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# Digital Entrepreneurship in Brazil: Insights from the Digital Platform Economy Index Analysis

**Sita Dewi Kusumaningrum[1, 2,*], Eristian Wibisono[3]**

[1] *Doctoral School of Business Administration, Faculty of Business and Economics, University of Pécs, Pécs, Hungary*

[2] *Department of Management, Faculty of Business and Economics, Universitas Islam Indonesia, Yogyakarta, Indonesia*

[3] *Department of Economics and Econometrics, Faculty of Business and Economics, University of Pécs, Pécs, Hungary*

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**ABSTRACT**

Digital Entrepreneurial Ecosystem (DEE) integrates the concepts of Digital Ecosystem (DE) and Entrepreneurial Ecosystem (EE). Developed over the last decade, research and application of DEE in developing countries remains limited. In this paper, we use a DEE in the form of the Digital Platform Economy (DPE) index, which measures the state of DEE in 116 countries, taking Brazil as a case study and comparing it with two benchmark countries (Uruguay and Argentina) that are members of the MERCOSUR group of economies. Through a five-step structured analysis, we first examine the general condition of Brazil's DEE in terms of development and then analyze the derived components of the DPE index to find the strengths and weaknesses of Brazil's DEE compared to the two benchmark countries. The results show a healthy balance between DE and EE in Brazil. However, through further analysis using the Penalty for Bottleneck (PFB) method, we recommend four main pillars of DEE, namely digital literacy, digital openness, digital adoption, and digital access, to maintain the balance between DE and EE and improve Brazil's DEE. Our results contribute to the development of DEE literature and promote DEE evaluation methods as a way to recommend DEE development in developing countries.

* Corresponding Author.
E-mail: sita.kusumaningrum@uii.ac.id

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# I. INTRODUCTION

Society has entered the digital age since the twenty-first century (Sachs, 2020). Nowadays, almost all business activities depend on information and digital technology, for instance, the internet and computers. More importantly, the concept of the digital platform economy has risen, which refers to the use of digital technology in the interactions of business, politics, and social activities, for instance, the human actions and interactions through Amazon, Facebook, Google, LinkedIn and other digital platform companies (Kenney & Zysman, 2016). In this matter, digital technologies have benefited economic activity by reducing five different economic costs, particularly search, replication, transportation, tracking, and verification costs (Goldfarb & Tucker, 2019). Besides, with the development of digital technologies, new economic activities were made possible as well as a substantial decrease in the cost of data in terms of search, storage, computing, and transmission (Zoltan J. Acs et al., 2021).

The rapid advancement of information and digital technology has also transformed entrepreneurial activities into digital entrepreneurship. Following this, academic literature has comprehensively defined the concept of digital entrepreneurship. For instance, digital technologies emerged in entrepreneurship through digital artefacts, digital platforms, and digital infrastructure (Nambisan, 2017). Further, digital entrepreneurship should consider the role of agents and users (Sussan & Acs, 2017). Digital entrepreneurship is also defined as the harmonization of conventional entrepreneurship with a new way of conducting business in the digital era (Le Dinh et al., 2018). However, digital entrepreneurship exists when entrepreneurs alter their business from offline to online (Kraus et al., 2019).

As platform-based companies and start-ups are flourishing, some start-ups are also categorized as unicorns because they have a more than $1 billion valuation (CBNInsights, 2022). The number of unicorns is a good way to assess DEE performance (Torres & Godinho, 2022; Venâncio et al., 2023). According to the data from cbninsights.com, there were around 1,204 unicorn companies worldwide in October 2022. At that moment, among Latin America and Caribbean/South American countries, Brazil has the highest number of unicorn companies (16), followed by Mexico (8), Colombia (3), Chile (2), Argentina (1), and Ecuador (1). Additionally, Brazil is ranked ninth among 49 countries with unicorn companies worldwide. In particular, Brazil's unicorns are specialized in 1) artificial intelligence, 2) fintech, 3) supply chain, logistics, and delivery, 4) e-commerce and direct-to-consumer, 5) mobile and telecommunications, and 6) others. Five unicorn companies in Brazil with the highest valuation, e.g., QuintoAndar, C6Bank, Creditas, Nuvemshop, and Wildlife Studios.

Brazil serves as a compelling case study for examining the digital entrepreneurial ecosystem in Latin America and Caribbean/South American countries. This is due to its unique socio-economic landscape and the growing importance of digital startups. Recent research highlighted that Brazil has emerged as a leader in the region, with a notable increase in the number of unicorns, highlighting the potential for high-growth ventures in the digital economy (Ács et al., 2022; Andonova et al., 2023). However, the existing literature revealed significant gaps in understanding the specific dynamics that influence digital entrepreneurship in Brazil. For instance, a study by Martínez & Bañón (2023) underscored the importance of social networks and learning from other entrepreneurs in fostering entrepreneurial intentions. Other research indicated that while Brazil has a robust digital infrastructure, disparities in access and digital literacy persist, especially in less urbanized areas, which may hinder the growth of digital entrepreneurship (Silva et al., 2022). These studies still overlooked the contextual factors that uniquely shape the Brazilian entrepreneurial landscape. In addition, Ibáñez (2022) pointed to the lack of comprehensive research on social entrepreneurship in Latin America, indicating the need for more focused studies that take into account local conditions. Furthermore, the work of Ács et al. (2022) suggested that while there has been significant investment in improving the digital ecosystem, the effectiveness of these initiatives remains understudied (Ács et al., 2022). These shortcomings in the literature, particularly regarding the interplay between institutional contexts and digital entrepreneurship, highlight the need to focus on Brazil as a case study.

The DPE Index has been used to assess the Digital Entrepreneurial Ecosystem (DEE), particularly in developed and high-income countries. For example, Wibisono (2023) found that in three developed European countries (Germany, France, and Austria), there were consistent challenges related to digital multisided platforms. In these countries, the process of matchmaking and the formation of digital entrepreneurial networks were still significant barriers despite their advanced digital ecosystems. However, the situation might

be different in developing countries. For example, Brazil, a developing country, has made remarkable progress in digital entrepreneurship and has more unicorns than some developed and developing countries. Leveraging insights from the DPE index can help identify specific areas for improvement and policy intervention and ultimately strengthen Brazil's position in the global digital economy (Zhang et al., 2023). Therefore, this paper will focus on Brazil's digital entrepreneurship as the land of the unicorn (Tunes, 2019) and the largest country in Latin America, the Caribbean, and South America. Brazil's DPE will be compared to Uruguay and Argentina, which have close socio-economic and geographical ties realized by joining the MERCOSUR economic block. Although Brazil is a developing country and has the lowest GDP per capita of the two countries, Brazil has the most unicorns compared to Uruguay and Argentina; even according to CBNInsights, Brazil ranked ninth in the world in 2022. However, in terms of the DPE Index, Brazil is still in the middle between Uruguay and Argentina.

