DIGITAL ENTREPRENEURSHIP LANDSCAPES IN DEVELOPING ASIA

INSIGHTS FROM THE GLOBAL INDEX OF DIGITAL ENTREPRENEURSHIP SYSTEMS

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ABSTRACT

Digitalization transforms how entrepreneurs pursue opportunities. To understand this transformative impact on entrepreneurship, we present the Global Index of Digital Entrepreneurship Systems (GIDES), a composite indicator developed to assess the performance of the digital entrepreneurial ecosystem at the national level. To address existing conceptual gaps, GIDES concurrently monitors the general, structural and digital framework contexts supporting digital entrepreneurship. The digital framework conditions, describing the general level of digitalization of the economy, affect entrepreneurial activity through their impact on general and systemic framework conditions. Unlike traditional entrepreneurship or most entrepreneurial ecosystem measures, GIDES takes a systemic approach utilizing the Penalty for Bottleneck (PFB) algorithm to spot bottlenecks connecting elements that could potentially degrade overall system performance. With GIDES, we provide a measure of the digital transformation of entrepreneurship for policymakers who want to improve the quality and productivity potential of the entrepreneurial resource allocation dynamic in their countries. For illustration, GIDES profiles the digital entrepreneurship systems of 113 countries, with a special focus on 21 in developing Asia.

Keywords: entrepreneurship, digitalization, digital entrepreneurship ecosystem, composite indicator, GIDES, Asian developing countries

JEL codes: L26, O32, O33, O57

1. Introduction

Digital technology is radically reshaping our world. There are studies measuring countries' progress in digitization, helping understand their position in the new era of digital competition (e.g., DEDI, DESI, or NRI[1]). While acknowledging the value of these studies, it is essential to stress that digital technologies directly transform entrepreneurship by changing the landscape of opportunities and how entrepreneurs pursue them. The integration of these technologies leads to the digital transformation of businesses, prompting them to transform their operations, enabling them to adapt to enhance competitiveness, efficiency, and customer satisfaction (Fitzgerald et al. 2014, Liu et al. 2011, Nambisan et al. 2019, Vial 2019). This transformation is embodied in digital entrepreneurship (DE), which refers to businesses that take advantage of digital technologies in their operations (Davidson and Vaast 2010, Hull et al. 2007, Nambisan 2017). In light of the above, it makes sense that DE has recently become a new focus in entrepreneurship research (Kollmann et al. 2022, Kraus et al. 2018).

To understand DE, it is necessary to consider not only the entrepreneur but also the environment (Zaheer et al. 2019). The entrepreneurial ecosystem (EE) approach has gained wide interest in entrepreneurship research over the last decade (García-Lillo et al. 2023). EE consists of interrelated actors and contextual factors influencing entrepreneurship (Ács et al. 2014, Stam and van de Ven 2021). It is a complex, self-organizing system with heterogeneous components, non-linear interactions, and open boundaries, and with a sensitivity to initial conditions and shocks (Roundy et al.

[1] Digital Ecosystem Development Index (DEDI) by Katz and Callorda (2018); Digital Economy and Society Index (DESI) by the European Commission (2023); Network Readiness Index (NRI) by Dutta and Lanvin (2022).

2018). However, Sussan and Acs (2017) identified a gap in the conceptualization of entrepreneurship in the digital age, pointing out that the concept of EE, while emphasizing a wide range of spatial contexts, does not integrate the digital context. Consequently, the concept of digital entrepreneurial ecosystem (DEE) has emerged, which integrates DE and EE concepts, emphasizing that the presence of DE in an economy depends on the entrepreneurial context. A comprehensive review by Bejjani et al. (2023) defines DEE as "complex and dynamic systems composed of heterogeneous actors that exploit digital technologies for value co-creation while relying on digital infrastructure that supports governance mechanisms, facilitates access to resources, enables the development of complementarities, and overcomes spatial boundaries." (p. 8).

The literature distinguishes three perspectives on the relationship between DE and EE (Bejjani et al. 2023). Some studies define DEE as a distinct concept, offering an explicit definition and often a conceptual model (e.g., Elia et al. 2020, Song 2019, Sussan and Acs 2017). Others extend the EE concept to include the impact of digital technologies in various contexts without explicitly labeling them as DEEs (e.g., Autio et al. 2018). The third group uses different terms to describe the interaction between digitalization and ecosystems (e.g., "digital platform"), indicating a lack of consensus on interpreting these ecosystems in a digital context. This conceptual diversity seems to be more of a barrier to progress in measurement.

Although EEs follow a unique evolutionary path (Neck et al. 2004), from a broader perspective, common structures and features that allow their comparative study can be identified (Szerb et al. 2019). Given the interrelatedness of EE components, their measurement requires a systemic approach. Current measures of country-level

entrepreneurship, however, often focus on “count” and “prevalence” indices, overlooking the system dynamics and diverse productivity potential of entrepreneurial activities.[2] Some promising frameworks for profiling EE exist, but they also lack a systemic approach and transparent methodological explanations.[3] In addition, all these measures fail to capture the structural elements of EEs in their operationalization (Autio et al. 2018b).[4] The Global Entrepreneurship Index (GEI/GEDI) employs a systemic approach, where the EE components are considered to “co-produce” system-level outcomes.[5] This is operationalized through the Penalty for Bottleneck (PFB) algorithm, which penalizes strong EE components for weak components—or bottlenecks—in both component- and index-level performance.

These highlight the necessity for further development of the DEE concept. However, there are already some noteworthy measurement methods for studying EE, which provide a promising starting point for determining the transformative effects of digitalization on entrepreneurship. The aim of this research was to create the Global Index of Digital Entrepreneurship Systems (GIDES). To overcome the outlined conceptual gaps, this national-level composite indicator is based on a theoretical framework model that seeks to reflect the complexity of DE through a concurrent assessment of the general, structural, and digital contexts. Moreover, to eliminate the indicated measurement

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[2] These measures are: (i) Preference for Self-employment, European Commission; Flash Eurobarometer 354 (Entrepreneurship in the EU and beyond) http://ec.europa.eu/public_opinion/flash/fl_354_en.pdf; (ii) Total Early-stage Entrepreneurial Activity (TEA), Global Entrepreneurship Monitor, https://www.gemconsortium.org/; and (iii) Start-up Ranking, StartupRanking.com, https://www.startupranking.com/ (accessed 9 November 2023).

[3] The frameworks are: (i) Kauffman Foundation’s EE initiative (Bell-Masterson and Stangler 2015); and (ii) EE Measurement Framework (Stam 2015, 2018).

[4] Startup Genome's Global Startup Ecosystem Index (https://startupgenome.com/) ranks city-level ecosystems based on their performance, but does not examine ecosystems at either the stand-up or scale-up stage.

[5] Detailed description of the index methodology offered by Ács et al. (2014).

deficiencies, GIDES offers a systemic perspective rooted in the concept of National Systems of Entrepreneurship (Ács et al. 2014), and utilizes the PFB algorithm to identify elements hindering DEE performance. In addition, ecosystem indices are not typically tested for robustness, even though composite index creation has several, not necessarily objective, decision points. Therefore, our aim is not the robustness of the analysis itself, but we also add those results to support the indicator. GIDES is useful to identify potential priority areas for policy intervention.

The structure of this paper is as follows: section 2 lays a conceptual groundwork for the impact of digitalization on entrepreneurship; section 3 introduces the structure of GIDES, explains its calculation, and the robustness analysis; and section 4 delves into the findings. The concluding section summarizes the study's key takeaways.

