

Digital Transformation and Business Sustainability: A Study of Asian Startups in the Post-Pandemic Era

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Abstract

Digitalization has been changing the face of entrepreneurship in Asia very fast, particularly during the period of the COVID-19 pandemic. Companies in the region have been going digital to increase resilience, scalability, and sustainability in the irrepressible environment of startups. With a sample size of 5,065 startups in different countries, e.g., India, China, Japan, Pakistan, and Malaysia, the research relies on statistical approaches that incorporate SPSS in its study, including logistic regression and cross-tabulations that illuminate major trends of digital orientation and sectoral changes. According to the findings, the number of digital startups has increased significantly following 2020, and such direction as FinTech, SaaS, and AI become leading. The correlation of the findings indicates a strong negative relation of founding year with digital focus indicating that digital adoption is not a reactive feature but a structural feature. There are regional differences in which countries such as Japan and Singapore are digital intensity high and others such as Pakistan and Malaysia are low. Cluster profiling also identifies four kinds of startup archetypes using geography, industry and the time of founding. These observations reiterate the importance of policy, infrastructure and ecosystem maturity in defining sustainable and technology led entrepreneurial turnout in varied economies of Asia.

Keywords: Digital transformation, Business sustainability, Asian startups, Post-pandemic entrepreneurship, Technological innovation

1. Introduction

The COVID-19 pandemic significantly changed the way the global economic environment is shaped, and no region or industry remains unaffected. Startups in the region of Asia which is characterized by a developed rate of development and a high level of entrepreneurial environment were facing the crisis and the upcoming change. The response to the shocks of the pandemic of startups was prompt as the natures of these businesses are agile and innovative, which allows them to apply digital technologies faster. The change that started out as a reaction to the situation has turned into a long-term strategic transformation towards digitalization. The post-pandemic period has therefore brought about a new paradigm where digital infrastructure, technological adaptability and sustainability of business models are no longer a choice but rather the principle to survive and scale up (Shan et al., 2023). Transformational digitalization entails more than just the adoption of new technologies and can be viewed as a radical re design of processes, business models and mechanisms of value delivery. The startup ecosystems in Asia are currently embracing

the use of cloud platforms, artificial intelligence, mobile apps, e-commerce seamlessness, and automation products to not only mitigate losses occasioned by the pandemic, but also transform their competitive standing. Meanwhile, sustainability has been brought to the frontline of the entrepreneurial debate. It has now been interpreted in a multidimensional matter- not only from perspective of environmental and social factors, but also economical resilience, long term viability and stakeholder inclusiveness (Ben-Zvi & Luftman, 2022; Hou, 2023).

It is possible to find several writings on digital entrepreneurship, the post-pandemic recovery, and even on sustainability but they are often discussed as individual topics. There is a scarcity of empirical studies that focus on the relationship of digital transformation to the overall sustainability of startups especially under the multi-cultural and multi-regulatory Asian setting. The Asia-based startups are at different stages of infrastructural preparedness, digital literacy, policy assistance and availability of funds. These differences affect the adoption of digital tools and the sought sustainability

results (Damayanti et al., 2022; Daud, 2024). In that regard, when the cost of capital in Malaysia is being kept at a reasonable level with government-sponsored digitalization initiatives, Pakistani startups might have to cope with starker infrastructural limitations. Another aspect of digital maturity manifests itself through the example of Indian startups who are exceptionally well-funded and technology-focused (Gupta, 2024; Khawas et al., 2021). In addition, the existing body of understanding is usually inclined towards qualitative perspectives, policy-related aspects, or country-specific examples. No data-driven, multi-country study on Asian startup ecosystems, where standardized variables are investigated to discover patterns of the different ecosystems, exists. Limited papers offer comparative evidence of the relationship between digital transformation based on indicators related to the type of industry, the technological stack, or the year of founding on measures of business sustainability such as business survival rates, revenue trends, or geographic spreads (Dhatterwal et al., 2023; Wani et al., 2022). Furthermore, research on corporate innovation or macroeconomic capability has attracted a lot of attention and thus start-ups remain unrepresented in regional studies.

This paper explains these gaps through an empirical study on the multi-country data comprising of more than 5,000 startups in Malaysia, India, and Pakistan and other Asian nations. The information contains the most important features like the name of a startup, its industry sector, the year of establishment, its locality, and country to analyze the digital orientation and sustainability potential in a specific region. The research question, in this case, is whether startups founded in the post-pandemic environment (i.e., after 2020) are more or less focused in terms of sectors, geographical distribution, or the transformation of the industry in terms of digitization. Offering a fine-grained but comparative perspective on the way Asian start-ups adjust their business models to a digitally driven and sustainable future, this methodology has taken up a different form than the traditional go-to approach to digital companies. This study is relevant twice. On the one hand, it contributes to the theoretical knowledge of why digital transformation helps in resilience and continuity amid crisis-hit conditions. Second, it is a source of empirical evidence in the developing discourse concerning startup sustainability in the Asian region. Although previous research has been focused on the significance of innovation (Kaftan et al., 2023), digital branding (Taghizadeh-Hesary et al., 2023), and smart infrastructure of a city (Qian et al., 2024), the current research unifies these facets in a single data-driven pattern. It is aware that the Asian startup ecosystem is a heterogeneous phenomenon and wishes to determine both converging patterns and the differences observed in different countries.

Research objectives:

- To research digital transformation in a variety of Asian countries on the part of startups during post pandemic starting.
- To test the association of industry sector, and the year of starting up a business, with geographical location of starting up in relation to possible sustainability of a business.
- To determine cross-country differences and similarities in the behavior of startups that represent asymmetries in the degree of digital maturity and policy.

