closely monitor such opportunities. Once these opportunities have been identified by managers, the next step is to integrate the resources to create/capture value from them.

The *second dynamic capability is seizing*, representing the mobilization of resources to address an opportunity and capture value from doing so (Teece, 2007). Therefore, seizing refers to the capacity to address innovative opportunities by implementing combined (internal/external) resources within the organization (Ridder, 2012). In this vein, seizing is associated with access to public subsidies or open collaboration practices motivated by innovation purposes, as well as by the possibility of combining public/private funds (Santiago et al., 2016; Guerrero et al., 2017; Herrera et al., 2018; Guerrero et al., 2019b). In emerging economies, the lack of R&D resources explains why an entrepreneurial innovation orientation pursues organizations to combine public-private

<sup>1</sup> Ordinary resources and capabilities are the resources and capabilities a firm control that are valuable, rare, imperfectly imitable, and not substitutable (Barney, 1991). These ordinary resources/capabilities are viewed as bundles of tangible (financial, physical, human) and intangible assets (knowledge capital, management skills, processes and routines, and controls of information) (Barney, 2001; Barney et al., 2001). In contrast, dynamic capabilities represent the evolution of those ordinary capabilities into sources/methods of wealth creation and capture by organizations operating in rapid technological change (Eisenhardt and Martin, 2000; Teece et al., 1997).

**Table 1**  
Key dimensions of innovation and entrepreneurial ecosystems.

Dimensions	Entrepreneurial ecosystem	Innovation ecosystem	Entrepreneurial innovation ecosystem
Unit of analysis	Entrepreneurs, intrapreneurs, start-ups	Organizations and institutions	Multiple and multi-level
Innovation definition	Actions that lead to competitiveness and formation of new firms	Technological and science-based	Incremental but mostly commercialization of radical disruptions
Innovation driver	Entrepreneurial cognition and opportunity recognition	R&D disclosures and technological inventions	Co-creation among entrepreneurs, inventors, other actors
Dynamic capabilities	Mostly oriented to exploration and exploitation of entrepreneurial opportunities	Mostly oriented to exploration and exploitation	Exploration, exploitation, transforming
Individuals	Entrepreneurs (individuals)	Inventors	Configuration of entrepreneurial and innovative teams
Organizations	Start-ups, corporate entrepreneurs	Knowledge producers (university, labs, TTOs)	Entrepreneurial firms embedded in innovation networks
Institutions	Institutions as facilitators - bottom-up (formal)	Institutions as constrains - top-down (formal and informal)	Multiple agency effects across a multitude of actors in different contexts
Policy emphasis	To foster creation and scaling-up of new firms (via subsidies and support programs)	To foster R&D activities through incentives	To foster the development of entrepreneurial innovations through policy frameworks and programs
Impacts	Job creation and economic growth	Economic growth	Societal, technological, economic growth
Spillover-effects	New markets configuration	New industrial configuration	New industrial markets

Source: authors.

financial resources. Consequently, organizations faced multiple learning/integrating processes of dynamic capabilities in re-designing business models to address new opportunities and mobilize obtained resources (Castiaux, 2012).

The *third dynamic capability* is transforming, representing a continued renewal and alienation of assets (Tece, 2007). These capabilities are actioned, embracing good open innovation practices for developing, integrating, and coordinating skills/assets/knowledge transfer (Castiaux, 2012). In the context of entrepreneurial innovation in emerging economies, certain public subsidies and support programs are designed to stimulate collaboration agreements among universities, research institutes, and enterprises to participate in specific entrepreneurial innovation projects (Archibugi and Coco, 2004, 2005; Hoekman et al., 2005; Feldman and Kelley, 2006; Autio et al., 2014; Herrera et al., 2016; Cano-Kollmann et al., 2017; Guerrero et al., 2017; Carayannis et al., 2018). In this view, the resources are transformed into entrepreneurial innovations that generate value-added to society.

Based on these arguments, we assume that participants in co-creation are involved in learning, transforming, and evolutionary procedures where routines become dynamic capabilities. In this regard, we propose the following hypotheses:

**H1a.** Dynamic capabilities increase the propensity of firms and regions to develop entrepreneurial innovations.

**H1b.** Organizations and regions with a supportive environment for entrepreneurial innovation are more likely to develop dynamic capabilities than organizations and regions with non-supportive

environments.

#### 4.1.2. Regional capabilities

Entrepreneurship scholars have examined how innovation ecosystems foster new venture creation, survival, evolution, and growth (Zahra and Nambisan, 2011), based on a dynamic view of ecosystems, which considers elements such as diversity, selection, related diversification, resilience, adaptation, and networking (Alvedalen and Boschma, 2017; Brown and Mason, 2017). This evolutionary perspective provides a sense of how, why, and when entrepreneurial ecosystems' elements have influenced innovation and entrepreneurship processes over time (Mack and Mayer, 2016; Spigel and Harrison, 2018; Foss et al., 2023).

Previous studies have recognized that fostering entrepreneurship and innovation requires a strong focus on designing appropriate environmental conditions and implementing effective public policies (Colwell and Narayanan, 2010). In particular, emerging and transitional economies are useful contexts for understanding the value creation promoted by government intervention via entrepreneurship and innovation ecosystems (Dixon et al., 2010). According to Autio et al. (2014), a supportive entrepreneurial innovation environment reduces risks, facilitates resources, and provides adequate policies/scenarios with multiple organizations/agents that operate within the context will be able to interact, to co-create radical innovations financed by public/private sources and to the evolution towards entrepreneurial and innovative organizations. Complementary, fostering entrepreneurship and innovation ecosystems involves a unique set of challenges that reflect entrepreneurs' desire to manage their new ventures while considering different sets of potentially conflicting forces in their ecosystems (Zahra and Nambisan, 2011).

Recent studies have shown that an entrepreneurial ecosystem is configured by certain institutions (rules of the game – formal- and culture -informal) and certain resources (physical, financial, leadership, human capital, knowledge, demand, and intermediaries) that will contribute (in)directly to productive entrepreneurial activities in society (Stam and van de Ven, 2019). Cherubini-Alves et al. (2021) identify the critical dimensions of entrepreneurship ecosystems associated with creating these productive activities in Brazil. Concretely, Cherubini-Alves et al. (2021, p. 77) have distinguished between knowledge infrastructures (e.g., universities, human development through education, and support systems) and socio-economic systems (e.g., culture, finance, market, and infrastructures). Following these arguments, the dynamic ecosystem capabilities are related to knowledge infrastructures and socio-economic systems (Cherubini-Alves et al., 2021) or well-known as ecosystems elements (Stam, 2015; Stam and van de Ven, 2019; Wurth et al., 2021).

*Knowledge infrastructure* refers to elements of an innovation or entrepreneurial ecosystem, where universities and research centers play a crucial role in research and inventions (Guerrero and Urbano, 2012; Link et al., 2015). In this view, organizations/individuals can access research and inventions by collaborating with skilled research teams (Zahra and Nambisan, 2011; Brown and Mason, 2017). Indeed, universities are strongly related to *human development* (inventors/creators/entrepreneurs) via different educational programs that provide skills/abilities and values/behaviors relevant to society and labor markets (Stephan et al., 2015). According to Audretsch et al. (2015), *knowledge infrastructure* enhances connectivity and linkages among researchers that facilitate inventions and recognize entrepreneurial opportunities. However, depending on the industry and public support, some knowledge infrastructures will be more conducive to entrepreneurial innovations than others.

Relevant innovation and entrepreneurial ecosystem elements are linked with a *supportive governmental framework* (Nambisan and Baron, 2013) mostly characterized by policies/programs (Stam, 2015), intellectual property rights (Acs et al., 2009), incentives for R&D investments (Autio et al., 2014; Dimos and Pugh, 2016), and R&D infrastructure (Siegel et al., 2003). A large body of literature has shown that

interventionist policies on entrepreneurship and innovation have mixed effects, in terms of effectiveness, in developed economies. No significant differences in efficiency or crowdfunding effects were identified in interventionist policies oriented to young European biotech companies (Bertoni and Tykvvá, 2015), Belgian firms backed by private or public venture capital (Alperovych et al., 2015), high-growth German and Canadian ventures (Cumming and MacIntosh, 2006; Cumming et al., 2018), global hubs (Lerner, 2009), applicants to the U.S. SBIR grant program (Howell, 2017), or applicants to the U.S. innovation program (Lanahan and Armanios, 2018). It also explains the growing body of literature that supports that non-interventionist policies are the antecedent of entrepreneurship and innovation (e.g., Bjørnskov and Foss, 2013; Boudreaux et al., 2019; Boudreaux and Nikolaev, 2018; Bradley and Klein, 2016; Dau and Cuervo-Cazurra, 2014; Gohmann et al., 2008; Nikolaev et al., 2018; Sobel, 2008).

*Socio-economic systems* comprise dynamic dimensions related to the presence of certain institutional pillars that define the rules of the game in society (Stam, 2015) through regulation, taxation, and government spending (Stansel et al., 2019) and culture, through entrepreneurial/innovative behaviors (Stam and van de Ven, 2019). In addition to these institutional dimensions, the socio-economic system also considers the existence of the market or demand of the population to purchase innovative products/services, the existence of public/private financial means, as well as the existence of intermediaries (Stam and van de Ven, 2019, p. 814).

Based on these arguments, we assume that organizations in regions characterized by supportive entrepreneurial and innovation ecosystems will have a stronger propensity to develop entrepreneurial innovations than those in non-supportive ecosystems. In this regard, we propose the following hypothesis:

**H2.** A supportive innovation and entrepreneurial ecosystem in a region increases entrepreneurial innovation.

#### 4.2. Measuring the economic impact of entrepreneurial innovation

Economic development is a result of complex entrepreneurial processes where many elements are interconnected (e.g., many organizations develop in close interaction with each other and with environmental factors) and where the development of communities requires more than just the development of many businesses but also infrastructure and organizations that can match together in advanced production systems (Spilling, 1996: 91). More concretely, Feldman (2014: 18) defines economic development as the expansion of capacities that contribute to the advancement of society through the realization of individual, firm, and community potential. Entrepreneurial and innovative organizations can pursue value propositions by creating initiatives that play very different roles within their ecosystems (Zahra and Nambisan, 2011). The outcomes produced within entrepreneurship and innovative ecosystems positively impact regional socio-economic progress (Nambisan and Baron, 2013).

Based on Schumpeter's (1942) work, entrepreneurial innovations are the manifestation of a creative-destruction process that expects to make better societies through positive externalities behind each disruptive initiative. In this view, the impacts of entrepreneurial innovation can be measured in terms of prosperity, quality of life, and the conditions for societal growth to ensure a sustainable future (Autio et al., 2014). Indeed, there is a general statement that entrepreneurship and innovation positively affect economic growth regarding employment, inversion, and competitiveness (Wong et al., 2005). Based on this statement, we argue that entrepreneurial innovation can increase prosperity/wealth, measured in terms of job creation and higher wages, resulting from increased demand for innovative goods/services (Verheul et al., 2002), as well as other non-pecuniary benefits, such as a significant increase in the quality of life and well-being (Wiklund et al., 2019; Kautonen et al., 2017; Wurth et al., 2021).

