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Digital entrepreneurship platforms: Mapping the field and looking towards a holistic approach

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ABSTRACT

Entrepreneurship is widely advocated as a driver of innovation and economic growth. Given today's technological and digital challenges, digital entrepreneurship in particular is a phenomenon on the rise, both through the digitization of existing businesses and the creation of digital enterprises.

Debates on the relevance of digital entrepreneurship have been published in a range of journals that vary in terms of their purpose and readership. As such, scholarly contributions to this topic remain largely fragmented. To address this gap, this review aims to map academic literature on digital entrepreneurship in order to facilitate a better understanding of antecedents and future work. This study combines bibliometric approaches to examine literature on digital entrepreneurship platforms, forming a holistic picture of the field's different aspects and trends. The content and thematic analysis of 97 articles allows us to identify five approaches: i) Digital Entrepreneurship Success Factors, ii) Digital Entrepreneurial Ecosystems and Smart Cities, iii) Digital Entrepeneurial Models, iv) Sharing Entrepreneurial Platforms, and v) Digital Platforms about Entrepreneurship Co-creation. Our findings further highlight the various gaps in digital entrepreneurship literature and raise some research questions that warrant future academic research. Our holistic model holds several implications for the theory and practice of the different aspects of digital entrepreneurship.

1. Introduction

It is widely recognised that entrepreneurship is one of the main drivers of economic prosperity [1,2]. It is clear to see that the most diverse industries and markets have been transforming their traditional business models, converting them into new models adapted to digital challenges [3]. This transformation, which simultaneously constitutes a challenge, is essentially due to entrepreneurial actions that enable the use of digital technologies and allow us to assert that we are indeed facing a new revolution: a digital revolution [4].

The process of reorganizing existing platforms and ecosystems could lead to substantial benefits for society as a whole. For example, new products and services offer usefulness for individuals, and updated working models can help achieve public objectives, including the regeneration of urban areas or the development of entrepreneurial solutions.

As this is a relatively recent field of research and it is currently in the process of being developed. Digital entrepreneurship therefore faces 'growing pains' [5]. These manifesting characteristics translate into a dynamic range of terminologies and emerging vocabulary (internet entrepreneurship, cyber entrepreneurship, digital entrepreneurship, among others), making academic research difficult [6,7]. Notwithstanding divergences in vocabulary, there is also a need for researchers to draw on several disciplines – as with the traditional entrepreneurship

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phenomenon – in order to understand digital entrepreneurship, making this phenomenon multidisciplinary [8].

Several authors argue that there is little clarity or consensus on digital entrepreneurship's purpose, nature, and boundaries [9]. Dimov [10] also argues that research does not always synchronize with practice. The existing literature on digital entrepreneurship has proliferated considerably if one looks at the increasing number of studies published each year. However, there have been few attempts to review previous literature on digital entrepreneurship systematically. Only five systematic reviews evaluating previous literature on digital entrepreneurship in this scientific domain have been identified [11]; Zaher et al., 2019; [12–14]. Steininger [11] systematized the literature on the different roles that information technology can take to support business operations and value creation. Zaheer et al. [7] sought to find out, through literature review, how established views of business processes are being overturned in a digital world. Secundo et al. [12] conducted their systematic review looking at the approaches that make up academic digital entrepreneurship. Kimjeon & Davidsson [13] provide a systematization of the influence of climate change mitigation challenges and environmental concerns on the use of various technologies in entrepreneurial activities. Da Fonseca & Campos [14] conducted a systematic review to analyze the interaction between digital entrepreneurship and consumers.

Thus, there is no sufficiently broad and integrative systematic review of the digital entrepreneurship phenomenon. Given this gap in academic literature, our study aims to map the literature on digital entrepreneurship to help us understand where it comes from and where it is going, providing opportunities for future research. In this study, we use bibliometric analysis to explore and identify different approaches to digital entrepreneurship and characterize them with regard to their underlying assumptions, research design, and contributions to the field, subsequently outlining future research trajectories.

This study makes several significant contributions. Firstly, we present a systematic review of the literature on digital entrepreneurship using bibliometric techniques. Our review helps identify what previous literature has examined on digital entrepreneurship and sets the stage for a second wave of research on this topic by synthesizing key knowledge gaps.

Secondly, our review challenges several prevailing theoretical/conceptual assumptions in the field of digital entrepreneurship research, offering new theoretical/conceptual insights that could shape future research on this topic. This review allows us to propose a holistic and integrated model of digital entrepreneurship. Thirdly, we proposed multiple potential directions and set out the roadmap for an informed research agenda.

The structure of the paper is as follows. After the introduction, the short literature review is presented, followed by the methodology and methods, the results, the discussion, and suggestions for future research streams.

2. Theoretical background

Ceccagnoli et al. [15]; p. 263) argued that "*platform technology owners co-create business value with other firms in their platform ecosystems by stimulating complementary invention and exploiting indirect network effects*". A platform's success depends on the engagement of all stakholders when it comes to the creation and capture of value. One key objective of governance mechanisms in digital platforms is to deliver complementor inducements to align with different stakeholders' interests [16–19].

The major themes of platform literature are as follows: network effects and competition dynamics; organization and dynamics in the digital platform environment; platform governance and creation and value in ecosystems; the rise of the sharing economy; the open innovation paradigm; and the entrepreneurial ecosystem.

Network effects were introduced in 1994 by Katz and Shapiro as: "*the value of (a) membership to one user (which) is positively affected when another user joins and enlarges the network*" [20]; p. 94). Network effects can lead to companies "inverting" themselves by changing their production methods from internal processes to external ones. Network effects however cannot develop internally as easily as they can develop externally because customers outnumber staff. The solution here is for clients to create value for other clients but, in order to facilitate and encourage this, they must be rewarded for doing so. Vertical integration is therefore abandoned in favour of open orchestration. Here, platform companies cultivate their own value and simultaneously orchestrate the creation of value by external parties.

Eisenmann et al. [21] identify the three main challenges that platform providers face: pricing, winner-take-all dynamics, and the threat of envelopment. Steininger [11] systematized the literature on the different roles that information technology can take to support business operations and value creation.

Adner [22] p. 42) defines the ecosystem construct as "*the alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize*". Zaheer et al. [7] sought to find out, through a literature review, how established views of business processes are overturned in a digital world. Nambisan and Baron (2019) investigated how interdependencies are driven and pushed by digital technologies, directing firms to create new business models and platform strategies to perform and develop process for new opportunities of value creation.