**Table 1.** Brazil's Country Development and Basic Level of Digitalization

| Indicators | 2020 | 2021 |
|---|---|---|
| Population (million) | 211.8 | 213.3 |
| Gross Domestic Product (GDP) Per Capita (Current International $ PPP) | 14,834 | 16,056 |
| Human Development Index (HDI)[a] | 0.758 (High) | 0.754 (High) |
| Global Innovation Index (GII) [b,c] | 31.94 (Rank 62/131) | 34.2 (Rank 57/132) |
| Total early-stage Entrepreneurial Activity (TEA) [d], % | 23.40 | 20.98 |
| Internet users/penetration, million/% | 150.4/71 | 160.0/75 |
| Social media users/penetration, million/% | 140.0/66 | 150.0/70.3 |
| Mobile connection, million/% of the total population | 205.8/97 | 205.4/96.3 |

Note: The data on population, internet, social media, and mobile connection is taken from We are social and Hootsuite[e]. It is stated by We are social and Hootsuite that data on the internet, social media, and mobile connection is not comparable between 2020 and 2021 due to different data sources. However, the number still can give helpful information

[a]https://hdr.undp.org/data-center/specific-country-data#/countries/BRA
[b]https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2020.pdf
[c]https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2021.pdf
[d]https://www.gemconsortium.org/economy-profiles/brazil-2
[e]https://datareportal.com/reports/digital-2020-brazil

Table 1 briefly presents Brazil's country development and a basic level of digitalization in 2020 and 2021. Table 1 shows that Brazil has a relative strength in almost all presented indicators. In terms of GDP per capita, as a middle-income country, Brazil's GDP per capita is above average. In addition, in terms of digitalization level, Brazilian enterprises experienced highly increased use of digital tools in response to COVID-19, especially in using social media platforms such as Facebook apps through mobile phones (Andrade et al., 2023; DAI & Ipsos, 2021). The fact that Brazilians who have access to the internet are ardent internet users lends further credence to this (McKinsey & Company, 2019). Interestingly, in terms of entrepreneurship, Brazil had times when doing business was very difficult, but some progress has been made in encouraging entrepreneurship (Viana, 2022).

As discussed earlier, there has been much literature that addresses how digital technology is transforming economic activity globally (Shkarlet et al., 2020), including transforming the small medium enterprises (Skare et al., 2023). A significant amount of the study on digital transformation examines its effects on enterprises and organizations, alterations in business processes, and the role of technology (Kraus et al., 2021). Still, few studies address how digital technology affects platform economy (Szerb et al., 2022). Therefore, this paper aims to answer research questions as follows:

1) How does Brazil's digital entrepreneurship performance based on development using the DPE 2020 Index measurement?
2) To what extent is Brazil's digital ecosystem (DE) balanced with its entrepreneurial ecosystem (EE), and how does this balance influence the robustness of its digital platform economy compared to Uruguay and Argentina?
3) What are the critical bottlenecks within Brazil's Digital Platform Economy (DPE) that hinder the development of its digital entrepreneurial ecosystem (DEE), and how can targeted policy recommendations address these weaknesses to foster growth?

Further, this paper is organized in the following way: section one is the introduction, section two will review the analytical framework of the DPE methodology, section three will analyze Brazil's performance compared to other countries and examine the balance of the digital ecosystem and entrepreneurship ecosystem including the strengths and weaknesses. This section will also provide policy suggestions based on quadrant analysis. The last section will be the conclusion.

## II. RESEARCH METHOD

Entrepreneurship matters for economic development and need an accurate measurement to facilitate its economic contribution (Ács et al., 2014). Additionally, there are three purposes for applying a correct measurement for the entrepreneurial ecosystem (Szerb et al., 2022), i.e., 1) to provide a robust policy recommendation, 2) to identify the relative development of components from making a comparison, and 3) to identify strengths and weaknesses of an ecosystem from others. Further, the measuring of entrepreneurship has advanced significantly during the last few decades (Szerb et al., 2016). Meticulously, Autio et al., (2018), presented five different approaches for measuring country-level entrepreneurship: 1) output (count) measures, e.g., Global Entrepreneurship Monitor (GEM); 2) attitude measures, e.g., Eurobarometer survey; 3) frameworks measures, e.g., OECD Entrepreneurship Indicators Program; 4) mixed (weighted) measures, e.g., The Global Entrepreneurship Index (GEI) and the Regional Entrepreneurship and Development Index (REDI); and 5) entrepreneurial ecosystem measures, e.g., the Kauffman Foundation's entrepreneurial ecosystem.

In the context of digital entrepreneurship, metrics and measurement methods are essential to monitoring the transformation of the entrepreneurial ecosystem towards digital. Currently, there are two country-level measures of digital and entrepreneurship ecosystems, the European Index of Digital Entrepreneurship Systems (EIDES) (Autio et al., 2018) and the DPE Index (Szerb et al., 2022). However, both measures have a different focus and use, as reported in Table 2. Further, this paper employs the DPE Index measure.

**Table 2.** Different Characteristics of EIDES and DPE

| Items | EIDES | DPE |
|---|---|---|
| Conceptual focus | Entrepreneurial development stages: stand-up, start-up, and scale-up | The context of users, agents, digital technologies, and institutions |
| Use/ Application | European Union member countries (27 members and the United Kingdom) | EU countries and other nations |

Sussan and Acs (2017) recognize a gap in entrepreneurship conceptualization in the digital era and proposed a platform-based ecosystem as a novel framework, the Digital Entrepreneurial Ecosystem (DEE). This DEE integrated the concept of the digital ecosystem (DE) and entrepreneurial ecosystem (EE) as an interaction between biotic (users and agents) and abiotic entities (digital infrastructure and digital platforms/institutions). Separately, the digital ecosystem consists of two foundation pillars (digital infrastructures and users), while the entrepreneurial ecosystem consists of institutions and agents. In detail, the DEE represents the four concepts of Digital User Citizenship, Digital Entrepreneurship, Digital Infrastructure Governance, and Digital Marketplace. Later, Song, (2019) reconfigured those concepts by replacing the digital marketplace concept with a Digital Multi-sided Platform.

