Ecosystems in Business

A systematic literature review of ecosystems and its dimensions

Luiz Henrique N. G. Moreira, Silvio R. L. Meira[1], Andre Neves, Felipe Silva Ferraz
Center of Advanced Studies and Systems of Recife
Recife, Brazil
E-mail: {lhgm}@cesar.school, [1]lhgondim@gmail.com

Abstract—**Business leaders and scholars struggle to separate Business Ecosystem (BE), Digital Ecosystem (DE), Digital Platform Ecosystem (DPE), and Innovation Ecosystem (IE). Uncertain ecosystem definitions affect business performance, innovation, and decisions. The objective of this paper is to conduct a systematic literature review of ecosystem and its dimensions in order to achieve clarity and precision about the definition of the concept. Snowball technique was used to identify relevant articles and mining techniques to examine how ecosystems have been defined. The results of the review revealed different meanings of digital ecosystems, but key similarities were identified.**

Keywords-ecosystems; digital ecosystems; business ecosystems; innovation platforms; business innovation; systematic literature review.

I. INTRODUCTION

The term ecosystem is a set of actors that includes a focal firm and other participants who share the same vision of value creation and are willing to work together through multi-lateral co-specializations under mutually agreed governance mechanisms [9]. The use of the term 'ecosystem' has increased in frequency as it entered the lexicon of technological and commercial companies; the concept of which can include different forms of associations of organizations like platforms, clusters, networks, and incubators [4]. Within the specific context of innovation, ecosystems refer to a complex and interconnected network that collaborate and interact with each other to drive innovation through the creation of new products, services, or solutions.

The terms Business Ecosystem (BE), Digital Ecosystem (DE), Digital Platform Ecosystem (DPE), and Innovation Ecosystem (IE) are often used interchangeably. These terms generally refer to the system that is in place for innovation in a business company to be created or developed [21]. However, these terms pertain to different aspects of ecosystem.

Unclear ecosystem definitions can affect the performance, innovation, and decisions of businesses. Having multiple definitions of a concept within a business company can lead to confusion and misalignment among employees, hindering effective communication and decision-making. It can also result in inconsistent implementation of strategies or objectives, impacting the company's overall efficiency and performance.

To address this problem, this research will attempt to examine how the concept ecosystem and its dimensions have been defined using previous research studies. Specific focus will be given to the business setting, where the concept of

digital ecosystem is necessary for competitive advantage and sustainability [14].

The research questions of the study are the following: 1. How has ecosystem been defined in business? and 2. What are the core similarities of the different terms that have been used to define ecosystem in business? These two research questions served as the basis that grounds this study.

The purpose of this research is to conduct a Systematic Literature Review (SLR) of ecosystem and its dimensions in order to achieve clarity and precision about the definition of the concept. Through this SLR, core similarities about the different definitions of ecosystem in the business setting can be identified.

This research is limited by the approach of SLR. The quality of SLR is dependent on the quality of the studies included. If the studies included have flaws and biases in their methodology, these issues may carry over to the SLR itself. Moreover, because of the heterogeneity of studies included in SLR, the methods, populations, and outcomes can vary, making the process of synthesizing and drawing clear conclusions challenging.

The structure of the paper will include several sections that will cover the entire study. Section II will cover the methodology of the SLR. Section III will present the different definitions and dimensions of ecosystem based on the SLR. Section IV will present the conclusions and future work recommendations.

II. METHODOLOGY

The methodology of the study will be informed by SLR. Systematic literature reviews aim to provide a comprehensive summary of existing research on a specific topic [20]. This comprehensive summary can be instrumental in helping other researchers and decision-makers acquire a deeper understanding of the current state of knowledge in a particular area of topic. The selection of SLR as a methodology was appropriate because the current study aims to examine how ecosystem and its related terms have been defined by previous researchers. Through this information, the researcher will be able to have a more precise definition of the core characteristics of this term.

The objective of this SLR is to examine the different definitions that have been made to define ecosystem and its other related terms. This SLR can be instrumental in the determination of themes or patterns from previous research that

can lead to a deeper and more precise understanding of the concept of ecosystem. This review can identify primary studies that focus on different definitions of the ecosystem, how it can be clarified and how it can be applied inside organizations. The review will also focus on key differentiations that can help in the understanding of the multi-dimensional nature of the concept of ecosystems.

A. Search Strategies

The databases considered in the study are listed below:
- ACM Digital Library (see Table 1)
- IEEE Xplore (see Table 1)
- ScienceDirect – Elsevier (see Table 1)

Many different terms were created to guarantee that important information would not be excluded when querying different search engines and databases. As a result, four search strings were created:

1. "Innovation"
2. "Decentralized Innovation" or "Regional Innovation"
3. "Regional Innovation Systems" and "Regional Innovations"
4. "Digital Business Strategy"

Within the search, the criteria below were applied in each database:
- Articles published after 2015 for qualitative analysis
- Studies that are published in the English language
- Studies that are available online
- Studies not based on research that express only the official opinions of governments and field experts
- Duplicated articles (see Table 1)

TABLE I: AMOUNT OF STUDIES FOUND ON EACH DATABASE

Database	Number of studies
ACM Digital Library	271
IEEE Xplore	2603
ScienceDirect – Elsevier	1656
Studies Duplicated – Removed	803
Manual Process Added	

B. Studies Selection Process

In the process of selecting information from the databases, the search strings were used separately on each database, all grouped later using Zotero software to adjust duplication and mine references, using a snowball approach. The searches were performed for articles not older than 2015. Table 1 shows the number of studies found on each database.