Given our discussion, entrepreneurial innovations are assumed to provide an opportunity for innovations to be co-created by organizational and ecosystem actors looking to produce impacts (Autio et al., 2014; Guerrero and Urbano, 2016; Guerrero and Urbano, 2019). Based on this assumption, entrepreneurial innovations are a vehicle by which organizations and supportive ecosystems generate impacts (Autio et al., 2014). Therefore, entrepreneurial innovations mediate the effect of organizational and regional capabilities on socio-economic impacts (Aguinis et al., 2017). In this regard, we propose the following hypotheses:

**H3.** Entrepreneurial innovation enhances socio-economic impact.

**H3a.** Entrepreneurial innovation mediates the relationship between dynamic organizational capabilities and socio-economic impact.

**H3b.** Entrepreneurial innovation mediates the relationship between a supportive entrepreneurship innovation environment and socio-economic impact.

#### 4.3. Proposed conceptual model

Fig. 1 presents our conceptual model. Our objective is to explore whether determinants such as organizational capabilities (H1a) and regional capabilities (H2) have a direct effect on the creative-destruction process of entrepreneurial innovation, as well as the manifestation of the socio-economic outcomes from these entrepreneurial innovations in society (H3). We tested two new relationships: (a) the influence of regional capabilities on organizational capabilities configuration (H1b), as well as (b) the mediation effect of entrepreneurial innovations on the relationship between determinants and impacts (H3a, H3b). Note that our paper applies the firm-level concept of dynamic capabilities to regions and links them to outcomes (entrepreneurial innovation).

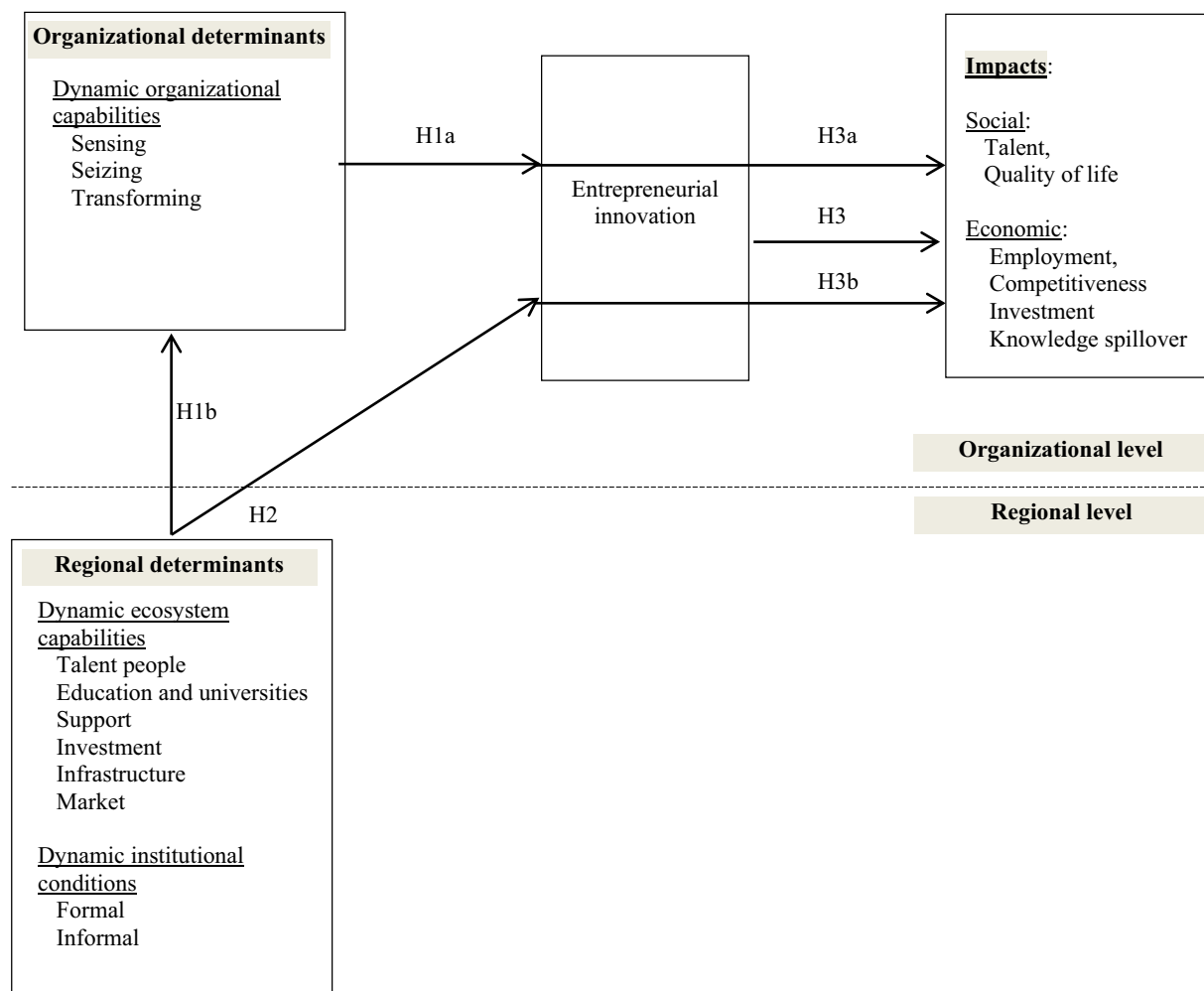
### 5. Methodology

#### 5.1. Entrepreneurship in Mexico and the Mexican innovation ecosystem

From 2009 to 2016, Mexico had the highest level of public subsidies for R&D in Latin America (OECD, 2013a, 2013b). A key government-funded program was the \$2.9 billion (U.S.) "Incentive Program for Innovation" (CONACYT, 2015<sup>2</sup>). This program was designed to stimulate growth/competitiveness, by strengthen collaboration between scientific organizations and enterprises, incorporating talent and specialized human capital, generating value-added innovations in specific strategic sectors, and creating/protecting intellectual property (Diario Oficial, 2014). The 2013 innovation and entrepreneurship policy evaluation conducted by the OECD highlighted weaknesses in the financial market, administrative barriers, low performance of research institutions, fragmentation of public incentives, and lack of continuity (see OECD, 2013a, 2013b). Following the OECD recommendations in 2013, the Mexican Institute of Entrepreneurship was established, with a substantial public investment in the entrepreneurship ecosystems (INADEM, 2015). It was decentralized across the Mexican geography participating through several agents (venture capitalists, financial organizations, chambers of commerce, higher education organizations and research centers, incubators and accelerators, and others). The innovation and entrepreneurship ecosystems focused on supportive environmental conditions for high-growth entrepreneurship and innovative activity.

According to the Global Innovation Index (GII), Mexico has generated a high rate of innovative output over the last decade (Dutta et al., 2020). The OECD indicators showed that the Mexican administration

<sup>2</sup> For further information, visit [<http://conacyt.gob.mx/index.php/fondo-s-y-apoyos/programa-de-estimulos-a-la-innovacion>].



Source: Authors

Fig. 1. Conceptual model. Source: authors.

had spent <0.5 % of the GDP on R&D over the last decade, while the number of government researchers and patents has decreased considerably (see OECD, 2021). The data also reveal that Mexico has done well with respect to the GII pillars (Dutta et al., 2020), including the development of human capital, infrastructure, market sophistication, business sophistication, technology, knowledge, and creative output. However, the institution pillar scores have been below the middle-income economies’ average, with a considerable distance from high-income economies. According to the Fraser Institute’s Economic Freedom (Stansel et al., 2019), Mexico has been positioned in the second quartile of economic freedom, given the highest freedom levels related to trade and regulations that reduce entry barriers. However, the country has shown the lowest legal systems and property rights levels—a plausible explanation of the current administration’s pro-market policies for entrepreneurial innovations.

5.2. Data collection

We collected data at the firm and regional levels. Firm-level data were derived from the 2016 Adult Population Survey (APS) Mexican Global Entrepreneurship Monitor (GEM). The GEM Mexican team added several questions in this survey to capture the entrepreneurs’ perception of the entrepreneurship innovation ecosystems, the use/applicability of the ecosystem supports, and the socio-economic contributions of

entrepreneurial innovation in the region. Our final sample consists of 933 Mexican firms in various industries and regions.<sup>3</sup> Regional level was derived from several secondary sources, including the National Experts Survey (NES) provided by the GEM project, the Mexican Institute of Statistics (INEGI), the Mexican Institute of Competitiveness (IMCO), the Entrepreneur Mexican Institute (INADEM), the Mexican Council of Science and Technology (CONACYT), and the Economic Freedom of

<sup>3</sup> The GEM methodology (Reynolds et al., 2005) involves collecting data from individual adult populations aged 18–64 years old, distributed in terms of age, gender, and region from different countries. This is done using two surveys: the Adult Population Survey (APS) and the National Expert Survey (NES). The APS captures information from the adult population, whether or not they are involved in any entrepreneurial activity. For example, in 2016, Mexico had a population of adults aged 18–64 years old of 121,519,221, and a total of 685,000 businesses (INEGI, 2013). Mexico is made up of 31 states, grouped into five regions: Bajío, North, Centre, Southeast, and Mexico City (Guerrero and Link). In the 2016 edition, the Mexican GEM Team collected data from 5111 individuals in the APS, distributed by gender, age, and region (typically, each country collects 2000 individuals, but some countries collect data at the regional level, such as Spain, Mexico, and Chile). Similarly, the Mexican GEM team collected information at an expert level across these five regions (typically, each country collects 36 experts at the country level, but some countries collect data at the regional level, such as Spain, Mexico, and Chile).

North America (Fraser Institute).

### 5.3. Description of variables

Table 2 describes our variables and contains descriptive statistics on these variables, which we use to test our conceptual model.

#### 5.3.1. Entrepreneurial innovations

Entrepreneurial innovation is understood to represent entrepreneurial opportunities focused on breakthrough innovations that are discovered/created by (intra)entrepreneurs as a result of a process of co-creation and evolution with the ecosystem (Autio et al., 2014; Guerrero and Urbano, 2016; Guerrero and Urbano, 2019). Adopting this conceptualization, we develop a proxy for entrepreneurial innovation that is based on standard measures of innovation in the 2016 APS GEM Mexico survey. More concretely, the GEM APS survey includes three categorical questions to capture innovation: (i) were the technologies or procedures available more than a year ago?, (ii) how many customers consider the product new/unfamiliar?, and (iii) how many businesses offer the same products? (Bosma, 2013; Guerrero et al., 2019a). According to Autio et al. (2014: 1098), GEM shows that, on average, only <30 % of all new ventures reported that their products were new to customers and most of their competitors, and a stricter criterion emphasizing radical novelty would likely result in an even lower percentage. By combining these standard measures of innovations and our additional questions, the variable *entrepreneurship innovation* was operationalized as *new technologies that were introduced less than a year ago in a new market with none/few competitors and considered new for all customers*. The determinants of these entrepreneurial innovations were measured using several metrics at the organizational and regional levels.