2. Theoretical Background

2.1 National Systems of Entrepreneurship (NSE)

To understand the level of DE at a country level, we utilize the concept of National Systems of Entrepreneurship (Ács et al. 2014). According to that, the pursuit of entrepreneurial opportunity by individuals drives a resource allocation dynamic at the national level that allocates resources toward economic uses. This is not a frictionless process, as starting a new business entails opportunity costs, since the human and financial resources allocated for entrepreneurial opportunity pursuit cannot be simultaneously deployed for alternative purposes (McMullen and Shepherd 2006). In any country, the entrepreneurial resource allocation dynamic is shaped by a myriad of individual-level decisions that may allocate resources to either low- or high-productivity

uses, including low-productivity uses such as subsistence entrepreneurship or high-productivity uses such as innovative, high-growth entrepreneurship. A core assumption in our theorizing is that this resource allocation dynamic ultimately contributes (or does not) to the country's Total Factor Productivity (TFP) (Ács et al. 2014). This dynamic is shaped by two key constraints. First, if the opportunity perceived by the entrepreneur turns out to be of high quality, resources will have been pushed toward highly productive uses, and the associated profit potential ensures that the entrepreneur will persist in the pursuit of opportunity. Alternatively, if the opportunity turns out to be of low quality, and if the entrepreneur perceives higher earnings potential in alternative occupational pursuits, they will abandon the perceived opportunity. The net outcome of these two mechanisms is that a high-quality entrepreneurial dynamic should allocate resources toward productive uses and thus help drive TFP and economic development (Ács et al. 2014).

Depending on how country-level framework conditions regulate this resource allocation process, the process may be more or less effective in contributing to the country's TFP. Empirical studies show that a country's framework conditions for entrepreneurship play a key role in regulating the quality of entrepreneurial resource allocation dynamic (Audretsch and Belitski 2017, Autio and Fu 2015, Rodríguez-Pose 2020). Favorable entrepreneurial framework conditions reduce barriers to start a business by lowering risks and facilitating resource access (Autio and Acs 2010).

The realization of the importance of how system-level framework conditions shape the quality of the entrepreneurial dynamic triggered the concept of EE in entrepreneurship

research (Autio et al. 2018b).[6] Although there is no universal definition for EEs, most definitions echo the notion of natural ecological ecosystems, in the sense that they are considered regional communities of stakeholders, embedded in a given economic, social, and institutional context, that generate a system-level outcome analogous to the "ecosystem service" generated by natural ecosystems (Acs et al. 2017, Neck et al. 2004, Roundy et al. 2018, Stam and Van de Ven 2021). As a novel form of regional clusters, EEs facilitate business model innovation and knowledge transfer, and help new businesses access the resources they need to start up and scale up (Autio et al. 2018b). At the national level, National Systems of Entrepreneurship are composed of regional EEs plus country-level framework conditions of entrepreneurship.

2.2 Digital Context

Digital technologies have a transformative impact on entrepreneurial opportunities by enabling often radical new ways for entrepreneurial businesses to organize for the creation, delivery, and capture of customer value (Autio and Rannikko 2017, Yoo et al. 2010). This phenomenon has been largely driven by the rapid and widespread adoption of public cloud technologies and the emergence of an "application economy" with the now-universal adoption of smartphones and applications therein. Digital artifacts, platforms, and infrastructures blur functional, organizational, and geographical boundaries, challenging established business practices (Hausberg et al. 2019).

[6] Following Autio et al. (2018b), we define an EE as primarily a regional-level phenomenon, as the regional community of stakeholders who collectively facilitate entrepreneurial stand-up, start-up, and scale-up in a given region. At the national level, we use the term: "national systems of entrepreneurship" to describe the broader constellation of country-level factors that shape the country's entrepreneurial resource allocation dynamic (Ács et al. 2014).

Autio et al. (2018b) observed that digitalization shapes entrepreneurship and EEs through the creation of novel digital affordances, which allow entrepreneurs to perform entirely new functions and discover new ways of organizing. Through the creation of digital affordances, digital technologies can enhance interactions and coordination between individuals and organizations, thereby opening new opportunities for value creation, delivery, and capture—i.e., business model innovation (Amit and Zott 2001). The firm's business model defines how it engages with its various stakeholders for value co-creating interactions. Digital affordances help enhance, extend, and enrich the value co-creation potential of such interactions. In so doing, digitalization potentially helps boost the productivity potential of the entrepreneurial resource allocation dynamic in countries.

Digitalization plays an important role in fostering regional EEs and national entrepreneurship systems by acting as one of the linking mechanisms between their constituent elements. This recognition has prompted the concept of DEE (Raut et al., 2021). Primarily a regional phenomenon, the DEE is defined as an open, loosely connected, demand-driven, self-organized, and participatory environment in which each participant is proactive and sensitive to their own utility and gain (Chang and West 2006). It describes a system in which participants (actors, institutions, and organizations) and their relationships are mutually supportive to increase their utility, gain advantage, and facilitate knowledge transfer (Audretsch et al. 2023, Li et al. 2012). The DEE focuses on new technological processes at the intersection of business and digital systems (Autio et al. 2018a, Nambisan 2017).

Policy conclusions suggest that in the context of a DEE, a stronger and more dynamic economy requires not only the development of digital physical infrastructure, but

also the balanced development of all elements of regional EEs and national-level systems of entrepreneurship. The development of the digital economy is influenced by regulations that create a favorable business environment, specific skills that help people and businesses to use advanced digital technologies, and effective institutions that support digitalization (World Bank 2016). Adaptability, absorptive capacity, and the diffusion of digital technology solutions and tools play a key role in the strength of the digital entrepreneurial ecosystem.

The smooth functioning of organizations in the digital era requires all actors to have a nuanced understanding of the current state of societal digitalization. Moreover, to advance progress toward a digital entrepreneurial economy, policymakers need reliable metrics to monitor and harness the productivity potential of digital advances for economic and societal welfare (Autio et al. 2019, Brown and Mason 2014). We next lay out the GIDES methodology developed to advance such an understanding.

3. The Global Index of Digital Entrepreneurship Systems

3.1 Index Structure

GIDES is a composite indicator designed to monitor the digitalization of society and the economy, with a focus on entrepreneurial processes. The logic behind the index is to use measures of digital conditions as weights to adjust the effect of institutional and contextual country-level framework conditions that shape the quality of entrepreneurial resource allocation dynamic.

The country-level framework conditions for entrepreneurship, encapsulated in the eight pillars of the index (Figure 1), regulate the quality of the country’s entrepreneurial

