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REVIEW OF ENTREPRENEURIAL ECOSYSTEM MODELS

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ABSTRACT

The aim of this paper is to contribute to the discussion of the entrepreneurial ecosystem through the entrepreneurial ecosystem models. The paper presents the most-cited models of the entrepreneurial ecosystem and discusses the elements of these models based on the literature review of scholarly articles, books, and scientific databases. We discuss six different models of the entrepreneurship ecosystem. The novelty of the paper is that we present the most-cited entrepreneurial ecosystem models and explore the various approaches to entrepreneurial ecosystem based on these models.

Keywords: Entrepreneurship, ecosystem, entrepreneurial ecosystem models, ecosystem actors, ecosystem pillars, startups.

INTRODUCTION

The popularity of an entrepreneurial ecosystem concept is clearly visible from the number of scholarly articles, the books being published and the increasing number of conferences being organized in the near past. Suffice it to mention that the leading scholars in the field of entrepreneurship research have published a few books related to the entrepreneurial ecosystem concept since 2018. Some of these well-known and highly cited books are as follows sorted by the year of publication:

- *Entrepreneurial ecosystems* by Spigel (2020)
- *The internet of things entrepreneurial ecosystems: challenges and opportunities* by Cunningham and Whalley (2020)
- *Startup communities: Building an entrepreneurial ecosystem in your city* by Feld (2020).
- *The startup community way: evolving an entrepreneurial ecosystem* by Feld and Hathaway (2020).
- *Entrepreneurial ecosystems. place-based transformations and transitions* by O'Connor, Stam, Sussan, and Audretsch (2018).

This list could be much longer if one would add only books on startups and scaleups. Additionally, entrepreneurial ecosystem research is published at both Q1 and Q2 level journals, and the top journals comprise more than 54% such as *Research Policy* (Q1), *Small Business Economics* (Q1), *European Planning Studies* (Q1), *Journal of Business Venturing* (Q1), *Entrepreneurship Theory and Practice* (Q1), *Journal of Technology Transfer* (Q1), *Strategic Entrepreneurship Journal* (Q1), *Journal of Small Business Management* (Q1), and *Journal of Business Research* (Q1) which are top most-cited ones and most of them published special issues on entrepreneurial ecosystem research (Velt et al., 2020).

Based on the abovementioned reasons it is worth conducting research related to the entrepreneurial ecosystem and contributing to the stack of knowledge in the research of the entrepreneurial ecosystem. To this end, the aim of this research is to answer the following research questions:

- How do we define the entrepreneurial ecosystem?
- What are the models developed to understand the entrepreneurial ecosystem?

The paper takes the form of a literature review of scholarly articles, books, and scientific databases such as ScienceDirect, Web of Science, Scopus, and Google Scholar. By doing so, this paper presents the most cited entrepreneurial ecosystem models and explores the various approaches to entrepreneurial ecosystem based on these models.

The structure of the paper is as follows. After the brief introduction part, the literature review of the concept is presented. The second section covers the most-cited entrepreneurial ecosystem models and the discussion of the components of these models. The concluding remarks, limitations, and summary of the paper are given under the conclusion and future challenges.

1. ENTREPRENEURIAL ECOSYSTEM CONCEPT

Moore (1993) popularized the term "ecosystem" in social science (Malecki, 2018) and suggested considering a firm not as a member of a single industry but as part of a business ecosystem.

Song (2019) mentioned some of the pioneering papers that have adapted the ecosystem concept for different literature[1] which is summarized below.

- Ecosystem concept was first introduced by Tansley (1935) and gained value after "*An evolutionary theory of economic change"* by Nelson and Winter (1982)
- Strategy literature (Moore, 1993); Iansiti and Levien, 2004)
- Knowledge ecosystems (Owen-Smith and Powell, 2004)
- Innovation ecosystems (Adner, 2006; Adner and Kapoor, 2010; Autio and Thomas, 2014),
- Entrepreneurial ecosystems (Cohen, 2006; Isenberg, 2010; Feld, 2012; Stam, 2015)
- Digital ecosystems (Boley and Chang, 2007; Weil and Woerner, 2015),
- Platform ecosystems (Gawer and Cusumano, 2008; Rysman, 2009)
- Organizational ecosystems (Mars et al., 2012)

The term "entrepreneurial ecosystem" is being discussed extensively by different scholars (Stam, 2015; Spigel 2017; Acs et al., 2017) as well as practitioners (Feld, 2012; Isenberg, 2010).