The development of digital technologies in previous years has heavily influenced the entrepreneurial process. Further investigation is therefore required in order to enable us to understand the dynamics of the digital entrepreneurial ecosystem [23]. Cunningham et al. [24] revealed the importance of new actors, discussing how they attract the attention of researchers when it comes to assessing the value of governance. Dong [25] investigated digital entrepreneurship in a regulatory environment through the longitinal study of digital start up from the Netherlands. Cumming et al. [26] focus on elements such as incubators and venture capital. The growing importance of universities and research centers also plays a central role in many investigations [27]; Link and Sarala, 2019; [28]. The open innovation paradigm increases the engagement of complementors and is closely related to another research theme: the openness of the platform and the degree of freedom researchers can exercise. This includes factors such as system accessibility and the level of autonomy an individual can exercise once they gain access. The decision as to whether or not an open or closed platform should be used can often present difficulties. Not opening enough could mean that third parties are restricted from participation and cannot add value. Being too open, on the other hand, might mean that control over the community could be lost, making it difficult to monetize.

Secundo et al. [12] conducted their systematic review by looking at the approaches that make up academic digital entrepreneurship. Kimjeon and Davidsson [13] went on to provide a systematization of the influence of climate change mitigation challenges and environmental concerns with regards to the use of various technologies in entrepreneurial activities. Da Fonseca and Campos [14] conducted a systematic review to analyze the interaction between digital entrepreneurship and consumers.

3. Methodology

The authors followed the procedures of a systematic review, as described by Kraus et al. [29,30]; to give structure to existing research on digital entrepreneurship. This procedure followed three steps: 1) planning the review, 2) conducting the review, and 3) reporting the review. The results of the final step are presented in Section 3 (Results).

3.1. Planning the review

Following the guidelines of Dabić et al. [31]; the first step to take

when outlining a research field is to select the related articles for inclusion in the analysis. A literature review protocol was developed. This included the study selection criteria. Articles relevant to the study were collected and compiled from the online database Web of ScienceTM Core Collection (WoS), owned by Clarivate Analytics, which includes thousands of active journals and provides a comprehensive view of research outputs worldwide [32]. The data used was collected from the Science Citation Index Expanded (SCI-EXPANDED), Social Sciences Citation Index (SSCI), Arts & Humanities Citation Index (A&HCI), and Emerging Sources Citation Index (ESCI).

Relevant articles were identified. To identify relevant articles, searches were conducted to look for the following phrases in the papers' titles, abstracts, or keywords:

TS = ("digita* entrepreneur*")

Refined by: Document Types: ("Article" Or "Review Article" Or "Early Access") and Web of Science Categories: ("Business Economics" or "Operations Research Management Science" or "Information Science Library Science" or "Computer Science) And Languages: (English).

The authors conducted a search of publication titles, keywords, and abstracts. A. search was conducted on December 1, 2021. It led to 275 research references. In step two, the authors restricted the analysis to articles only. This reduced the number of possible contributions to 220. In step three, the authors narrowed the search even further, focusing only on contributions published in *Business Economics*, *Operations Research Management Science*, *Information Science Library Science*, and *Computer Science*. This reduced the number of research articles to 160. In step four, the authors restricted the search to articles published in English, which reduced the article number to 155. In stage five, to further restrict the search pool to only higher quality articles, only journals with 2 or more stars were selected, as listed in the CASBS (Chartered Association of Business Schools) ranking. This reduced the number of relevant articles to 97. In the sixth step, the authors analyzed the titles, keywords, and abstracts of the remaining articles to exclude those that were not relevant to achieving the research objective. The final set comprised 83 articles that proved suitable for structuring research in digital entrepreneurship. Fig. 1 summarizes the various steps performed to select the relevant contributions.

The articles included were written by 593 authors (641 author participations). Of these, 22 articles were published by a single author, and 571 articles were published as part of a co-authorship.

3.2. Methods

This literature review was based on quantitative technique bibliometrics (e.g., [33], i.e., following workflow guidelines for scientific research mapping using bibliometric methods. Bibliometric analysis is a methodology used on a global scale to evaluate the research conducted [34]. This approach comprises the application of quantitative and statistical analysis to publications, including articles and their citations, and is employed to evaluate research performance as it provides data on all activities in the scientific domain. Summaries of this data provide a

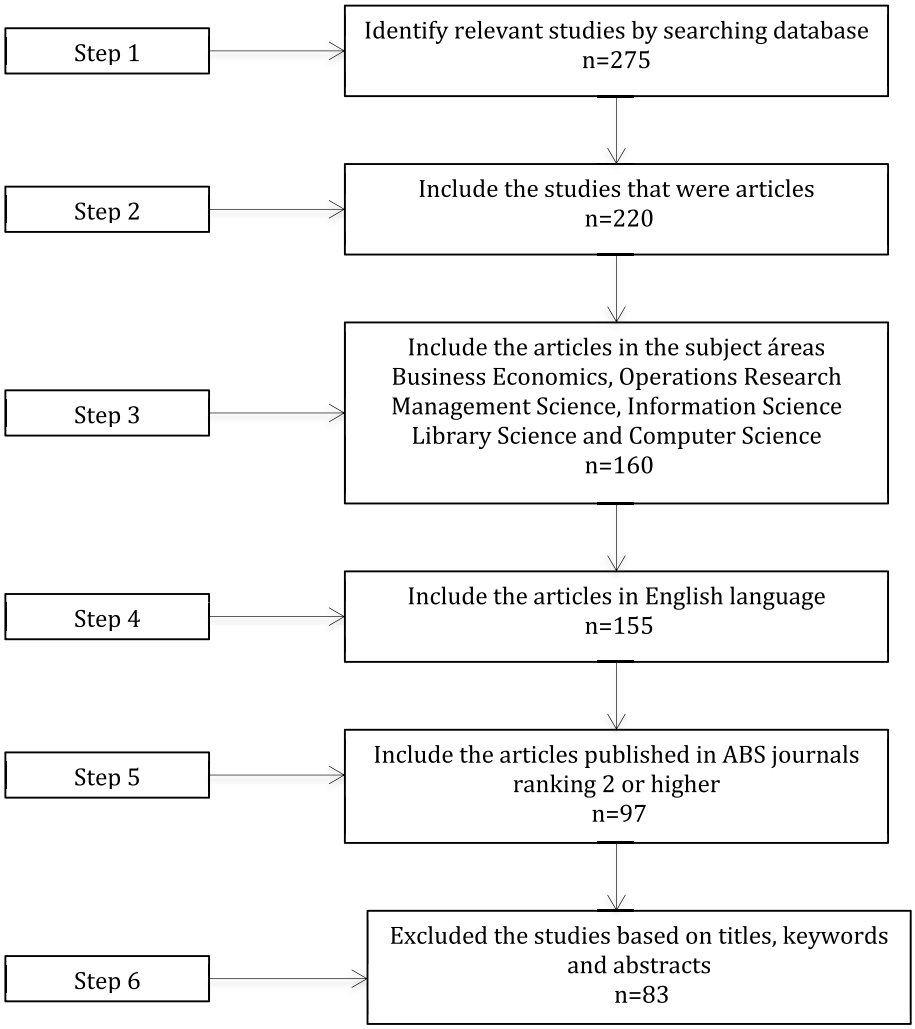

Fig. 1. The data selection process.

broad perspective on research activities and areas of impact [35–37].

