Digital Economy from a Business Ecosystem Perspective

Abstract

This research aims to investigate how business ecosystem perspective has been applied in the current literature bank of research on digital economy. The results indicated that business ecosystem has been increasingly being applied in digital economy research especially in the last 5 years. Most of the research are founded and focused on strategy and innovation related topics. After the bibliometrics analysis and content analysis with the collected data set, this research categorized them into 8 clusters highlighting current research and its trends covering sharing economy, platform economy, digital transformation, and ecosystem dynamics. A framework of ecosystem dynamics is developed to present the dynamics among platform, ecosystem, and products/services in the context of digital economy.

Keywords: digital economy; business ecosystem; platform

Introduction

With many new information and communication technologies (ICTs) diffused and underpinned economic changes in the first two decades of the 21st century, digital economy emerged as an increasing important phenomenon around the world, in particular in the developing countries (Bukht and Heeks 2017, Rani and Furrer 2021, Soluk, Kammerlander et al. 2021). Since the typically-cited origin of the term Digital Economy (Tapscott 1996), it has attracted vast of researchers and practitioners to study this new form of economy from different

perspectives, including technology perspective (Sibanda, Ndiweni et al. 2020), process/flow perspective (Pyroh, Prokopenko et al. 2021, Stroiko, Nazarova et al. 2021, Zhghenti and Chkareuli 2021), structural perspective (Buletova, Stepanova et al. 2020, Miao 2021), and business model perspective (Haaker, Ly et al. 2021, Schiavone, Mancini et al. 2021, Arrigo 2022).

In the context of digital economy, with the massive dissemination of information and commercial contents on the Internet, new relationships established among various stakeholders play a critical role in the success of the digital economy. Those stakeholders form a business ecosystem where they can communicate, collaborate, and co-evolve with each other (Li, Du et al. 2017, Jumasseitova and Potluri 2020, Mas and Gomez 2021). In other words, it could be argued that traditional industries organized as linear value chains now has transformed into a new way of value creation via business ecosystem (Valdez-De-Leon 2019). Since its origin in 1990s (Moore 1993, Moore 1996), the concept of business ecosystem has been applied into many areas especially innovation (Radziwon, Bogers et al. 2017, Dias Sant´Ana, de Souza Bermejo et al. 2020, Foguesatto, Santini et al. 2021) and entrepreneurial (Colombo, Dagnino et al. 2019, Hakala, O'Shea et al. 2020, Zhang and Roelfsema 2020). However, there is still limited knowledge of its application in the research on digital economy.

In light of this research gap, this research aims to investigate *how business ecosystem perspective has been applied in the research on digital economy*. This research conducted a bibliometrics analysis to address this research question, the research results contribute to the further development of the knowledge bank of digital economy and also business ecosystem. The research also brings future research directions as the results of the bibliometrics analysis.

Methodology

This research conducted a bibliometrics analysis to address the research question. In order to build the data set for this research, we used “digital economy” and “business ecosystem” to search in the WoS (Web of Science) database. Then, we filtered the result with only articles in the categories of business, management, and economics which result in 50 articles for the bibliometrics analysis. Citespace were used to conduct the bibliometric study. It allows the analysis and visualization of trends and patterns in a research area (Chen 2017), and the main goal of this tool is to facilitate the analysis of emerging trends in a knowledge domain. That is appropriately match with our research purpose to identify the time trends through bibliometrics analysis to explore the high-frequency keywords and the research trend (Liang and Liu 2018).

Before the detailed keywords analysis, below presented some basics from the collected data set.

Time trend of publications

Figure 1 shows the time trend of the research on digital economy with the perspective of business ecosystem. It indicated a fast-growing trend of the publications from 2017 to 2022, especially a big jump in 2021. As highlighted in Figure 1, there is an increasing citation of those paper published in this area.