When we search the concept of the entrepreneurial ecosystem, we do come across different approaches. As Spigel (2020) mentions in the introduction of his book named "*Entrepreneurial ecosystems*", the main logic of the entrepreneurial ecosystem is that entrepreneurship is a team sport. He continues by arguing that entrepreneurial ecosystems provide two things for entrepreneurs:

- Entrepreneurial resources such as funding, skilled workforce, and entrepreneurial knowledge available to use by entrepreneurs.
- An environment where the resources mentioned above are accessible.

As a common definition of the entrepreneurial ecosystem we prefer Stam and Spigel's (2018) definition:

"A set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship within a particular territory." (Stam and Spigel, 2018, p. 407).

Their definition is the most common and comprehensive definition when compared to the other definitions (Burda et al., 2020).

Stam and Van de Ven (2021) highlighted some empirical studies that analyse the way the entrepreneurial ecosystem leads to entrepreneurship and value creation at the regional level (Fritsch, 2013; Autio et al., 2014; Tsvetkova, 2015). In addition, other researchers argued how early entrepreneurial success, strong entrepreneurial culture, and supportive public policies (Mack and Mayer, 2016) along with cohesive social and economic system (Spigel, 2017) contributed to a strong entrepreneurial ecosystem.

At the national level, Acs et al. (2014) applied large-scale quantitative methods in an attempt to analyse strong entrepreneurial ecosystems.

The latest entrepreneurial ecosystem concept, as was analysed and framed by Wurth et all. (2021), has emerged as a development of research and discussion in various related works of literature which could be summarized as below:

[1] Jacobides et al. (2018) summarize the ecosystems literature as: 1) business ecosystem centered on a focal firm and its environment, 3) innovation ecosystem centered on a particular innovation or new value proposition, and 3) platform ecosystem focused on how actors organized around a platform.

- Entrepreneurship context
- High-growth entrepreneurship
- Clusters
- Regional innovation systems
- Entrepreneurial environments
- Business ecosystems.

2. ENTREPRENEURIAL ECOSYSTEM MODELS

In this section, we briefly discuss six models in the literature about entrepreneurial ecosystem models. All the models are widely known except for the Six+Six entrepreneurship ecosystem model (Koltai, 2016) and the innovation-driven entrepreneurship approach (Murray and Budden, 2017).

Below is the list of all six models which are later discussed in detail in this section:

1. Ecosystem domains by Isenberg (2010)
2. Ecosystem pillars by World Economic Forum (2013)
3. Six+Six entrepreneurship ecosystem model by Koltai (2016)
4. Ecosystem attributes by Spigel (2017)
5. Innovation-driven entrepreneurship approach by Murray and Budden (2017)
6. Entrepreneurial ecosystem model by Stam and Van de Ven (2021).

2.1. Ecosystem domains

Daniel Isenberg is one of the pioneers who has been conducting research and helping to formulate policies in the field of an entrepreneurial ecosystem.

In his model depicted in Figure 1, we see a static system showing that the entrepreneurial ecosystem consists of six domains: policy, markets, finance human capital, support, and culture that are believed to promote entrepreneurship.