Although co-citation analysis has occupied a pervading position in bibliometric analysis, there has recently been a resurgence in the use of bibliographic coupling as opposed to this historical preference for co-citation analysis [38], allowing even the most recent publications to be included when assessing potential patterns and trends among publications [39]. The more articles cited together, the more likely those publications cover the same research topic [39]. To understand the evolution of digital entrepreneurship in more depth, we applied qualitative coding and thematic analysis to our sample (n = 83). To connect the bibliographic coupling analysis and content analysis for theme can uniquely identify a cluster very robustly, a keyword and co-occurrence word analysis was done to arrive at these clusters through a more objective lens. Co-occurrence word analysis links two articles that cite the same articles. The more papers they share, the more likely these two publications cover the same research topic. If a set of articles shares keywords, it is a likely sign that the same or similar ideas are covered in these articles. More generally, these articles are expected to depict central topics and intellectual structures of an area of knowledge.

Network theory was used to graphically map the bibliographic coupling analysis. The clusters were determined using methodologies adopted by Waltman, van Eck, and Noyons [40]. To perform all calculations, we used Microsoft Excel 2010 (Microsoft Corporation, Washington, USA), VOSviewer version 1.6.14 [41], and Bibliometrix [42] software.

4. Results

The results section is structured as follows. Firstly, the characterization of the sample of articles that make up this investigation is presented. To this end, the analysis provides the chronological evolution of both the number of published articles and the articles with the highest number of citations. Next, the bibliographic coupling analysis results present the conceptual structure of the articles included in this study, allowing for the establishment of dominant themes.

4.1. Sample characterization

Fig. 2 summarizes the evolution of both the number of articles and the number of citations in digital entrepreneurship research. The average year of publication was 2019. The growing interest in research on digital entrepreneurship began to develop over the last decade, with particular progress evident after 2017.

Fig. 2 shows that, since 2020, this topic has gained considerable momentum. 65% of all articles published on this topic were published within this time period (22.9% in 2020 and 42.1% in 2021). In terms of the number of citations, the articles involved in this study cited an average of 22.2 times for a total of 1846 citations (see Table 1).

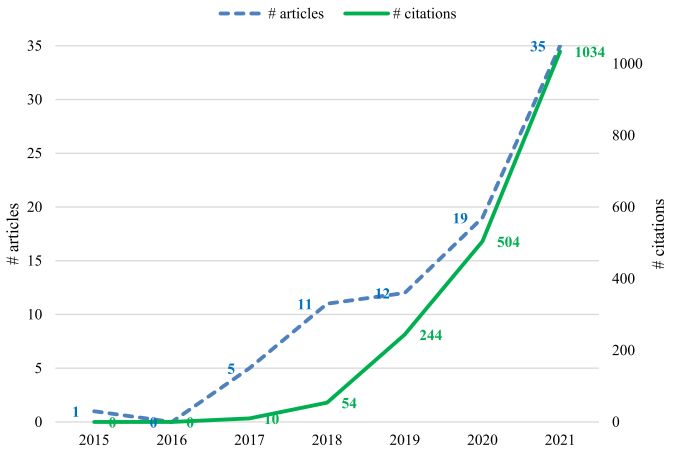

Fig. 2. Number of articles published and citations by year.

Table 2 shows the ten articles with the highest number of citations. Four of the most cited articles were published in 2017, and two were published in 2020. The articles with the highest number of citations were by Nambisan [43] (376 citations), Sussan & Acs [44] (136 citations), Li et al. [45] (132 citations), and Dy et al. [46] (99 citations).

The articles were also organized based on the countries of affiliation in which the different digital entrepreneurship topics were studied (Table 3). Italy came first (21 articles), followed by the USA (19 articles), England (17 articles) and Germany (16 articles) as the most active countries (in terms of their number of articles) (see Table 4).

4.2. Bibliometric analysis

4.2.1. Bibliographic coupling analysis

The initial sample of 83 articles, containing 4877 cited references, was reduced to 73 articles with at least more than one reference in common. Based on the bibliographic coupling matrix, the common reference matrix between the 73 publications was determined to establish a network of connections between the articles and the cluster.

Fig. 3 presents the network of articles obtained from the common reference matrix data and the respective clustering of publications determined through cluster analysis (Table 3).

The cluster analysis revealed five sets of articles [46,50–55]. Their thematic analysis allowed us to assess considerable differences in their issues, while some links between clusters were identified. Given the content of the articles, the differentiated clusters are as follows: (1) Digital Entrepreneurship Success Factors; (2) Digital Entrepreneurship Ecosystems and Smart Cities; (3) Digital Entrepreneurship Models; (4) Sharing Digital Entrepreneurship; and (5) Digital Entrepreneurship Co-creation.

4.3. Digital entrepreneurship: thematic groups

4.3.1. Digital Entrepreneurship Sucess Factors (cluster 1, n = 26)

Berger et al. [56] argue that digitalization is currently the most important force in entrepreneurship and innovation. The uncertainty inherent in business processes and results is thus transformed by digital technologies [8,43,57–59]. In this regard, Vassilakopoulou et al. [60] developed a model that traces the dynamics between uncertainty, tactics, enablement, and novelty.

This has two implications: there are fewer limited entrepreneurial processes and outcomes and less of a predefined locus of entrepreneurial agency. In this sense, von Briel et al. [61] and Lehmann and Recker [62] argue that digital businesses are formed around ideas that have digital artifacts at their core. These authors have developed a theory that explains how the composition of these digital artifacts influences venture creation processes. With regards to digital venture creation, Fossen et al. [63] concluded that highly skilled employees and those working in ICT and facing destructive digitization processes are more likely to become digital entrepreneurs. However, digital entrepreneurship does not seem

Table 1
Summary of articles resulting from the searches.

Description	Results
Documents	83
Sources (Journals, Books, etc.)	35
Keywords Plus (ID)	330
Authors' Keywords (DE)	355
Period	2015–2021
Average citations per documents	22.2
Authors	236
Author Appearances	264
Authors of single-authored documents	7
Authors of multi-authored documents	229
Single-authored documents	8
Authors per document	2.9

Table 2
Top publications in the Digital Entrepreneurship field.

Article	# Citations
Nambisan [43]	376
Sussan & Acs [44]	136
Li et al. [45]	132
Dy et al. [46]	99
Ghezzi & Cavallo [47]	86
Richter et al. [48]	82
Elia et al. (2020)	70
Srinivasan & Venkatraman [49]	57
Zaheer et al. [7]	34
Steininger [11]	36

Table 3
List of countries with the highest number of articles in the digital entrepreneurship field.