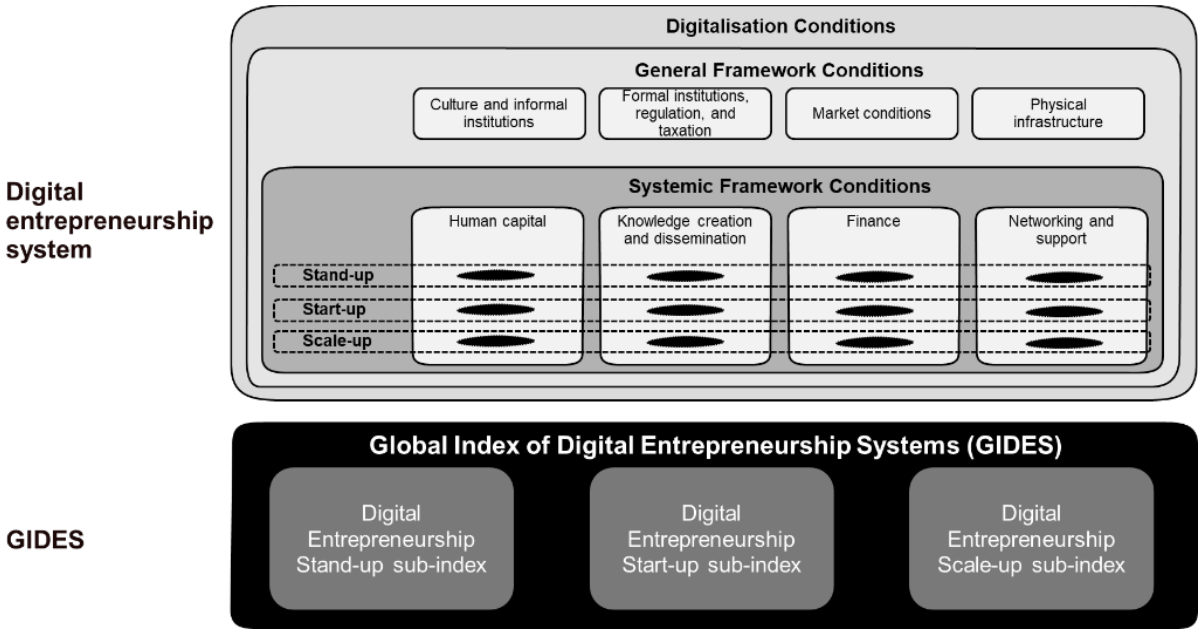
dynamic in two ways: (i) by shaping resource allocation trade-offs toward entrepreneurship versus alternative occupational pursuits (General Framework Conditions [GFCs]); (ii) by regulating the availability of external resources to this pursuit (Systemic Framework Conditions [SFCs]). GFCs capture the general context for entrepreneurial activity in a country and include pillars as (i) culture and informal institutions; (ii) formal institutions, regulation, and taxation; (iii) market conditions; and (iv) physical infrastructure. All these conditions have been shown to shape entrepreneurial activity (Autio et al. 2013; de Soto 2000; Djankov et al. 2002, 2003, 2006; Seung-Hyun et al. 2007; Wennberg et al. 2013). SFCs are resource-related conditions that directly affect a country's entrepreneurial dynamics and include: (i) human capital (Marvel et al. 2016, Shane 2003, Unger et al. 2011); (ii) knowledge creation and dissemination (Audretsch and Lehmann 2005, Iftikhar et al. 2022, Qian and Acs 2013); (iii) finance (Charfeddine and Zaouali 2022); and (iv) networking and support (Koo and Cho 2011, Zhao et al. 2022). In practice, businesses need many different resources to grow successfully. SFCs have a different impact on the three stages of entrepreneurial development: stand-up, start-up, and scale-up. These resources are not substitutable against one another. Therefore, the SFCs have to come together to help “co-produce” the system outcomes.

High-quality data on a country’s framework conditions for entrepreneurship is crucial to better understand how a given country could enhance the quality of its entrepreneurial resource allocation dynamic, and consequently, the ability of this dynamic to contribute toward the country’s TFP.

As a third layer in our model, the digital framework conditions describe the general level of digitalization of the economy, as it affects entrepreneurial activity through its

impact on general and systemic framework conditions. For each pillar, we have calculated an appropriate digital weight reflecting the digital conditions in the country relevant to that pillar. For each pillar, we calculate a non-digitalized version and a digitally weighted version. The digitalized versions of pillars we call Digital Framework Conditions for entrepreneurship.

Figure 1: Structure of the Global Index of Digital Entrepreneurship Systems Index



Source: Adapted from Autio et al. 2020.

An earlier version of the GIDES methodology, the European Index of Digital Entrepreneurship Systems (EIDES), was developed as a part of a 3-year research project (2018–2020) for the European Commission's Joint Research Centre.[7] GIDES has the same index structure, but its indicator set has been adjusted according to data availability.

[7] EIDES (Autio et al., 2018b, 2019, and 2020) was the first attempt to measure both the framework (physical) and digital conditions for entrepreneurial stand-up, start-up, and scale-up in the 27 European Union countries and the United Kingdom.

3.2 Index Operationalization

In GIDES, both GFCs and SFCs are operationalized as index pillars consisting of sets of individual variables. Each pillar value is obtained by calculating the arithmetic mean of the normalized individual variables. Each framework condition is represented by a single pillar value. GIDES calculates distinct pillar values for SFCs across the three entrepreneurial life cycle stages (stand-up, start-up, and scale-up). Thus, the index consists of a total of 16 pillars: 4 for GFCs and 4 for each of the three stages of SFCs. Each index pillar is matched with a corresponding digital weight. The measures of the different digital conditions (one for each pillar) are calculated as the arithmetic mean of their constituent variables after normalization. Thus, the index offers two pillar values for each general and systemic framework condition: a digitalized value and a non-digitalized value.

To capture system dynamics, two methodological steps followed when aggregating individual pillar values into three sub-indices: Equalization of Pillar Averages and the PFB algorithm (Ács et al. 2014). The equalization step adjusts the scales of each pillar to have the same average value, while the bottleneck algorithm introduces non-substitutability across pillars and penalizes for gaps and variances among individual pillar values. The sub-indices, representing general and systemic framework conditions in both digital and non-digital versions, are calculated as arithmetic means of equalized and bottleneck-penalized pillar values. The overall GIDES value is the arithmetic mean of the measures for general and systemic framework conditions. The full details of these steps are explained in Appendix 1.[8] This approach provides an accurate representation of

[8] The appendixes are available at http://dx.doi.org/10.22617/WPS240095-2.

national digital entrepreneurial ecosystems. It allows for differentiation between digital and non-digital dynamics and provides insights into general framework conditions, digitalization, and the three sub-dynamics of the overall entrepreneurial dynamic.

GIDES consists of 103 individual indicators. The description of all the indicators used in the GIDES calculation can be found in Appendix 2. The data used for GIDES calculation were mostly the latest available between June and August 2021, covering years 2019, 2020, or 2021 for most indicators. GIDES scores range theoretically from 0 (low) to 100 (high).

3.3 Robustness Analysis

In a composite indicator analysis, the compilation of the final index involves a series of choices. The aim of the robustness (or uncertainty) analysis is to examine the extent to which the final index value is sensitive to choices made during the index compilation when it comes to choices such as the selection of individual indicators and the weighting of different components of the index (Saisana et al. 2005, Van Roy and Nepelski 2016). As such, the choice of the indicators used to populate the index pillars in the overall index is generally formed by expert judgment, data availability, and checks on statistical consistency. In the case of the GIDES index, robustness analysis entailed compensability effect analysis, an examination of the role of individual index pillars and the different sub-indices in different country groups, and a drop-out effect examination of individual index pillars.

3.3.1 Compensability Effect

Compensability is the "existence of trade-off, i.e., the possibility of offsetting a disadvantage on some criteria by a sufficiently large advantage on another criterion" (Munda 2008, p. 71). The Ordered Weighted Averaging (OWA) approach was used for the pillars to present one aspect of compensability in the case of the GIDES index (Yager 1996). This technique looks for different weighting scenarios and strategies to combine individual indicators into an overall index. Five scenarios were defined for the OWA operators (set of weights, where the sum of the weights is 1):

(i) **Purely optimistic operator *(o)***. The variable (in our case, the index pillar) with the largest value is assigned the weight value 1, and all the other pillars are assigned the weight value 0, the sum of all individual weights being 1. This means that the sub-index value equals the largest individual pillar value. Conceptually, in terms of system behavior, this approach expresses an "or" condition for individual system components: as long as at least one system component is healthy, the entire system is considered to be in a healthy state. In other words, the performance of the best-performing system component is able to fully substitute for performance gaps among the less well-performing system components.

(ii) **Purely pessimistic operator *(p)***. The index pillar with the lowest value is assigned a weight of 1, and all other pillars are assigned a weight value of 0. The value of the overall index equals the value of its most poorly performing pillar. Conceptually, this can be understood as an "and" condition: individual system components cannot be used to compensate for possible gaps in other system components (i.e., zero

substitutability), and the overall system performance is therefore defined by its most poorly performing component.

(iii) **Arithmetic means operator**. The sub-index value is calculated as the arithmetic mean of its pillars, and the overall index value is calculated as the arithmetic mean of its sub-indices. Comparison against this strategy allowed us to check the difference between penalty-weighted results and the simple arithmetic mean of all components.

(iv) **Arithmetic plus geometric means operator**. Sub-indices are calculated as the arithmetic means of its pillars, and the overall index value is calculated as the geometric mean of its sub-indices.

