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FROM BUSINESS TO DIGITAL BUSINESS ECOSYSTEMS: EXPLORING DIGITAL LANDSCAPE OF DYNAMIC CAPABILITIES

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Abstract: *Ecosystems' approach to various research streams as an analogy is still actual. In the beginning, it represented the key point to describe the companies' dynamics within their economic environment. However, it was more and more used as an analogy, especially in emphasizing and exploring loosely coupled networks. From this point of view, the arising business ecosystems seem to respond to the need of conceptualizing the collaborative relations across those networks. The evolution of this concept requires continuous review, especially through the lens of technological changes and the fast speed of digitalization. Thus, this paper aimed to explore the evolution from business to digital business ecosystems especially based on the processes view within the digital transformation and the dynamic capabilities' view. To explore the most important research streams in this field there was applied morphological analysis based on literature review that represented an overview of the current trends and provided future insights for ecosystems research.*

Key words: *Business ecosystems, co-creation, digital business ecosystems, digital transformation, innovation, morphological matrix.*

1. INTRODUCTION

The concept of business ecosystems is still widely used within academic and practical field. In the early stages of development of this concept, business ecosystems were seen rather as a complex structure formed in order to deliver innovation as a common objective [1]. According to Moore a business ecosystem comprises a community of actors, dispersed on three main development levels: the core level, extended level and ecosystem level [1], [2]. This type of configuration was explored further to understand how the structural composition evolved. However, within the innovation management studies, an ecosystem point of view was preferred to explore the complexity metrics and modelling opportunities. According to Adner a business ecosystem can be explored from two points of view: structural and affiliation [3]. Based on this approach there were defined a variety of ecosystems' architypes and configurations. Innovation as a valuable resource for ecosystems' participants development requires not only clear alignment to the common objective, but also constant exploration of necessary dynamic capabilities [4]. From this point of view the linkages between dynamic capabilities and innovation development remain not entirely explored.

The continuous development of this concept led to the transition from business ecosystem to the emergence of digital ones [5]. Partially this concept was defined in order to delimitate ecosystems development within digital context [6]. According to the Skilton within this context a variety of technology applications were developed [7], which led to the adoption of platform-based configuration [8] and platform supremacy [9]. Ecosystems which adopted this type of structure are facing different challenges, especially in terms of privacy and trust [7].

The strategic management studies explore deeply the linkage between organizational strategies and highly dynamic environments [10]. From this point of view according to Trunk et al identified the potential of artificial intelligence (AI) usage as a support process in

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decision making. According to the authors systematic review, the processes which are using the power of AI present significant benefits, at the same time it is concentrated on knowledge gathering rather than on its diffusion [10] which is highly encouraged within a business ecosystem. Moreover, the current research is still concentrated on discovering the balance between the benefits and the potential risks of using AI, the clear distinction between automated and human-centered processes and the potential to generate new capabilities from strategic point of view [10].

The transition from business to digital business ecosystems requires not only a strategic thinking, but also to identify and implement digitalization. Up until now within the scientific literature there was highlighted the relevance of open innovation [11]. There was highlighted the strategical benefit of using open innovation by connecting it to the core managerial processes especially in ecosystem's partner scouting [11].

From this point of view, it is essential to understand how digital business ecosystems evolved especially by facing pandemic period. This type of context favorized the fast adoption of technology, along with emergence of new software instruments. Thus, this paper aims to discover and highlight new research streams within digital business ecosystems by integrating business, innovation and digital ecosystems. Also, in order to provide the most essential features, the morphological matrix analysis based on the digital transformation as an integrative context will be applied.

2. RESEARCH METHODOLOGY

The aim of the present research is to identify and highlight the existing research streams within ecosystems field of study. Ecosystems by definition represent highly complex and dynamic structures. As it was stated before, innovation represents an essential key aspect involved into ecosystems development. However, it represented also a reference for comparative analysis of different type of ecosystems within the scientific literature. From this point of view the following assumptions were made:

- Innovation contributes to the business ecosystems' value proposition
- At least two relevant transitions can be traced: from business to digital ecosystems and to digital business ones
- Digital transformation context generates specific dynamic capabilities.