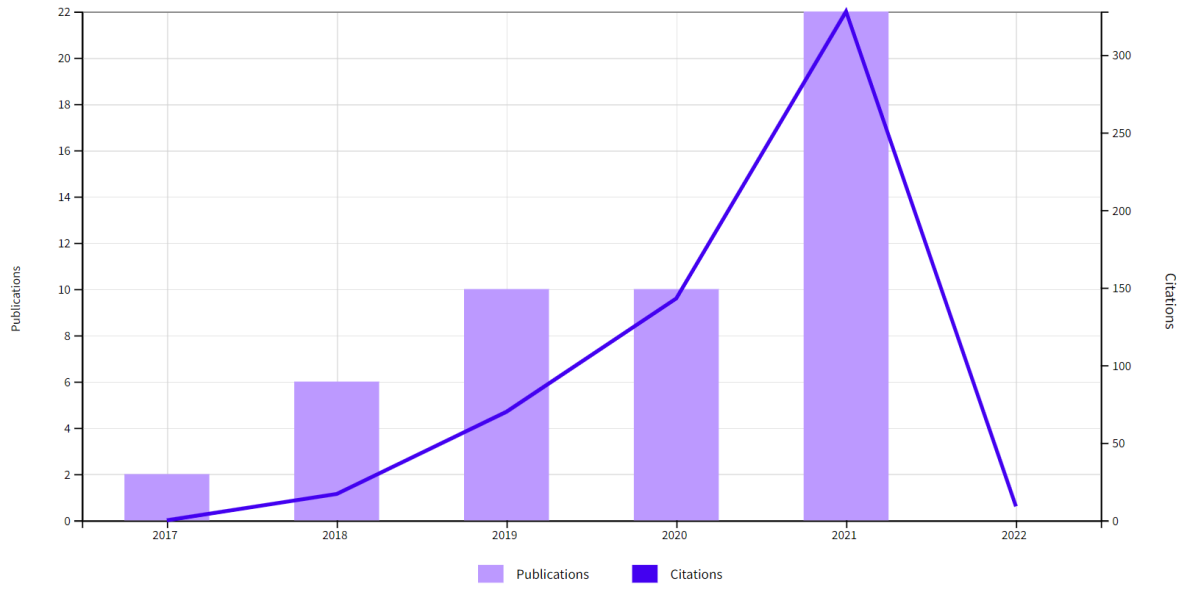

Figure 1. Times cited and publications over time

Table 1 presented the citation statistics of the most cited 10 paper within the collected data set. In particular, the paper of (Teece 2018) is the most cited paper with a total citation of 208, which is far more than other publications.

Table 1. Citation statistics

	Publications	2018	2019	2020	2021	2022	Average per year	Total
	Total of the 50 publications	**17**	**70**	**143**	**328**	**9**	**113.4**	**567**
1	Profiting from innovation in the digital economy: Enabling technologies, standards, and licensing models in the wireless world Teece, DJ Oct 2018 | RESEARCH POLICY 47 (8) , pp.1367-1387	8	34	54	111	1	41.6	208
2	Digitalization in retailing: multi-sided platforms as drivers of industry transformation Hanninen, M; Smedlund, A and Mitronen, L 2018 | BALTIC JOURNAL OF MANAGEMENT 13 (2) , pp.152-168	3	9	11	26	0	9.8	49
3	Open innovation, information, and entrepreneurship within platform ecosystems Eckhardt, JT; Ciuchta, MP and Carpenter, M Sep 2018 | STRATEGIC ENTREPRENEURSHIP JOURNAL 12 (3) , pp.369-391	1	10	14	20	1	9.2	46
4	How Do Intelligent Goods Shape Closed-Loop Systems? Rajala, R; Hakanen, E; (...); Westerlund, M May 2018 | CALIFORNIA MANAGEMENT REVIEW 60 (3) , pp.20-44	1	7	7	15	0	6	30
5	COMPETING IN DIGITAL MARKETS: A PLATFORM-BASED PERSPECTIVE Cennamo, C May 2021 | ACADEMY OF MANAGEMENT PERSPECTIVES 35 (2) , pp.265-291	0	1	6	18	0	12.5	25
6	The Role of Marketing in Digital Business Platforms Rangaswamy, A; Moch, N; (...); Wirtz, J 7Aug 2020 | JOURNAL OF INTERACTIVE MARKETING 51 , p8p.72-90	0	0	5	15	3	7.67	23
7	Th10e age of digital entrepreneurship Sahut, JM; Iandoli, L and Teulon, F Feb 2021 | SMALL BUSINESS ECONOMICS 56 (3) , pp.1159-1169	0	1	1	17	0	9.5	19
8	Liminal movement by digital platform-based sharing economy ventures: The case of Uber Technologies Garud, R; Kumaraswamy, A; (...); Xu, L Apr 2020 (Early Access) | STRATEGIC MANAGEMENT JOURNAL	0	0	4	14	1	6.33	19
9	The Promise of Fintech in Emerging Markets: Not as Disruptive Zalan, T and Toufaily, E Dec 31 2017 | CONTEMPORARY ECONOMICS 11 (4) , pp.415-430	3	1	8	7	0	3.17	19
10	Exploring the growth challenge of mobile payment platforms: A business model perspective Jocevski, M; Ghezzi, A and Arvidsson, N Mar-apr 2020 | ELECTRONIC COMMERCE RESEARCH AND APPLICATIONS 40	0	0	3	13	1	5.67	17

Findings

This research conducted detailed keyword analysis to understand the current research hot spots and the research trends.

Major keywords and topics

Figure 2. presented the visualized cloud of high frequency keywords in the 50 publications. Important keywords are highlighted with larger fonts, while the colour of a keyword is determined by the cluster to which the keyword belongs. We will analyse the clusters in next section. Table 2 listed most of the keywords in descending order of frequency.