Countries	# Articles
Italy	21
USA	19
England	17
Germany	16
Australia	14
France	11
People's Republic of China	8
Sweden	8
Netherlands	7
Denmark	6

to be a viable option for less skilled individuals. Ammirato et al. [64] sought to classify the different profiles of digital entrepreneurs. They concluded that there are three distinct types of digital entrepreneurs: 'very young emerging', 'focused emerging', and 'experienced in business'.

For Cavallo et al. [65]; digital entrepreneurship essentially depends on external funding sources for the promotion of growth. For these authors, funding positively affects the growth of new digital companies. Schueckes et al. [66]; on the other hand, argue that digital entrepreneurship is dependent on internal funding sources in the early stages, such as the entrepreneur's own degree of investment. Sansone et al. [67] demonstrate that the growth of new digital start-ups is associated with the fact that they belong to social incubators and do not have profit as their sole objective. Wang [68] argues that companies with higher degrees of entrepreneurial orientation leverage dynamic marketing capabilities more effectively and thus perform better. For Upadhyay et al. [69]; artificial intelligence is an essential factor in the performance of companies. However, the adoption of this digital process by companies depends on factors such as: performance expectations, openness, social influence, hedonic motivations, and regeneration.

For Nambisan et al. [70]; entrepreneurial ecosystems play a key role in the growth of companies. From their perspective, digital ecosystems require entrepreneurs to fulfill two roles simultaneously: be a member of the ecosystem and a leader of a new company.

If it is essential to see the factors that give rise to the success of digital entrepreneurship, it is no less essential to know the causes of its failure. Several authors argue that exposure to digital media and the absence of high levels of sociocultural propensity for digital entrepreneurship are both potentiators of mortality for these types of companies. Oppositional situations drive success for digital companies [71–73].

4.3.2. Digital Entrepreneurial Ecosystems and Smart Cities (cluster 2, n = 16)

Jacobides et al. [74] p.2264) defines digital ecosystems as "*interacting organizations that are digitally connected and enabled by modularity, and are not managed by a hierarchical authority*".

Mason and Brown [75]; p. 13) state that entrepreneurial ecosystems emerge in "*places that already have an established and highly regarded knowledge base which employs significant numbers of scientists and engineers*", arguing that technology disruption creates new opportunities. The success of entrepreneurship is intrinsically linked to the movements of other entrepreneurs and is coordinated within and across digital platforms [49,76–78]. For Butler et al. (2020), it is critical to understand how entrepreneurs support digital platforms through their options when it comes to connecting to them, such as through social media. For Sanasi et al. [79]; the emergence of a sharing revolution leads to a new social collaboration system enabled by digital technologies. This is important to the study of digital entrepreneurial ecosystems [80–83]. Sussan and Acs [44] argue that integrating the digital ecosystem and the entrepreneurial ecosystem help us better understand the interactions of agents and users, incorporating insights into individual and social consumer behavior. Today's digital technologies have a significant impact on how new business ventures are imagined and created. The emerging technology paradigm leverages the potential of collaboration and collective

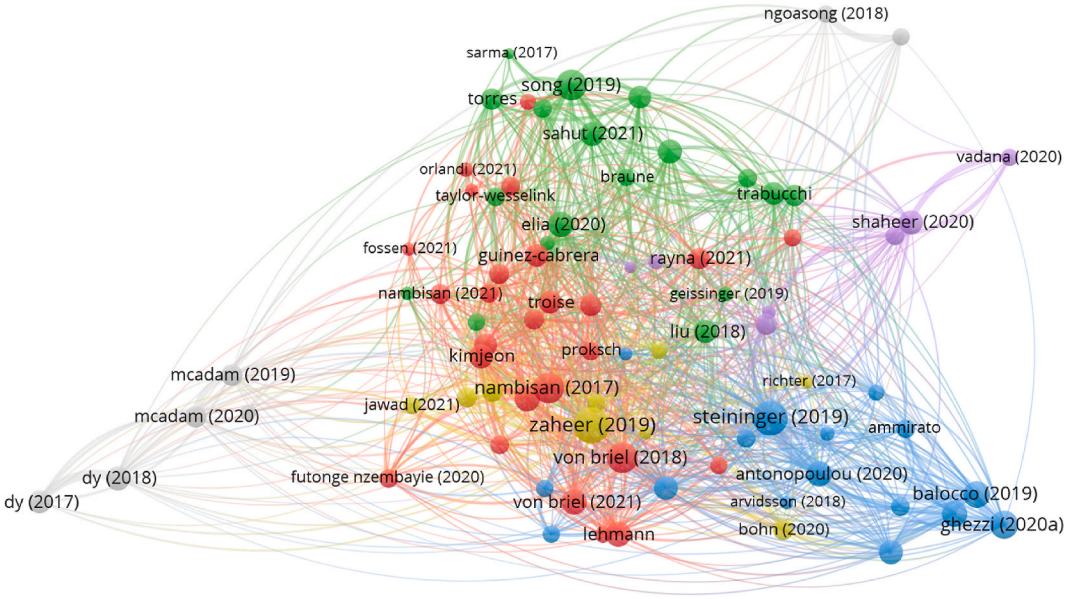

Fig. 3. Bibliographic coupling network and its clusters.

intelligence when it comes to designing and launching more robust and sustainable business initiatives. Gianluca et al. [84] created a definition of a digital entrepreneurial ecosystem, which included four dimensions associated with digital actors (who), digital activities (what), digital motivations (why), and digital organization (how). Beliaeva et al. [85] argue that the innovation ecosystem is crucial in shaping digital entrepreneurship.

Sarma and Sunny [86] bring us the concept of the smart city. It can be said that 'smart cities' are a pre-paradigmatic domain; that is, one in which the absence of a dominant model leads to several non-aligned models. For Saram and Sunny [86]; economic growth and social development are the smart city's goal, and thus public policies are of particular interest. For Sahut et al. [87]; it is fundamental for us to understand the circumstances and reasons that facilitate digital entrepreneurship, as well as the public policies that aim to support it. In this sense, Geissinger et al. [88] showed us that a city's economic and technological diversity can provide the necessary conditions for institutional change to occur.

4.3.3. Digital Entrepeneurial Models (cluster 3, n = 15)

Li et al. [45] and Jafari-Sadeghi et al. [89] showed us that, despite the difficulties inherent in most SMEs (such as limited and inadequate resources), problems have been the impetus for digital transformation, enabling them to achieve a competitive advantage. Arvidsson and Monsted [90] show that organizations that fail to innovate are disrupted by those that do. Digital technology makes corporate entrepreneurship increasingly powerful and fruitful. In the same vein, several authors argue that digital startups often undergo innovations in their value architecture and business models [91,92].