The following step was to identify the most relevant theories and to analyze the bibliographical resources in order to extract the most specific features. Based on literature review there was extracted the most relevant metrics corresponding to different ecosystems by taking into consideration the transition from business to digital ecosystem and from business to digital business ecosystem.

Moreover, to understand the existing research streams, there was adopted morphological analysis methodology and created a research matrix. The main outcome of the matrix was to identify the gap between the existing and potential research streams which can be further explored.

The research matrix was performed on the existing theories by taking into considerations the following criteria: (a) the modified dynamic capabilities framework; (b) practices and key features identified within the scientific literature which responds to the declared assumptions. At last, there were defined the most relevant key features which lead to identifying new research streams and consequently a new framework of analysis.

3. INNOVATION WITHIN BUSINESS ECOSYSTEMS

Business ecosystem concept is still widely used and explored as a multidisciplinary lens. This concept was explored especially through the innovation layer [1], as a highly dynamic environment [2, 12], network interdependencies [13], co-evolution processes [14]. Krome and Pidun brought in front business ecosystem as a complex strategy and suggested that within strategic management discipline business ecosystems can provide valuable insights [15]. Especially interesting is the value proposition feature [15]. The authors made a clear distinction between ecosystem value offers for potential clients and distinguished separately

partners value propositions [15, 16, 17], as it is presented in Table 1.

Table 1

Differences in business ecosystems' value offerings [15]

Features	Clients' value	Partners' value
Strategy type	Diversity of complementors proposition	Attracting new participants
Relations	Trade-off Platform type	Keystone-partner type
Key features	Variety and quality	Control and governance
Mechanism	Value creation	Orchestration value
Result	Differentiates the ecosystem from its competitors; Increases ecosystem dynamics	Competitive architypes Increases collaboration and coopetition Provides new growth opportunities

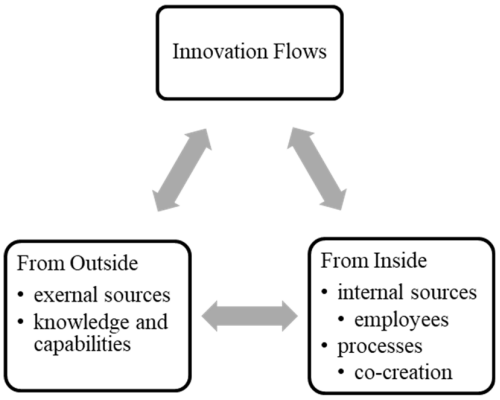

Fig. 1. Open Innovation flows [17], [18].

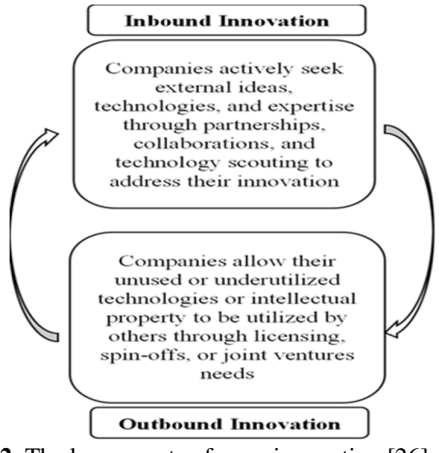

Fig. 2. The key aspects of open innovation [26], [27].

Moreover, by taking into consideration the fact that innovation itself should be the common objective, the business ecosystem building can be viewed from a combination of people, technology, clients' requirements and processes [18]. According to McLaughlin and Caraballo, to achieve ecosystem growth, innovation should be seen as a common strategy and as a complex process integrated into participants development mechanisms [18]. The idea, which was sustained by innovation management researchers, according to this current there should exist two flows of innovation: inside-out and outside-in [19], [20], as it is shown in the Figure 1.