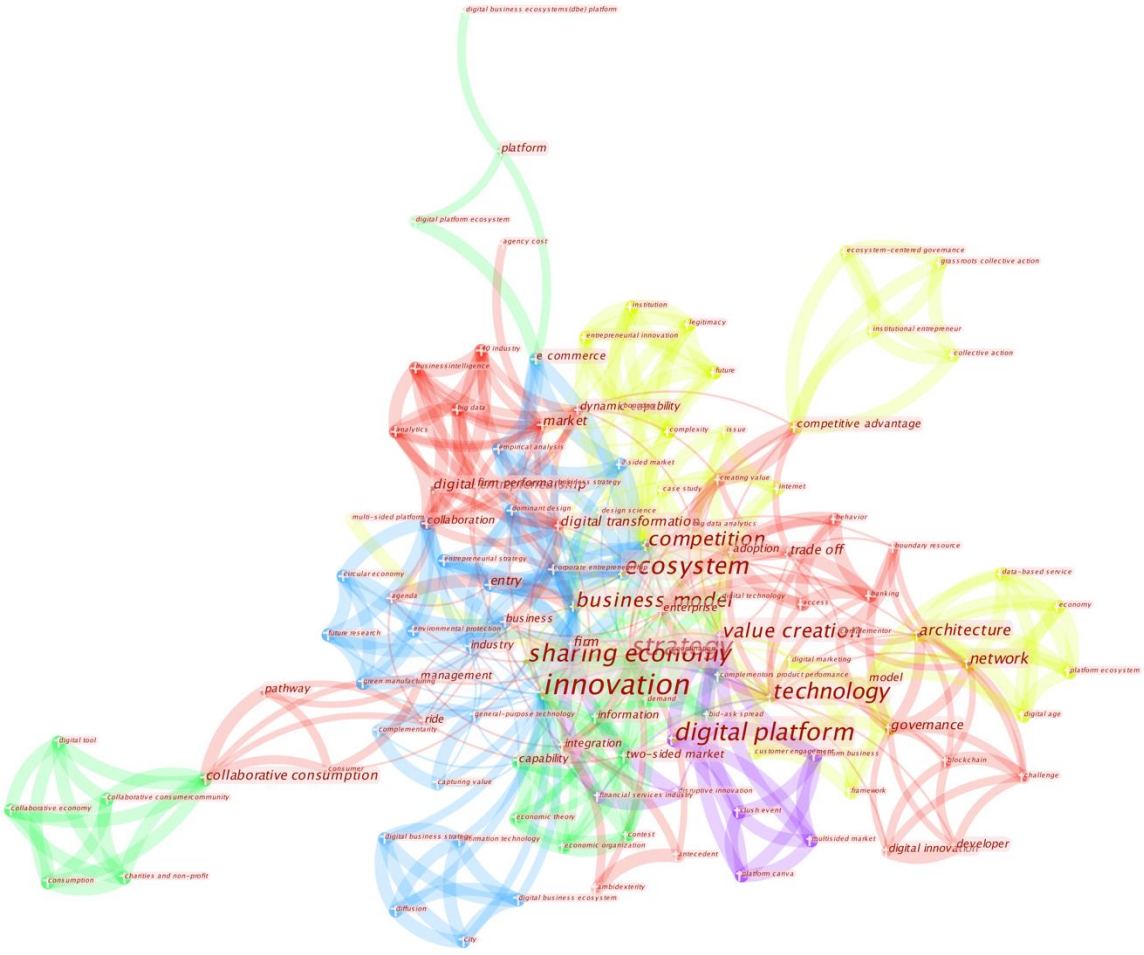

Figure 2. Frequency of keywords

Table 2. Frequency of keywords

Frequency	Keyword	Frequency	Keyword	Frequency	Keyword
16	**innovation**	2	enterprise	1	business strategy
					data-based
13	**strategy**	2	integration	1	service
12	**digital platform**	2	e commerce	1	creating value
					green
11	**ecosystem**	2	management	1	manufacturing
10	**sharing economy**	2	ride	1	demand
9	**technology**	2	developer	1	2 sided market
7	**competition**	2	digital innovation	1	big data analytics
7	**business model**	2	pathway	1	challenge
					complementors
					product
6	**value creation**	2	platform	1	performance
4	**architecture**	1	boundary	1	future research
					digital
4	network	1	analytics	1	technology
			Business		customer
3	digital transformation	1	intelligence	1	engagement
					platform
3	market	1	big data	1	ecosystem
3	governance	1	4.0 industry	1	circular economy
3	firm	1	complexity	1	digital age
					entrepreneurial
3	entry	1	contest	1	strategy
	collaborative				
3	consumption	1	economic theory	1	banking
3	trade off	1	blockchain	1	internet
	digital		entrepreneurial		
3	entrepreneurship	1	innovation	1	behavior
			economic		
2	collaboration	1	organization	1	capturing value
2	model	1	institution	1	diffusion
					general-purpose
2	capability	1	legitimacy	1	technology
2	business	1	future	1	access
			corporate		multisided
2	adoption	1	entrepreneurship	1	market
2	dynamic capability	1	digital marketing	1	slush event
					collaborative
2	information	1	economy	1	economy
2	two-sided market	1	dominant design	1	bid-ask spread
					digital business
2	industry	1	boundary resource	1	ecosystem
2	firm performance	1	complementor	1	city
			environmental		
2	competitive advantage	1	protection	1	platform canva