#### 5.3.2. Organizational capabilities

The *dynamic organizational capabilities* have been configured via its inter-relation with entrepreneurship innovation ecosystems for sensing, seizing, and transforming the resources required to pursue entrepreneurial innovation opportunities. Based on theoretical foundations (Teece, 2007, 2012), the 2016 APS GEM Mexico survey included questions regarding (i) the number of support programs and subsidies received and (ii) the collaboration agreements celebrated with enterprises, research centers, universities, and other agents associated with the development of entrepreneurial and innovative activities during the last three years. Adopting Teece (2007) and Castiaux (2012), we operationalized the three dynamic organizational capabilities. The first dynamic capability, *sensing* (monitoring opportunities), was captured by the number of support programs used to develop innovative and entrepreneurial activities during the analyzed period. Looking for support programs helps monitor updated information related to the R&D government's priorities (e.g., areas, sectors, or activities) in the policy framework (Guerrero and Martínez-Chávez, 2020). As a result, monitoring support programs represents a source of entrepreneurial and innovation opportunities in context-specific like the emerging Mexican economy. The second dynamic capability, *seizing* (mobilizing of public/private resources), is measured by the number of public subsidies associated with developing innovative and entrepreneurial activities gained during the analyzed period. Public subsidies are a good mechanism to co-fund the identified opportunities in the support programs. It is not a crowding-out effect because the nature of the Mexican R&D subsidies requires the financial co-responsibility among agents enrolled in subsidized partnerships (e.g., new ventures and scientific organizations) (Guerrero and Urbano, 2016; Herrera et al., 2018; Guerrero and Link, 2021). As a result, the mobilization of resources for developing these entrepreneurial innovations includes private organizations' investments complemented by public resources in context-specific like the emerging Mexican economy. The third dynamic capability, *transforming* (open innovation practices to acquire knowledge/skills), was captured by the number of agreements celebrated with universities, research

centers, and other enterprises for developing innovative and entrepreneurial activities during the analyzed period. We assume that collaboration represents the most appropriate strategy for transforming public-private resources to exploit opportunities (Guerrero and Link, 2021). More concretely, open collaborations facilitate the flow of resources, knowledge, and skills required to generate outcomes in context-specific like the emerging Mexican economy.

#### 5.3.3. Regional capabilities

We have identified two sets of metrics at the regional level: (i) dynamic ecosystem capabilities and (ii) dynamic institutional conditions.

Concerning the supportive entrepreneurship innovation environment, *dynamic ecosystems capabilities* were measured by considering the intersection between the elements related to the generation/commercialization of knowledge and government intervention identified in previous studies (Archibugi and Coco, 2004, 2005; Zahra and Nambisan, 2011; Autio et al., 2014; Cherubini-Alves et al., 2021), as well as the elements related to entrepreneurial ecosystems (Stam, 2015; Stam and van de Ven, 2019; Wurth et al., 2021). Regarding human talent, we used two proxies: (a) *the population with higher education* captured by the number of individuals with higher education per total economically active population in the region from 2013 to 2016 according to the INEGI; and (b) *the researchers per habitant* captured by the number of researchers per the total economically active population in the region from 2013 to 2016 according to the CONACYT. With respect to investment, we used two proxies (a) *entrepreneurship subsidies* captured by the public investment in entrepreneurship per total economically active population in the region from 2013 to 2016, according to the IMCO and INADEM; and (b) *R&D subsidies* captured by the public investment in R&D per total economically active population in the region from 2013 to 2016 according to the INEGI. Regarding infrastructure, we used two proxies (a) *the R&D centers per habitant* captured by the number of researcher centers per the total economically active population in the region from 2013 to 2016 according to the CONACYT; and (b) *the professional entrepreneurship infrastructure* captured by the experts' 1–5 Likert scale valuation of the professional infrastructure that has supported entrepreneurs in the region from 2013 to 2016 according to the NES GEM Mexico. Also, we used the *entrepreneurship education programs* proxy captured by the experts' 1–5 Likert scale valuation of the education in entrepreneurship in the region from 2013 to 2016 according to the NES GEM Mexico. Likewise, according to the NES GEM Mexico, we used the financial support proxy captured by the experts' 1–5 Likert scale valuation of the financial agents (VC, business angels, and 3Fs) in the region from 2013 to 2016, as well as the internal market proxy captured by the experts' 1–5 Likert scale valuation of the internal market conditions in the region from 2013 to 2016.

To assess *dynamic institutional conditions*, we used the following proxies contained in the Fraser Institute Economic Freedom Index (Stansel et al., 2019): (a) *Government spending* integrated by the regional government expenses on consumption, subsidies, insurance, and business from 2013 to 2016; (b) *Taxation* integrated by the regional government taxation of income, payroll, property, and sales from 2013 to 2016; and (c) *Regulations* integrated by the regional regulations in markets (labor, property, and business) from 2013 to 2016. Given the institutional voids, we also used the *corruption proxy* based on the INEGI Corruption Index that captures the level of corruption per region from 2013 to 2016 (Jauregui et al., 2020; Guerrero and Urbano, 2020). Regarding informal institutions, we used *the culture proxy* based on the APS GEM survey that captures the percentage of the Mexican adult population who perceived entrepreneurship as a good professional career per region from 2013 to 2016 (Bosma, 2013). All regional information was aggregated per region based on the location of each organization.

#### 5.3.4. Entrepreneurial innovation impacts

To assess entrepreneurial innovation impacts, the literature

**Table 2**  
Description of variables and descriptive statistics.

Dimension	Variable	Description	Period	Source	Mean	S.D.	Min	Max
Entrepreneurial innovation	Entrepreneurial innovation	New technologies with less than one year of antiquity were introduced in a new market with none/few competitors and considered new for all clients	2016	APS GEM Mexico	0.168	0.174	0.000	1.000
	Sensing	Number of supports gained for developing innovations and entrepreneurial activities in the last three years			0.596	0.011	0.000	4.000
Dynamic organizational capabilities	Seizing	Number of public subsidies received for developing innovations and entrepreneurial activities in the last three years	2013–2016	APS GEM Mexico	0.238	0.085	0.000	3.000
	Transforming	Number of collaborations agreements with enterprises and scientific organizations for developing innovations and entrepreneurial activities in the last three years			0.368	0.288	0.000	3.000
Determinants	Talent: population with higher education	Number of individuals with higher education per total economically active population in the region during the last three years	2013–2016	INEGI	4.286	0.210	3.685	4.659
	Talent: researcher per hab.	Number of researchers per the total economically active population in the region during the last three years	2013–2016	CONACYT	1.633	0.159	1.966	2.052
	Investment: entrepreneurship subsidies	Public investment in entrepreneurship per total economically active population in the region during the last three years	2013–2016	IMCO, INADEM	2.218	0.165	1.609	2.484
	Investment: R&D subsidies	Public investment in R&D per total economically active population in the region during the last three years	2013–2016	INEGI	3.571	0.918	1.852	5.159
	Infrastructure: R&D centers per hab.	Number of researcher centers per the total economically active population in the region during the last three years	2013–2016	CONACYT	2.567	0.743	0.824	3.549
	Infrastructure: professionals	Experts' valuation of the professional infrastructure that has supported entrepreneurs in the last three years in the region	2013–2016	NES GEM Mexico	1.016	0.055	0.883	1.144
	Education: entrepreneurship educational programs	Experts' valuation of the education in entrepreneurship in the last three years in the region	2013–2016	NES GEM Mexico	3.236	0.188	2.760	3.680
	Finance: financial supports	Experts' valuation of the financial agents (VC, business angels, 3Fs) that has supported entrepreneurs in the last three years in the region	2013–2016	NES GEM Mexico	0.876	0.056	0.727	1.007
	Market: internal market	Experts' valuation of the internal market conditions in the last three years in the region	2013–2016	NES GEM Mexico	1.032	0.029	0.974	1.102
	Formal – government spending	Overall score integrated by the regional government expenses on consumption, subsidies, insurances, and business during the last three years	2013–2016		4.597	1.022	3.030	4.659
Dynamic institutional conditions	Formal – taxation	Overall score integrated by the regional taxation of income, payroll, property, and sales during the last three years	2013–2016	Fraser Institute	4.671	1.364	2.440	6.110
	Formal - regulations	Overall score integrated by the regional regulations in markets (labor, credit, and business) during the last three years	2013–2016		7.080	0.119	6.880	7.24
	Formal – corruption	The index of corruption per region during the last three years	2013–2016	INEGI	4.474	0.814	4.234	4.555
Impacts	Informal – entrepreneurship as a good career	Percentage of the adult population who perceived that entrepreneurship is a good career per region	2013–2016	APS GEM Mexico	0.344	0.698	0.000	1.000
	Impact on competitiveness	Ventures that have impacted the regional competitiveness	2016		0.297	0.057	0.000	1.000
	Impact on well-being	Ventures that have impacted the regional well-being	2016		0.246	0.031	0.000	1.000
	Impact on employment	Ventures that have impacted the generation of employment in the region	2016	APS GEM Mexico	0.249	0.033	0.000	1.000
	Impact on talent attraction	Ventures that have impacted the regional attraction of talent	2016		0.121	0.026	0.000	1.000
	Impact on investment attraction	Ventures that have impacted the regional investment attraction	2016		0.125	0.033	0.000	1.000
	Impact on the sector	Ventures that have impacted the development of the sector in the region	2016		0.209	0.068	0.000	1.000

(continued on next page)

Table 2 (continued)

Dimension	Variable	Description	Period	Source	Mean	S.D.	Min	Max
Objective measures	Impact on the market	Ventures that have impacted the development of the market in the region	2016		0.205	0.044	0.000	1.000
	Labor market productivity	The labor contribution to the economic growth in the region during the last three years	2013–2016	IMCO	2.449	0.033	0.942	4.605
	Foreign direct investment	The foreign direct investment in the region during the last three years	2013–2016	IMCO	0.493	0.046	0.207	1.428
	Value-added per industry	The value-added per industry in the region during the last three years	2013–2016	IMCO	4.605	0.394	3.906	6.291
Organizational	Size	A categorical variable that measures the number of employees of the firm is as follows zero employees, 1–5 employees, 6–19 employees, and >20 employees	2016	APS GEM Mexico	1.244	0.060	0.000	4.000
	Sector	A categorical variable that indicates the sector in which operated the organization as follow extractive, transformative, business service and consumer-oriented	2016		2.832	1.614	0.000	4.000
Regional	Regions	Categorical variables that indicate where the organization is allocated Bajío, North, Centre, Southeast, and Mexico City	2016	APS GEM Mexico	3.114	1.481	1.000	5.000

recognizes several societal impacts (quality of life, the attraction of talent) and economic impacts (employment, attraction of investment, competitiveness, and knowledge spillovers) of entrepreneurial innovations that have been studied using subjective and objective measures (Verheul et al., 2002; Wong et al., 2005; Feldman, 2014; Kautonen et al., 2017; Wiklund et al., 2019). Typically, the impact of entrepreneurial innovation has been measured by observable variables because they are easy to collect. However, those observable variables may not reflect organizational perceptions (Li et al., 2018), as well as the main observable variables could show an inverse or bidirectional relationship (Audretsch et al., 2008; Audretsch and Keilbach, 2008). Based on this disadvantage, subjective measures are now at the forefront of some academic analyses for capturing organizational perceptions of impacts (Chen and Lin, 2014). The main disadvantage of subjective measures is associated with individuals' interpretations that could not show the same tendencies as objective measures (Khuntia et al., 2018). Based on these arguments, this study used a mixed set of metrics about entrepreneurial innovation impacts: (i) subjective metrics and (ii) objective metrics captured from the existing secondary sources.