Open innovation is a paradigm that emphasizes the importance of leveraging external knowledge and resources to complement internal capabilities and drive innovation proposed and developed further by Chesbrough [21]. Traditionally, innovation was seen as a closed and internal process, where companies would conduct their research and development in-house, guarding their intellectual property, Figure 2. However, in the modern interconnected world, open innovation recognizes that valuable ideas and technologies can come from various sources, including customers, suppliers, universities, startups, and even competitors [21 - 23]. Open innovation encourages collaboration among different entities to co-create solutions and share risks and rewards ventures' needs [24].

Open innovation and ecosystems are two interconnected concepts that play a crucial role in fostering innovation and collaboration in today's business landscape. Innovation ecosystems and open innovation often go hand in hand. Consequently, the concept of business ecosystem under open innovation umbrella seems to overlap with platform-based ecosystems [25].

4. DIGITAL BUSINESS ECOSYSTEM: CONCEPT AND RESEARCH STREAMS

Digital Business Ecosystem development and evolution as a complex dynamic structure was described by Nachira et al in 2007 [28]. According to the Senyo et al this type of ecosystem emerged as a result of digital innovation development [29].

The late research in the domain revealed that digital business ecosystem is rather seen as a new collaborative environment for digital value co-creation [29, 30]. At the same time platform development is perceived as an essential activity nurtured by digital environment and is characteristic to this type of ecosystems [6], [31].

Moreover, the analogy with biological ecosystem brought in front the capability of a digital ecosystem to adapt, evolve, interact and act as independent subsystem [25]. From this point of view, Subramanian et al framework suggests that in a digital business ecosystem the main accent should be concentrated on created value. According to the authors the provided value can be an extension of a traditional one or newly created through production and consumption subsystems [32] and by linking business with technology subsystems [33].

4.1 From Business to Digital Ecosystems

The use of internet and fast rhythm of technological changes favorized the emergence of digital ecosystem. At the same point it seemed relevant for this transition to use specially designed software architectures [34]. One particularity of this transition is the creation of digital artefacts – entirely digital components of businesses [35].

Table 2.

The transition from business to ecosystem [1], [34-38]

Features	Business Ecosystems	Digital Ecosystems
Strategy type	Innovation at the core	Platform based technologies at the core
Relations	Keystone leader	Platform developer
Key features	Life cycle assessment Orchestration and governance	Control and governance
Mechanism	Value co-creation Orchestration and governance of ecosystem Co-evolution	Orchestration value Digital network creation Co-evolution through algorithms
Result	Network of interconnected actor Innovation collaborative development	Software subsystem and architectures development Specially designed virtual networks Digital artefacts Hubs' creation

Going further, a digital ecosystem can be viewed as a combination of hardware and software subsystems [36] which contribute to the platform creation. Within this transition the theories concentrated rather on finding new hybrid forms of ecosystems, such as software one. The most relevant differences are presented in Table 2.

4.2 Digital Business Ecosystem: processes under the digital transformation influence

Digital transformation is one of the most actual research streams. On-going development of new technologies pushed forward the digital business ecosystem concept development. The first consideration we addressed to is linked to the changes which occurs during in ecosystems formation. As this structure is highly adaptable and complex, business model innovation became a must. According to Karakay the digital transformation process favors this type of innovation as it can generate various new models [39]. Consequently, this approach generated the adoption of platform-based ecosystems and generation of new digital architypes [40, 41].

Moreover, digital transformation requires a complex and long-term approach. According to the Cennamo et al this type of process can affect the overall ecosystem and should imply four major components: developed strategies, organizational processes, governance mechanisms and innovation [42]. From this point of view the starting point is to understand which internal process can be innovated in order to enhance the value generation [42]. The processes under digital transformation context are mainly concentrated in three main groups as is shown in Table 3.