The results indicated that innovation, strategy, digital platform are the three top used keywords in those publications. We can see that most of the research are strategy and/or innovation related topics, this is consistent with another analysis result showing that the most

cited journals in those 50 papers are actually strategy/innovation subject areas related, including Strategic Management Journal (30), Harvard Business Review (29), and Research policy (26) (see Figure 3). We can argue that most of the publications within the business/management categories are focused on strategy/innovation related topics, and are also grounded on the strategy/innovation theories.

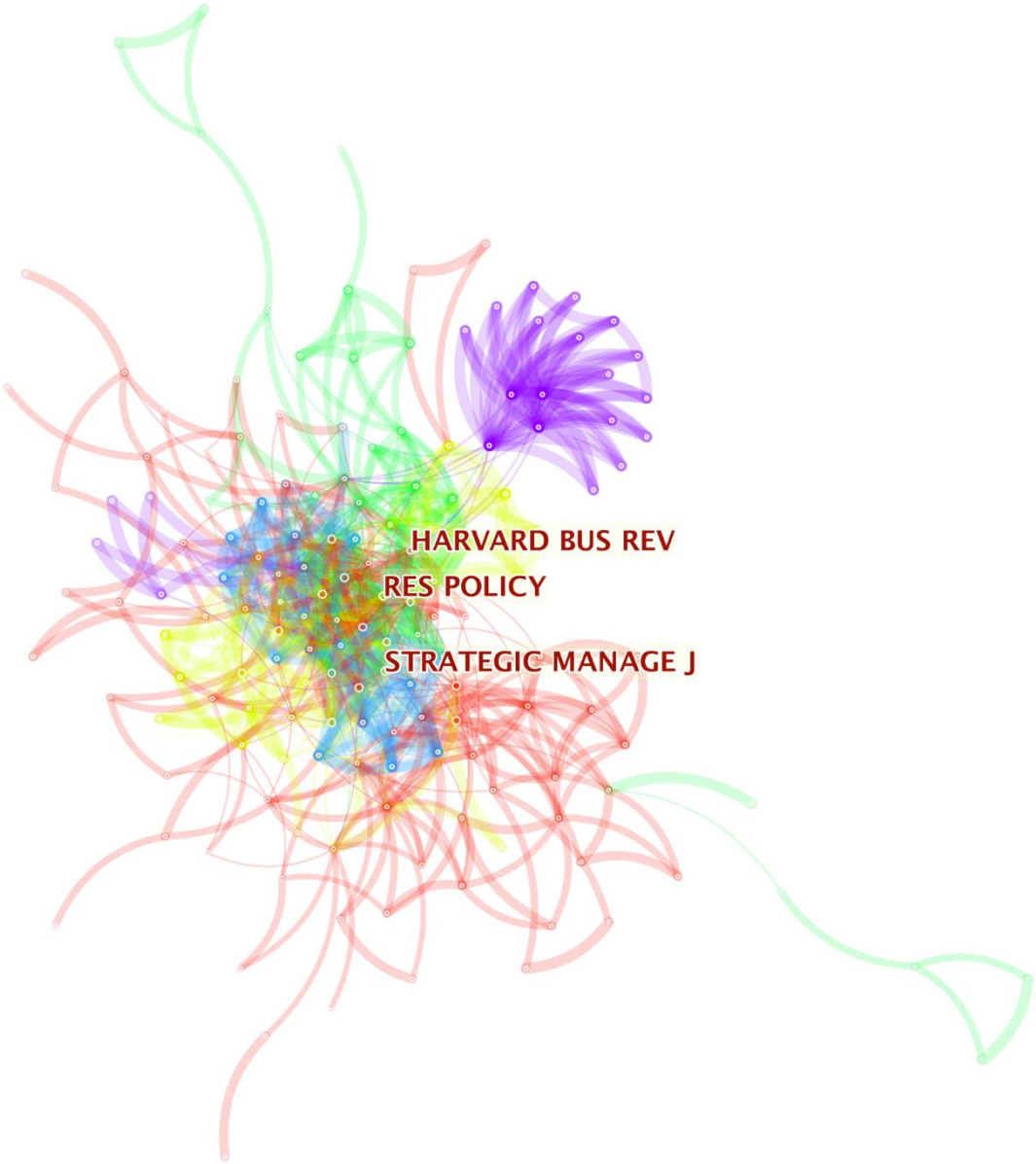

Figure 3. Most cited journals

Evolution of keywords and topics

In order to understand current research and identify the research trend in this area, we took a closer look at the keywords in the citation networks of those 50 publications with a timeline view. Together with the detailed content analysis, we used CiteSpace software to extract the keywords and categorise the publications in the collected data set into eight clusters as presented in Figure 4.