A set of pragmatic methods based on lean and agile principles can support digital entrepreneurs facing business model innovation [47] [25,93–95]. Balocco et al. [96] show how business model change is a process that often involves new ventures, especially in dynamic environments, such as the digital industry. Copying them is a key tactic for entrepreneurs trying to shorten the transition to current and new business models and avoid revenue losses. Thus, according to Gupta and Bose (2019), pioneering digital companies usually rely on new business models that differentiate them from their competitors. The authors find that searching for the right business model is a constant challenge for entrepreneurs.

Thus, Standing and Mattsson [97] argue that the digital business model spans the disciplines of information systems, marketing, and entrepreneurship. These authors believe that it is essential to know how entrepreneurs identify business opportunities and convert them into their business model. Within business models, established cooperation are of extreme importance. Du et al. [98] studied the importance of digital ecosystems and argue that crowdsourcing intermediaries are driving a new force of digital entrepreneurs, creating online service markets where service providers seek to establish contacts with customers worldwide.

4.3.4. Sharing digital entrepreneurial platforms (cluster 4, n = 9)

Entrepreneurship is an important part of the economic landscape. Digital entrepreneurship in particular has changed the way business creation can be done (Bohn et al., 2021; [99,100]. Digital entrepreneurs are usually presented as young, urban, well-educated individuals working on innovative projects.

In sharp contrast to this view, Delacroix et al. [101] identify digital subsistence entrepreneurs as a new type of entrepreneur recently emerging in developed countries. For the authors, sales activities in Facebook groups can help us to understand the profiles of digital entrepreneurs. More and more people are sharing and exchanging information, knowledge, data, and goods. In this way, the 'sharing economy' assumes more and more importance [48].

Abubakre et al. [102] and Zhao et al. [103] found that IT culture is a key predictor when it comes to achieving digital entrepreneurship success. The authors also found that an IT entrepreneur's innovation ability and their experience in IT projects positively affect the relationship between IT culture and digital entrepreneurship success.

4.3.5. Digital paltforms about entrepreneurship co-creation (cluster 5, n = 7)

Digital entrepreneurs face the commitment to novelty, just like any other entrepreneur. However, this commitment to novelty manifests itself differently: it is mediated by an artifact - digital platforms [104]; Absan et al., 2021).

For Shaheer et al. [105] and Vadana et al. [106]; the speed of internationalization of digital innovations, is subject to cultural, administrative, geographic, and economic distances, which may act as barriers to user adoption, ultimately preventing the internationalization of these applications. However, this ceases to be a barrier if digital entrepreneurs involve users in the co-creation of value [14].

For Chan et al. [107]; given the nature of crowdfunding environments (intrinsically motivated stakeholders) and reward-based structures, a potential crowding out effect exists, whereby a higher level of cash salience leads to decreased funding contributions and commitment. Thus Schiavone et al. [108] draw attention to the fundamental role that the user plays in digital entrepreneurship.

4.3.6. Keyword and Co-word analysis

Fig. 4 shows the frequently occurring words in the author keywords of the articles studied, indicating a thematic focus in these works. The most popular keywords of the selected papers are "business model"; "digital innovation", "digital platforms" and "digital technologies"; "ecosystem" or "entrepreneurial ecosystem"; "startup"; "co-creation"; "smart cities", "entrepreneurial orientation" and "sharing economy".

To deepen the analysis further, the authors created a network diagram using co-occurring words of the keywords used in the articles studied. Keywords were used with at least two co-occurrences. Using cluster analysis, six clusters were determined, revealing closely associated keywords. Each cluster was given a unique color to demonstrate the themes contained by the co-occurring words. Fig. 5, shows this network of keywords obtained based on the data from the co-occurrence matrix of keywords. The network diagram highlights the co-occurring clusters of the keywords, suggesting six thematic clusters. Based on the analysis of the network diagram and an interpretation of each cluster and its structure, the previous five thematic areas could be determined: (1) Digital Entrepreneurship Sucess Factors (Dynamic capabilities, entrepreneurial orientation, entrepreneurial opportunity); (2) Digital Entrepreneurial Ecosystems and Smart Cities; (3) Digital Business Models; (4) Sharing Economy; and (5) Co-creation. These results reinforce the clusters previously determined in the bibliographic coupling analysis, showing the reliability and validity of these clusters (see Fig. 6).

5. Discussion

The bibliometric methods applied in our research allow us to discover the relational nature of knowledge creation in digital entrepreneurship. We reveal that many trends and patterns in digital entrepreneurship have emerged from our systematic review. One characteristic of digital entrepreneurship research is its multidisciplinary nature, spanning multiple disciplinary boundaries. Therefore, it is no surprise that the research field is somewhat heterogeneous, with multiple lines of inquiry each with distinct characteristics and trajectories.

We have examined the organizational structure of digital entrepreneurship research and it is encouraging that we have been able to identify research streams that could potentially fill each domain of its intellectual structure. The field of digital entrepreneurship generally reveals that significant progress has been made in a short period of time, and an impressive portfolio of contributions have been developed at various levels of analysis. At the same time, it is clear that, while some

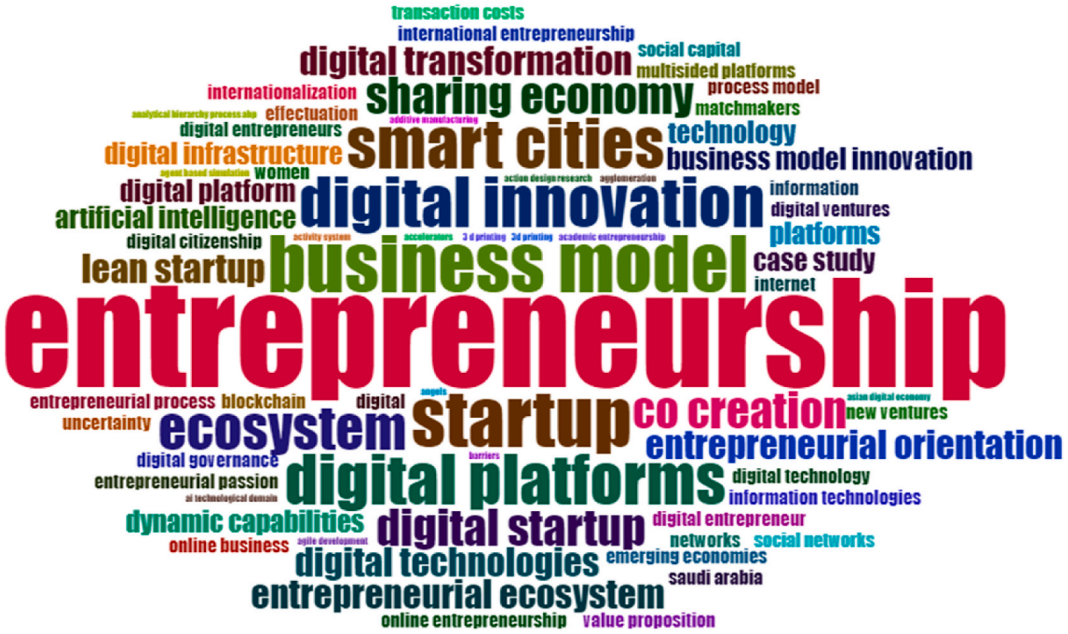

Fig. 4. Word cloud of the authors keywords.