Further, following the work of Kenney & Zysman (2016), Song (2019), and Sussan & Acs (2017), the new DPE Index 2020 was created. The DPE methodology is created based on the National Systems of Entrepreneurship Ács et al. (2014) for measuring the size of the digital platform economy at the country level. In addition, the DPE methodology provides a framework for investigating the changing structure of the economy, identifying weaknesses in the ecosystem, and providing robust policy suggestions. Beyond a regional or local perspective, this methodology is advantageous for evaluating countries' digital efficiency through international comparisons. The DPE Index 2020 covers 116 countries.

Next, Figure 1 depicts the structure of DPE Index. It comprises four sub-indices, twelve pillars, 24 variables, and 61 indicators. Regarding the sub-indices, it entails four concepts: 1) Digital Technology Infrastructure (DTI), which comprises demand and supply side users; 2) Digital User Citizenship (DUC), which comprises application developers and other agents to support innovation, experimentation, and value creation; 3) Digital Multi-sided Platform (DMSP), which coordinates social and economic activities between users and agents; and 4) Digital Technology Entrepreneurship (DTE), which relates to platform-related technology infrastructure. Additionally, the twelve pillars comprise: 1) digital access (level of citizens' access to digital infrastructure such as computers, internet, laptop, others); 2) digital freedom (enough freedom for digital infrastructure development), 3) digital protection (level of law and regulation protection from piracy and cybercrime); 4) digital literacy (level of citizens' abilities to use computers, digital infrastructure, and digital platforms): 5) digital openness (country's level to reach and use the digital

infrastructure); 6) digital rights (citizens' legal rights to use digital infrastructure and protect their privacy at the same time); 7) networking (ability to grasp the network effect and other external effects of multi-sided platform), 8) matchmaking (ability to capture multi-sided platform business models different from earlier models); 9) financial facilitation (various financial aspects to realize matchmaking start-ups, financial transaction via internet, and platform provision for financial source providers and users); 10) digital adoption (agents' basic capabilities to use digital technologies); 11) technology absorption (agents' advanced capabilities to build new business models and/or digital products/services; and 12) technology transfer (the agents' knowledge spillover effect when working on discovery, evaluation, and exploitation).

| | SUB-INDICES | PILLARS | VARIABLES (Entrepreneurship/Digital) |
|---|---|---|---|
| DIGITAL PLATFORM ECONOMY | Digital Technology Infrastructure | Digital access | Digital access institutions |
| | | | Digital access digital technology |
| | | Digital freedom | Digital freedom institutions |
| | | | Digital freedom digital technology |
| | | Digital protection | Digital protection institutions |
| | | | Digital protection digital technology |
| | Digital User Citizenship | Digital literacy | Digital literacy institutions |
| | | | Digital literacy users |
| | | Digital openness | Digital openness institutions |
| | | | Digital openness digital technology |
| | | Digital rights | Digital rights institutions |
| | | | Digital rights digital technology |
| | Digital Multi-sided Platform | Networking | Networking agents |
| | | | Networking users |
| | | Matchmaking | Matchmaking agents |
| | | | Matchmaking users |
| | | Final facilitation | Final facilitation agents |
| | | | Final facilitation users |
| | Digital Technology Entrepreneurship | Digital adoption | Digital adoption agents |
| | | | Digital adoption digital technology |
| | | Technology absorption | Technology absorption agents |
| | | | Technology absorption digital technology |
| | | Technology transfer | Technology transfer agents |
| | | | Technology transfer digital technology |

Source: Szerb et.al (2022).
**Figure 1.** The DPE Index structure

The last important concept of DPE methodology is the advantage of this method for policy recommendations. This method can provide an individual recommendation which is country sensitive, includes the overall ecosystem development and the balance of digital and entrepreneurship components (quadrant analysis) and identifies the bottlenecks (poorly performing pillars) across the twelve pillars. Comprehensively, the DPE framework suggests at least three steps in using the methodology for providing policy recommendations:

1. Identify and interpret the country's performance on the overall DPE score in terms of a development-implied trend line;
2. Examine the balance of the digital and entrepreneurship ecosystem, which is a key requirement for a robust digital platform economy; and
3. Obtain and learn the weak components (bottlenecks) of the DPE economy for policy recommendation.

## III. METHODOLOGY

Our current study follows the DEE framework outlined in the previous section and uses the measurement results of the Digital Platform Economy (DPE) Index 2020, referring to Acs et al. (2020) and Szerb et al. (2022). We apply the same analytical approach to examine the digital entrepreneurship landscape in Brazil and compare it with Uruguay and Argentina as benchmarks, all three of which are part of the MERCOSUR economic group. To carry out this analysis, the three basic steps of the DPE index analysis are further decomposed into five analytical steps, namely:

1. First step: evaluating Brazil's digital entrepreneurship performance based on development using the DPE 2020 Index measurement. The result of analysis presented the relationship between the DPE Index and development of Brazil which was proxied by GDP per capita. In this part, the Brazil's performance was compared to the top 5 countries in the world and several Latin America and Caribbean countries.
2. Second step: analyzing the four subindices of Brazil's digital platform economy based on the DPE 2020 Index measurement.
3. Third step: evaluating twelve pillars of the DPE Index, which represented the entire Digital Ecosystem (DE) and Entrepreneurial Ecosystem (EE) elements. This pivotal phase also revealed bottleneck pillars, comprising the weakest pillars that pose substantial impediments capable of destabilizing the ecosystem's balance. Identifying these weakest pillars is essential for suggesting policies aimed at enhancing DEE or advancing the DPE index. In this phase, the Brazil's performance on the pillars level was compared to other countries, including Uruguay and Argentina.
4. Fourth step: analyzing Brazil's overall digital entrepreneurship profile analysis.
5. Fifth step: elaborating policy suggestions for advancing Brazil's DPE index. This referred to the position of Brazil in the six groups of countries (six quadrants). The quadrants were structured based on the difference between the digital ecosystem and entrepreneurship ecosystem scores and the deviation from the implied development trend line in the DPE

2020 index measurement. Quadrants 1 to 3 represent countries with DPE Index scores higher than their similarly developed peers but vary in DE and EE balance: Quadrant 1 has a stronger DE than EE, Quadrant 2 shows a balanced DE and EE (within ±5%), and Quadrant 3 has a weaker DE than EE. In contrast, Quadrants 4 to 6 feature countries with DPE Index scores lower than average. Quadrant 4 has a weaker DE compared to EE, Quadrant 5 shows a balanced DE and EE (within ±5%), and Quadrant 6 has a stronger DE than EE despite the lower overall DPE score. This framework helps assess a country's digital and entrepreneurial ecosystem balance. Further, the formulation of proposed policy advice is set by targeting a 10% increase in the DPE Index.