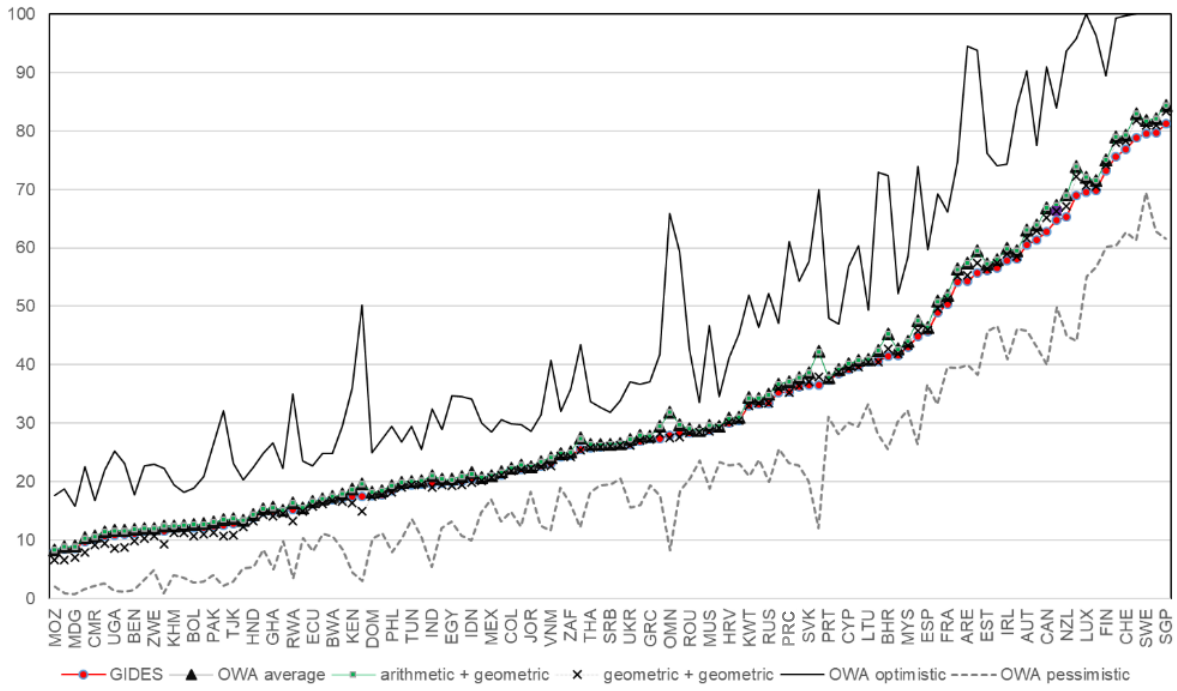
(v) **Geometric means operator**. Sub-indices are calculated as geometric means of individual pillars, and the overall index value is calculated as the geometric mean of its sub-indices.

In the first three strategies, the final index value is calculated as the simple arithmetic mean of its sub-indices. The OWA operators are applied for the pillars. Geometric mean, similarly to our penalized weighting scheme, supports the “and” condition, as it gives lower index values if the distribution of individual pillar values is uneven. Altogether, thus, we have five weighting scenarios, which will be compared to our overall GIDES index values calculated using the PFB algorithm. The results are presented in Figure 2.

In Figure 2, pessimistic and optimistic strategies provide maxima and minima, and the remaining scenarios yield index values in between. It is also clear that the aim of the penalty weighting was reached, as the overall GIDES index values are always below the average line. This means that substitutability among individual index pillars is restricted

within the GIDES index, and balanced performance is rewarded where there are no large performance differences across individual pillars. Introducing the geometric mean in most cases yields values that are similar to the PFB algorithm and the simple arithmetic mean scenarios. The GIDES index value (based on PFB) is a little bit below the different averages at the best positions of the ranking. This is also logical, as the best-performing countries can afford to be penalized the most in absolute terms for the imbalance among individual pillar values.

Figure 2: Global Index of Digital Entrepreneurship Systems Values Calculated with Different Weighting Scenarios



GIDES = Global Index of Digital Entrepreneurship Systems, OWA = Ordered Weighted Averaging.
Source: Authors' calculations.

Figure 2 focuses on the overall GIDES index scores. We can see that the penalized weighting scheme (PFB) performs similarly to the non-extreme weighting strategies (extremes being the optimistic and pessimistic OWA solutions). The different non-extreme

weighting scenarios yield very similar final scores. Additionally, the PFB strategy also reaches its objective of rewarding balanced distributions among individual pillar scores and unrewarding unbalanced distributions. Therefore, the weighting scheme of the GIDES index can be regarded as free from distortion, while its penalizing aim is sufficiently met.

3.3.2 Analysis by Country Development Stages

The countries included in the GIDES index were assigned into five development stages based on their GIDES index value: Leaders, Followers, Catchers-Up, Laggards, and Tailenders. As a further robustness check for the index, we first checked the contribution of the individual pillar values and sub-indices to this grouping. We applied the analysis of variance (ANOVA) method to see if the individual pillar values and the sub-indices exhibited a significant stochastic relationship with the development stages. The deviation ratio was calculated.[9] In all cases, the p-values were below 0.001, which means that the sub-indices and individual pillars exhibited a significant relationship with the development stages. All sub-indices and pillars exhibited deviation ratios above 0.70, indicating a strong stochastic relationship between the development stage and the sub-index or pillar values. This strongly supports the classification power of the development stages. Going into more detail, the pairwise comparison of the development stages was performed. As the group sizes were relatively small, the pairwise comparisons of the Kruskal-Wallis

[9] The deviation ratio suggests how strong the relationship is between the grouping criterion (development stage) and the quantitative variables (sub-indices and pillars). Relationships above 0.70 are considered as strong, between 0.30 and 0.70 as moderate and below 0.30 as weak.

procedure were applied instead of the post hoc tests of ANOVA. Bonferroni adjusted p-values are indicated.

Tables 1 and 2 present the p-values of the Kruskal-Wallis pairwise comparisons by development stages. There are several pairs with non-significant differences, which might support the idea of including fewer development stages in the country grouping. The top three clusters might have been handled together. However, interpretability and policy guidelines (i.e., practical reasons) justified the distinction of these groups as well. Additionally, if we pay attention to the actual mean values of the pillars by development stages, a clear increasing pattern of these means can be recognized from left to right. This suggests that the creation of the five development stages is meaningful. This process was repeated with the “raw” pillars, and it can be concluded that the comparison by development stages represents similar results after and before the transformation of the pillars.

Table 1: Kruskal-Wallis Pairwise Comparisons of Development Stages, by Pillars

Structure		Pillar	1-2	1-3	1-4	1-5	2-3	2-4	2-5	3-4	3-5	4-5
Contextual influences		Culture and informal institutions	0.999	0.285	***	***	0.999	*	***	0.319	***	***
		Formal institutions, regulation and taxation	0.999	0.112	***	***	0.999	*	***	0.607	***	0.001
		Market conditions	0.999	0.492	***	***	0.999	*	***	0.178	***	***
		Physical infrastructure	0.999	0.387	***	***	0.999	*	***	0.359	***	0.001
Entrepreneurship sub-dynamics	Stand-up	Human capital	0.999	0.289	***	***	0.999	*	***	0.214	***	***
		Knowledge creation and dissemination	0.999	0.324	***	***	0.999	*	***	0.314	***	***
		Finance	0.999	0.204	***	***	0.999	**	***	0.184	***	0.009
		Networking and support	0.999	0.223	***	***	0.999	*	***	0.261	***	0.001
	Start-up	Human capital	0.999	0.196	***	***	0.999	*	***	0.331	***	0.001
		Knowledge creation and dissemination	0.999	0.289	***	***	0.999	*	***	0.340	***	***
		Finance	0.999	0.273	***	***	0.999	**	***	0.178	***	0.006
		Networking and support	0.999	0.333	***	***	0.999	**	***	0.108	***	0.003
	Scale-up	Human capital	0.999	0.398	***	***	0.999	*	***	0.218	***	0.001
		Knowledge creation and dissemination	0.999	0.237	***	***	0.999	*	***	0.571	***	***
		Finance	0.999	0.161	***	***	0.999	**	***	0.181	***	0.022
		Networking and support	0.999	0.377	***	***	0.999	**	***	0.158	***	***

Note: * p<0.1; **p<0.05***p<0.001.
Source: Authors' calculations.