This approach requires understanding how digital context can influence business model innovation [42].

4.3 The dynamic capabilities research stream

The dynamic capabilities framework was developed by Teece to identify and describe the source of organizational competitive advantage [43]. According to [44] this type of capabilities is triggering organizational change and increase the adaptability features. According to this framework, there can be defined three main stages [44, 45]:

Table 3.

Organizational versus ecosystems' processes within digital transformation context [42]

Variable	Internal perspective	Ecosystem perspective
Organizational streams	Value co-creation The use of big data Micro-foundations creation Digital mindset consolidation Exploit existing assets	Value co-generation Digital alignment process Open type governance Redefining roles Multi-sided platform creation
Strategical streams	Creation of digital artefacts Designing digital architypes Configuring for digital transformation Digital strategy formulation	Implementation f a multi-channel management process Business model innovation Aggregated offerings by using network Digital strategy implementation

Table 4.

The operational versus Dynamic capabilities [44]

Variable	Operational Capabilities	Dynamic Capabilities
Focus on	Production and sale of the products In-house perspective Monitoring the internal environment	Strategic and technological opportunities Monitoring the external environment
Requirements	Operational leadership Efficient sourcing Effective marketing	Specific configuration of competencies and assets
Results	Identifying the innovation processes Profit generated by the knowledge	Identifying innovative products and services Profit generated by competencies

- *Identification stage* – according to this stage it is relevant first to formulate the strategy, to identify opportunities and potential threats and to link them to clients' requirements. Also, this stage implies to monitor and detect all relevant changes;
- *Seizing stage* – to create necessary configuration of the resources, assets and competencies with respect to the identified opportunities or threats. Characteristic to this stage are the innovation processes and arising of new systems;
- *Transforming stage* – continuous improvement and reshaping. Usually, it is associated with business model innovation and organizational transformation. From this point of view, it is relevant to acknowledge and to understand the difference between dynamic and operational capabilities, presented in Table 4. However, within the scientific literature there seem to be explored and proposed an additional stage;
- *Integration stage* – reconfiguration of existing operational capabilities [46] and resources [47]. Within the digital transformation context there have been illustrated the arising digital dynamic capabilities which are rather related to platform-based integration and reconfiguration [48].

5. RESEARCH STREAMS MATRIX

In order to create the research matrix, morphological analysis theory was applied. Although it is usually used as a creative method in product development [49] within the current research it was used as a method to systemize the existing theories, to highlight the similarities and to understand how ecosystems theories evolved in time under specific assumptions. The most relevant aspect of the analysis is related to the creation of morphological matrix. As a part of technical creation, it is used mostly for creativity enhancement and to generate technical solutions [49, 50]. However, within the current research this type of matrix was used in order to reveal first of all the existing themes based on literature review. Thus, each type of ecosystem was analyzed through the lens of specific metrics such as: strategy type, adopted relations, generated key features, provided mechanisms and gained results. Next step was to corelate those metrics with the dynamic capabilities' framework stages. Moreover, based on there was identified and extracted the common features of the existing theories and applied exclusion rules.

Table 5.

Traditional and emerging new research streams within ecosystems' field [15-48], [51-52]