We also included subjective metrics, using additional questions in the 2016 APS GEM survey. Using a Likert scale (1-lowest, 5-highest), the respondent per organization evaluated how its organization has contributed to the region in terms of competitiveness, well-being, generation of employment, the attraction of talent, the attraction of investment, and development of the industry and market (Verheul et al., 2002; Wong et al., 2005; Feldman, 2014; Kautonen et al., 2017; Wiklund et al., 2019; Wurth et al., 2021). Regarding objective metrics, using the secondary data provided by the IMCO, our proxies were (a) the labor market contribution to the economic growth in the region from 2013 to 2016, (b) the foreign direct investment in the region from 2013 to 2016, and (c) the value-added per industry in the region in the region from 2013 to 2016 (Audretsch et al., 2008; Audretsch and Keilbach, 2008; Stam, 2015; Cherubini-Alves et al., 2021). All regional information was aggregated per region based on the location of each organization.

### 5.3.5. Control variables

We included several control variables. According to Bosma (2013), the GEM project data include organizational characteristics, such as size (using a categorical variable that measures firms with zero employees, 1–5 employees, 6–19 employees, and >20 employees) and the sector (using a categorical variable as follow extractive, transformative, business service and consumer-oriented). These organizational variables allow for controlling the role of size and sector in developing entrepreneurial innovations (Dutrénit et al., 2010; Guerrero and Urbano,

2016). Finally, a categorical variable captured *the regions* as follows: Bajío, North, Centre, Southeast, and Mexico City according to the traditional regional classification used by the INEGI.

### 5.4. Data analysis

Because we combine organizational-level observations (dynamic organizational capabilities) with state-level measures (regional dynamic capabilities), we analyze our data using structural equation modeling (SEM). This statistical technique is warranted because it enables us to examine a set of relationships between one or more independent or dependent variables (see the constructs proposed in our conceptual model in Fig. 1), either continuous or discrete (Tabachnick and Fidell, 1996). Thus, the SEM allows us to estimate the (in)direct effects between latent organizational-level and regional-level variables (Audretsch et al., 2008). In this way, the multi-level structural equation modeling allows for assessing the mediation within and across our levels of analysis (MacKinnon and Valente, 2014; Preacher et al., 2016; Aguinis et al., 2017). First, we developed the preliminary tests to corroborate the constructs' reliability and validity using the confirmatory factor analysis and the Cronbach alpha (Table 3). Our tests showed acceptable parameters between 0.6 and 0.7 (see Shook et al., 2004). Second, we tested the individual correlation per variable (including the VIF test) and did not find significant correlations more than (Table 4). Third, we run Model 1 using subjective socio-economic impacts from the GEM business owner's responses (Fig. 2). As a robustness test, we run Model 2 using objective socio-economic impacts from the official statistics to replicate the analysis (Fig. 3). Both models presented a good fit according to the established patterns (Shook et al., 2004). More concretely, the Chi-square (919.456) tested the model and the independence, GFI (0.879) evidence good model testing the portion of the variance in the sample variance/co-variance matrix, CFI (0.912) indicates a good fit, and RSEA (0.59) estimates a good fit compared to the saturated model. Concerning the relationship between the main latent variables, the main components show a positive and significant effect (see Appendix A). Fourth, SEMS allows seeing each variable's weight and contribution to explaining the relationship among constructs (Fox, 1980; Sobel, 1982; Cheung and Lau, 2008). In this vein, we estimated the direct (H1, H2, H3), indirect (H1a), and mediation effects (H3a, H3b). To test the mediation effects, we first confirmed the existence of the requirements for mediation (Aguinis et al., 2017).

We implemented two robustness tests. The first consisted of replicating the SEM (Model 1) using secondary data (objective measures) for testing the entrepreneurial innovation impacts (Model 2). It helps us to

**Table 3**  
Reliability and validity.

Dimension	Items	Internal validity	Confirmatory factor analysis	Reliability: Alpha Cronbach	Co-variance analysis among constructs	
Determinants	Dynamic organizational capabilities	Sensing	0.6506	KMO = 0.6930 chi2 = 382.52 Sig***	0.6854	Coefficient: 0.068 SE: 0.039 no sig
		Seizing	0.7733			
		Transforming	0.8376			
	Dynamic regional capabilities	Talent: population with higher education	0.9174	KMO = 0.7020 chi2 = 5082.57 Sig***	0.8143	
		Talent: researcher per hab.	0.9655			
		Investment: entrepreneurship subsidies	0.8330			
		Investment: R&D subsidies	0.7451			
		Infrastructure: R&D centers per hab.	0.9644			
		Infrastructure: professionals	0.6412			
		Education: entrepreneurship educational programs	0.9014			
		Finance: financial supports	0.5222			
		Market: internal market	0.5000			
		Formal – government spending	0.5000			
		Formal – taxation	0.5709			
		Formal - regulations	0.6974			
		Formal – corruption	0.2643			
		Informal – culture	0.2920			
		Impacts	Subjective measures			
Impact on well-being	0.8075					
Impact on employment	0.7960					
Impact on talent attraction	0.5674					
Impact on investment attraction	0.5584					
Impact on the sector	0.8149					
Objective measures <sup>a</sup>	Labor market productivity		0.4945	KMO = 0.4911 chi2 = 591.26 Sig***	0.4111	
	Foreign direct investment		0.2057			
	Value-added per industry		0.4946			

Notes: <sup>a</sup>Given the nature of the variables and the validity measures, we introduced these variables as independent items. Level of statistical significance: \*\*\*p ≤ 0.001; \*\*p ≤ 0.050; \*p ≤ 0.100.

corroborate the impact of entrepreneurial innovations considering objective metrics of impacts from official reports (similar to Audretsch et al., 2008 and Cherubini-Alves et al., 2021). The second robustness test was the use of the Two-Stage Least Squares (2SLS) estimator (Wooldridge, 2010). The 2SLS estimator provides a means to overcome potential endogeneity issues (Bascle, 2008; Bennett and Nikolaev, 2021). Indeed, Audretsch and Keilbach (2008, p. 753) used this technique to control the inverse relationship between GVA on the entrepreneurial activity budget of universities and its economic impact. We replicated SEM Model 1 using 2SLS to explore our exogenous and endogenous variables (see Model 3 in Appendix C).

## 6. Results and discussion

Our theoretical model (see Fig. 1) considers two determinants of entrepreneurial innovations (organizational capabilities and regional capabilities) and the contributions of these entrepreneurial innovations on socio-economic impacts. Fig. 2 shows the SEM regression weights [Model 1].

### 6.1. Measuring the determinants of entrepreneurial innovations

#### 6.1.1. Organizational capabilities

The first organizational determinant is *dynamic organizational capabilities* (Ridder, 2012; Castiaux, 2012). As shown in Appendix B, we find that dynamic organizational capabilities have positively contributed to entrepreneurial innovations [0.435; p ≤ 0.001]. Note that each component also has a positive impact on entrepreneurial innovation: monitoring opportunities [0.829; p ≤ 0.001], mobilizing resources [0.452; p ≤ 0.001], and transforming these resources [0.600; p ≤ 0.001] (supporting H1a). Previous studies have shown that Mexican organizations discover/create opportunities while scanning public support and

integrating them into their innovative and entrepreneurial processes (Dutrénit et al., 2010; Santiago et al., 2016). Likewise, previous studies have evidenced that Mexican organizations seize capabilities when strategically looking for private-public formulas to address their business opportunities (Herrera et al., 2018; Guerrero and Link, 2021). However, the intensity of these effects could vary across sectors and regions (see Appendix A). We also assume that organizations intending to develop entrepreneurial innovation could have different sources of opportunities and mechanisms to access resources for exploiting them.

#### 6.1.2. Regional capabilities: ecosystem and institutional conditions

Regarding the *dynamic ecosystem capabilities*, our results support the idea that regional capabilities have positively contributed to entrepreneurial innovation [0.220; p ≤ 0.050]. More specifically, results show two interesting patterns in each ecosystem element’s contribution to entrepreneurial innovations. First, a positive effect pattern from ecosystems’ components like entrepreneurship investment [0.890; p ≤ 0.001], R&D investment [0.690; p ≤ 0.001], researcher centers [0.990; p ≤ 0.001], and professional infrastructure [0.191; p ≤ 0.001] on entrepreneurial innovations (supporting H2). Second, a negative effect pattern from ecosystems’ components like a population with higher education [−0.880; p ≤ 0.001], R&D researchers [−0.970; p ≤ 0.100], entrepreneurship education programs [−0.878; p ≤ 0.001], financial support [−0.345; p ≤ 0.100] and internal market [−0.107; p ≤ 0.001] on entrepreneurial innovations. Previous studies have found mixed effects on the “effectiveness” government intervention policies that stimulate entrepreneurial innovations (Armanios et al., 2017; Cumming et al., 2018; Lanahan and Armanios, 2018; Guerrero and Urbano, 2019), as well as market-oriented policies as the antecedent of entrepreneurial innovations (e.g., Boudreaux et al., 2019; Boudreaux and Nikolaev, 2018; Nikolaev et al., 2018). Likewise, Cherubini-Alves et al. (2021) highlighted distinct configurations and heterogeneity in the intersection