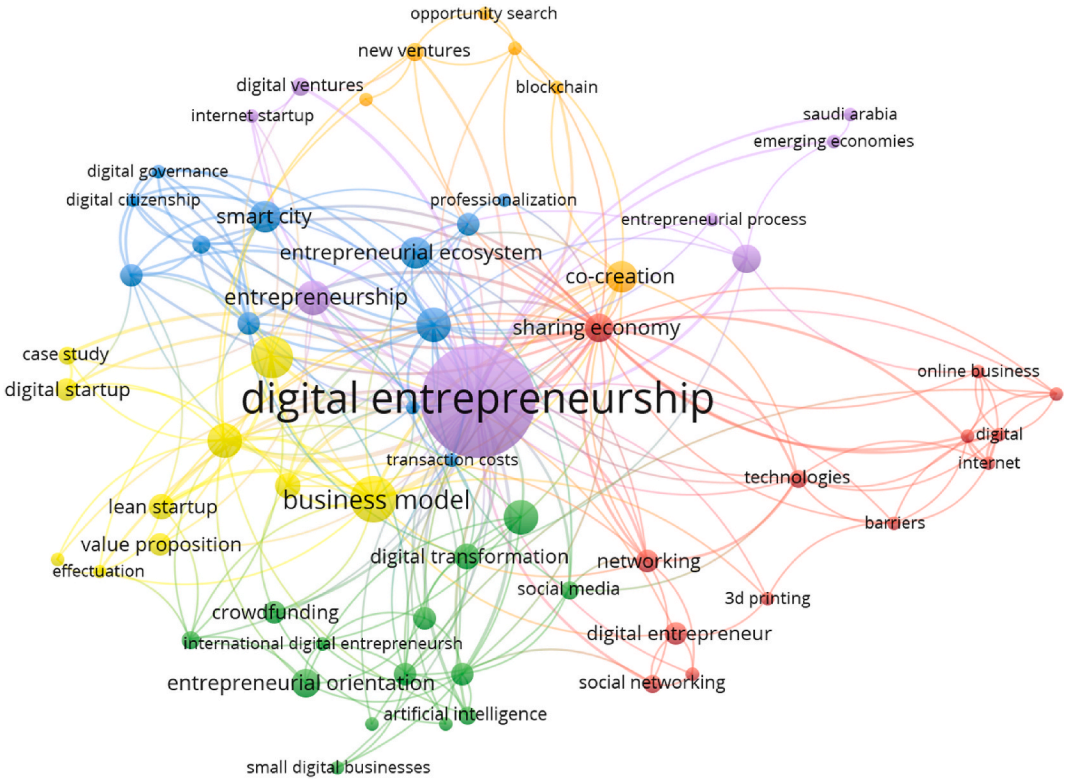

Fig. 5. Co-occurrence word network and its clusters.

areas have been intensively researched, there is still a way to go.

Fig. 4 shows the digital entrepreneurship framework. This figure intends to present a holistic model to enable us to understand the five fundamental approaches to digital entrepreneurship.

5.1. Future research agenda

For future researchers, we offer some recommendations that cover the entire field of digital entrepreneurship research. To this end, we position our proposals at the level of the specific subfields identified.

5.1.1. Need for research at the digital entrepreneurship success factor level

Digital entrepreneurial ecosystems might be intensified and impacted by the legitimation effects of their platforms. The legitimation processes ensue when an entrepreneurial ecosystem evolves. The entrepreneurial ecosystem might be subject to legitimation procedures and functions, thus gaining legitimacy of its own. Future research should ask: What are the main factors influencing digital entrepreneurship