		Dynamic capabilities framework			
		Sensing (Common objective)	**Seizing (processes)**	**Transformation (continuous development)**	**Integration (operational capabilities)**
Business Ecosystems	**Strategy type**	Product / services centric	The use of open innovation	Not entirely explored	Not entirely explored
	Relations	Keystone, dominators and niche players	Value co-creation Co-innovation	Not entirely explored	In-house co-creation
	Key features	Interconnectivity	Not entirely explored	Transforming capability	Not entirely explored
	Mechanism	Co-evolution	Governance Value orchestration	Platform development Business model innovation	Outbound innovation In-house platforms development
	Result	Network of interconnected actor Triadic approach	Not entirely explored	Innovation collaborative development	Not entirely explored
Digital Ecosystems	**Strategy type**	Platform based technologies at the core	Not entirely explored	Not entirely explored	Not entirely explored
	Relations	Not entirely explored	Platform leaders' engagement	Not entirely explored	Platform based technologies
	Key features	Not entirely explored	Control and governance	Technology usage	Not entirely explored
	Mechanism	Not entirely explored	Control and governance Orchestration value	Digital network creation	Co-evolution through algorithms
	Result	Technological opportunities Hubs' creation	Software subsystem and architectures development	Specially designed virtual networks	Digital artefacts
Digital Business Ecosystems	**Strategy type**	Strategic and technological opportunities	Not entirely explored	Not entirely explored	Not entirely explored
	Relations	Not entirely explored	The use of big data	Technological discovering	Not entirely explored
	Key features	Digital transformation key aspects	Equilibrium between value and platform	Not entirely explored	Not entirely explored
	Mechanism	Not entirely explored	Regulation of platforms behavior Value co-creation	Implementation of a multi-channel management process Orchestrating digital innovation	Not entirely explored
	Result	Digital strategy implementation	Software subsystem and architectures	Exploit existing assets Digital mindset consolidation Digital leadership	Micro-foundations creation Digital artefacts

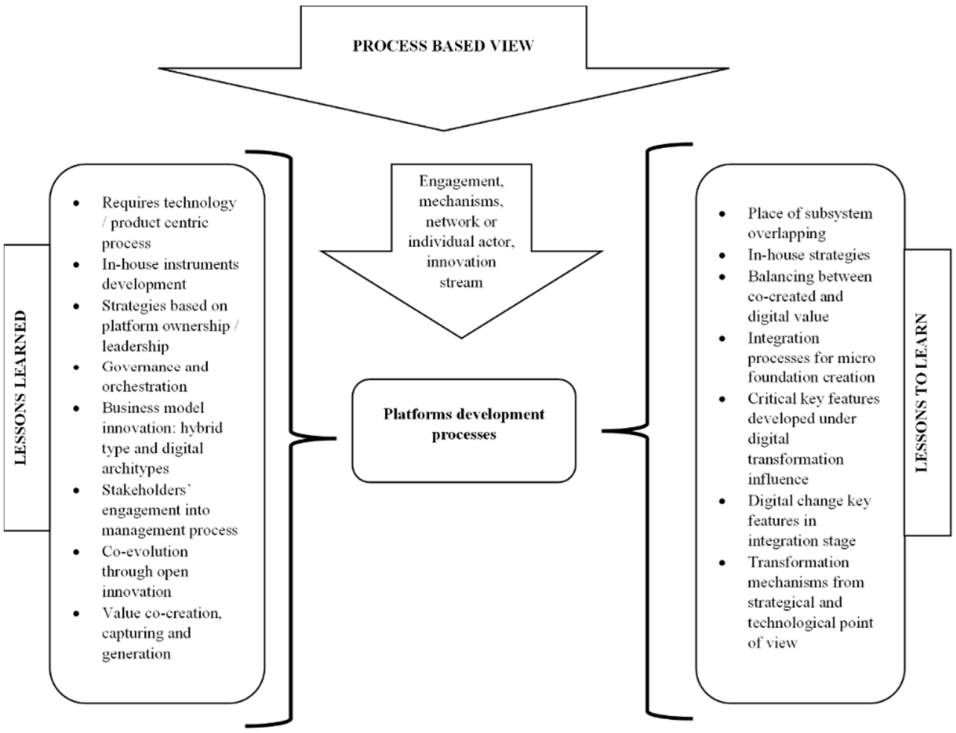

Fig. 3. Key themes and emerging future research streams [12-52]

Thus, in realization of research matrix there were used following restrictions:

- Analyzing theories restricted to the ecosystem level, rather than individual one;
- Theories should be related to the dynamic capabilities' framework stages and corelated for each type of ecosystem separately;

Moreover, it is important to highlight the fact that in realizing this matrix there were taken into consideration process-based theories, as it represents one of the most challenging approaches to building ecosystems theory further. Based on that fact, the next step was to identify the common features which represented the core of research directions framework presented in Figure 3.