**Table 4**  
Correlation matrix.

Dimensions	Items	VIF	Entredn	OC1	OC2	OC3	RC1	RC2	RC3	RC4	RC5	RC6	RC7	RC8	RC9	RC10	RC11	RC12	RC13	RC14	S11	S12	S13	S14	S15	S16	S17	O11	O12	O13	CV1	CV2	CV4			
Dynamic Organizational capabilities	Entrepreneurial Innovation		1.000																																	
	OC1. Sensing	1.73	0.228*	1.000																																
	OC2. Seizing	1.70	0.186*	0.489*	1.000																															
Dynamic Regional capabilities	OC3. Transforming	1.32	0.205*	0.449*	0.497*	1.000																														
	RC1. Talent: Population with higher education	4.04	-0.417*	0.013	0.044	0.026	1.000																													
	RC2. Talent: Researcher per hab.	4.10	-0.360*	0.020	0.049	-0.014	0.539*	1.000																												
	RC3. Investment: Entrepreneurship subsidies	3.67	-0.307*	0.009	-0.017	0.058	0.332*	0.556*	1.000																											
	RC4. Investment: R&D subsidies	2.80	-0.400*	0.083*	0.054	0.023	0.358*	0.558*	0.358	1.000																										
	RC5. Infrastructure: R&D centers per hab.	3.45	0.275*	0.011	0.090*	-0.011	0.575*	0.554*	0.353*	0.581*	1.000																									
	RC6. Infrastructure: professionals	4.05	-0.212*	-0.122*	-0.065*	-0.151*	-0.442*	-0.231*	0.158*	-0.080*	-0.084*	1.000																								
	RC7. Education: Entrepreneurship educational programs	4.95	-0.231*	-0.135*	-0.086*	-0.139*	0.320*	0.352*	0.299*	-0.318*	0.319*	0.319*	1.000																							
	RC8. Finance: financial supports	4.31	-0.290*	-0.097*	-0.072*	-0.077*	-0.137*	-0.064*	-0.338*	-0.197*	-0.180*	0.391*	0.102*	1.000																						
	RC9. Market: internal market	4.19	-0.339*	-0.170*	-0.132*	-0.172*	-0.094*	0.157*	0.076*	0.193*	0.198*	0.412*	0.395*	0.221*	1.000																					
	RC10. Formal – government spending	3.76	0.155*	-0.011	0.147*	-0.013	-0.305*	-0.211*	0.139*	0.080*	0.074*	0.356*	0.352*	-0.259*	-0.044	1																				
	RC11. Formal – taxation	2.58	0.103*	-0.016	0.005	-0.087*	-0.486*	-0.496*	0.051	-0.528*	-0.466*	0.460*	0.032	0.042	-0.016	0.470*	1																			
	RC12. Formal – regulations	1.12	-0.037	-0.015	0.118*	0.085*	0.410*	0.487*	-0.007	0.482*	0.429*	-0.148*	0.309*	-0.112*	0.169*	0.080*	-0.497*	1																		
	RC13. Formal – corruption	3.76	0.069*	0.101*	0.069*	0.065*	0.053	-0.066*	-0.221*	0.033	-0.112*	-0.111*	-0.588*	0.264*	-0.229*	-0.211*	-0.264*	0.006	1.000																	
RC14. Informal – culture	4.39	0.036	0.007	0.140*	-0.041	0.091*	0.091*	-0.027	0.118*	0.139*	-0.035	-0.042	-0.047	-0.097*	0.091*	-0.010	0.129*	0.084*	1.000																	
Subjective measures	S11. Impact on competitiveness	2.60	0.135*	0.293*	0.361*	0.358*	-0.073*	-0.101*	0.021	0.002	-0.097*	-0.096*	-0.127*	0.007	-0.129*	-0.028	-0.005	-0.048	0.061	-0.005	1.000															
	S12. Impact on well-being	2.56	0.035*	0.256*	0.213*	0.331*	-0.091*	-0.092*	0.048	-0.0086	-0.098*	-0.097*	-0.070*	-0.025	-0.121*	-0.003	-0.016	-0.025	0.025	-0.039	0.538*	1.000														
	S13. Impact on employment	2.34	0.052*	0.275*	0.251*	0.364*	-0.055	-0.105*	0.030	0.0169	-0.112*	-0.111*	-0.142*	0.056	-0.092*	-0.085*	-0.031	-0.059	0.069*	-0.053	0.552*	0.518*	1.000													
	S14. Impact on talent attraction	1.76	0.184*	0.214*	0.362*	0.290*	-0.037	-0.004	-0.007	0.0301	0.012	0.012	-0.132*	-0.112*	-0.167*	0.096*	0.037	0.019	0.043	-0.008	0.433*	0.245*	0.317*	1.000												
	S15. Impact on investment attraction	1.82	0.184*	0.167*	0.363*	0.274*	-0.019	0.045	0.039	0.0611	0.061	0.060	-0.108*	-0.237*	-0.230*	0.183*	0.017	0.094*	0.014	0.063	0.359*	0.384*	0.323*	0.5340*	1.000											
	S16. Impact on the sector	2.42	0.058*	0.252*	0.306*	0.302*	-0.102*	-0.114*	0.067*	-0.0023	-0.118*	-0.117*	-0.106*	-0.054	-0.150*	-0.014	-0.015	-0.042	0.027	-0.014	0.510*	0.572*	0.599*	0.385*	0.378*	1.000										
	S17. Impact on the market	2.12	0.026*	0.266*	0.280*	0.333*	-0.102*	-0.134*	0.086*	-0.0215	-0.145*	-0.145*	-0.118*	-0.011	-0.112*	-0.044	0.031	-0.111*	-0.004	-0.080*	0.590*	0.521*	0.594*	0.379*	0.379*	0.579*	1.000									
Objective measures *	O1. Labor market productivity	3.63	-0.099*	0.076*	0.044	0.058	0.477*	0.463*	0.075*	0.371*	0.488*	0.488*	0.240*	-0.025	0.123*	-0.038	-0.561*	0.292*	0.103*	0.065*	0.040	0.074*	0.045	-0.017	0.013	0.058	0.005	1.000								
	O2. Foreign direct investment	4.21	0.069*	0.029	0.032	-0.021	0.181*	0.089*	-0.105*	0.274*	0.117*	0.117*	-0.092*	-0.053	0.081*	-0.201*	-0.160*	0.107*	-0.041	-0.060	0.033	0.009	0.028	0.083*	0.085*	-0.009	-0.036	0.415	1.000							
	O3. Value-added per industry	4.49	-0.136*	0.054	-0.002	0.040	0.459*	0.428*	0.109*	0.359*	0.4736*	0.373*	0.238*	-0.072*	0.189*	-0.226*	-0.588*	0.761*	0.017	0.081*	-0.009	0.044	0.033	-0.039	0.005	0.036	-0.013	0.581*	-0.465*	1.000						
Control variables	CV1. Size	1.15	0.289*	0.129*	0.151*	0.178*	-0.014	-0.035	-0.023	0.004	-0.013	-0.012	-0.120*	-0.049	-0.095*	-0.003	0.035	-0.052	0.010	0.008	0.185*	0.075*	0.113*	0.171*	0.144*	0.057	0.137*	-0.066*	0.071*	-0.066*	1.000					
	CV2. Sector	1.25	0.155*	0.186*	0.012	0.048	-0.108*	-0.110*	0.210*	-0.055	-0.144*	-0.143*	0.021	-0.145*	-0.005	-0.002	0.094*	-0.143*	-0.163*	-0.009	0.110*	0.117*	0.125*	0.041	0.049	0.114*	0.096*	-0.167*	0.049	-0.0194	0.1232*	1.000				
	CV3. Regions	4.34	-0.283*	-0.055	-0.197*	-0.006	-0.206*	-0.421*	-0.300*	-0.363*	-0.410*	-0.410*	-0.086*	0.504*	0.171*	-0.526*	-0.168*	-0.284*	0.286*	-0.110*	0.030	0.061	0.081*	-0.171*	-0.257*	0.061	0.051	-0.074*	-0.297*	-0.030	-0.127*	-0.119*	1.000			

Level of statistical significance: \*\*\*p ≤ 0.001; \*\*p ≤ 0.050; \*p ≤ 0.100.

of entrepreneurial innovations and ecosystem elements conducive to knowledge-intensive ventures.

Regarding *dynamic institutional conditions*, this study analyzes the influence of institutional pillars (Stam, 2015) through regulation, taxation, and government spending (Stansel et al., 2019) and culture through entrepreneurial/innovative behaviors (Stam and van de Ven, 2019). Our results show the negative effects of institutional pillars like government spending [-1.624; p ≤ 0.001], taxation [-0.185; p ≤ 0.050], and regulations [-0.169; p ≤ 0.001] on entrepreneurial innovations. A plausible explanation could be the temporality of public instruments fostering entrepreneurship and innovation (Guerrero and Link, 2021) and the nature of the socio-economic system in emerging economies (Cherubini-Alves et al., 2021). A surprising finding is that corruption appears to have a positive impact on entrepreneurial innovation [0.210; p ≤ 0.001]. Based on the negative effect of institutional pillars, a plausible explanation is that corruption is positively associated with efficiency in countries where formal institutions are ineffective (Jauregui et al., 2020). Regarding informal institutions, our results also show positive effects of culture [0.128; p ≤ 0.100] on entrepreneurial innovation. It is a good signal about recognizing and legitimizing entrepreneurship in Mexican society.

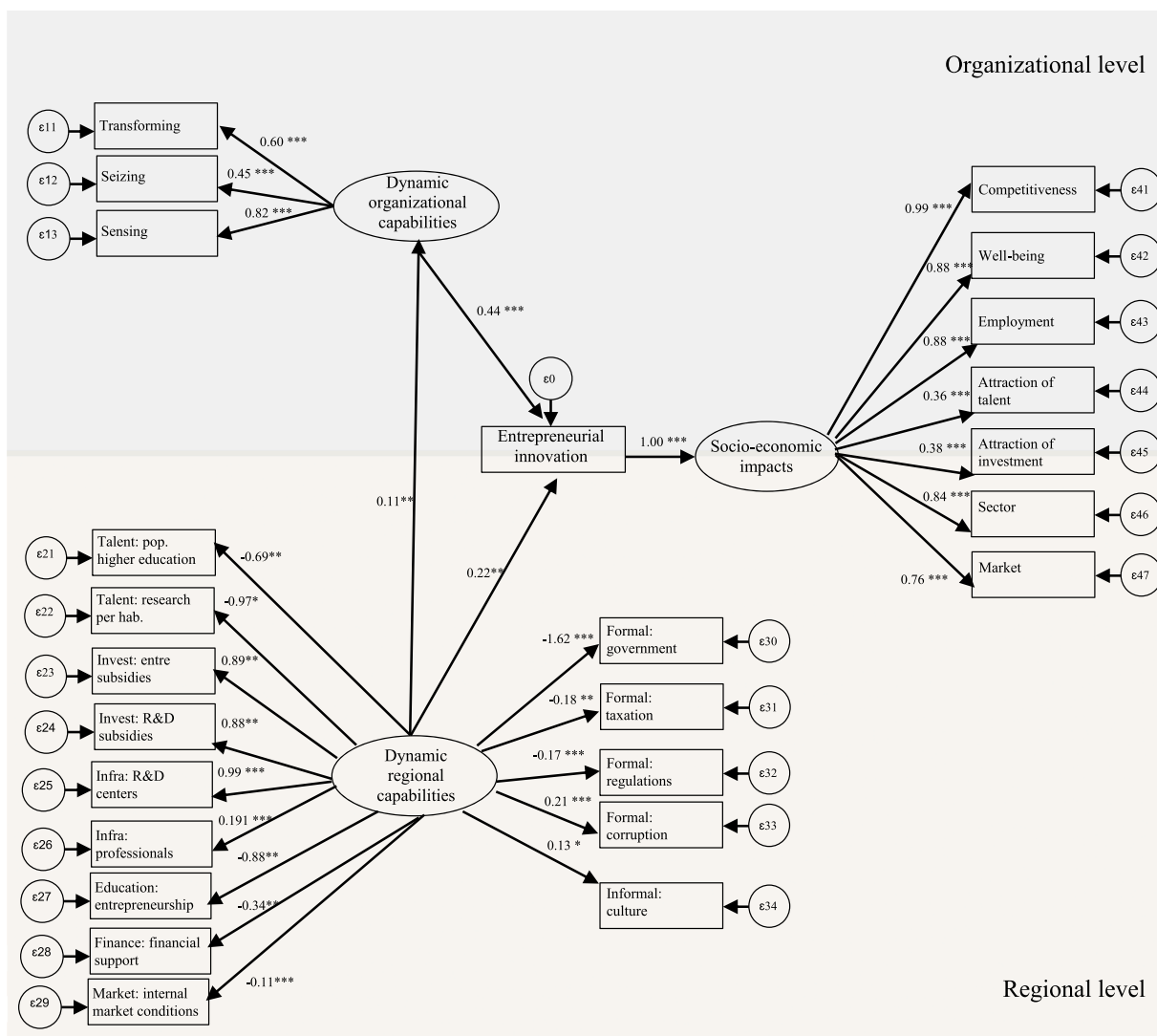
Regarding *the link between organizational capabilities and ecosystem capabilities*, we assume that organizations allocated to supportive entrepreneurship innovation ecosystems reinforced their dynamic capabilities (Autio et al., 2014). Results show that a supportive ecosystem is favorable for improving organizational capabilities [0.056; p ≤ 0.050]; especially positively influencing transforming capabilities [0.703; p ≤ 0.050]; sensing capabilities [0.562; p ≤ 0.050]; and seizing capabilities [0.255; p ≤ 0.050]. Nevertheless, this analysis should also consider the bi-directional relationships between organizational capabilities and ecosystem conditions.