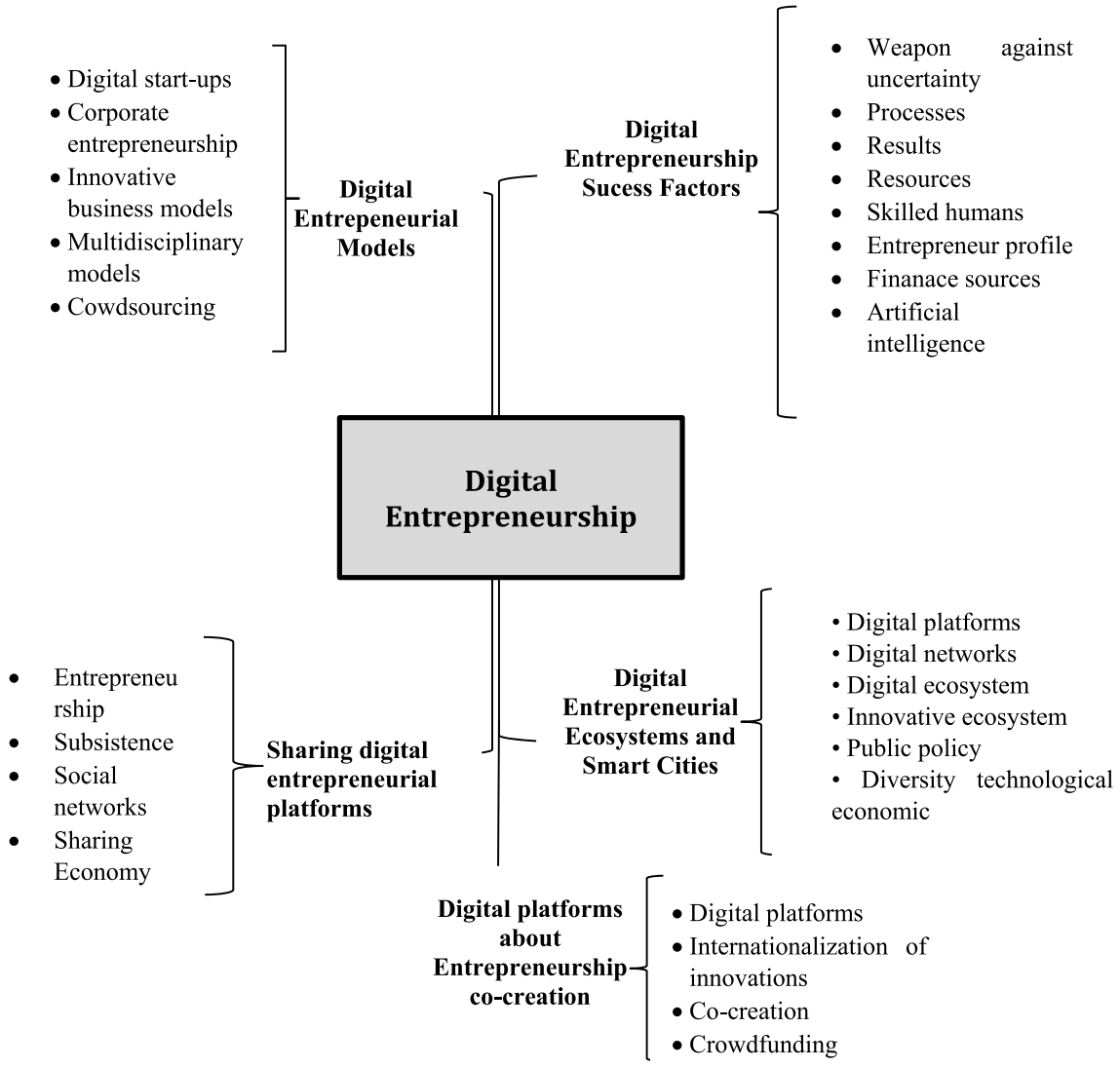

Fig. 6. Digital entrepreneurship framework.

ecosystems?; and What are the weights of the factors influencing the implementation of an effective digital ecosystem? Future investigations should consider the heterogeneous nature of different types of financing, establishing whether the innovative performance of new firms affects the relationship between financing and firm growth.

Future studies could also assess external factors, such as economic and technological determinants that may influence the growth of digital start-ups. Given that the two roles that the entrepreneur has to play in digital ecosystems (ecosystem member and leader of a new company) are prone to conflict, it is crucial that, in future research, mediating factors that prevent the conflicted relationship between these two roles (e.g., stress and higher or lower levels of commitment) are studied. Considering the role of social incubators, future research should analyze the taxonomy and definition of social incubators in different countries (developed and developing). Future research should study the suitability of opportunities and entrepreneurs. New lines should be opened up to enable us to better understand the distinguishing characteristics of digital entrepreneurship, in contrast with 'traditional' entrepreneurship practices. Future research could focus on recruitment and training on the development of dynamic marketing capabilities and entrepreneurial orientation. A longitudinal study that gathers more information on how firms sustain competitive advantage over time through dynamic marketing capabilities would also be interesting.

Future research should focus on identifying other country-level variables that may act as proxies for technological and human digital infrastructures. Researchers should also study how entrepreneurial persistence may be driven by other factors, such as the effect of online market-specific factors, like negative customer reviews and conflict between entrepreneurs and platforms.

5.1.2. Need for research on digital entrepreneurial ecosystems and smart cities

Future research should study the differences between risk takers and opportunity takers, among other psychological characteristics in digital or other media. The analysis of the in-depth digital skills necessary for individuals to prepare for different types of digital markets is also critical. Many important digital platforms and ecosystems are used globally. Researchers should therefore also ask how regulatory apparatus, which

still examine these dynamics based on individual countries' needs, should be modified?

Further research should be devoted to the study of: i) how digital technologies can improve the performance of the entrepreneurship process in technological terms, including factors such as time to market, idea robustness, product innovation, customer loyalty, and scale of results; ii) how collective intelligence (principles and tools) impacts the design, development, and launch of the new venture; iii) how the business model impacts actors who decide to associate with and participate in a digital entrepreneurial ecosystem; and iv) how to develop new theories on technology entrepreneurship strategies and processes trough the adoption of a digital economy and a sharing perspective platform.

Further studies should identify new innovation ecosystems and identify actors that could shape digital entrepreneurship. Future research could also study other countries' contexts - for example, developed vs. emerging economies - to identify a country's effect in shaping innovation ecosystems and digital entrepreneurship.

Future researchers could also address the influence of the business life cycle and how entrepreneurs plan and implement their strategies to move from lower to higher levels of digitization.

Future research may also identify the role of innovation ecosystem actors during different stages of the firm's life cycle, establishing how firms evolve in their relationships throughout their development.

Future research is vital to entrepreneurship in the digital economy when it comes to including literature from other knowledge field. With reference to political science, academic literature provides the knowledge needed to understand the shades of digital governance, digital citizenship, and the relevance of these two factors in the world of digital ecosystems. Literature on information management systems explains how a system of technologies and digital infrastructures can serve as a germination bed for digital entrepreneurs. Economics and industrial organizations can help us to understand how the digital ecosystem unfolds into digital platforms and multifaceted markets.

5.1.3. Need for research on digital entrepeneurial models

Future research should explore different types of startups, such as non-digital, funded and unfunded, and those owned in other countries. The specifics of the types of transition process for each type of startup should also be studied. Future research could also investigate the creation of value and competitive advantage, according to the different options of the startups.

Future research should study the (institutional) characteristics of the regions in which digital entrepreneurial ecosystems are formed. Deeper investigation of supporting factors for successful digital entrepreneurial models, elements of synergisitc coupling in the digital platforms, case studies, and limitations should be further investigated.

Studying technology ambidextrously can open new avenues for research on the relationship between knowledge ambidextrousity and technological ambidextrousity. This correlation can help practitioners in their efforts to exploit technologies and different knowledge sources in order to overcome the strategic and operational challenges associated with digital transformation.

Future research could examine the specific impact of strategic learning on the business environment that affects business model transformation for successful digital entrepreneurship.

A deeper investigation of supporting factors for successful digital entrepreneurial models, elements of synergistic coupling in the digital platforms, case studies, boundaries, and regulations are necessary.

5.1.4. Need for research on sharing digital entrepreneurial platforms

Future research should include other perspectives (e.g., customers) to facilitate a more balanced understanding of the sharing economy.

More quantitative research is required to comprehend the sharing of the digital entrepreneurial platform and the role of interplay between technological architecture and governance tools and mechanisms in inducing platform organizations to produce diverse levels of complementary engagement. Researchers should consider how the relative power of orchestrators could be assessed.

The link between the sharing economy and entrepreneurship needs more attention and development for us to better understand the various options that the sharing economy can offer for start-ups in this area.

Products that are shared need to be studied more closely, and the sharing economy is not only limited to physical goods as it also offers huge potential for services. Therefore, further research could contribute to developing our framework and to facilitating a deeper understanding of the sharing economy concept and its configuration.

Finally, further research should also include cultural variables, investigating the development of the various sharing economy approaches over time. In media companies, it is essential to look at the development of sharing economy companies over several years, in order to investigate the factors behind their long-term success.

5.1.5. Need for research on digital paltforms about entrepreneurship co-creation

Future research should explore the exact mechanisms behind the impact of geographic distance in cyberspace. There is substantial variation among start-ups when it comes to pursuing different demand strategies. As such, an understanding of entrepreneurial opportunity recognition in digital contexts is needed. Researchers should consider who the right ecosystem participants are, and what they have to offer. Further research could develop more advanced theories to evaluate different methods.