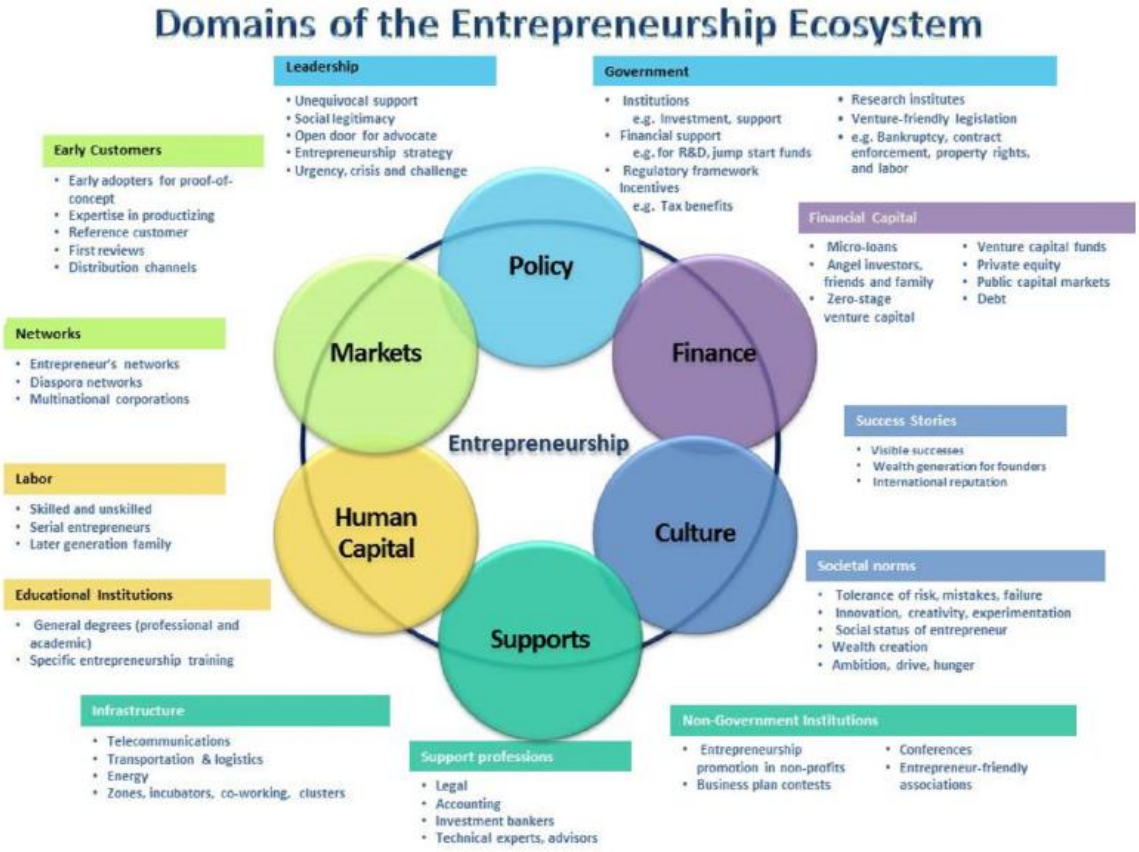
Some of the elements shown in the figure are similar to the biotic factors[2] in natural ecosystems — such as educators and bankers while other elements such as infrastructure or culture are abiotic factors[3] (Isenberg, 2016).

Isenberg (2016) criticizes the view of equating entrepreneurship with startups and argues that the essence of entrepreneurship is growth which happens when business actors create extraordinary value for customers and capture extraordinary economic value for themselves, either through recombining assets, repurposing existing assets, acquiring new assets, or creating new assets.

[2] Biotic factors are living things within an ecosystem; such as plants, animals, and bacteria. https://www.canr.msu.edu/resources/biotic-abiotic Accessed 11/30/2021

[3] Abiotic factors are non-living components; such as water, soil and atmosphere. https://www.canr.msu.edu/resources/biotic-abiotic Accessed 11/30/2021

Figure 1. Domains of the entrepreneurship ecosystem.



Source: Isenberg and Onyemah (2016, p. 62).

Table 1 Possible reasons why the ecosystem actors invest in entrepreneurship.

Educators	*Financers*	*Service professionals*	*Media representatives*	*Corporations*	*Elected officials*
For research, intellectual property, donations, reputation, attraction of students and faculty	To increase return on assets or investment	To broad their client base and as a result their revenues	To create a more compelling content and attract readers and advertisers	For a better access to talent, innovation, supply chains, markets, and acquisitions	To create quality jobs, to be popular and get re-elected

Source: Author's own illustration based on Isenberg (2016)

Isenberg (2016) also posits that his entrepreneurship ecosystem model resembles the natural ecosystems in not having central control, having multiple sources of intention, and multiple means of meeting participants' needs.