Cluster #1: Sharing economy (platform and two-sided market).

Cluster #2: Platform economy (data-based service).

Cluster #3: Platform economy (financial service).

Cluster #4: Digital transformation (business strategy).

Cluster #5: Digital transformation (business model).

Cluster #6: Digital transformation (strategic capability).

Cluster #7: Digital service.

Cluster #8: Ecosystem dynamics.

Sharing economy (Cluster #1), digital economy (Cluster #2, 3) and digital service (Cluster #7) represents the three key scopes of digital economy as defined by (Bukht and Heeks 2017). After in-depth content analysis, we notice that more and more literature is moving away from defining digital economy to focusing on how to manage digital economy to achieve relevant benefits as promised. Hence, we added "digital transformation" for the Cluster #4,5,6, to reflect these three growing research clusters. Those three clusters are mainly grounded on the classical strategy and innovation disciplines. We also found the emerging Cluster #8 emphasizing the ecosystem related issues, such as governance, multi-sided market, coordination mechanism with platform.

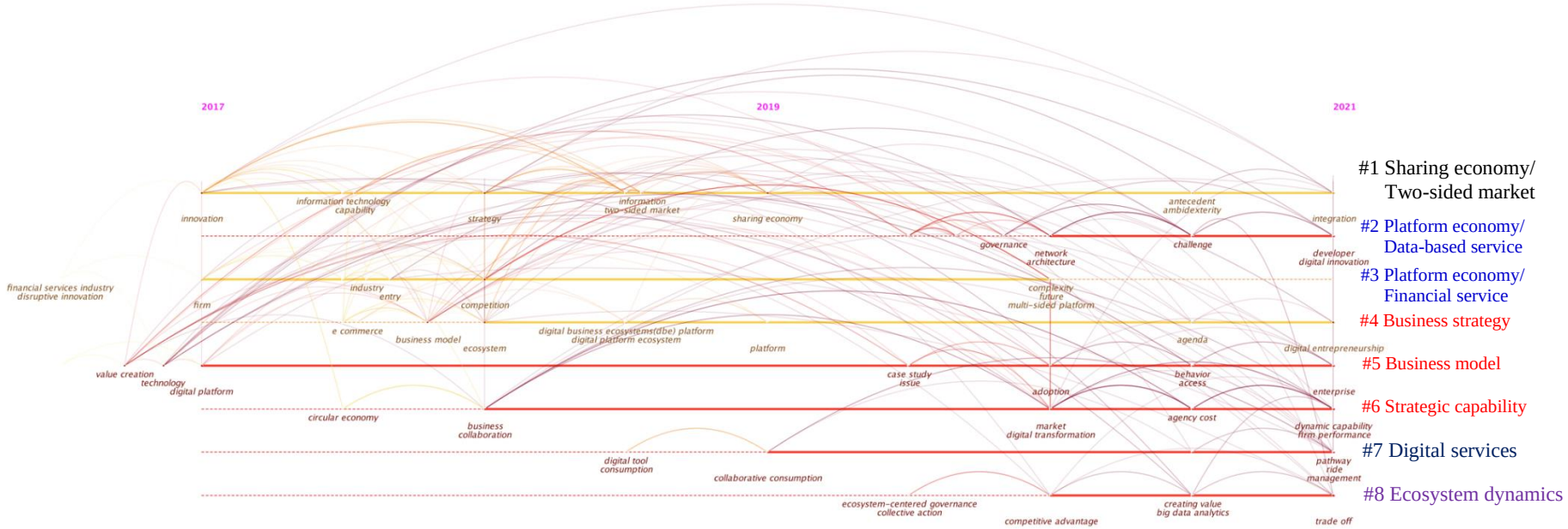

Figure 4. Timeline view of the keywords

Cluster #1: Sharing economy (platform and two-sided market). This is a well-established theme of digital economy, and it is also an extension of the existing research on sharing economy but with more focus on the adoption and implementation of digital technologies. Platform and two-sided market are the two widely appeared keywords in this research cluster. Many literatures have a focus on defining (Markman, Lieberman et al. 2021) and contextualizing (Bai and Velamuri 2021) sharing economy. But more and more literature has started to emphasize the importance of the digital technologies and digital platform. To some extent, digital platforms are dominating the digital economy (Garud, Kumaraswamy et al. 2021, Mosterd, Sobota et al. 2021). For example, digital platform is critical to create the necessary knowledge for resource integration and smart mobility service exchange (Pulkkinen, Jussila et al. 2019). Meanwhile, sharing economy business model could be spread to new platforms (Geissinger, Laurell et al. 2021). Digital tools enabled collaborative and social dynamics will support knowledge sharing and facilitate opportunity recognition (Romanelli 2018, Sahut, Iandoli et al. 2021). Within the context of collaborative consumption like bike-sharing, the use of digital tools helps to increase the community's well-being potential (e.g. development of social ties, solidarity and social equality) while reducing its negative effects (e.g. fatigue due to community involvement and difficulty integrating new members) (Guillemot and Privat 2019, da Silveira, Levrini et al. 2021).

Cluster #2: Platform economy (data-based service) and ***Cluster #3: Platform economy (financial service)***. As indicated from the Figure 4, we can see an evolution of this platform economy theme that, the early research focuses on financial services (Cluster #3), and the later ones are more focused on data-based services (Cluster #2). For instance, platforms like mobile money (Bongomin, Yosa et al. 2021), mobile payment (Jocevski, Ghezzi et al. 2020), Fintech (Zalan and Toufaily 2017, Langley and Leyshon 2021), and crowdfunding (Foa 2019, Tajedin, Madhok et al. 2019) attracted large attentions from academia and practitioners. Issues like