### 6.2. Measuring the socio-economic impacts of entrepreneurial innovation

The effects of entrepreneurial innovations on social and economic impacts were tested using subjective measures based on respondents' perceptions (see Model 1, Fig. 2). Regarding *the social impacts*, entrepreneurial innovations in emerging economies emerged from opportunities strongly related to generating social value added in terms of prosperity or improving the quality of life (Verheul et al., 2002; Wong et al., 2005; Wiklund et al., 2019; Kautonen et al., 2017). In this vein, results show that Mexican ventures are positively impacting well-being [0.886; p ≤ 0.001], job creation [0.884; p ≤ 0.001], and attraction of talent [0.365; p ≤ 0.001] through their entrepreneurial innovations. Regarding *the economic impacts*, entrepreneurial innovation generates economic externalities (Zahra and Nambisan, 2011; Nambisan and Baron, 2013; Autio et al., 2014). Results show that entrepreneurial innovations are positively impacting Mexican regional competitiveness [0.990; p ≤ 0.001], the development of sectors [0.847; p ≤ 0.001], the development of the Mexican market [0.763; p ≤ 0.001] and attracting national or international investments [0.388; p ≤ 0.001]. Our test supports the theoretical assumptions about the socio-economic impacts of entrepreneurial innovation in emerging economies (H3).

### 6.3. Measuring the mediation effect of entrepreneurial innovation

Previous sections analyzed the determinants (dynamic capabilities at organizational and regional levels) and the impacts (social and economic) of entrepreneurial innovations. We theoretically assumed that entrepreneurial innovations are the vehicle used by organizations and ecosystems to generate society's outcomes. Results show the positive effect of dynamic capabilities on socio-economic impacts through entrepreneurial innovation [0.019; p < 0.050]. Concretely, results show that organizations are impacting regional competitiveness [0.034 p <

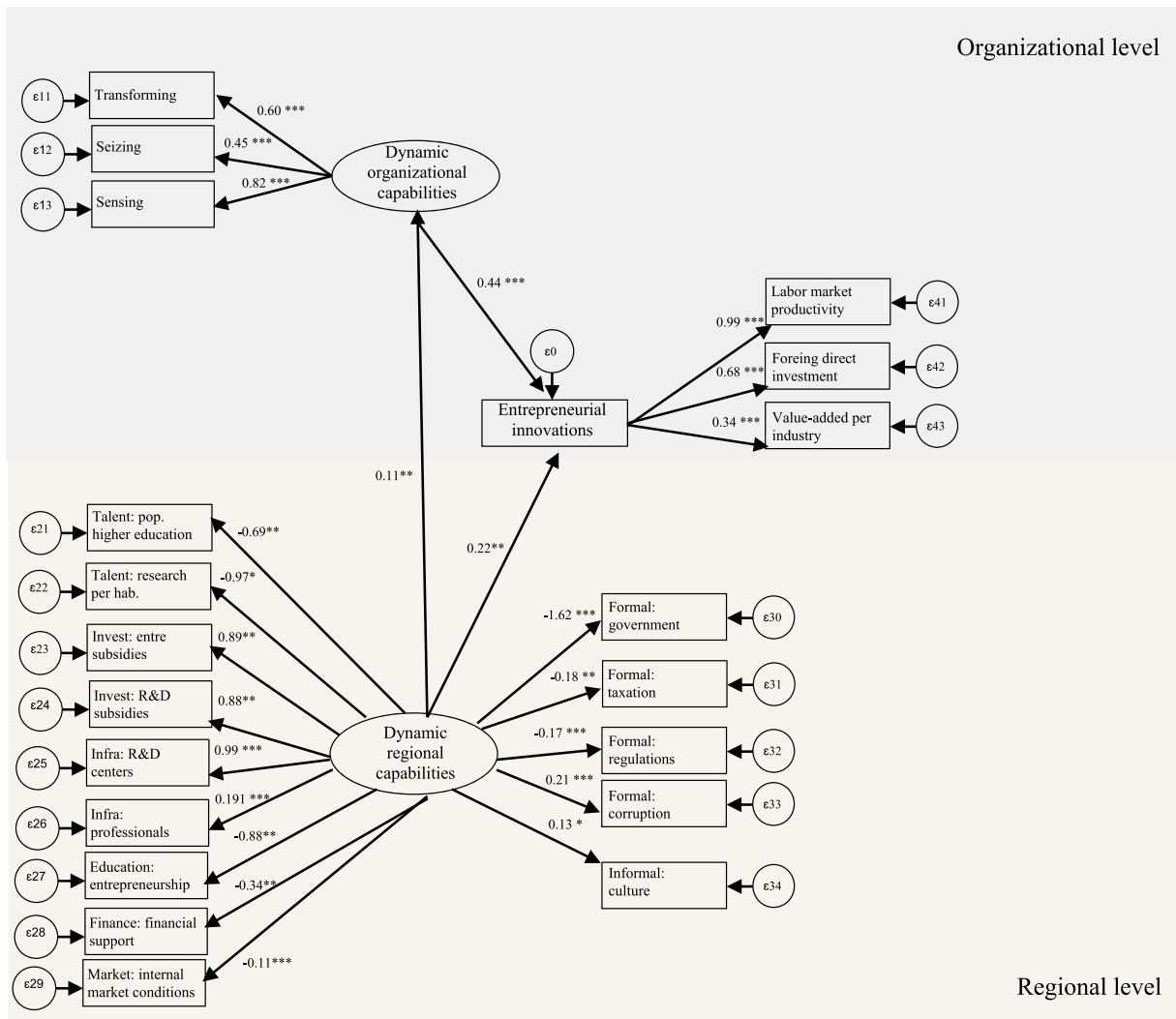


Standardized values; Chi2 = 919.456 \*\*\*; RSEA = 0.059; CFI = 0.912; GFI = 0.879; Controlled by region/sector

H	Relationship	Direct effect			Indirect effect			Mediation effect
		Coef.	S.E.	Sig.	Coef.	S.E.	Sig.	
H1a	Dynamic capabilities → Entrepreneurial innovation	0.435	0.175	***				Not applicable
H1b	Supportive ecosystems → Dynamic capabilities → Entrepreneurial innovation	0.106	0.028	**				
H2	Supportive ecosystems → Entrepreneurial innovation	0.220	0.018	**				
H3	Entrepreneurial innovation → Socio-economic impacts	1.000	0.035	***				Partial mediation
H3a	Dynamic capabilities → Entrepreneurial innovation → Socio-economic impacts	0.735	0.043	***	0.019	0.004	**	
H3b	Supportive ecosystems → Entrepreneurial innovation → Socio-economic impacts	0.107	0.037	**	0.078	0.017	***	Partial mediation

Level of statistical significance: \*\*\* p ≤ 0.001, \*\* p ≤ 0.05, \* p ≤ 0.10.

Fig. 2. Structural equation modeling regression weights [Model 1].



Standardized values; Chi2 = 919.456 \*\*\*; RSEA = 0.100; CFI = 0.812; GFI = 0.896; Controlled by region/sector

H	Relationship	Direct effect			Indirect effect			Mediation effect
		Coef.	S.E.	Sig.	Coef.	S.E.	Sig.	
H1a	Dynamic capabilities → Entrepreneurial innovations	0.435	0.175	***				Not applicable
H1b	Supportive ecosystems → Dynamic capabilities	0.106	0.028	**				
H2	Supportive ecosystems → Entrepreneurial innovations	0.220	0.018	**				
H3	Entrepreneurial innovations → Socio-economic impacts							
	Labor market productivity	0.990	0.033	***				
	Foreign direct investment	0.680	0.026	***				
H3a	Dynamic capabilities → Entrepreneurial innovations → Socio-economic impacts							
	Labor market productivity	0.416	0.062	***	0.036	0.014	**	Partial mediation
	Foreign direct investment	0.287	0.051	***	0.025	0.010	*	
	Value-added per industry	0.497	0.054	***	0.050	0.015	***	
H3b	Supportive ecosystems → Entrepreneurial innovations → Socio-economic impacts							
	Labor market productivity	0.783	0.008	***	0.006	0.001	***	Partial mediation
	Foreign direct investment	0.161	0.028	***	0.003	0.001	*	
	Value-added per industry	0.606	0.030	***	0.006	0.001	***	

Level of statistical significance: \*\*\* p ≤ 0.001, \*\* p ≤ 0.05, \* p ≤ 0.10.

Fig. 3. Structural equation modeling regression weights [Model 2].

0.050], regional well-being [0.031;  $p < 0.050$ ], and regional employment [0.031;  $p < 0.050$ ] through the development of entrepreneurial innovations. Likewise, results show the positive effect of regional capabilities on socio-economic impacts through entrepreneurial innovation [0.078;  $p < 0.001$ ]. Specifically, results show that supportive ecosystems are impacting regional competitiveness [0.107  $p < 0.001$ ], regional well-being [0.095;  $p < 0.001$ ], and regional employment [0.095;  $p < 0.001$ ] via entrepreneurial innovations. We found partial moderation because direct/indirect effects (dynamic capabilities and supportive environment) on socio-economic impacts are statistically significant (supporting H3a and H3b). This type of mediation is common (Aguinis et al., 2017), in which case the mediator (entrepreneurial innovations) only mediates part of the effect of the intervention (dynamic capabilities and supportive environment) on the outcome (socio-economic impacts). Even after introducing the mediator into the model (Fox, 1980; Sobel, 1982; Cheung and Lau, 2008). Our test supports the theoretical assumptions about the mediation effect of entrepreneurial innovations on the relationship between determinants and impacts (H3a and H3b).

#### 6.4. Robustness tests

Some additional robustness tests were implemented.

##### 6.4.1. Replication of Model 1 using objective measures

The first robustness test replicates Model 1 using objective measures from official statistics to analyze socio-economic impacts (Model 2, Fig. 3). The general model shows good specifications (Shook et al., 2004), and similar trends are observed in Model 1. These results show that entrepreneurial innovations are impacting Mexican society through labor market productivity [0.99;  $p < 0.001$ ], as well as economic impacts via attracting foreign direct investment [0.68;  $p < 0.001$ ] and value-added per industry [0.340;  $p < 0.001$ ]. The highest contributions of entrepreneurial innovation are related to social impacts (regional employment) over economic impacts (attraction of foreign investment and value-added to the industry). A plausible explanation could be that Mexico has produced more innovation output than innovation input (Dutta et al., 2020).

##### 6.4.2. Replication of Model 1 using the Two-Stage Least Squares (2SLS) and subjective measures

The second additional test replicated Model 1 using the Two-Stage Least Squares (2SLS) estimator (see Model 3 in Appendix C). The 2SLS results confirm the positive effect of dynamic organizational capabilities (e.g., the highest contribution of sensing and transforming) on the development of entrepreneurial innovations (H1a). Likewise, the supportive environmental conditions (e.g., entrepreneurship investment, R&D investment, research centers, professional infrastructure) on the development of entrepreneurial innovations (H2), but also the negative effects of certain ecosystem elements (e.g., population with higher education, R&D researchers, entrepreneurship education, financial support, and internal market). Remarkably, results show the negative effect of the formal institutional pillars (e.g., government spending, taxation, and regulations). Finally, this additional test confirms the positive and significant effect of entrepreneurial innovations on socio-economic impact's subjective measures (H3)- especially the highest contribution on economic impacts on competitiveness.