## IV. RESULT AND DISCUSSION

### A. Brazil's Performance based on Development

This part elaborates Brazil's overall Digital Platform Economy Index score in 2020, which considers the economic development based on Table 3 and Figure 2. This analysis aims at investigating the progress of Brazil's digital platform economy ecosystem. In detail, Table 3 presents the DPE Index 2020 of several countries with their per capita Gross Domestic Product (GDP) of International $ Purchasing Power Parity (PPP) of 2017. The top five countries with the highest DPE Index 2020 out of 116 are the United States (85.0), the United Kingdom (82.7), the Netherlands (82.4), Canada (78.2), and Sweden (76.8). The United States and Canada are in North America, while the United Kingdom, the Netherlands, and Sweden are in Europe. It is interesting that although the United Kingdom has a GDP of 2017 of 39,753, which is lower than the Netherlands (48,473), Canada (44,018), or Sweden (46,949), its DPE Index 2020 is in the second rank. Besides presenting the top five, Table 3 also shows several Latin America and Caribbean countries where Brazil is also included in this region. Among Latin America and Caribbean countries, the DPE score of Brazil (31.2) is in the fourth position after Chile, Uruguay, and Costa Rica. However, among the 116 countries, Brazil ranks 51, with an International $14,103 PPP per capita GDP in 2017.

Meanwhile, Figure 2 shows the connection between development and the DPE Index score through an implied development trend line because every country has different levels of development. In more detail, the red trend line (third-degree trend line) indicates a strong correlation (the Pearson correlation coefficient is 0.66) between countries with per capita GDP equal to or less than the International $65,000 PPP and their DPE Index score. Further, the R-Square value is 0.9032, which explains around 90% of the variation between development (measured by per capita GDP) and digital platform-based ecosystem (DPE Index). Based on that, the DPE Index methodology suggested interpreting a country's position below or above the implied development trend line. In this case, Brazil's position is above the trend line, with a DPE Index score is 31.2.

**Table 3.** The DPE Index of Top 5 and Several Latin America and Caribbean Countries, 2020

| World Rank | Country | DPE 2020 | GDP 2017 |
|---|---|---|---|
| 1 | United States | 85.0 | 54,225 |
| 2 | United Kingdom | 82.7 | 39,753 |
| 3 | Netherlands | 82.4 | 48,473 |
| 4 | Canada | 78.2 | 44,018 |
| 5 | Sweden | 76.8 | 46,949 |
| 38 | Chile | 40.6 | 22,767 |
| 42 | Uruguay | 36.3 | 20,551 |
| 46 | Costa Rica | 34.1 | 15,525 |
| 51 | Brazil | 31.2 | 14,103 |
| 52 | Argentina | 30.4 | 18,934 |
| 53 | Mexico | 29.4 | 17,336 |
| 59 | Colombia | 28.0 | 13,255 |
| 60 | Panama | 28.0 | 22,267 |
| 74 | Peru | 23.6 | 12,237 |
| 79 | Ecuador | 21.3 | 10,582 |
| 83 | Dominican Republic | 19.8 | 14,601 |
| 84 | Jamaica | 19.7 | 8,194 |
| 93 | El Salvador | 16.7 | 7,292 |
| 94 | Paraguay | 15.6 | 8,827 |
| 95 | Guatemala | 15.0 | 7,424 |
| 98 | Honduras | 13.9 | 4,542 |

Note: DPE = Digital Platform Economy index score; GDP = the per capita GDP of the country in International $ Purchasing Power Parity (PPP).

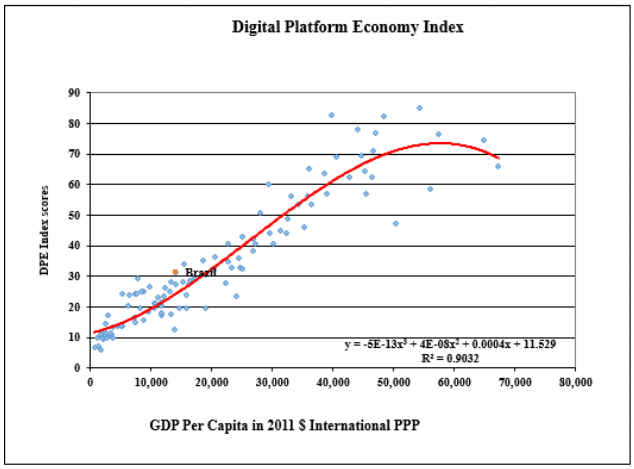


**Figure 2**. Brazil DPE position based on the connection between development and DPE Index Score, 2020
Note: PPP = Purchasing power Parity

## B. The Four Subindices Analysis

This part investigates the four subindices of Brazil's digital platform economy. This analysis will give a deeper understanding of the strengths and weaknesses of Brazil's digital platform economy through the score of Digital Technology Infrastructure (DTI), Digital User Citizenship (DUC), Digital Multi-Sided Platform (DMSP), and Digital Technology Entrepreneurship (DTE). Figure 3 depicts Brazil's performance on the four subindices level in 2020 out of 116 countries. In order, the score of Brazil's DPE subindices level from the highest to the lowest and their world rank are DMSP (36.5; rank 43), DTI (31.4; rank 52), DTE (31.3; rank 53), and DUC (25.8; rank 63). As a result, the strength of Brazil's digital platform economy is on DMSP, while the weakness remains on DUC with a 29.3% difference. The lowest score of DUC can be related to the high percentage of a cyberattack threatening the user's privacy. Brazil was the country that suffered the most cyberattack in the world in 2019 (OECD, 2020).

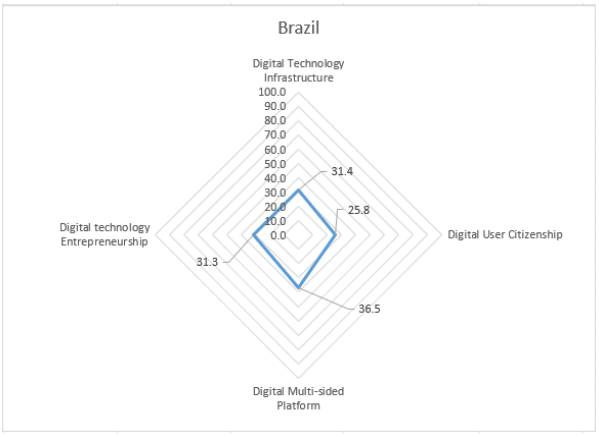


**Figure 3.** Brazil's performance on the four subindices level, 2020

## C. Twelve-Pillar Analysis and Comparison to Other Countries

This part analyzes the performance of Brazil's DPE on the twelve-pillar level compared to other countries. First, it will investigate Brazil's twelve-pillar DPE compared to 33% percentile and 67% percentile of 116 countries. Figure 4 depicts the pillar level of Brazil's performance in a spider graph, while Table 4 details the numbers. It can be seen from Figure 4 that almost all of Brazil's DPE pillar scores are still below those of the 67% percentile countries, except the matchmaking pillar is on par (green section in Table 4). The matchmaking pillar score means that digital entrepreneurship in Brazil can capture the multi-sided platform effect (the interaction of buyers and sellers through the platform) similar to the 67% percentile countries. In addition, almost all of Brazil's DPE pillar scores are above those of the 33% percentile countries, except the digital literacy pillar score is still below (red section in Table 4). The digital literacy pillar score shows Brazil has not yet focused on digital literacy. A survey on Brazil's Micro, Small, and Medium Enterprises (MSMEs) in 2021 also found that high cost and lack of knowledge were still a challenge for the MSMEs to fully leverage digital tools in their business practices (DAI & Ipsos, 2021).