adoption factors, platform governance, organizational paradox, and platform growth are centre of those research (Jocevski, Ghezzi et al. 2020, dos Santos and Marx 2021). Along with the fast growth of big data and wide application of relevant digital technologies, within the Cluster 3, more research is focus on data-based services. Such as, blockchain-based digital extension service (Sandstrom 2021), dApp service (Leiponen, Thomas et al. 2021), platform services (social media) (Alaimo, Kallinikos et al. 2020), digital labour market (Surie and Sharma 2019), smart mobility service (Pulkkinen, Jussila et al. 2019). The widely adoption of digital technologies not only facilitate the creation of big data everywhere, but it also contributes to significantly reduce the cost of using data including search, storage, computation, and transmission (Acs, Song et al. 2021). This is believed to enable those new economic activities including the data-based services as mentioned above.

Same as the sharing economy cluster, platform economy is also a long-standing research stream. Platform related issues have been heavily addressed in current literature bank, such as platform openness (Gandia and Parmentier 2020, Mosterd, Sobota et al. 2021), dependency (Cutolo and Kenney 2021, Mosterd, Sobota et al. 2021), heterogeneity and governance (Yi, He et al. 2019), legitimacy (Garud, Kumaraswamy et al. 2021, Prasetyo 2021), marketing (Rangaswamy, Moch et al. 2020), and competition (Cennamo 2021). Another key area of platform related research is linked with ecosystem (Pulkkinen, Jussila et al. 2019), we will discuss this in detail in the Cluster #8.

Cluster #4: Digital transformation (business strategy). Following the pace of digital economy, digital transformation is revolutionizing firms' business processes, business models, and value delivery to customers (Friedrichsen 2018). More and more enterprises are strengthening their digital transformation strategies (Cluster #4) together with creative business models (Cluster #5) and strategic capabilities or processes (Cluster #6).

In terms of strategies, the digitalization of economy activities is shifting the nature of competition, which in turn affects the fundamental ways of firm competing with others in the digital market (Cennamo 2021). Hence well-defined business strategies are critical to the success of digital transformation of firms in the context of digital economy. Developing digital transformation competency is proved to positively affect platform development (Min and Kim 2021), resource orchestration helps to create value and gain competitive advantage for platform firms (Zeng, Tavalaei et al. 2021). In the retailing sector, strategy of developing multi-sided platform helps to transform the transaction logic to compete against new forms of business (Hanninen, Smedlund et al. 2018). Meanwhile, adopting open innovation strategy will encourage complementors to develop complementary products, services, or technologies that could add value to the platform (Eckhardt, Ciuchta et al. 2018).

Cluster #5: Digital transformation (business model). The current advancement in digital technologies offer new opportunities to design and model new digital business models. For instance, disruptive technologies could increase the intelligence of goods, and the use of intelligent goods could revitalize new business model to boost the sustainability of industrial ecosystem (Rajala, Hakanen et al. 2018). Meanwhile, it is not an easy job to design an effective digital business model and make it profitable (Teece 2018). There is a growing number of researches focusing on the business model related topics. For example, a well-designed digital business model is believed helpful to achieve value co-creation within a healthcare ecosystem with ridesharing for non-emergency medical transportation (Schiavone, Mancini et al. 2021). New business models help retailers and suppliers meet the ever changing and demanding needs of retail shoppers (Hanninen, Smedlund et al. 2018). Obviously, a platform-based business model (Jocevski, Ghezzi et al. 2020) is on growing trend as discussed above. A relational business model design is proposed to mitigate the risks of stakeholders against the development of digital platform (Ricart, Snihur et al. 2020).