Table 2: Kruskal-Wallis Pairwise Comparisons of Development Stages by Sub-indices

Sub-index	1-2	1-3	1-4	1-5	2-3	2-4	2-5	3-4	3-5	4-5
Stand-up	0.999	0.367	***	***	0.999	*	***	0.219	***	***
Start-up	0.999	0.337	***	***	0.999	*	***	0.220	***	***
Scale-up	0.999	0.377	***	***	0.999	*	***	0.202	***	***

Source: Authors' calculations.

3.3.3 Drop-out Effect of the Pillars

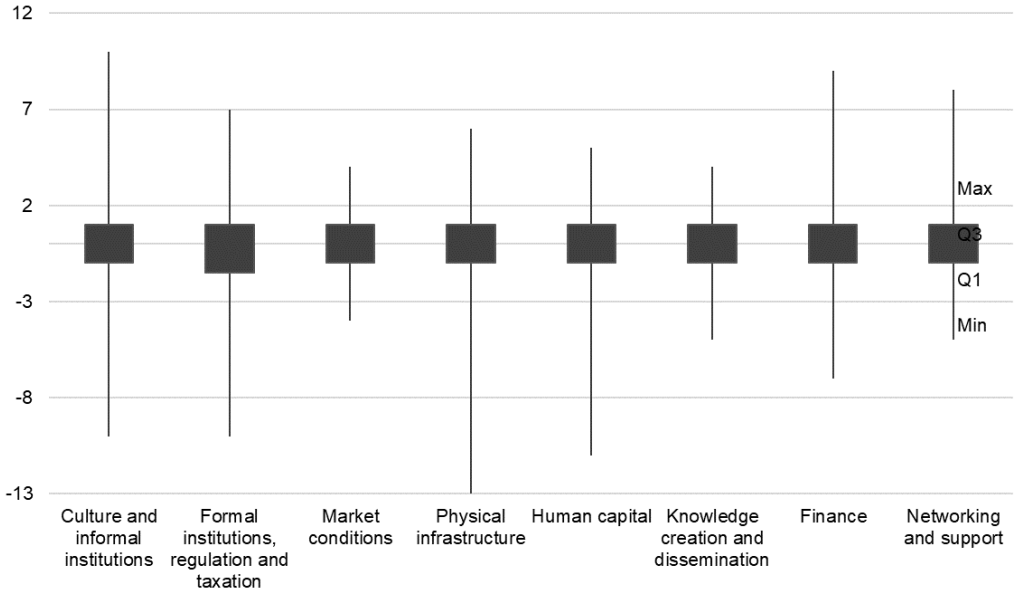
A typical test of the robustness of an index is to drop out one pillar at a time and check the resulting changes (if any) in the rank of the regions (Organisation for Economic Co-operation and Development [OECD] 2008). This is an appropriate method to evaluate the balance among the pillars in the GIDES index. During this analysis, GIDES values are calculated with the original methodology and the penalized weighting method, but we discarded one pillar at a time. The contextual influence pillars were dropped out individually before the average adjustment procedure. The entrepreneurship sub-dynamics pillars were removed from each phase (stand-up, start-up, scale-up) at the same time. Eight simulations were run to see the effect of excluding a pillar.

The box-plot figure (Figure 3) refers to the different simulations. It displays the minimum and maximum values together with the lower and upper quartile (Q1, Q3) values (range and inter-quartile range) of the distribution of the difference between the modified ranks, obtained by discarding one pillar at a time, and the reference rank, which is computed based on the original GIDES index scores. The horizontal axis labels tell us which pillar was excluded.

The maximum of the interquartile range (difference of the upper and lower quartile: Q3-Q1) is 3, but it appears only in the case of "Formal institutions, regulation and

taxation". For all other cases, the interquartile range is only two positions (Q1 is –1 and Q2 is +1). This means that in each case, the middle 50% of the rank changes are at most one position only. This analysis shows that the main characteristics and the rankings of countries are captured correctly by the GIDES methodology. There are no pillars that unduly dominate the index over other pillars, and the overall index result is a balanced outcome of the pillars. Looking at the full range (max-min) the lowest is –13, while the highest is +10. These are only modest differences compared to the number of observations (113 countries), and there are only six countries concerned: Bangladesh, Georgia, India, Oman, Sri Lanka, and Tajikistan.

Figure 3: Distribution of the Rank Differences, Discarding One Pillar at a Time



Source: Authors' calculations.

Our three robustness analyses provide a solid support for the robustness of the overall GIDES index. The analyses suggest that the index provides a synthetic picture of the GIDES for the included countries, while representing a balanced diversity of the different index pillars.

4. Results

4.1 Country Ranking

Table 3 shows the GIDES performances for each of the 21 countries in developing Asia. Based on the global ranking,[10] Singapore featured the world's best-performing Digital Entrepreneurship System, followed by the United States, Sweden, Denmark, and Switzerland. The majority of the countries in the GIDES top 30 are European.

Table 3: Global Index of Digital Entrepreneurship Systems Scores in Developing Asia

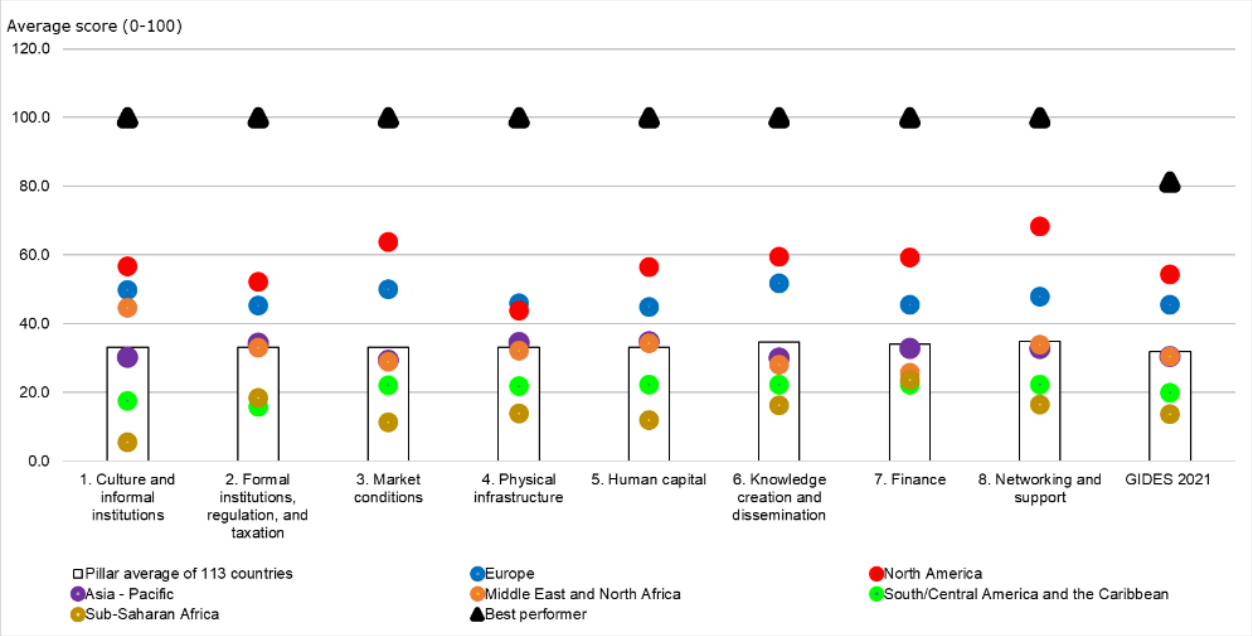
Country	Stand-up System		Start-up System		Scale-up System		GIDES	
	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Singapore	79.8	2	83.6	1	80.4	1	81.3	1
Korea, Republic of	51.6	22	54.9	20	55.9	20	54.1	22
Malaysia	43.1	28	41.7	29	44.3	26	43.1	27
China, People's Republic of	34.8	40	34.1	40	37.1	35	35.3	39
Georgia	28.7	48	28.8	48	27.6	52	28.3	50
Kazakhstan	27.6	51	26.6	58	28.0	51	27.4	52
Armenia	25.6	59	26.6	57	25.8	59	26.0	58
Thailand	25.9	55	24.4	59	27.3	54	25.9	59
Azerbaijan	25.9	56	23.5	60	27.0	55	25.5	60
Viet Nam	22.9	63	21.8	65	24.5	63	23.1	63
Indonesia	22.4	65	16.8	82	22.0	69	20.4	71
India	19.0	78	19.7	71	20.2	75	19.6	75
Philippines	18.5	79	16.9	81	20.1	76	18.5	79
Sri Lanka	17.9	80	16.7	83	17.9	82	17.5	82
Mongolia	17.1	85	18.2	77	16.4	86	17.2	84
Kyrgyz Republic	15.1	90	15.0	87	15.5	90	15.2	88
Tajikistan	13.2	95	12.4	95	12.8	99	12.8	95
Bangladesh	12.4	98	11.9	96	13.3	95	12.5	96
Pakistan	12.0	100	11.7	97	13.3	96	12.3	97
Cambodia	11.9	101	11.7	98	12.3	103	12.0	101
Nepal	11.8	102	10.4	104	12.2	104	11.5	104