## 7. Conclusions

### 7.1. Theoretical contributions

Our paper applies firm-level concepts of dynamic capabilities to regions and links them to outcomes (entrepreneurial innovation). In doing so, we make two theoretical contributions. The first is that we provide theoretical insights into the positive effect of organizational capabilities

(H1a) and regional capabilities (H2) on entrepreneurial innovation, as well as the influence of ecosystems on the configuration of dynamic organizational capabilities (H1b). Our study shows the negative effects of certain ecosystem elements (talent, education, finance, and market) and institutional pillars (except corruption and culture). Considering the current debates about the lack of a consistent theoretical foundation (definitions) and empirical bases (operationalization) of ecosystems (Stam and van de Ven, 2019; Cherubini-Alves et al., 2021; Wurth et al., 2021), our proposed theoretical model and methodological design contribute with metrics that can be replicable for a better understanding of the determinants and impacts of entrepreneurial innovations in a particular emerging economy ecosystem (i.e., Mexico). Indeed, our operationalization of dynamic organizational capabilities contributes to the strategic management literature, confirming their relevance to fostering entrepreneurial innovation in emerging economies (Ridder, 2012; Cano-Kollmann et al., 2017; Girod and Whittington, 2017).

The second contribution is that we provide insights into the contribution of entrepreneurial innovation to socio-economic impact, measured by subjective and objective measures (H3) and the partial mediation effect of entrepreneurial innovation (H3a and H3b), which allow us to understand the effect of the entrepreneurial and innovation ecosystems. Our findings showed the benefits of entrepreneurial innovations like economic/innovative performance, technological, societal, and economic effects in society (Autio et al., 2014). Our results also contribute to the academic debate on the economic impact of entrepreneurial innovation (Guerrero and Urbano, 2019), as well as assessing non-pecuniary outcomes, including improvements in the quality of life and societal well-being (Wiklund et al., 2019; Kautonen et al., 2017; Wurth et al., 2021). To survive and thrive in emerging economies, entrepreneurs/organizations require a deeper understanding of opportunities' sources, determinants, constraints, and societal impacts (Nambisan and Baron, 2013). In many cases, a better understanding of these conditions could represent a source of multiple entrepreneurial innovation opportunities.

### 7.2. Lessons learned from an emerging economy: implications for practitioners

Our findings have several managerial and policy implications.

For *managers*, our findings highlight the benefits of being part of the co-creative process with different agents involved in the innovation and entrepreneurial ecosystems. Several benefits to sustain the development of dynamic capabilities, such as accessing public funds and transferring knowledge/technologies, are gained during open collaborations. Our results mainly showed active *sensing* opportunities across sectors and the *transformation* of routines into entrepreneurial capabilities at an organizational level. However, the analyzed sample still requires more *seizing* efforts to mobilize resources among the entrepreneurial and innovation ecosystem. If organizations expect to capture value as economic performance and technological advances should develop entrepreneurial innovations. As a result, it is an invitation to do critical analysis for organizational leaders looking to build a competitive advantage strategy based on positive returns for organizations and societies. In emerging economies, a sustainable mindset is also crucial, considering that public interventions are temporal, and organizations need to be sustainable in the long term.

For *policymakers*, our findings illustrate the role of regional capabilities in determining entrepreneurial innovation in this emerging economy. This provides support for continuing and possibly, leveraging, public-private investments and physical/professional infrastructure that connects entrepreneurial innovations with strategic regional sectors and social priorities. It is thinking about potential socio-economic externalities that could be co-created by ecosystems agents and creative/innovative entrepreneurs by efficiently using these investments and infrastructures. Indeed, these actions could (in)directly reinforce an entrepreneurial and innovation culture across regions by strengthening

innovative entrepreneurs' role models and their contributions to society. Based on negative results, one potential implication could be reviewing the quality/efficiency of the main institutional pillars. A plausible explanation of the weaknesses is the lack of monitoring and continuity across regional/national administrations. It has generated spaces for corruption, the inefficient use of public resources, and other societal externalities (i.e., drug cartels). Considering that public resources are scarce, policymakers could improve the institutional bases/pillars thinking on facilitating: (a) the formation/retention/attraction of innovative entrepreneurial talent; (b) the formation/attraction of business angels, smart capital, and foreign investors; and (c) the appropriated rules of the game in the internal market.

For *stakeholders*, our findings provide insights into positive outcomes of entrepreneurial innovation initiatives and evidence of the relevance of in-depth analysis/evaluation of tangible/intangible contributions. Therefore, it is also an invitation for transparency and openness to promote the evaluation of public policies. Evaluation of public policies requests more pro-active and effective institutions during the implementation of current/future public programs. Based on returns, the public resources could be assigned to entrepreneurship and innovation programs with greater long-term sustainability and promote dynamic environments.

### 7.3. Limitations and research agenda

Our study has several limitations, which constitute opportunities for additional research.

The *first limitation* is the timeframe of the analysis. As well as any entrepreneurship process, entrepreneurship, and innovation ecosystems are involved in a dynamic and co-evolutionary process (Lowe and Feldman, 2017; Audretsch et al., 2022) that demands context-specific metrics that may be available/applicable for one specific context but may not be for another (Stam and van de Ven, 2019). Although this study does not adopt an evolutionary perspective, the variable "time" is a critical factor related to the maturity of ecosystems, the development of entrepreneurial innovations, and the generation of socio-economic impacts. Our analysis used a cross-sectional dataset from 2013 to 2016. It opens a research opportunity for longitudinal analysis (e.g., multiple cases, panel data, or pre/post studies) to capture detailed information concerning the entrepreneurial innovations' quality, the dynamic capabilities' evolution, the outcomes/impacts' generation, the agents/intermediaries' inter-relations, and the before/after of the government injection of funding for fostering entrepreneurship and innovation. However, we should consider the nature and particularities of our research setting. Concretely, the duration of the public administrations that conditioned the definition of public instruments that foster entrepreneurship and innovation (i.e., six years in our research setting). It implies that the lack of continuity will limit the effectiveness/impacts of public instruments (Guerrero and Link, 2021). Therefore, implementing short/long-term metrics is useful for capturing insights into the effects across administrations (Guerrero and Urbano, 2019), as well as showing empirical bases of ecosystems that allow a better understanding of policy-making (Wurth et al., 2021) in emerging economies (Cherubini-Alves et al., 2021).

A *second limitation* is associated with the spatial dimension. In emerging economies, entrepreneurship and innovation ecosystems tend to be impregnated by institutional voids (Bruns et al., 2017). Conceptually, a future research agenda demands different theoretical approaches (e.g., institutional or evolutionary) for exploring the unique characteristics across geographical and agent levels (Armanios et al., 2017; Guerrero et al., 2019b). Methodologically, this research explored the Mexican case that could be a reference for other Latin-American countries such as Chile, Colombia, Brazil, and Perú. These economies are R&D/entrepreneurship oriented and participate in the GEM Consortium. A natural extension demands an in-depth analysis of different geographical units (countries, regions, metropolitan cities) and

contrasting, replicating, or extending the analysis across different emerging economies. We encourage researchers to replicate and improve the metrics proposed in this study (see Anderson et al., 2019; Cherubini-Alves et al., 2021). A good exercise will be the consideration of new additional ecosystem pillars (e.g., size of government, trade freedom, regulations, legal systems, and property rights) that should be established at the regional level to evaluate the pro-market policies for entrepreneurial innovations (see Stansel et al., 2019). Likewise, an in-depth analysis of some control variables should be considered in future research. Specifically, which type of effect (e.g., direct, curvilinear) could produce corruption or other institutional voids on entrepreneurial innovations (see Jauregui et al., 2020).

Our *third limitation* is associated with the operationalization of our variables. Adopting the Autio et al. (2014) broad definition, we operationalize the variable entrepreneurial innovations using the available information from the GEM APS survey. The GEM dataset has several positive features (e.g., replicability across the participant countries) and several negative ones (e.g., limited information at the organization level and restrictions regarding the add questions in the APS that affected the purpose of country comparison or increased data collection costs). Future empirical research is encouraged to replicate our entrepreneurial innovation measurements and propose better indicators to understand different emerging economies better. Adopting strategic management approaches (Teece, 2007, 2012; Castiaux, 2012), we added questions in the APS survey to capture dynamic capabilities' role in entrepreneurial innovations. It is another open window for replicating our analysis of emerging economies that participate in the GEM consortium and improving the institutional influences on the origins of dynamic capabilities (Dunning and Lundan, 2010) or combining other sources of information like national innovation surveys. Another natural extension of this work should also consider the operationalization of the link between dynamic capabilities, the multidimensional nature of technological change (Archibugi and Coco, 2004, 2005; Archibugi et al., 2009) and sustainability (Buzzao and Rizzi, 2021) across developing and developed countries using secondary datasets.

Regarding the outcomes/impacts of entrepreneurial innovation, we adopted both objective and subjective variables. The collection of economic/financial information in emerging economies is almost impossible. Organizations do not provide economic/financial information for confidentiality and security agreements. Facing this problem, we collected subjective information using perceptual questions at an organizational level. The main advantage was capturing the organizational perception of the impacts/outcomes obtained from their entrepreneurial innovations. The main disadvantage was not relating inputs (ordinary resources) with dynamic capabilities and impacts using objective measures. Complementary, we used objective measures for approximating the generated impact of those entrepreneurial innovations at the regional level. The main disadvantage is that those indicators may be influenced by reverse causality recognized by similar studies studying the relationship between entrepreneurship and economic impacts (Audretsch et al., 2008; Audretsch and Keilbach, 2008). Considering that they might drive large/multinational corporations' innovation results, future research demands new and mixed methods to measure entrepreneurial innovations' impacts/outcomes at the regional level (Khuntia et al., 2018; Li et al., 2018; Guerrero and Urbano, 2019), as well as exploring the influence of ecosystems in the configuration of dynamic organizational capabilities (Teece et al., 2016).

A *fourth limitation* is associated with statistical models. Our initial proposal was to implement a multi-level structural equation modeling to explore organizational and regional dimensions like similar studies (Audretsch et al., 2008). Unfortunately, the limited number of observations per city/region does not allow us to achieve this purpose (Du Toit and Du Toit, 2008). Also, we run the 2SLS as a robustness test similar to previous studies (Audretsch and Keilbach, 2008). Improving econometric models and robustness tests for analyzing complex models is also a challenge in the research agenda of entrepreneurial innovations.

The measurement demands novel ways (e.g., longitudinal experiments, ethnographies, fuzzy models) to measure and test the dynamic configuration, evolution, and impacts of entrepreneurial innovation ecosystems worldwide (Aguinis et al., 2017; Anderson et al., 2019; Cherubini-Alves et al., 2021).

Our *fifth limitation* is the assumption of socio-economic impacts generated, directly or indirectly, by the influence of environmental conditions (most of them motivated by government intervention). The aim of this study was not the evaluation of public mechanisms for fostering entrepreneurship and innovation ecosystems. In this sense, we believe that a natural extension of this research should analyze public mechanisms that have incentivized entrepreneurial innovation in priority sectors (Guerrero and Urbano, 2019). It will help to understand the effectiveness of these governmental initiatives (Edquist, 2011; Guerrero and Link, 2021). Another natural extension could be implementing public policy evaluation methodologies that allow control/focus groups to understand the contribution to developing entrepreneurial innovation initiatives and the associated socio-economic impacts. It is also important to review and discuss the effectiveness of entrepreneurial innovations generated through government intervention via policy frameworks or generated via market orientation (Boudreaux et al., 2019).

We hope that our research inspires researchers to further explore the antecedents and consequences of entrepreneurial innovation, based on multidisciplinary perspectives (economic, strategic, geographic, and sociological).