6. DISCUSSION AND CONCLUSION

The concept of business ecosystem still represents one of the most challenging in terms of research streams. Defined as a complex system of actors, interconnected and co-evolving around the common strategy, this concept generated in time various research streams.

First wave in the business ecosystems research, was concentrated on defining the structure of such economic entity. At the same time there was explored the strategical relevance especially through actors' roles and collaborative relations. In the same time, there was agreed upon the fact that a business ecosystem should be able to create new niches when it is formed with innovation as a common objective. This view suggested the importance not only of the ecosystem participants, but also the network they are from. Thus, within this current emerged a clear distinction between structure and affiliation of the business ecosystem.

Next wave in the theory building was marked by increasing attention for innovation itself, especially the open innovation. This research flow highlighted the relevance of strategic change through platform development. This fact didn't change the triadic approach for business ecosystem analysis. However, it shifted the attention to other ecosystem, such as digital one, industrial, entrepreneurial ecosystems.

Although the digital ecosystem concept isn't new, it gained an incredible attention especially since the interest for connectivity increased. According to the previous studies, one particularity of this structure is represented by software ecosystem. This research flow generated new insights in the digital ecosystem domain as it brought forward the concepts like digital artefacts, virtual networks, etc. at the same time this flow presented this structure as a composite layer within digital business ecosystem.

From this point of view, the present research aimed to explore how ecosystem concept evolved with respect to the current research interests. Thus, in order to highlight the most relevant and important features, the research was conducted by applying the morphological matrix. The chosen criteria of analysis were extracted based on comparative analysis among those three ecosystems: business, digital and digital business ecosystem, combined with those extracted from dynamic capabilities framework.

The main objective was to identify similar metrics from the current theories within ecosystems field and to explore other potential research streams. Important to notice that digital transformation was presented as limitative context for research and the main interest was concentrated on exploring theories from the process point of view.

The main findings of this research revealed the fact that platform-based ecosystems are preferred especially through the lens of digital transformation. However, if in previous research streams the main interest was concentrated on value co-creation and generation, and orchestration of the ecosystem, within the current research stream processes are more valuable from the integration point of view. Another interesting aspect is that there can be traced a shift from strategical relevance to technological one.

Innovation and the power of collective engagement still remains one important feature which should be analyzed further. Dynamic capabilities framework serves the main objective namely to understand how individual ecosystems' participant can evolve within digital transformation.

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De la ecosisteme de afaceri către ecosisteme digitale de afaceri: explorarea capabilităților dinamice din perspectiva digitală

Abordarea ecosistemelor în diverse direcții de cercetare continuă să fie de actualitate. La început, a reprezentat punctul cheie pentru a descrie dinamica companiilor în mediul lor economic. Cu toate acestea, a fost din ce în ce mai folosit ca o analogie, în special în accentuarea și explorarea rețelelor de afaceri mai puțin închegate. Din acest punct de vedere, ecosistemele de afaceri emergente par să răspundă nevoilor de conceptualizare a relațiilor de colaborare între acele rețele. Evoluția acestui concept necesită o revizuire continuă, mai ales în lumina schimbărilor tehnologice și a vitezei rapide de digitalizare. Astfel, această lucrare își propune să exploreze evoluția de la ecosistemele de afaceri la cele digitale de afaceri, în special pe baza viziunii proceselor de transformare digitală și a capabilităților dinamice. Pentru a explora cele mai importante direcții de cercetare în aceste în domeniul ecosistemelor, a fost realizată o cercetare bibliografică bazată pe metodologia morfologică și care reprezintă o imagine de ansamblu asupra tendințelor actuale și poate oferi perspective viitoare pentru cercetarea ecosistemelor.

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