Cluster #6: Digital transformation (strategic capability). Besides strategies and business models, firms could promote digital transformation via developing relevant strategic capabilities. For examples, the capability of reduced transaction costs driven by platforms and ecosystems orchestration and the related or integrated multiple level sources of knowledge could speed benefits of domestic firms and subsidiaries of global organizations (D'Oliveira and Goncalo 2021). For start-up companies, the capability of expanding their scopes of business in terms of coverage areas and diversity of products/services helps their success (Almunawar and Anshari 2021). This capability is achieved through a well-orchestrated collaboration in offering attractive values to customers. The capability of circumvent knowledge constraints is a important to those new forms of organizations enabled by digital technologies (Tajedin, Madhok et al. 2019). Digital boundary control capability is critical to companies within mutli-sided platforms (Gandia and Parmentier 2020).

Cluster #7: Digital transformation (digital service). With the rapid and wide adoption of digital technologies, the creation and delivery of digital services demand new and creative ways, which creates a scope in the digital economy. When developed as commercially viable and constantly updatable data bundles out of diverse and dynamic data types, platform services are essential to make the complementarities that are claimed to underlie ecosystem formation (Alaimo, Kallinikos et al. 2020). Using different digital tools like blockchain (Leiponen, Thomas et al. 2021, Sandstrom 2021) and IoT (Mosterd, Sobota et al. 2021) become effects way to create new digital services.

Cluster #8: Ecosystem dynamics. The ecosystem dynamics summarized is presented as Figure 5. Different from previous research only focus on the mechanism between platform and ecosystem, this research included products/services as the third elements.

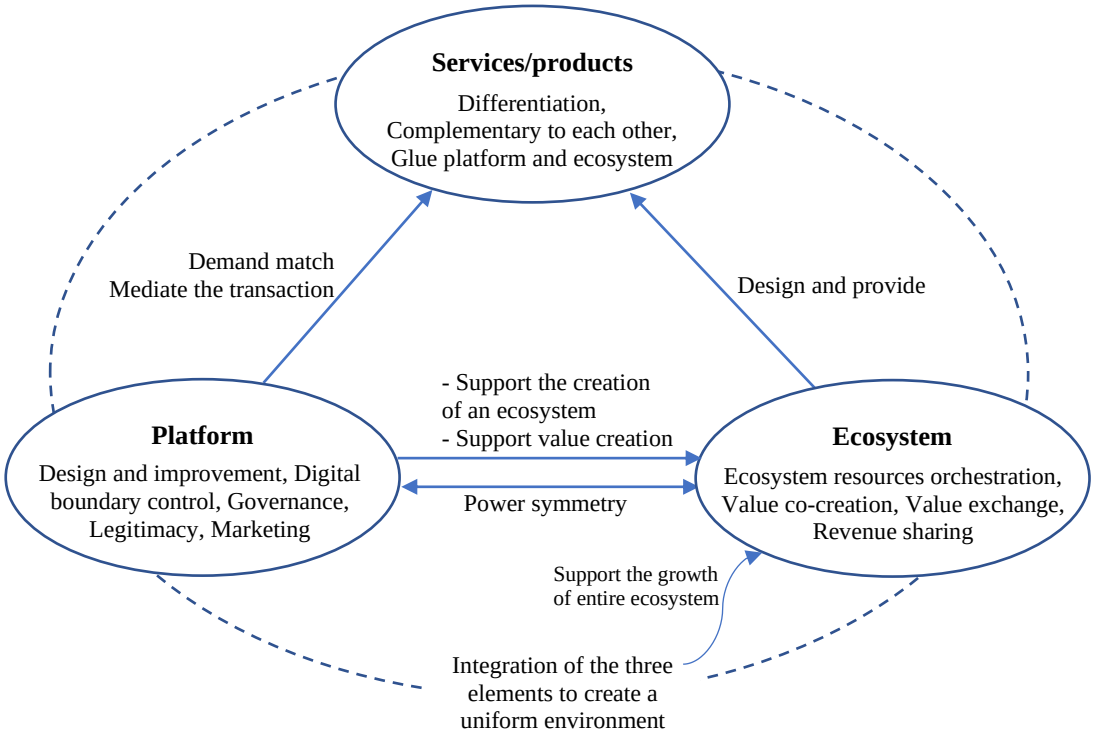

Figure 5. Ecosystem dynamics

One of the key mechanisms is the integration of these three elements and facilitating with each other. For example, the success of smart mobility services sharing relies on the three elements – ecosystem, platform, and smart services creating a uniform environment in which to grow the business in an emerging market (Pulkkinen, Jussila et al. 2019). Moreover, the opportunities that platform-mediated markets offer not only attract enormous numbers of entrepreneurs but also support the growth of entire ecosystems of producers, sellers, and specialized service providers (Bongomin, Yosa et al. 2021, Cutolo and Kenney 2021).