In table 1, we illustrate the main motivations of the ecosystem actors who are willing to invest in entrepreneurship.

2.2 *World Economic Forum's Ecosystem Pillars*

Another entrepreneurial ecosystem model is the one developed by the World Economic Forum researchers. It is clearly mentioned in the report that the following two questions on entrepreneurial ecosystems have been central:

Question 1 – What do entrepreneurs perceive to be the differences between entrepreneurial ecosystems around the globe in terms of the ready availability of the various pillars that make up an ecosystem?

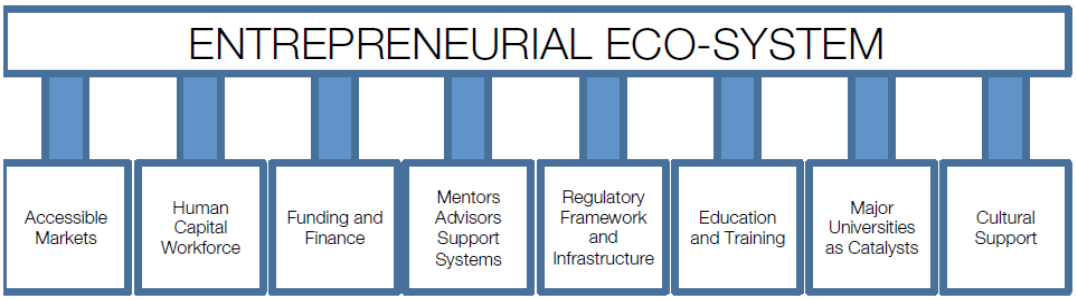
Question 2 – Which pillars of an entrepreneurial ecosystem do entrepreneurs view as most important to the growth/success of their companies?

The World Economic Forum's (2013) model of entrepreneurial ecosystems contributed to the entrepreneurial ecosystem research in two important ways:

1. Entrepreneurs were asked both abovementioned two central questions whereas other analyses of entrepreneurial ecosystems do not use to support their argument gathered directly from entrepreneurs.
2. Entrepreneurs who have been surveyed were both asked the abovementioned two questions although some of the previous research papers focused on the first question only. However, without answering the second question policy-makers cannot understand the most important factor which accounts for the growth and success of entrepreneurial firms.

Based on this report, we can distinguish three pillars as the most pivotal for the growth of entrepreneurial firms: (1) accessible markets, (2) human capital/workforce, and (3) funding and finance.

Figure 2. World Economic Forum's model of entrepreneurial ecosystems.



***Source*:** World Economic Forum (2013, p. 6).

The research group behind the data collection has used the following two different sources of information:

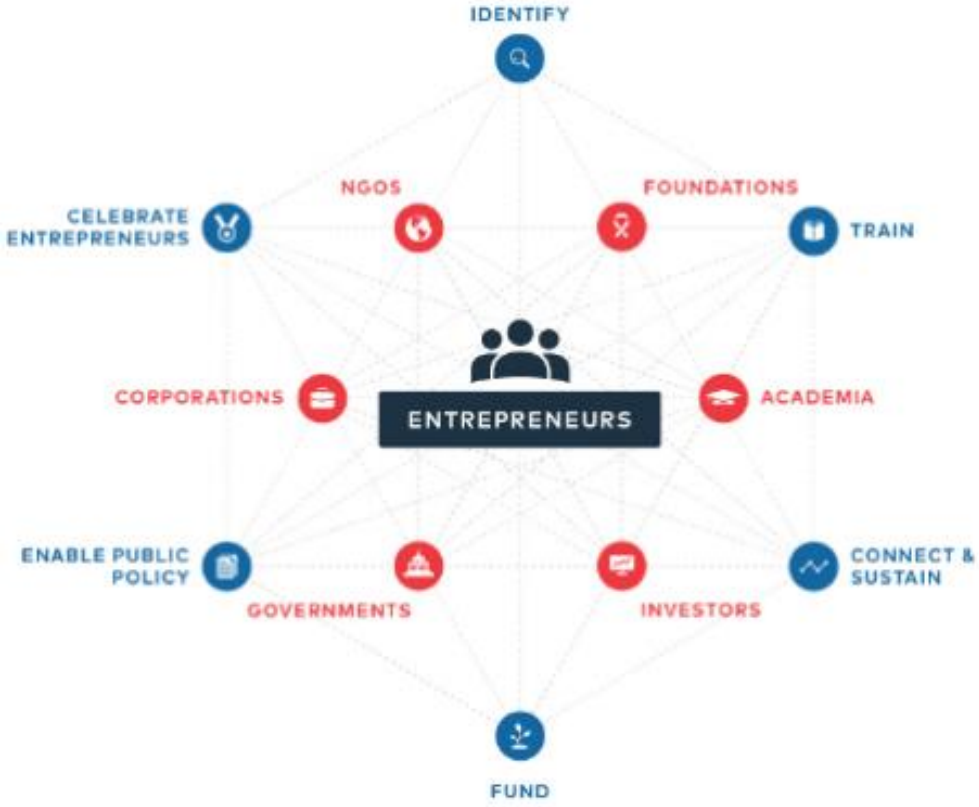
1. Online survey of more than 1,000 individuals with extensive experience in early-stage companies, the Stanford Graduate School of Business' alumni database for a two-phase survey, and additional databases such as from Endeavor, Pakistan, and from Australia.
2. Executive cases based on the survey among founders and senior executives of 43 early-stage companies with the focus of identifying their company growth and how entrepreneurial ecosystems contributed to this growth.

Figure 2 illustrates the World Economic Forum's model of entrepreneurial ecosystems which is comprised of eight ecosystem pillars: accessible markets, human capital, funding and financing, support systems, regulatory framework and infrastructure, education and training, major universities, and cultural supports. Although some of these pillars are similar to Isenberg's domains, major universities as catalysts pillar are an addition to this model.

2.3. Entrepreneurial ecosystem model

This model is developed by Steven Koltai, who created and ran the *Global Entrepreneurship Program* for the U.S. Department of State. The model is not the most cited among the scholars compared to the other models. Koltai's model (Koltai, 2016) is comprised of six pillars and six types of actors. The six pillars are: *identify, train, connect & sustain, fund, enable, celebrate entrepreneurs,* and the six types of actors are: *NGOs, foundations, academia, investors, government, and corporations.*

Figure 3. Koltai's Six + Six Entrepreneurship Ecosystem Model



***Source*:** Koltai (2016, p. 111).

The first pillar of the model is called identify, which represents relevant activities in order to discover new entrepreneurs or new business ideas. Second pillar is train which explains that without educational resources knowledge transfer is impossible and training may come in different forms (e.g. entrepreneurship hubs, aid programs, mentors)

Next comes connect and sustain, the third pillar of the model. Here connect refers to all the networks of information flow among entrepreneur, government, funders etc. The sustain, which is non-financial support such as mentorship, training as well as business support services delivered by incubators and accelerators to help entrepreneurs grow their startups.

Fund is the fourth pillar which includes all types of financing (e.g. debt, grant, equity) and access to capital for all stages of a venture in order to start or grow a business.

The fifth pillar is called enable, which refers to the legal, fiscal, and regulatory systems that influence the entrepreneur to operate as well as the policy that may influence the entrepreneur to formalize a business (Khattab and Al-Magli, 2017).

The last pillar is called celebrate which is a very critical matter for different cultures. Entrepreneurship must be celebrated as a desirable and viable career path in society which in turn will encourage would-be-entrepreneurs to work more on their business ideas.