Source: Authors' calculations.

[10] The list of countries included in the global ranking is available in Appendix 3.

Examining the GIDES scores at the regional level highlights significant differences in median performance across world regions (Figure 4). The differences between regions are more pronounced across the different pillars. The average GIDES score (last column) for the 113 economies is 31.9, measured on a scale of 0 to 100, with 100 indicating the "frontier," an ideal and hypothetical scenario where a country performs perfectly on every aspect of the index. The North American and European regions outperform the rest of the world for all pillars, but they still fall short of the ideal performance frontier by 45 and 55 index points, respectively. The average lag in Asia and the Pacific is more than 70 points. Even Singapore still has room for improvement, as it falls short of the frontier by 19 points.

Figure 4: Digital Entrepreneurial Ecosystem Gaps Across World Regions



Note: Average scores across regions by pillars.
Source: Authors' calculations.

Based on cut-off points derived from the data, the countries were divided into five groups: leaders (GIDES score above 60), followers (GIDES score above 45 and up to 60), catchers-up (GIDES score above 35 and up to 45), laggards (GIDES scores above 20 and up to 35), and tailenders (GIDES score below 20) (Table 4). Several patterns are

notable in this grouping. First, when considering the gross national income (GNI) per capita data, only high-income countries fall into the category of leaders and followers. The catchers-up mostly comprise high-income economies, while the laggards mainly consist of upper-middle-income countries. The majority of the tailenders are from low-income or lower-middle-income countries. Second, some countries perform above expectations given their level of development. For instance, despite being upper-middle-income countries that would typically be categorized as laggards, Malaysia and the People's Republic of China (PRC) are among the catchers-up. Indonesia, Ukraine, and Viet Nam are classified as lower-middle-income countries and would fall into the tailenders group. However, they are assigned to the laggards group in GIDES. Third, there are countries that underperform relative to their level of development. Despite being high-income countries, Croatia, Greece, Hungary, Kuwait, Oman, and Uruguay, fall into the laggards category, while they should be considered catchers-up or followers. Furthermore, Albania, Bosnia and Herzegovina, Botswana, Dominican Republic, Ecuador, Guatemala, Lebanon, Peru, and Paraguay are upper-middle-income countries that would be classified as laggards, but they are grouped among the tailenders.

Table 4: Global Index of Digital Entrepreneurship Systems Country Groupings Based on Performance at Different Income Levels

High-income Group			Upper-middle-income Group			Lower-middle-income Group			Low-income Group	
Country	**Rank**		**Country**	**Rank**		**Country**	**Rank**		**Country**	**Rank**
Singapore	10		**Malaysia**	61	(+)	Ukraine	120	(+)	Rwanda	174
United States	6		**PRC**	60	(+)	**Viet Nam**	132	(+)	Uganda	172
Sweden	11		Russian Federation	59		**Indonesia**	113	(+)	Mali	171
Denmark	8		Costa Rica	58		Egypt, Arab Rep.	118		Madagascar	187
Switzerland	2		Bulgaria	63		Morocco	124		Burkina Faso	173
Netherlands	13		Mauritius	62		**India**	143		Mozambique	188
Finland	15		Romania	56		Tunisia	128			
Norway	3		**Georgia**	108		**Philippines**	121			
Luxembourg	5		**Kazakhstan**	68		**Sri Lanka**	114			
UK	23		Türkiye	64		Kenya	147			
New Zealand	21		Montenegro	70		**Mongolia**	116			
Germany	17		Serbia	73		**Kyrgyz Republic**	160			
Canada	19		**Armenia**	109		Ghana	137			
Australia	12		**Thailand**	77		Algeria	119			
Austria	14		**Azerbaijan**	105		Honduras	139			
Israel	20		South Africa	93		**Tajikistan**	164			
Ireland	7		North Macedonia	89		**Bangladesh**	141			
Belgium	16		Brazil	71		**Pakistan**	154			
Estonia	34		Jordan	107		Senegal	153			
Japan	24		Argentina	65		Bolivia	123			
United Arab Emirates	18		Colombia	88		El Salvador	117			
ROK	27		Moldova	102		**Cambodia**	151			
France	22		Mexico	69		Nigeria	142			
Malta	33		Panama	57		Zimbabwe	162			
Spain	29		Namibia	103		**Nepal**	158			
Czech Republic	38		Lebanon	91	(-)	Benin	154			
Slovenia	32		Bosnia and Herzegovina	84	(-)	Tanzania	163			
Bahrain	35		Peru	85	(-)	Zambia	158			
Saudi Arabia	37		Dominican Republic	75	(-)	Cameroon	150			
Lithuania	40		Botswana	81	(-)					
Italy	26		Albania	94	(-)					
Cyprus	31		Ecuador	90	(-)					
Latvia	42		Paraguay	95	(-)					
Portugal	36		Guatemala	104	(-)					
Qatar	9									
Slovak Republic	41									
Poland	49									
Chile	54									
Hungary	45	(-)								
Kuwait	25	(-)								
Croatia	52	(-)								
Uruguay	47	(-)								
Oman	53	(-)								
Greece	39	(-)								

Leaders
Followers
Catchers-up
Laggards
Tailenders

(+) = country performance above expectations for level of development, (–) = country performance below expectations for level of development, GNI = gross national income, PRC = People's Republic of China, ROK = Republic of Korea, UK = United Kingdom.

Continued on the next page

Notes:
1. The countries in bold are the 21 developing Asian countries.
2. No operator means that country performance is in line with the level of development.
3. Rankings shown are those given by the World Bank (based on the GNI per capita [$] in 2020 at nominal values, according to the Atlas method [5]).

Source: Authors' calculations.

4.2 Key Takeaways for Developing Asian Countries

Our analysis examines a group of 21 developing Asian countries (Table 5). The rankings of developing Asian countries vary significantly: the gap between the best (Singapore) and worst-performing (Nepal) countries in the region is a considerable 69.8 index points. The GIDES rankings of developing Asian countries are broadly aligned with their economic development levels. GIDES is especially relevant for developing Asia because it has reached an income level where productivity growth is vital for sustaining the remarkable economic growth it enjoyed in the past few decades. Entrepreneurship, in particular innovative entrepreneurship, contributes greatly to productivity growth.