**Figure 4.** Brazil's Performance on the Pillar Level, 2020

**Table 4.** Twelve Pillar Score of 33% percentile, 67% percentile, and Brazil

| Countries | 33% percentile | 67% percentile | Brazil |
|---|---|---|---|
| Digital Access | 13.7 | 50.6 | 27.8 |
| Digital Freedom | 24.5 | 40.9 | 34 |
| Digital Protection | 20.3 | 43.2 | 34 |
| Digital Literacy | 24.5 | 40.3 | 22.9 |
| Digital Openness | 17.2 | 50.4 | 22 |
| Digital Rights | 20.7 | 40.4 | 33 |
| Networking | 21.9 | 38.5 | 35.7 |
| Matchmaking | 22.4 | 45.3 | 45.7 |
| Financial Facilitation | 19.7 | 43 | 32 |
| Digital Adoption | 24.4 | 40.9 | 26.4 |
| Technology Absorption | 23.8 | 39.1 | 36 |
| Technology Transfer | 24.3 | 40.9 | 33.1 |
| **DPE Index** | **21.4** | **40.6** | **31.2** |

Note: Green section indicates almost equal score, while red section indicates weakest score of Brazil's pillars compared to 33% percentile

Next, this part analyzes Brazil's twelve-pillar DPE compared to Uruguay and Argentina as benchmarking countries. According to Country Similarity Index 2020 (Jones, 2022), those two countries are similar to Brazil in the demographics, culture, government, infrastructure, and geography criteria. Besides, all of them are members of MERCOSUR (MERCOSUR, n.d.). As shown in Table 3,

Uruguay's DPE position is in the 42-world rank (36.3) with an International $20,551 PPP per capita GDP, while Argentina is in the 52-world rank (30.4) with an International $18,934 PPP per capita GDP. Further, Figure 5 depicts Brazil's performance's pillar level compared to Uruguay and Argentina in a spider graph, while Table 5 shows the numbers and ranks in detail. Based on Figure 5, Brazil's performance is indicated by a red line which shows the different positions of strong and weak pillars compared to Uruguay and Argentina. Among the three countries, it is obvious that Brazil has five strongest pillars (digital protection, matchmaking, financial facilitation, technology absorption, and technology transfer) and five weakest (digital access, digital literacy, digital openness, digital rights, and digital adoption). These findings on the weakest pillars are in line with the findings of OECD (2020), which highlight two challenges: 1) the challenge in expanding quality broadband to rural and remote areas in Brazil and 2) the challenge in increasing the adoption and use of digital technologies in Brazilian firms, particularly the micro-enterprises. In addition, Uruguay has an outstanding pillar, digital rights (100).

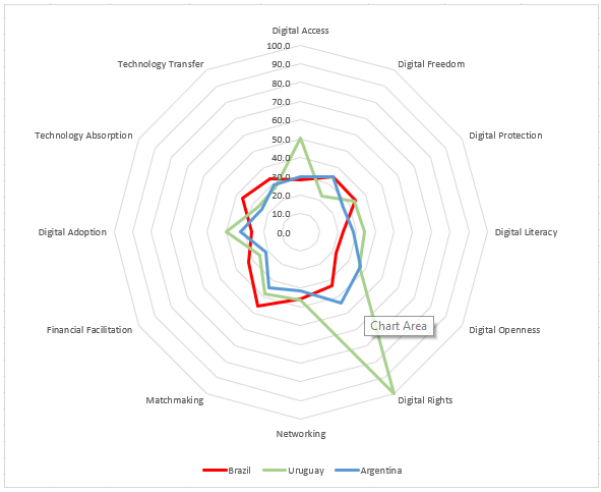


**Figure 5.** Brazil's performance on the pillar level compared to Uruguay and Argentina, 2020

**Table 5.** DPE Index Score and Rank among Uruguay, Brazil, and Argentina, 2020

| Categories/groups | Uruguay | | Brazil | | Argentina | |
|---|---|---|---|---|---|---|
| | Score | Rank | Score | Rank | Score | Rank |
| Digital Access | 50.5 | 1 | 27.8 | 3 | 29.5 | 2 |
| Digital Freedom | 22.2 | 3 | 34.0 | 2 | 34.2 | 1 |
| Digital Protection | 32.9 | 2 | 34.0 | 1 | 26.5 | 3 |
| Digital Literacy | 34.0 | 1 | 22.9 | 3 | 28.3 | 2 |
| Digital Openness | 36.1 | 2 | 22.0 | 3 | 37.1 | 1 |
| Digital Rights | 100.0 | 1 | 33.0 | 3 | 43.6 | 2 |
| | | | | | | |
| Networking | 36.5 | 1 | 35.7 | 2 | 31.4 | 3 |
| Matchmaking | 38.1 | 2 | 45.7 | 1 | 34.2 | 3 |
| Financial Facilitation | 25.0 | 2 | 32.0 | 1 | 21.3 | 3 |
| Digital Adoption | 40.0 | 1 | 26.4 | 3 | 32.2 | 2 |
| Technology Absorption | 26.8 | 2 | 36.0 | 1 | 24.2 | 3 |
| Technology Transfer | 27.3 | 3 | 33.1 | 1 | 28.8 | 2 |
| **DPE Index** | **36.3** | **1** | **31.2** | **2** | **30.4** | **3** |

Note: Green section indicates an almost equal score, while the yellow section indicates an outstanding score