Future studies will also afford us the opportunity to investigate the effect of culture on fundraising success through the global expansion of existing platforms.

More research is needed to analyze the formalized frameworks with which platform and digital ecosystem players' abuse their positions, rather than take advantage of entrepreneurial opportunities.

Platform businesses force and drive us to think differently, diverting and turning our mindset into one that encourages us to try new things and fail before we succeed. These businesses also enrich our teams' digital IQs and challenge their thinking. The main problem here is instigating cultural shifts, as this requires ongoing stakeholder communication and the fostering of experimentation.

Future researchers should devise new models to integrate insights from academic literature on the cognitive styles and attitudes evident throughout the entrepreneurial process. Thus, future research should examine the additional characteristics of the crowdfundi

ng platforms that are most likely to benefit from the spatial, temporal, and structural effects of crowdfunding.

Future research should also study both digital and non-digital ecosystems in an attempt to help examine these contexts.

In Table 5, we present a synthesis of future lines of investigation.

6. Conclusions

Digital ecosystems tend to redefine what we believe public and private sectors of interest, thus designing new forms of 'invisible infrastructure' to encourage emerging entrepreneurs to set up their

Table 4
Clusters of bibliographic coupling.

Authors	Clusters
[8,12,13,43,56–73,109–112]	Cluster 1 (N = 26) Digital Entrepreneurship Sucess Factors
[44,49,76–79,81–83,85–88, 113,114,115]	Cluster 2 (N = 16) Digital Entrepreneurial Ecosystems and Smart Cities
[11,25,45,72,89–98,116];	Cluster 3 (N = 15) Digital Entrepeneurial Models
[7,48,99–103,117,118]	Cluster 4 (N = 9) Sharing Digital Entrepreneurial
[14,104–108,119]	Cluster 5 (N = 7) Digital Entrepreneurship Co-creation

Table 5
Synthesis of future lines of investigation.

Clusters	Future Lines Research
Digital entrepreneurship success factor level	• Future research should ask: What are the main factors influencing digital entrepreneurship ecosystems?; and What are the weights of the factors influencing the implementation of an effective digital ecosystem? • Future investigations should consider the heterogeneous nature of different types of financing. • Future studies could also assess external factors, such as economic and technological determinants, that may influence the growth of digital start-ups. • Considering the role of social incubators, future research should analyze the taxonomy and definition of social incubators in different countries (developed and developing). • Future research should study the suitability of opportunities and entrepreneurs. • Future research could focus on recruitment and training to develop dynamic marketing capabilities and entrepreneurial orientation. • Future research should identify other country-level variables that may act as proxies for technological and human digital infrastructures.
Digital entrepreneurial ecosystems and smart cities	• Future research should study the differences between risk takers and opportunity takers, among other psychological characteristics in digital or other media. • Further studies should identify new innovation ecosystems and identify actors that could shape digital entrepreneurship. • Future research could also study other countries' contexts - for example, developed vs. emerging economies - to identify a country's effect in shaping innovation ecosystems and digital entrepreneurship. • Future researchers could also address the influence of the business life cycle and how entrepreneurs plan and implement their strategies to move from lower to higher levels of digitization. • Future research may also identify the role of innovation ecosystem actors during different stages of the firm's life cycle, establishing how firms evolve in their relationships throughout their development.
Digital entrepeneurial models	• Future research should explore different types of startups, such as non-digital, funded and unfunded, and those owned in other countries. • Future research should study the (institutional) characteristics of the regions in which digital entrepreneurial ecosystems are formed. • Studying technology ambidextrously can open new avenues for research on the relationship between knowledge ambidextrousity and technological ambidextrousity. • Future research could examine the specific impact of strategic learning on the business environment that affects business model transformation for successful digital entrepreneurship.
Sharing digital entrepreneurial platforms	• Future research should include other perspectives (e.g., customers) to facilitate a more balanced understanding of the sharing economy. • Researchers should consider how the relative power of orchestrators could be assessed. • The link between the sharing economy and entrepreneurship needs more attention and development for us to understand better the various options that the sharing economy can offer for start-ups in this area.
Digital paltforms about entrepreneurship co-creation	• Further research should also include cultural variables, investigating the development of the various sharing economy approaches over time. • Future research should explore the exact mechanisms behind the impact of geographic distance in cyberspace. • Researchers should consider who the right ecosystem participants are, and what they offer. Further research could develop more advanced theories to evaluate different methods. • Future studies will also allow us to investigate the effect of culture on fundraising success through the global expansion of existing platforms. • More research is needed to analyze the formalized frameworks with which platform and digital ecosystem players' abuse their positions, rather than take advantage of entrepreneurial opportunities. • Future researchers should devise new models to integrate insights from academic literature on the cognitive styles and attitudes evident throughout the entrepreneurial process. • Future research should also study both digital and non-digital ecosystems in an attempt to help examine these contexts.

'scaffolding,' which will support them in assembling and creating new products and services. In the recent years, research on digital entrepreneurship has gained significant attention. However, there is a need to understand the phenomenon in all its breadth and scope within an organization, so that when business models are built, they can include all of the variables needed to analyze digital entrepreneurship.

Our research brings forward two main contributions. Firstly, at a methodological level, our bibliometric approach has allowed us to better understand the relationships between ideas, authors, and research streams and how the research field is structured. Secondly, at the level of digital entrepreneurship research, bibliometric techniques enable us to discover subfields within digital entrepreneurship literature. This allows us to characterize them based on the articles that comprise them. Bibliometric approaches have been especially useful because of digital entrepreneurship's multidisciplinary and heterogeneous nature, spanning several business and social science disciplines. We show that distinct trajectories develop around the phenomenon of digital entrepreneurship specifically. Identifying trends, patterns, and trajectories has allowed us to develop future research agendas with digital entrepreneurship in mind.

The full potential of this partnership will be accomplished if the technological, operating, and regulatory innovations are dealt with jointly rather than individually. Government procurement can be reworked through these ecosystems on its most fundamental basis.

Precise forecasts and artistic creativity in platform-based partnerships and collaborations might broaden the scope of these possibilities further, enabling new infrastructures to connect with the old to great effect.

We acknowledge some limitations related to our research. Although bibliometric approaches have provided us with robust, transparent, and replicable methods for systematic literature reviews, we chose to analyze sampling and keywords. The cut-off points we set to reduce the datasets risk avoiding the study of certain developments at the level of the research field. Nevertheless, our techniques allow us to understand the general directions in which mainstream digital entrepreneurship research is converging. In this way, these findings provide us with useful tools with which to characterize the field of study, understand its internal structure, highlight what has not yet been done with the digital

entrepreneurship research agenda, and open up promising avenues for future research.

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