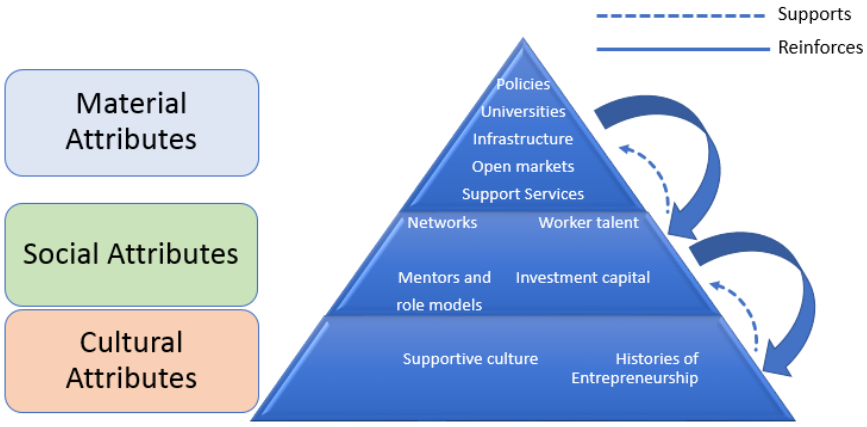
The author argues that entrepreneurship ecosystems play an instrumental role in producing high levels of entrepreneurship not only locally but also both at the regional and national levels. Koltai (2016) believes that the US government can support the development of these ecosystems in developing countries which in turn will contribute to entrepreneurship and by implication job creation that enables to absorb idle youth cohorts into the workplace. This per se will lead to economic growth and greater stability in these countries.

Koltai (2016) suggests that in order to increase the quantity and quality of high-growth, job-creating startups each of the six pillars of his Six + Six model needs to be developed.

2.4. Ecosystem attributes

Spigel (2017) argues that "entrepreneurial ecosystems are combinations of social, political, economic, and cultural elements within a region that support the development and growth of innovative startups and encourage nascent entrepreneurs and other actors to take the risks of starting, funding, and otherwise assisting high-risk ventures" (Spigel, 2017, p.50).

Figure 4. Spigel's model of entrepreneurial ecosystems



***Source*:** Spigel (2017, p. 57).

According to Spigel (2017), ecosystem attributes are classified into three:

1. *Cultural*: These attributes are the underlying beliefs and outlooks about entrepreneurship in a specific geography and are divided into two main attributes: cultural attitudes and histories of entrepreneurship
2. *Social*: These attributes are the resources accessed through or embedded in networks and are divided into four main attributes: networks, investment capital, mentors and dealmakers, and worker talent.
3. *Material*: These attributes are those with a tangible presence and are divided into four main attributes universities, support services and facilities, policy and governance, and open markets.

By suggesting this model (see Figure 4), Spigel (2017) argues that ecosystems are composed of cultural, social, and material attributes that provide benefits and resources to entrepreneurs and their interrelationship helps reproduce the ecosystem over time.

2.5. Innovation-driven entrepreneurship approach

This model is developed by MIT researchers Murray and Budden (2017), which uses 'innovation ecosystems' and 'entrepreneurship ecosystems' (*iEcosystems*) framework interchangeably. Innovation-driven entrepreneurship approach emphasizes a more comprehensive understanding of the 'system' which is broken down into four core elements (see Figure 5) that lead to 'comparative advantage' and ultimately (to a greater or lesser extent) 'impact' within an *iEcosystem*.

Figure 5. Innovation-driven entrepreneurship model

***Source*:** Murray and Budden (2017, p. 4).

Foundational institutions are sitting at the bottom of the triangle and are comprised of institutions, rules, practices, and norms that are often taken for granted but ensure investment protection which ultimately benefits the economy. They mainly include rule of law, property rights, financial institutions, freedom for new ideas, and general ease of doing business.

Innovation Capacity (I-Cap) is one of two engines of the 'system' the capacity of a place – a city, a region, or a nation – to develop new ideas and to take them from 'inception to impact' (whether this is economic, social and/or environmental impact). To put it simply, innovation capacity is not only the development but also the translation of scientific 'solutions' into useful products, technologies, and/or services that truly solve problems.