Meanwhile, Table 5 helps to investigate the comparison in more detail. In comparison with Uruguay, Brazil has six pillars as the DPE strengths (digital freedom, digital protection, matchmaking, financial facilitation, technology absorption, and technology transfer) and five pillars as the DPE weaknesses (digital access, digital literacy, digital openness, digital rights, and digital adoption). At the same time, Brazil only has one pillar that scores almost equal to this country (networking), while the digital rights pillar is the pillar with the farthest score different to Uruguay. Correspondingly, in comparison with Argentina, Brazil has six pillars as the DPE strengths (digital protection, networking, matchmaking, financial facilitation, technology absorption, and technology transfer) and five pillars as the DPE weaknesses (digital access, digital literacy, digital openness, digital rights, and digital adoption). Although Brazil and Argentina have nearly the same DPE Index, they only have one pillar that scores almost equal: digital freedom. Furthermore, although Brazil has lower per capita GDP, it has DPE Index slightly higher than Argentina. In general, this comparison can answer the question of why even though Brazil possessing a DPE Index that is intermediate between Uruguay and Argentina, Brazil can have the highest number of unicorns. This is partly due to the high value of Brazil's DMSP sub-index, which consists of the Networking, Matchmaking, and Financial Facilitation pillars. DMSP is a platform that coordinates social and economic activities between users and agents. In fact, the values of Matchmaking and Financial Facilitation Pillars are the highest among the three.

Last, this part will compare Brazil's twelve pillars to the clusters' performance of the DPE Index. Based on Table 6, there are four clusters or groups, namely **Leaders** (Canada, Iceland, Netherlands, Sweden, Switzerland, United Kingdom, USA), **Followers** (Australia, Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Hong Kong, Ireland, Israel, Japan, South Korea, Luxembourg, Malta, New Zealand, Norway, Singapore, Spain, Taiwan), **Gainers** (Argentina, Bahrain, Brazil, Bulgaria, Chile, China, Costa Rica, Croatia, Cyprus, Czech Republic, Georgia, Greece, Hungary, Italy, Latvia, Lithuania, Macedonia, Malaysia, Mauritius, Mexico, Montenegro, Oman, Poland, Portugal, Qatar, Romania, Russia, Saudi Arabia, Slovakia, Slovenia, Turkey, Ukraine, United Arab Emirates; Uruguay), and **Laggards** (Albania, Algeria, Armenia, Azerbaijan, Bangladesh, Benin, Bosnia and Herzegovina, Botswana, Burundi, Cambodia, Cameroon, Colombia, Dominican Republic, Ecuador, Egypt, El Salvador, Ethiopia, Guatemala, Honduras, India, Indonesia, Iran, Jamaica, Jordan, Kazakhstan, Kenya, Kuwait, Kyrgyzstan, Lebanon, Madagascar, Malawi, Mali, Moldova, Mongolia, Morocco, Namibia, Nepal, Nigeria, Pakistan, Panama, Paraguay, Peru, Philippines, Rwanda, Senegal, Serbia, Sri Lanka, South Africa, Tanzania, Thailand, Tunisia, Uganda, Vietnam, Zambia, Zimbabwe). Brazil belongs to Gainers countries together with Argentina and Uruguay. Gainers countries have DPE Index score mean of 35.9. Although this cluster has good digital technology and engaged users, many components of the ecosystem for digital entrepreneurship still need to be developed (Szerb et al, 2022). In this case, Brazil and Argentina have DPE Index below the Gainer's DPE Index score mean, while Uruguay has DPE Index above the Gainer's DPE Index score mean. However, Brazil has the advantages of having two pillars with a score above the Gainers: matchmaking and technology absorption (indicated by green sections in Table 6). Unfortunately, Brazil has four relatively severe disadvantages compared to the Gainers countries: digital access, digital literacy, digital openness, and digital adoption (indicated by red sections in Table 6). The high value of the Matchmaking pillar is also a justification why Brazil can be the country with the most unicorns compared to Gainers countries. Matchmaking pillar is a component of Digital Multi-Sided Platform that focuses on capturing user contributions and the competitive drive of startups.

**Table 6.** The Performance of Clusters vs Brazil on the DPE Index, 2020

| Categories/groups | Leaders | Followers | Gainers | Laggards | Brazil | Difference (Brazil-Gainers) | |
|---|---|---|---|---|---|---|---|
| | | | | | | Point | % |
| Digital Access | 82.3 | 74.9 | 43.7 | 11.1 | 27.8 | -15.9 | -57.19 |
| Digital Freedom | 80.2 | 60.3 | 35.3 | 22.2 | 34.0 | -1.3 | -3.82 |
| Digital Protection | 88.3 | 74.2 | 37.5 | 14.6 | 34.0 | -3.5 | -10.29 |
| Digital Literacy | 77.4 | 59.2 | 33.6 | 24.1 | 22.9 | -10.7 | -46.72 |
| Digital Openness | 76.6 | 71.7 | 43.2 | 13.4 | 22.0 | -21.2 | -96.36 |
| Digital Rights | 68.5 | 62.8 | 36.3 | 22.2 | 33.0 | -3.3 | -10.00 |
| Networking | 84.1 | 64.2 | 37.2 | 19.1 | 35.7 | -1.5 | -4.20 |
| Matchmaking | 82.7 | 61.3 | 40.6 | 18.1 | 45.7 | 5.1 | 11.16 |
| Financial Facilitation | 79.3 | 70.1 | 38.3 | 16.8 | 32.0 | -6.3 | -19.69 |
| Digital Adoption | 81.8 | 63.0 | 39.0 | 18.6 | 26.4 | -12.6 | -47.73 |
| Technology Absorption | 83.3 | 59.1 | 34.4 | 22.9 | 36.0 | 1.6 | 4.44 |
| Technology Transfer | 82.0 | 63.2 | 35.8 | 20.6 | 33.1 | -2.7 | -8.16 |
| DPE Index | | | | | **31.2** | | |
| DPE Index score mean | **77.7** | **61.3** | **35.9** | **17.4** | **31.2** | **-4.7** | **-15.06** |
| *Number of cases* | 7 | 20 | 35 | 54 | 1 | | |

Note: Green section shows Brazil's pillars which scores are above the Gainers (the advantages)
The red section shows Brazil's pillars which scores are below the Gainers (the disadvantages)

According to CBNInsights, the number of large platform-based digital entrepreneurs in Brazil that have reached unicorn status has grown significantly with business models that leverage networking, matchmaking, and financial facilitation, as mentioned in the DEE framework. This business model is often referred to in management literature as a two-sided platform business model, although the term "multisided platform" is now more commonly used. Multisided platforms connect different groups of users, such as buyers and sellers of products or services, and facilitate transactions between them (Trabucchi & Buganza, 2020, 2021). In the DEE framework (DPE index), the network pillar represents the platform's ability to foster connections between these users. A strong network enables the platform to build a customer base within its digital entrepreneurship ecosystem. According to Eben & Robertson, (2022), Brazil's

large population increases the availability of these networks in sufficient numbers. In addition, at the core of DMSP is matchmaking, a process by which the platform connects users (buyers of products/services) with product/service providers, aiming to optimize time and cost efficiency. Well-known Brazilian unicorns such as Nubank, iFood, and 99 are examples of platforms with substantial customer bases. According to Andersson Schwarz (2017), companies with a significant number of users have a strong foothold in the digital market, which user loyalty should also support. Finally, the third pillar emphasized in these business platforms is financial facilitation, which includes easy-to-use payment systems, efficient transaction processes, and linking payments directly to users' debit or credit cards (Kazan et al., 2018; Ortino, 2022). These three pillars have grown significantly in Brazil and are marked by the significant growth of unicorn companies, which ultimately shows the significant growth of the Brazilian digital entrepreneurial ecosystem.