A total of 83 primary studies were selected, supplemented by adopting backward snowballing [19]. In snowballing, additional papers are identified either from the paper's reference list (backward snowballing), or from the citations to that paper (forward snowballing). As a result, an additional two primary studies were identified from backward snowballing, increasing the final tally to 85.

TABLE II: AMOUNT OF STUDIES FILTERED IN EACH STEP OF SELECTION PROCESS

Phase of Selection Process	Number of studies
1. Databases Search	3726
1.1 Database cleansing (before 2015)	303 removed | 3423
2. Title Analysis (contain Ecosystem, Systems, Innovation, Hub)	1571 removed | 1852
3. Abstract Analysis (contain Business, Ecosystem)	1769 removed | 83
4. Last articles for Quality Analysis	83

C. Quality Assessment

For quality and quantitative assessment, six questions were used to help in the quality assessment of the SLR. The questions are:

1. Does the study provide a definition of ecosystem or its related terms?
2. Is the study peer-reviewed?
3. Is the study based on research – not merely on specialists' opinions?
4. Is the context of the study adequately described?
5. Were research results adequately explained and described?
6. Does the study contribute to research related to innovation, where business ecosystems are described?

III. DEFINITIONS & DIMENSIONS OF ECOSYSTEMS

In the context of ecosystem research, our systematic literature review has not only provided valuable insights into the various definitions and dimensions of ecosystems in the business setting but has also laid the foundation for future investigations, which may explore barriers to ecosystem adoption, the potential for establishing a culture of innovation collaboration, and a deeper understanding of the components essential for the functionality of ecosystems in diverse organizational contexts.

A. Definitions

Ecosystems, derived from the field of biology, pertain to collections of mutually reliant entities. Complementarities are a necessary condition for their functioning, as they must be present in both the consuming and production domains. Ecosystems inside organizations undergo changes as partners engage, disengage, allocate investments, or redirect their efforts. The promotion of a diversified environment has the potential to provide useful knowledge and facilitate accelerated learning [18].

Business ecosystems refer to "a distinctive organizational form consisting of members co-evolving their capabilities and aligning themselves with a common interest" [13]. In another research, business ecosystem has been defined as a group of actors who are economically connected to each other in order to produce valuable goods and services to customers [22].

The term digital ecosystem has been defined in terms of being a virtual environment that consists of various digital entities such as software applications, hardware, and related processes [12]. Another definition of digital ecosystem focuses

on the interconnectedness of different businesses with shared interest in order to utilize digital technology in order to generate products or services [3].

Digital platform ecosystem refers to the context that facilitates the configuration of a new model based on the ability to combine different processes, technology, actors, and interests in order to create new services or products [6]. Another study operationalizes the concept in terms of its five key characteristics, which include "generativity, convergence, share-ability, modularity, multiplicity and sustainable business model innovation" [11].

Innovation ecosystem pertains to the processes that allow the adaptation needed for sustainable transition and transformation of a particular context [5]. The term has also been defined as the loose connection among different business entities that evolve each other's capabilities based on shared technology, knowledge, or skills [8].

B. Dimensions

The scope of ecosystem research is contingent upon the chosen unit of analysis. There are three broad categories that can be identified: the "business ecosystem," which emphasizes the relationship between enterprises and their surrounding environment; the "innovation ecosystem," which revolves on the concept of innovation and the actors that support it; and the "platform ecosystem," which investigates how players organize themselves in relation to a platform. Our primary focus will be on the examination of innovation ecosystems.

The concept of an ecosystem may be described as a framework that comprises several stakeholders who are crucial for the realization of a value proposition [1]. The aforementioned interconnections exhibit a state of multilateral interdependence, which distinguishes them from conventional economic frameworks.

Ecosystems can be characterized as assemblies of agents that possess multilateral, non-generic complementarities, rather than being governed in a hierarchical manner [10]. The primary area of interest lies in the temporal and causal factors contributing to the emergence of ecosystems.

The concept of business ecosystems centers on the interplay between a company and various external entities, such as other businesses, institutions, and individuals. These interactions have a significant influence on the enterprise itself, as well as its consumers and suppliers [15].

The concept of innovation ecosystems centers around the examination of innovations and its various components and complements. It places particular emphasis on the collaborative efforts of interdependent actors in the creation of customer-facing solutions [2].

Platform ecosystems consist of both organizational and market intermediary platforms. These platforms are characterized by a core platform that is surrounded by peripheral companies. These companies are connected through shared technologies, which facilitate the process of value co-creation [16].

Platform ecosystems exhibit distinct features in the form of intricate inter-organizational connections, resembling commercial networks. These connections facilitate

entrepreneurial endeavors and facilitate transactions across diverse user groups [7]. In essence, ecosystems encompass intricate interdependencies and diverse complementarities, presenting different viewpoints on their functioning, be it in the realms of business, innovation, or platforms.

IV. CONCLUSION AND FUTURE WORK

The purpose of this research is to conduct a Systematic Literature Review (SLR) of ecosystem and its dimensions in order to achieve clarity and precision about the definition of the concept. Through this SLR, core similarities about the different definitions of ecosystem in the business setting can be identified. The results of the SLR suggest that the different terms highlight themes of interconnectedness of different entities and the creation of a new product or services. The results also reaffirmed the existence of different dimensions of ecosystems.

Based on the results that were presented, future research could further examine the barriers in the adoption or success of ecosystems in business setting. Future researchers could also explore the question of whether companies can establish a culture of innovation collaboration that is independent of their core. More detailed information of the components of a well-functioning ecosystem can also be pursued by future researchers.

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