Entrepreneurship Capacity (E-Cap) is another engine of the 'system' that is a subset of the more general entrepreneurial capability which also supports the 'innovation-driven' side of entrepreneurship capacity. Both E-Cap and I-Cap are built on foundational institutions, and their combination of (and linkages between) innovation and entrepreneurship capacities within a geographic region drives impact.

Comparative Advantage are specific areas of strength of any region's economy that distinguish it from the rest of the economies. For 'innovation-driven entrepreneurship ecosystems' (iEcosystems), such 'comparative advantage' is a distinctive strength in both innovation and entrepreneurship capacities. For instance, the comparative advantage could be geographical clusters or industrial sectors whether they be clusters in the life sciences, IT services or education.

Impact comes from the combination of E-Cap and I-Cap combined with core comparative advantage and often taking specific actions through 'program and policy interventions' (PPIs) that are subject to different measurement tools.

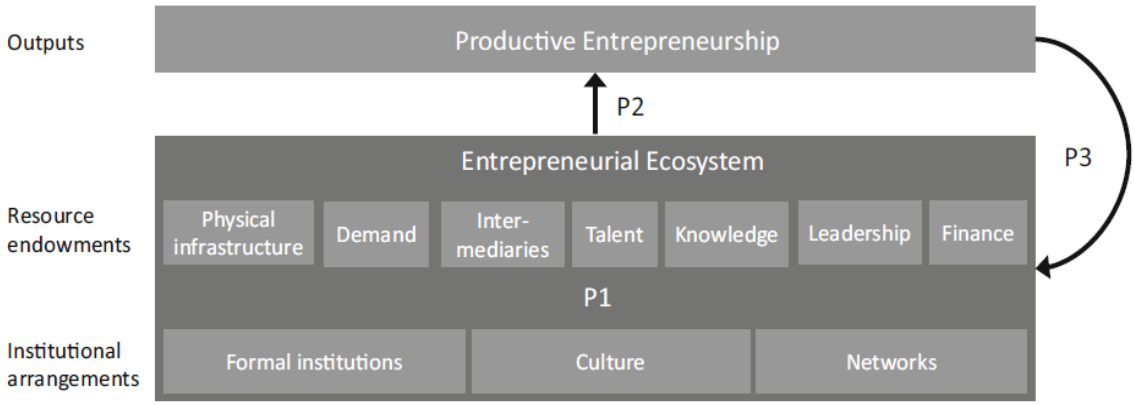
The impact can be measured in the form of economic or social progress indicators where the most commonly used metric is GDP per capita, such as the Social Progress Index (SPI) or UN Sustainable Development Goals (SGDs) respectively.

2.6. Entrepreneurial ecosystem model

Building on prior academic studies Stam and Van de Ven (2021) propose an integrative model of entrepreneurial ecosystems consisting of ten elements and entrepreneurial outputs.

They based their conceptualization on the so-called infrastructure for entrepreneurship (Van de Ven, 1993). Their entrepreneurial ecosystem concept is based on a social system framework and is comprised of the institutional arrangements and resource endowment elements of the infrastructure.

Figure 6. Elements and outputs of the entrepreneurial ecosystem



***Source*:** Stam and Van de Ven (2021, p. 813).

The institutional arrangements component has got three pillars which are formal institutions, culture, and network elements. The physical infrastructure, finance, leadership, talent, knowledge, intermediate services, and demand elements fall under the resource endowment component. The third component is considered the output of the entrepreneurial ecosystem and is called productive entrepreneurship where the entrepreneurial firms commercialize innovations and create new value.

In order to have an insight into the model, it is worth viewing table 2 which accurately illustrates the details like concepts, definitions of constructs, and elements of the entrepreneurial ecosystem model of Stam and Van de Ven (2021).