### D. Brazil's Overall Digital Entrepreneurship Profile Analysis

This part aims at analyzing Brazil's overall digital entrepreneurship profile. A balance between the digital and the entrepreneurship components is a prerequisite for a robust and healthy digital entrepreneurship economy (Szerb et al., 2022). For that reason, Brazil's complete profile analysis will be based on Table 7, which consists of 1) the sub-indices score, 2) the pillars score, 3) the entrepreneurship ecosystem score, and 4) the digital ecosystem score. In general, Brazil has a relatively well-developed digital ecosystem. The digital ecosystem score is around 1.9% higher than the entrepreneurship ecosystem score, 53.2 and 52.2, respectively. Out of twelve components, only matchmaking (56.2) is well-balanced between the digital ecosystem and entrepreneurship ecosystem. In detail, digital literacy (61.6) and digital protection (61.6) are the most robust components of the digital ecosystem, while digital access (44.9) is the weakest component. In addition, digital access (74.2) is the most vital component in the entrepreneurship ecosystem, while digital literacy (34.0) is the lowest component. Further, Brazil has four pillars as bottlenecks: digital openness (22.0), digital literacy (22.9), digital adoption (26.4), and digital access (27.8). The difference between the lowest and highest pillar score is relatively high: 51.9%. Nevertheless, the Government of Brazil has tried to encourage digitalization by enforcing the Brazilian Digital Transformation Strategy (E-Digital) in 2018-2021 (OECD, 2020).

**Table 7.** Brazil's Full Profile

| Pillars/ Sub-Indices | | Pillar/ Sub-Index Score | Entrepreneurship Ecosystem Score | Digital Ecosystem Score |
|---|---|---|---|---|
| DTI | Digital Access | 27.8 | 74.2 | 44.9 |
| | Digital Freedom | 34.0 | 48.6 | 57.4 |
| | Digital Protection | 34.0 | 44.1 | 61.6 |
| **Digital Technology infrastructure** | | **31.4** | | |
| DUC | Digital Literacy | 22.9 | 34.0 | 61.6 |
| | Digital Openness | 22.0 | 39.0 | 50.5 |
| | Digital Rights | 33.0 | 54.3 | 52.6 |
| **Digital User Citizenship** | | **25.8** | | |
| DMSP | Networking | 35.7 | 51.6 | 57.6 |
| | Matchmaking | 45.7 | 56.2 | 56.2 |
| | Financial Facilitation | 32.0 | 57.7 | 48.3 |
| **Digital Multi-sided Platform** | | **36.5** | | |
| DTE | Digital Adoption | 26.4 | 46.5 | 52.7 |
| | Technology Absorption | 36.0 | 57.2 | 53.5 |
| | Technology Transfer | 33.1 | 54.5 | 50.7 |
| **Digital Technology Entrepreneurship** | | **31.3** | | |
| **Digital Platform Economy Index** | | **31.2** | **52.2** | **53.2** |

## E. Policy Suggestions Based on Quadrant Analysis

This section will discuss a policy suggestion based on the quadrant analysis of the DPE methodology, as shown in Figure 6. The quadrant analysis displays the relationship between X-axis, the difference between the DPE index trend line and the actual DPE index score in percentage, and Y-axis, which is the difference between the digital ecosystem scores and the entrepreneurship ecosystem score. As a rule, the relationship considers accepting a deviation from the projected development trend line of less than -5% as well as a -5% to 5% difference between the digital and entrepreneurship ecosystem scores. As a result, out of six quadrants, Quadrant II is the good position. It can be seen from Figure 6 that Brazil's position is on Quadrant II. The position is determined by the point consisting of 1.93% (the difference between the digital ecosystem and entrepreneurship ecosystem) and 20.6% (the difference between DPE and DPE trend). This also means that Brazil has a higher DPE index score than the average similarly developed countries. Besides, the digital ecosystem and the entrepreneurship ecosystem components shared in this country are within the -5% to 5% range. Therefore, as policy recommendations, Brazil should keep the balance between the digital ecosystem (DE) and the entrepreneurial ecosystem (EE); the existing DE and EE balance is delicate.

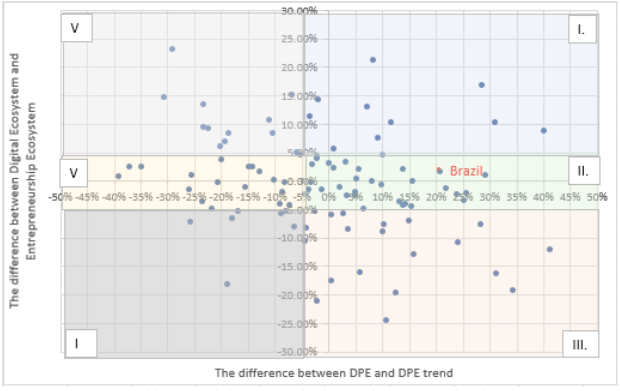


**Figure 6.** Brazil's position on the quadrant analysis

Although Brazil is in a good position, optimizing additional resources would be well-intentioned. Besides, DPE Index 2020 methodology is a comprehensive country-level measurement encapsulating two critical aspects: the simultaneous operationalization of different pillars to create a high-quality ecosystem dynamic and the concept of bottlenecks. Therefore, Brazil should highlight priority areas that could be explored further by referring to the policy optimization (applying a 10% increase of the DPE Index score) as presented in Table 8. In this case, Brazil should spend each 32% of the additional resources on the digital literacy and digital openness pillar, 19% on digital adoption, and 16% on the digital access pillar.