Then, the GEM methodology identifies the percentage of individuals who are involved in entrepreneurial activities, including new and

established businesses. In 2016, the sample was 933 representatives of businesses in Mexico at both a national and regional level. In the 2016 edition, thanks to additional funding, we were able to add extra questions to the APS (e.g., dynamic organizational capacities questions and subjective measures of impacts) that made this manuscript possible. Therefore, individuals who were identified as entrepreneurs during the screening and survey process were asked about these questions. However, due to funding restrictions, the Mexican team did not allow us to add questions in subsequent years.

**CRedit authorship contribution statement**

**Maribel Guerrero:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Donald Siegel:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Methodology, Investigation, Formal analysis, Conceptualization.

**Declaration of competing interest**

The authors declare that they have known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

**Data availability**

The authors do not have permission to share data.

**Appendix A**

*A.1. Contrasting priority industries supported by the government with the industries/regions identified in our sample*

Mexican government		Distribution of entrepreneurial innovations identified in our sample					
Priority industries	% of the total of projects	Entrepreneurial innovation	Mexican regions				
			Bajío	North	Centre	Southeast	Mexico City
Agro-industrial	9.62 %	3.8 %	20 %	80 %	0 %	0 %	0 %
Automotive	10.05 %	6.1 %	38 %	63 %	0 %	0 %	0 %
Chemical	9.07 %	0.8 %	100 %	0 %	0 %	0 %	0 %
Engineering	6.07 %	7.6 %	20 %	80 %	0 %	0 %	0 %
Food products	11.10 %	31.3 %	29 %	61 %	0 %	2 %	7 %
Metal mechanic	5.04 %	2.3 %	33 %	67 %	0 %	0 %	0 %
Biotechnology	6.66 %	0 %	0 %	0 %	0 %	0 %	0 %
Others	15.55 %	13.7 %	22 %	61 %	0 %	6 %	11 %
Pharmaceutic	5.54 %	2.3 %	33 %	0 %	0 %	67 %	0 %
TICS	17.64 %	10.7 %	14 %	57 %	0 %	7 %	21 %
Aerospatiale	3.77 %	0 %	0 %	0 %	0 %	0 %	0 %
Textile	5.96 %	21.4 %	25 %	50 %	4 %	11 %	11 %
Total	100.0 %	100.0 %	26 %	59 %	1 %	6 %	8 %

Note: Bajío (Aguascalientes, Guanajuato, Jalisco, Michoacán, Nayarit); North (Baja California, Chihuahua, Coahuila, Durango, Nuevo León, Sinaloa, Sonora, Tamaulipas); Centre (Hidalgo, Morelos, Puebla, Querétaro, Tlaxcala, Zacatecas); Southeast (Campeche, Chiapas, Guerrero, Oaxaca, Quintana Roo, Tabasco, Veracruz, Yucatán) and Mexico City.

Source: Self-devised based on CONACYT (2015).

*A.2. Detailed SME direct and indirect effects [Model 1]*

H	Relationship	Direct effect			Indirect effect		
		Coef.	S.E.	Sig.	Coef.	S.E.	Sig.
H1a	Dynamic capabilities → Entrepreneurial innovation	0.435	0.172	***			
	Sensing				0.829	0.041	***
	Seizing				0.452	0.043	***
H1b	Transforming				0.600	0.045	***
	Supportive ecosystems → Dynamic capabilities → Entrepreneurial innovations	0.106	0.028	**	0.056	0.004	**
	Sensing				0.562	0.236	**

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H	Relationship	Direct effect			Indirect effect		
		Coef.	S.E.	Sig.	Coef.	S.E.	Sig.
H2	Seizing				0.255	0.103	**
	Transforming				0.703	0.296	**
	Supportive ecosystems → Entrepreneurial innovations	0.220	0.018	**			
	Talent: population with higher education				-0.880	0.082	***
	Talent: researcher per hab.				-0.970	0.104	*
	Investment: entrepreneurship subsidies				0.890	0.038	***
	Investment: R&D subsidies				0.690	0.057	***
	Infrastructure: R&D centers per hab.				0.990	0.136	***
	Infrastructure: professionals				0.191	0.040	***
	Education: entrepreneurship educational programs				-0.878	0.072	***
	Finance: financial supports				-0.345	0.030	*
	Market: internal market				-0.107	0.018	***
	Formal – government spending				-1.624	0.035	***
	Formal – taxation				-0.185	0.030	**
	Formal - regulations				-0.169	0.041	***
	Formal – corruption				0.210	0.036	***
Informal – culture				0.128	0.012	*	
H3	Entrepreneurial innovations → Socio-economic impacts	1.000	0.035	***			
	Impact on competitiveness				0.990	0.037	***
	Impact on well-being				0.886	0.038	***
	Impact on employment				0.884	0.038	***
	Impact on talent attraction				0.365	0.018	***
	Impact on investment attraction				0.388	0.018	***
	Impact on the sector				0.847	0.035	***
	Impact on the market				0.763	0.037	***
H3a	Dynamic capabilities → Entrepreneurial innovations → Socio-economic impacts	0.735	0.043	***	0.019	0.004	**
	Impact on competitiveness				0.034	0.015	**
	Impact on well-being				0.031	0.012	**
	Impact on employment				0.031	0.013	**
	Impact on talent attraction				0.012	0.005	**
	Impact on investment attraction				0.013	0.006	**
	Impact on the sector				0.029	0.012	**
	Impact on the market				0.026	0.011	**
H3b	Supportive ecosystems → Entrepreneurial innovations → Socio-economic impacts	0.107	0.037	**	0.078	0.017	***
	Impact on competitiveness				0.107	0.037	***
	Impact on well-being				0.095	0.032	***
	Impact on employment				0.095	0.032	***
	Impact on talent attraction				0.039	0.014	**
	Impact on investment attraction				0.042	0.014	**
	Impact on the sector				0.091	0.031	***
	Impact on the market				0.082	0.028	***

A.3. Robustness test using two-stage least-squares regression [Model 3]

Stage 2		DV: socio-economic impacts																	
		Model 3a			Model 3b			Model 3c			Model 3d			Model 3e			Model 3f		
		Competitiveness			Well-being			Employment			Attraction of talent			Attraction of investment			Market		
		Coef.	R.S.E.	Sig.	Coef.	R.S.E.	Sig.	Coef.	R.S.E.	Sig.	Coef.	R.S.E.	Sig.	Coef.	S.E.	Sig.	Coef.	S.E.	Sig.
Instrumented variable	Entrepreneurial innovation	0.510	0.026	***	0.396	0.126	***	0.477	0.111	***	0.574	0.097	***	0.562	0.094	***	0.545	0.111	***
Control variables	Size	0.029	0.033	*	0.025	0.033		0.065	0.021		-0.051	0.024		-0.051	0.024		-0.011	0.030	
	Sector	0.010	0.009	*	0.017	0.009	*	0.022	0.006	**	-0.012	0.006	*	-0.011	0.006	*	-0.065	0.008	
	Region	0.065	0.013	***	0.061	0.013	***	0.062	0.010	***	0.024	0.010		-0.019	0.009	*	-0.062	0.013	***
Stage 1		DV: entrepreneurial innovations																	
		Coef.	S.E.	Sig.	Coef.	S.E.	Sig.	Coef.	S.E.	Sig.	Coef.	S.E.	Sig.	Coef.	S.E.	Sig.	Coef.	S.E.	Sig.
Dynamic organizational capabilities	Sensing	0.412	0.014	***	0.412	0.014	***	0.412	0.014	***	0.412	0.014	***	0.412	0.014	***	0.412	0.014	***
	Seizing	0.189	0.025	*	0.189	0.025	*	0.189	0.025	*	0.189	0.025	*	0.189	0.025	*	0.189	0.025	*
	Transforming	0.589	0.020	**	0.589	0.020	**	0.589	0.020	**	0.589	0.020	**	0.589	0.020	**	0.589	0.020	**
Dynamic regional capabilities	Talent: population with higher education	-0.545	0.092	***	-0.545	0.092	***	-0.545	0.092	***	-0.545	0.092	***	-0.545	0.092	***	-0.545	0.092	***
	Talent: researcher per hab.	-0.270	0.042	**	-0.270	0.042	**	-0.271	0.042	**	-0.271	0.042	**	-0.271	0.042	**	-0.271	0.042	**

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Stage 1		DV: entrepreneurial innovations														
		Coef.	S.E.	Sig.	Coef.	S.E.	Sig.	Coef.	S.E.	Sig.	Coef.	S.E.	Sig.			
Control variables	Investment: entrepreneurs' subsidies	0.555	0.078	*	0.555	0.078	*	0.555	0.078	*	0.555	0.078	*	0.555	0.078	*
	Investment: R&D subsidies	0.127	0.032	***	0.127	0.032	***	0.127	0.032	***	0.127	0.032	***	0.127	0.032	***
	Infrastructure: R&D centers per hab.	0.385	0.065	***	0.385	0.065	***	0.385	0.065	***	0.385	0.065	***	0.385	0.065	***
	Infrastructure: professionals	0.500	0.013	*	0.500	0.013	*	0.500	0.013	*	0.500	0.013	*	0.500	0.013	*
	Education: entrepreneurship program	-0.682	0.109	***	-0.682	0.109	***	-0.682	0.109	***	-0.682	0.109	***	-0.682	0.109	***
	Finance: supports	1.466	0.053	*	1.466	0.053	*	1.466	0.053	*	1.466	0.053	*	1.466	0.053	*
	Market: internal market	-0.666	0.010	***	-0.666	0.010	***	-0.666	0.010	***	-0.666	0.010	***	-0.666	0.010	***
	Formal – government spending	-0.450	0.045	*	-0.450	0.045	*	-0.450	0.045	*	-0.450	0.045	*	-0.450	0.045	*
	Formal – taxation	-0.174	0.057	*	-0.174	0.057	*	-0.174	0.057	*	-0.174	0.057	*	-0.174	0.057	*
	Formal – regulations	-0.303	0.036	*	-0.303	0.036	*	-0.303	0.036	*	-0.303	0.036	*	-0.303	0.036	*
	Formal – corruption	0.151	0.015	*	0.151	0.015	*	0.151	0.015	*	0.151	0.015	*	0.151	0.015	*
	Informal – culture	0.161	0.014	*	0.161	0.014	*	0.161	0.014	*	0.161	0.014	*	0.161	0.014	*
	Size	0.092	0.021	***	0.095	0.021	***	0.095	0.021	***	0.095	0.021	***	0.095	0.021	***
	Sector	0.030	0.006	***	0.031	0.006	***	0.031	0.006	*	0.031	0.006	***	0.031	0.006	***
	Region	-0.059	0.010	***	-0.062	0.010	***	-0.062	0.010	***	-0.062	0.010	***	-0.062	0.010	***
	N	933			933			933			933			933		
	IV F-Stat	26.88			26.88			26.88			26.88			26.88		
	R-square	0.328			0.328			0.328			0.328			0.328		

Notes:

(a) Instrumented variable: entrepreneurial innovations

(b) Equations:

Stage 2:  $y_1 = \beta_0 + \beta_1y_2 + \beta_2z_1 + \dots + u_1$ ; where  $y_1$  = socio-economic impacts;  $y_2$  is the endogenous part of Eq. (2).

Stage 1:  $y_2 = \pi_0 + \pi_1z_1 + \pi_2z_2 + \dots + v$ ; where  $y_2$  = entrepreneurial innovations;  $z_1$  = organizational dynamic capabilities;  $z_2$  = regional dynamic capabilities.

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