Table 5: Global Index of Digital Entrepreneurship Systems Scores of the 21 Developing Asian Countries

Country	Score	Rank	Country	Score	Rank
Singapore	81.3	2	India	19.6	75
Korea, Rep. of	54.1	22	Philippines	18.5	79
Malaysia	43.1	27	Sri Lanka	17.5	82
China, People's Republic of	35.3	39	Mongolia	17.2	84
Georgia	28.3	50	Kyrgyz Republic	15.2	88
Kazakhstan	27.4	52	Tajikistan	12.8	95
Armenia	26.0	58	Bangladesh	12.5	96
Thailand	25.9	59	Pakistan	12.3	97
Azerbaijan	25.5	60	Cambodia	12.0	101
Viet Nam	23.9	63	Nepal	11.5	104
Indonesia	20.4	71			

Source: Authors' calculations.

Based on the GIDES ranking, Singapore outperforms all other Asian countries. Among developing Asian countries, the Republic of Korea is the only follower, while Malaysia and the PRC are the only catchers-up countries. However, despite being in the same group, they differ greatly in their rankings. Malaysia ranks 10 places ahead of the PRC in all three sub-indices. The next 7 countries on the list (from Georgia to Indonesia) are among the laggards, while the last 10 (from India to Nepal) belong to the group of tailenders—Bangladesh, Cambodia, Nepal, Pakistan, and Tajikistan all perform below the tailenders group's average.

In the following sections, we analyze the different pillars of developing Asian countries. Table 6 displays the pillar scores for each country as well as two benchmarks: the average scores for the countries with the most advanced digital entrepreneurial ecosystems (leaders) and the average scores for the 21 developing Asian countries. The last two columns in Table 6 show the highest and lowest scores for each pillar in each country. We found that the pillar with the smallest variance across developing Asian countries is Physical infrastructure, while the Culture and informal institutions pillar, which measures the recognition of entrepreneurs by the population, shows the largest variance (ranging from 3.1 in Nepal to 97.2 in Singapore). Examining the least favorable pillars, we observe that the majority of developing Asian countries struggle to recognize the importance of entrepreneurs, as reflected by the Culture and informal institutions pillar. This is the weakest pillar in 14 out of 21 countries, including all tailenders, three laggards (Indonesia, Viet Nam, and Thailand), and one catchers-up (PRC). On the other hand, the most favorable pillar is Physical infrastructure in 7 of the 21 countries, Human capital in 6 countries, and Networking and support in 3.

Overall, we can conclude that the weakest pillar for developing Asian countries is Culture and informal institutions, while the most favorable pillar is Physical infrastructure. Asian governments can help improve the attitude of their citizens toward entrepreneurship through public education campaigns that highlight the contributions of entrepreneurship to economic growth and development. Such campaigns are not costly and, hence, represent a cost-effective form of promoting entrepreneurship. In contrast to Asia, for countries with the most advanced digital ecosystems (leaders), the most favorable pillars are typically Culture and informal institutions and Formal institutions, regulation, and taxation, while Physical infrastructure is the least favorable.

The analysis at the pillar level confirms that the digital entrepreneurial ecosystem profiles of the 21 Asian developing countries are highly diverse. As a result, each country must develop a customized policy for promoting digitalization and entrepreneurship by addressing the identified bottlenecks. For instance, focusing on improving the Market conditions pillar in Singapore and the Culture and informal institutions pillar in Nepal could lead to a significant enhancement in the digital entrepreneurial ecosystem performance of these two countries.

Table 6: The Pillar Level Values of the 21 Developing Asian Countries

Country	1	2	3	4	5	6	7	8	Less Favorable	Most Favorable
Singapore	97.2	85.7	61.6	74.8	100.0	82.0	100.0	83.8	Market conditions	Human capital, Finance
Korea, Rep. of	55.6	40.7	70.3	61.3	66.4	50.4	50.7	61.6	Formal institutions, regulation, taxation	Market conditions
Malaysia	46.7	45.6	43.4	32.2	58.5	40.5	40.9	48.9	Physical infrastructure	Human capital
PRC	25.6	33.4	61.1	51.4	32.0	27.6	39.2	30.3	Cultural and informal institutions	Market conditions
Georgia	28.5	59.3	18.8	32.0	20.1	22.0	37.3	22.6	Market conditions	Formal institutions, regulation, taxation
Kazakhstan	37.9	27.8	25.8	36.0	41.1	25.0	25.4	18.9	Networking and support	Human capital
Armenia	27.6	28.5	19.4	25.0	32.1	28.9	27.6	24.1	Market conditions	Human capital
Thailand	18.3	22.4	27.5	33.4	25.0	23.8	32.2	31.5	Cultural and informal institutions	Physical infrastructure
Azerbaijan	39.9	31.2	17.1	28.2	40.7	26.1	15.4	23.5	Finance	Human capital
Viet Nam	11.6	19.5	31.2	40.8	24.4	22.7	20.7	24.9	Physical infrastructure	Culture and informal institutions
Indonesia	10.4	22.1	14.7	24.0	29.0	22.3	22.0	30.4	Cultural and informal institutions	Networking and support
India	5.3	26.4	19.8	32.4	23.1	20.8	20.1	23.0	Cultural and informal institutions	Physical infrastructure
Philippines	8.0	16.2	19.3	19.2	21.5	24.4	18.0	30.9	Cultural and informal institutions	Networking and support
Sri Lanka	3.0	14.4	8.7	50.3	13.4	23.8	21.7	24.1	Cultural and informal institutions	Physical infrastructure
Mongolia	8.4	12.4	16.1	22.4	16.1	18.2	30.2	21.4	Cultural and informal institutions	Finance
Kyrgyz Republic	11.8	12.1	10.9	18.8	21.4	16.9	17.0	17.0	Market conditions	Human capital
Tajikistan	3.7	15.6	8.5	2.9	22.7	19.7	18.6	19.4	Physical infrastructure	Human capital
Bangladesh	2.1	10.0	7.8	32.1	8.5	14.5	20.1	14.6	Cultural and informal institutions	Physical infrastructure
Pakistan	4.9	13.9	9.1	26.5	6.0	15.9	14.2	16.0	Cultural and informal institutions	Physical infrastructure
Cambodia	4.0	14.4	8.8	18.5	9.4	13.1	13.1	20.0	Cultural and informal institutions	Networking and support
Nepal	3.1	11.6	7.6	22.7	7.4	17.5	14.5	13.6	Cultural and informal institutions	Physical infrastructure
Average of the Asian Region	***21.6***	***26.8***	***24.2***	***32.6***	***29.5***	***26.5***	***28.5***	***28.6***	***Cultural and informal institutions***	***Physical infrastructure***
Average of the Leaders	***85.2***	***85.6***	***71.9***	***61.9***	***73.8***	***76.9***	***70.7***	***75.6***	***Physical infrastructure***	***Culture and informal institutions, Formal institutions, taxation, regulation***

PRC = People's Republic of China.
Note: The colors reflect to the value of the score from the best (green) toward the medium (amber) to the worst (red).
First row: 1 = Culture, informal institutions; 2 = Formal institutions, regulation, taxation; 3 = Market conditions; 4 = Physical infrastructure; 5 = Human capital; 6 = Knowledge creation and dissemination; 7 = Finance; 8 = Networking and support
Source: Authors' calculations.