**Table 8.** The Distribution of Additional Resources for a 10% Increase in the DPE Index Scores

| Pillar | Required Increase in Pillar | Percentage of Total New Effort |
|---|---|---|
| Digital Access | 0.05 | 16% |
| Digital Freedom | 0.00 | 0% |
| Digital Protection | 0.00 | 0% |
| Digital Literacy | 0.10 | 32% |
| Digital Openness | 0.10 | 32% |
| Digital Rights | 0.00 | 0% |
| Networking | 0.00 | 0% |
| Matchmaking | 0.00 | 0% |
| Financial Facilitation | 0.00 | 0% |
| Digital Adoption | 0.06 | 19% |
| Technology Absorption | 0.00 | 0% |
| Technology Transfer | 0.00 | 0% |
| Sum of additional resources | 31.0 | |

Based on the quadrant analysis (Figure 6) and the Penalty for Bottleneck (PFB) analysis (Table 8), there are two critical points to note. *First*, despite the relatively balanced state of the Digital Ecosystem (DE) and the Entrepreneurial Ecosystem (EE) in Brazil, there are noticeable weaknesses in the four pillars that act as bottlenecks as a result of the PFB analysis, namely digital access, digital literacy, digital openness, and digital adoption. The first three pillars are the constituent elements of the Digital Technology Infrastructure (DTI) and Digital User Citizenship (DUC) sub-indices, which are integral parts of the Digital Ecosystem (DE) framework. As noted by experts, it is critical for countries to focus their efforts on improving the digital literacy of their citizens (Sharma et al., 2016) and fostering a culture of digital openness (Ali & Jabeen, 2024). Improving digital literacy enables platform users or customers to understand the nature and characteristics of digital technologies. Meanwhile, digital openness facilitates increased (digital) access to new technologies and accelerates the knowledge transfer process, creating opportunities for future collaboration. Digital adoption is the weakest pillar in the Brazilian Entrepreneurial Ecosystem (EE) framework. According to Nambisan (2017), digital adoption plays a critical role in digital entrepreneurship by ensuring that relevant technologies are effectively implemented in the digital entrepreneurial ecosystem. Therefore, aligning the use of relevant technologies with current user needs is critical to

increasing customer perceptions of a digital platform's entrepreneurial capabilities. *Second*, Brazil and other countries facing similar challenges with weak or developing digital ecosystems can gain valuable insights from this policy analysis. To effectively balance DE and EE, policymakers need to assess the state of the fundamental pillars that make up DEE from two perspectives. Strong pillars serve as the backbone of successful DEE, while weak pillars provide opportunities for targeted policy interventions (Autio & Levie, 2017). In developing countries, there is an urgent need to upgrade digital infrastructure and improve the quality and skills of developers and platform users (Li et al., 2020; Sturgeon, 2021). These efforts require complex support, particularly in terms of budget allocations to build digital infrastructure and education and training to improve the skills and competencies of digital entrepreneurs.

These findings highlight that developing countries such as Brazil, despite still facing various socio-economic constraints, actually have a relatively more robust digital entrepreneurial ecosystem due to the support provided by the pillars of the Digital Multisided Platform (DMSP). This is in contrast to the findings of Wibisono (2023), who observed challenges in the developed countries of the European Union related to the dimensions of the DMSP. This difference implies that, in certain contexts, developed countries may be able to draw valuable lessons from the experiences of developing countries to address or improve certain DEE dimensions that are weaker in their countries. Conversely, developing countries also have much to learn from developed countries in their efforts to build a strong digital infrastructure that can strengthen their digital entrepreneurship ecosystem.

## V. CONCLUSION

This study applies the DPE methodology to assess Brazil's digital entrepreneurial ecosystem. As the land of unicorn companies in Latin America and the Caribbean/South America, Brazil has a DPE score of 31.2, which ranks 51 in the world and fourth in the region. Additionally, Brazil's DPE performance in terms of development is above the trend line. Regarding the four subindices analysis, Brazil has a strength in the Digital Multi-Sided Platform and a weakness in the Digital User Citizenship with a 29.3% difference. Next, compared to the 33% and 67% percentile countries, Brazil is in the middle position between both. Only one pillar still becomes a disadvantage because the score is below the 33% percentile countries, which is the digital literacy pillar.

Meanwhile, when comparing to similar countries (Uruguay and Argentina) simultaneously, Brazil has five strongest pillars (digital protection, matchmaking, financial facilitation, technology absorption, and technology transfer) and five weakest pillars (digital access, digital literacy, digital openness, digital rights, and digital adoption). This study also compared Brazil's pillars to Gainers countries. The result shows that Brazil has two advantages pillars (matchmaking and technology absorption) and four disadvantages pillars (digital access, digital literacy, digital openness, and digital adoption). Moreover, Brazil's overall digital entrepreneurship profile reveals a well-balanced digital entrepreneurial ecosystem. Further, according to quadrant analysis, Brazil is in a good position ecosystem, the existing DE and EE balance is delicate, and the DPE index score is higher than the average similarly developed countries.

Nevertheless, Brazil should highlight four priority areas as policy optimization: digital literacy, digital openness, digital adoption, and digital access. These findings can provide critical inputs for Brazilian Governments. Besides based on these findings, the Brazilian Government can encourage the development of digital entrepreneurship while make progress in tackling the digitalization challenge through "Brasil Eficiente" Program (Efficient Brazil), which consists of eight programs, including the Brazilian Digital Strategy, Digital Citizenship Platform, and Projects of simplification of tax, social security and work services for both enterprises and citizens (Deloitte, 2019). Moreover, the Brazilian Government can eliminate digital adoption barriers by addressing regulations restricting e-commerce development and disincentive taxes.

Last, the study of Brazil's digital entrepreneurial (DEE) ecosystem through the lens of the Digital Platform Economy (DPE) index has several limitations. A substantial limitation is the focus on comparative analysis with only two peer countries in the region, namely Uruguay and Argentina. While this comparison provides valuable insights, it may not capture the full spectrum of variability in the region, especially given the diverse socioeconomic context across Latin America and Caribbean/South American countries (Andonova et al., 2023). In addition, reliance on the DPE index, while comprehensive, may overlook qualitative factors that influence the entrepreneurial environment, such as cultural

attitudes toward entrepreneurship and the role of the informal economy in digital entrepreneurship (Klein & Braido, 2024).

Future research directions could include a broader comparative analysis covering more countries in Latin America and Caribbean/South American countries to better understand regional differences and similarities in DEE development. In addition, qualitative research exploring the lived experiences of entrepreneurs in Brazilian DEEs could provide deeper insights into the challenges and opportunities they face, particularly in terms of digital literacy and access. By addressing these limitations and expanding the scope of research, researchers can contribute to a more nuanced understanding of the Brazilian digital entrepreneurship landscape and its implications for policy and practice.

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