Table 2. Constructs of entrepreneurial ecosystem elements and outputs

Concept	*Construct*	*Definition*	*Element*
Institutions	Formal institutions	The rules of the game in society	Formal institutions
	Informal institutions	Cultural context	Culture
	Social networks	The social context of actors, especially the degree to which they are socially connected	Networks
Resources	Physical resources	The physical context of actors that enables them to meet other actors in physical proximity	Physical infrastructure
	Financial resources	The presence of financial means to invest in activities that do not yet deliver financial means	Finance
	Leadership	Leadership that provides guidance for, and direction of, collective action	Leadership
	Human capital	The skills, knowledge and experience possessed by individuals	Talent
	Knowledge	Investments in (scientific and technological) knowledge creation	Knowledge
	Means of consumption	The presence of financial means in the population to purchase goods and services	Demand
	Producer services	The intermediate service inputs into proprietary functions	Intermediate services
New value creation	Productive entrepreneurship	Any entrepreneurial activity that contributes (in)directly to net output of the economy or to the capacity to produce additional output	Productive entrepreneurship

***Source*:** Stam and Van de Ven (2021, p. 813).

Additionally, Stam and Van de Ven (2021) base their entrepreneurial ecosystem causal model on three propositions.

1. Co-evolutionary proposition- it emphasizes the co-evolution and mutual interdependence of elements of entrepreneurial ecosystems.
2. Upward causation proposition- it focuses on how the ten elements of the entrepreneurial ecosystem cause productive entrepreneurship which authors refer to as upward causation: structure affecting the agency.
3. Downward causation proposition- it focuses on how successful entrepreneurs become role models and network developers which are considered as positive feedback effects of entrepreneurs on the finance, culture, leadership, and network elements of entrepreneurial ecosystems. Authors refer to this as downward causation: agency affecting the structure.

Since the Stam and Van de Ven's (2021) model is based on the other approaches and models mentioned in the literature, until now it is the most structured and developed model of the entrepreneurial ecosystem when compared to the other models.

CONCLUSION AND FUTURE CHALLENGES

The aim of this paper is to contribute to the body of knowledge on the concept of the entrepreneurial ecosystem and to shed light on the most referred entrepreneurial ecosystem models. To this end, the paper compares the most cited models of the entrepreneurial ecosystem.

As per the future research prospects, the paper by Wurth et al. (2021) is one of the latest studies which presents a critical literature review and a transdisciplinary research program for entrepreneurial ecosystem research and practice.

Wurth et al. (2021) put together a very important analysis and developed their research in three key ways in order to position the entrepreneurial ecosystem in a broader concept as stated below:

1. Presented systematic literature review of the entirety of the entrepreneurial ecosystem concept (i.e. not just specific ecosystems or specific domains).
2. Identified the causal mechanisms based on the systematic literature that link the regional contexts in which entrepreneurship takes place with specific outcomes such as firm growth, innovation, and increases in overall welfare.
3. Developed a new typology of the conceptual micro-foundations of entrepreneurial ecosystem thinking and suggested a research agenda to strengthen and make the conceptual and empirical basis relevant to policymakers, entrepreneurs, and researchers.

In addition to the above research directions the entrepreneurial ecosystem literature will benefit a lot from an evolutionary perspective rather than a static framework analysis as it is argued by Malecki (2018, p. 10) that "in order to understand the emergence and evolution of an entrepreneurial ecosystem, we have to go beyond the lists of factors/components/elements approach." Auerswald and Dani (2017, p.105) also support the evolutionary perspective and their findings suggest that contrary to the linear development of the traditional industry life cycle the life cycle of the entrepreneurial ecosystem is best characterized by "the evolutionary dynamics of complex adaptive systems".

Current paper is far being perfect and has some limitations. One of the limitations of the paper is that this research focuses on the selected papers published in the academic journals mainly indexed in Science Direct and Web of Science. Therefore, it would be better to include other relevant research databases to get the most comprehensive analysis (e.g. cross-country analysis of different elements of the entrepreneurial ecosystem) and be able to compare other approaches and contributions to the entrepreneurial ecosystem body of knowledge. Another limitation is that some of the interesting topics (e.g. measurement approaches of entrepreneurial ecosystems, different case studies across industries) are not included in this study due to the scope of the study and to avoid the complex discussions in one paper. Therefore, these limitations can be the motivation for the new research and some of them are already topics of the ongoing debate in the entrepreneurship literature.

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