5. Discussion

5.1 Conclusions

Recent research confirms that a supportive environment plays a crucial role in encouraging entrepreneurs who innovate and create many jobs (Autio and Rannikko 2016), and that country-level conditions can exercise an important influence on the quality of the country's entrepreneurial dynamic (Autio and Fu 2015). It is therefore important to develop metrics to measure relevant country-level framework conditions for entrepreneurship, so policymakers can design better-informed support to improve the country's entrepreneurial resource allocation dynamic. A particularly pertinent set of country-level framework conditions are found in digitalization since digital technologies and infrastructure are the key drivers of business model innovation and digital transformation. Digital framework conditions are particularly pertinent for entrepreneurship because entrepreneurs are at the frontier of discovering how new digital affordances can be harnessed to discover novel ways to organize the creation, delivery, and capture of value. Digital entrepreneurs, typically operating in transnational entrepreneurial ecosystems, occupy the frontier in experimenting with novel digital affordances and harnessing these to challenge industry incumbents with radically new business models. This way, digital entrepreneurs act as the primary agents of progress toward a frontier of the digital economy and improvement of total factor productivity therein.

Country-level digitalization is a complex multifaceted phenomenon. To date, there have been few systemic measures to capture this phenomenon and how it combines with the country's entrepreneurial resource allocation dynamic. To address this gap and to

help policymakers assess and improve the state of the country's digital entrepreneurship system, we developed a new composite indicator, the GIDES. The index captures the interplay between country-level digitalization and its entrepreneurial resource allocation dynamic. To provide a clear reflection of the complex country-level dynamic, we developed an index methodology that sets it apart from traditional "count" indices by its systemic approach that portrays the country-level entrepreneurial dynamic within the country's digitalization context. Traditional provide primary snapshot data that describes the prevalence of entrepreneurs and self-employed persons, but they say little about the context within which those entrepreneurs find themselves. This is an important shortcoming, since the entrepreneur's context exercises an important influence upon how significant productivity potential a given entrepreneur will possess to begin with and how likely the entrepreneur is to realize that potential and drive economic development. The integrated approach presented in this paper can help policymakers contextualize the strategic options and feasibility of policy support.

As another constraint of "count" indices of entrepreneurial activity is that such indices are normally computed as arithmetic averages between individual index components, which constrains their ability to truthfully portray systemic phenomena and highlight areas that should be prioritized for policy intervention. Such indices implicitly assume full substitutability among index components, as shortcomings in any one index component can be fully substituted for by increases in any other index component. This approach conflicts with the reality of systemic phenomena such as regional entrepreneurial ecosystems or national systems of entrepreneurship. To provide another simplistic example, increasing public funding for start-ups is not likely to significantly

enhance the productivity potential of the country's entrepreneurial resource allocation dynamic if individuals with high human and social capital prioritize alternative career options over entrepreneurship. Even well-funded start-ups are not likely to innovate and succeed if their entrepreneurial management teams are weak. In reality, gaps in different constituent components of national systems of entrepreneurship are only limitedly substitutable against one another, and the PFB algorithm of the GIDES index has been designed to provide a clearer reflection of this reality. Relevant for policy debates, this feature of the GIDES index has permitted us to perform the policy optimization simulation, which highlights potential priority areas for policy action: the type of guidance "count" indices are unable to provide when there are several confounding factors, as is the case for entrepreneurship and digitalization in many economies.

Summarizing, what sets GIDES apart is its ability to merge both digitalization and entrepreneurship systems into one unified, multifaceted measure at the country level. This allows for a consistent and quantifiable assessment of the strengths and weaknesses of a country's digital entrepreneurship system. Our methodology identifies priority areas for policy intervention to enhance the country's digitally enhanced entrepreneurial resource allocation dynamic.

The GIDES index allows meaningful comparisons across 113 countries in world regions. It ranks Singapore in first place globally, and the Republic of Korea, Malaysia, and the PRC also score well. However, most Asian developing economies lag behind, suggesting plenty of scope for improvement. The index score for the best-performing Singapore is more than seven times that of the worst-performing country, Nepal. On average, the developing Asia country group scores highest in Physical infrastructure, the

only pillar in which it reaches the average score of all 113 countries. The Culture and informal institutions area is the worst-performing on average, even below the global average in this category. This implies that cultural support for digital entrepreneurship is generally low in most Asian developing countries. Factors such as how people view entrepreneurs in terms of status and career choice, the level of corruption affecting this view, and how widely accepted digitization is, contribute to this trend. However, there are notable variations in this regard across the region. Asian governments can directly support entrepreneurship, for example, by providing financial assistance for startups and youth entrepreneurs. But equally importantly, they can improve the cultural attitudes of Asians toward entrepreneurship via public education campaigns that highlight the valuable contributions of entrepreneurs to the economy and society.

Country case studies and industry analyses can help shed further light on different contexts. Policymakers in these countries should focus on a better understanding of nuances and improving these elements accordingly. However, it is essential to note that this investigation is by no means the final word but merely the beginning of a thorough investigation to determine the specific bottlenecks in the 21 developing Asian countries.

5.2 Limitations

The GIDES index offers several methodological advances over conventional indices that enable it to produce more relevant insight for policy. However, it nevertheless has several limitations. First, digitalization is a complex phenomenon, and as a global index, GIDES is restricted to using digitalization measures that are available for all 113 countries in the index. In many cases, we have been constrained to using digitalization measures that

describe the country as a whole rather than describing specifically its entrepreneurial businesses. Greater specificity could be achieved by focusing on narrower groups of countries in specific world regions where statistics agencies are more likely to collect comparable data.

Another limitation has to do with how values have been assigned to pillar weights. Although our PFB and Average Pillar Adjustment methods represent an improvement over simple unweighted arithmetic means calculations, they remain computational methods, and there is no theory to inform weight valuation. In reality, the prioritization of individual index pillars is likely to vary from country to country, depending on each country's idiosyncratic conditions and societal and economic arrangements.

The GIDES index methodology represents important advanced over conventional index methodologies, particularly in terms of its ability to highlight potential priority areas for policy action.

5.3 Implications for Policy Practice

Given that the primary motivation behind the GIDES index was to help inform policy, we offer some thoughts how policymakers could best harness the index to facilitate policy insight. First, as previously highlighted, we do not believe that we will ever be able to find a single, "ideal" configuration of a country's digital entrepreneurship system that would fit all countries. This means that insights regarding "what works well" in one country may or may not travel well to another country context. In fact, we believe that the further away two countries are in terms of economic development, the less transferable such insights are likely to become. However, this does not mean that no country comparisons would

ever be valuable. We believe that the most valuable comparisons would be ones comparing countries at similar levels of economic development. We believe that policy insights could be maximized by the following heuristic:

(i) Form a peer group of two to three countries committed to improving their digital entrepreneurship systems. The countries should be quite similar to one another in terms of economic development—e.g., a group of ASEAN member countries.

(ii) Consider each country's GIDES index profiles to identify each country's relative strengths and weaknesses.

(iii) Go beyond the GIDES index and conduct close-up studies of each country's strengths and weaknesses using rich country-specific data. This includes identification and close-up analysis of relevant policy programs in each country's areas of relative strength.

(iv) Organize regular workshops to debate emerging lessons and identify transferable good practices.

In addition, each participating country should engage entrepreneurial ecosystem stakeholders, policymakers, and other important stakeholders in their own priority areas for a bottom-up process of ecosystem analysis, bottleneck identification, and ideation and implementation of bottom-up, grounded policy initiatives. Given that the GIDES index is an "outside-in" index, in the sense that it looks at each country's national system of digital entrepreneurship from the "outside" using descriptive metrics, it is important to complement GIDES insights with insights derived from the "inside" of the country's digital entrepreneurship system. We believe that a combination of "outside in" and "inside out" insights not only helps form a balanced and unbiased view of the system dynamics, but

it also helps build stakeholder-level commitment to the implementation of prioritized policy interventions.

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Digital Entrepreneurship Landscapes in Developing Asia

Insights from the Global Index of Digital Entrepreneurship Systems

This paper introduces the Global Index of Digital Entrepreneurship Systems (GIDES), a composite indicator that assesses these ecosystems at the national level. GIDES considers the general, structural, and digital framework conditions that support digital entrepreneurship, and identifies system bottlenecks. GIDES profiles 113 countries, focusing on 21 in developing Asia, and the paper suggests how it can support policymaking.

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