Platform has significant implications for the theory of firm in the digital economy (Spulber 2019). In retail sector, digital platform in particular multi-sided platform connects with suppliers from around the world and forms a large ecosystem, which transformed the transaction logic of retailing as simply intermediate transactions between buyers and suppliers rather than handling the entire supply and logistics chain themselves (Hanninen, Smedlund et

al. 2018). Platforms not only support the creation of a business ecosystem, but also support value creation between multiple participant groups, and this operationalization of an ecosystem's value co-creation represents the "core interaction" of a platform (Korhonen, Still et al. 2017, Schiavone, Mancini et al. 2021). For instance, the development of the Italian Circular Economy Stakeholder Platform facilitates stakeholders' engagement and support to create a digital innovation ecosystem focused on the circular economy (Del Vecchio, Passiante et al. 2021). Taking social media as an example, platform infrastructure improvement will motivate content creator to supply more comments (Bhargava 2021). A digital platform is critical to create knowledge for resource integration and products/services exchange (Pulkkinen, Jussila et al. 2019).

Ecosystem plays a critical role to achieve value co-creation, this is regarded as an essential nature of a business ecosystem. For example, digital business ecosystems should enable value co-creation and development among ecosystem stakeholders like communities, governments, businesses and people (Romanelli 2018). For Fintech, the bank-fintech collaboration will create new value for ecosystem partners and speed up innovation (Zalan and Toufaily 2017). One of the main mechanisms to success is enabling ecosystem resource coordination including internal and external resources to create value and gain a competitive advantage (Zeng, Tavalaei et al. 2021). Besides value co-creation, value exchange needs well collaborated within the business ecosystem (Almunawar and Anshari 2021). In particular, if the complementors are encouraged to develop complementary products, services, or technologies that can add value to the platform and the ecosystem (Eckhardt, Ciuchta et al. 2018). For sharing economy, the sharing platform could work with ecosystem partners including asset providers and users to reduce commercial friction by increasing trust, facilitating interaction, easing resource access and orchestration, and maximizing ecosystem-wide value (Markman, Lieberman et al. 2021).

Products/services are the items eventually consumed by customers; it plays an important role in the digital economy. That's why we included it into this ecosystem dynamics framework which is different from previous research mainly covering platform and ecosystem. The importance of services of social media platforms has been highlighted that develop as commercially viable and constantly updatable data bundles out of diverse and dynamic data types are essential to the making of the complementarities that are claimed to underlie ecosystem formation (Alaimo, Kallinikos et al. 2020). To mobile application complementors on a strictly regulated platform, they can take advantage of higher degree of product/service differentiation to enhance their performance (Yi, He et al. 2019). In the smart city context, smart services glue the ecosystem and platform together and create the outcomes that solves the defined business problems (Pulkkinen, Jussila et al. 2019).

It is worthy to be aware that occasionally there will be resistance from various stakeholders against the digital platform, relational business model design with inclusive stakeholder value proposition and ecosystem-centred governance will be needed (Ricart, Snihur et al. 2020). The power a symmetry in the relationship between the platform and its ecosystem members is intrinsic to the economics and the technological architecture of digital platforms (Cutolo and Kenney 2021). Appropriate revenue sharing between platform owner and users will also help to benefit the entire ecosystem (Bhargava 2021).

Conclusions

This paper conducted bibliometrics analysis with the collected data set from the WoS database, aiming to understand current research on digital economy with a business ecosystem perspective. This is an ongoing project, only the publications from the WoS databased were collected for this paper, continuing research will collect further publications from the Scopus, Science Direct databased to bring more comprehensive view of the current literature bank.

The research results have visualized the collected publications in particular its keywords to better understand current research. We found it is a growing trend that applying business ecosystem view into research on digital economy. The results also categorized the keywords into eight clusters which represent current research themes and also reveal the research trends. The results from the clusters indicated there are well standing themes on sharing economy and platform economy related topics. Within the platform economy cluster, it is found that the literature shifting the research focus from financial services to data-based services. It is expected more research on data-based business models will be input into current literature bank.

It is evidenced that business ecosystem has been applied into digital economy research, most of the paper has highlighted the importance of the coordination between platform and ecosystem. However, there is still limited research about the mutual mechanism between platform and ecosystem. Also, research has highlighted the interaction among platform, ecosystem, and services, it would be more comprehensive if the future research covers this triangle perspective.

Furthermore, new business models in digital economy are in a fast-growing pace, it worthy to conduct longitude empirical study to bring comprehensive implications to the knowledge development and business practice.

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