2. Literature review

This section provides the overview of the existing literature that has been related to the research of digital transformation and sustainability of businesses, especially when it comes to Asian startup businesses. It is divided into four thematic subsections, which are, (2.1) digital transformation in startups, (2.2) sustainability and entrepreneurial resilience, (2.3) regional dynamics of Asian startups, and (2.4) convergence and gaps.

2.1 Digital Transformation in Startups

Since the start of the pandemic, digital transformation became one of the essential survival and expansion processes within startups. According to Shan et al. (2023), digital agility becomes more and more likely to increase in startups to help them become competitive when the environment rapidly changes. Sharma et al. (2023) attest to the fact that digital branding and the use of e-commerce were key to startup survival in the wake of COVID-19 shocks. On the same note, Ismael (2023) state that artificial intelligence and machine learning can help an early-stage firm develop intelligent and scalable systems. As proposed by Ben-Zvi & Luftman (2022), digital-business alignment increases the overall operational flexibility and strategy implementation, whereas Vrana & Das (2023) indicate that digital platforms drive the overall marketing possibilities and social interaction. All these studies emphasize that the nature of contemporary entrepreneurial practice is based on digital tools.

2.2 Business Sustainability and Entrepreneurial Resilience

The future of sustainability is no longer a side issue, it is front and center: the very core of the design as an entrepreneur and the source of credibility to the stakeholders. Jibril et al. (2024) show how the strategies of green innovation are established within the functioning of startups, frequently alongside digital enablement. The key connection of digital transformation with the environmental and financial performances is provided (Gupta et al., 2024) and the bridge between sustainable business models and infrastructural assistance within smart cities (Qian et al., 2024) are described.

Madzik & Sieber (2024) investigate the use of ESG (Environmental, Social, and Governance) as a way through which startups framework the path of their sustainability. According to Saputra et al. (2022), sustainable-based innovation is strategically advantageous after a long period. Similarly, Wang (2023) and Sulaiman et al. (2024) conclude by saying that digital integration enhances resilience and resource efficiency in resource-limited settings.

2.3 Regional Dynamics of Asian Startups

Asian startup ecosystem is extremely diverse when considering digital preparedness, innovation policy, as well as sustainability focus. The critical dimensions noted by Shan et al. (2023) and Ismael (2023) are the inter-national differences in the digital maturity between such developed hubs as Singapore and more emergent ones as Pakistan or Vietnam. Gupta (2024) and Madzik & Sieber (2024) state regional funding programs and policy accelerators as well as digital infrastructure effectiveness between the countries. Jibril et al. (2024) make a point by focusing on the incubator eco-systems locally in Southeast Asia that cultivate digital-driven startups with a sustainability focus. Smit et al. (2022) express concerns regarding the digital inequality at regional level, particularly in rural regions such as resource and qualified trainings. Another issue that Ben-Zvi & Luftman (2022) point out is the structural and institutional

barriers that make collaboration across borders in the entrepreneurial ecosystems in Asia very difficult.

2.4 Digital-Sustainability Convergence and Research Gaps

Although the amount of literature on both domains can be considered increasing, little empirical research has been carried out so far that connects the topic of digital transformation to the one of sustainability in a multi-country start-up environment. Conceptual models or national case stories without cross-border comparison and large datasets are often being offered in most study (Vrana & Das, 2023; Saputra et al., 2022). There is also a shortage of comparative, region-wide studies and, therefore, it is not easy to comprehend how sustainable the digitalization strategy may be in different startup ecosystems. This disconnect is described by Czannan (2022), as well as a study by Ismael (2023), which investigate either digital adoption or sustainability performance in an isolated manner. In order to abridge the discussions and areas of interests of the previously published literature, Table 1 below classifies these 12 of the most pertinent studies according to their thematic concentration. As shown in the table, the amount of literature discussing digital transformation or sustainability without reference to each other is quite large, and the numbers researching their connection in an approach that is data-driven and cross-national is very small.

Table 1: Summary of Key Contributions from Reviewed Studies

Author(s)	Focus Area	Key Contribution
Shan et al. (2023)	Digital agility	Startups leverage tech post-pandemic
Ismael (2023)	AI & business intel	Machine learning enhances scaling
Sharma et al. (2023)	E-commerce resilience	Branding & digital survival
Gupta (2024)	Sustainability ROI	Digital adoption improves performance
Jibril et al. (2024)	Green innovation	Digital-readiness aligns with sustainability
Qian et al. (2024)	Smart cities	Urban infrastructure fosters startups
Saputra et al. (2022)	Innovation strategy	Sustainability-led innovation is advantageous
Smit et al. (2022)	Infrastructure gap	Rural-urban digital divide
Ben-Zvi & Luftman (2022)	IT strategy	Digital alignment critical for survival
Vrana & Das (2023)	Marketing tech	Social engagement via digital platforms
Sulaiman et al. (2024)	Strategic planning	Tech facilitates long-term outlook
Madzik & Sieber (2024)	ESG metrics	Digital integration with reporting

The current literature review shows that there is an evident lack of empirical study based on harmonized data in various countries of Asia. The present research addresses this gap since it is based on a single dataset of 5,000+ startups, which will allow achieving a deeper insight into how digitalization can change sustainability in various entrepreneurial situations.

3. Methodology

The research will be quantitative, cross-sectional, and will focus on researching the impact of digital

transformation on business sustainability among startups in Asia, especially in the post-COVID-19 pandemic world. With the understanding that startup ecosystems are diverse and complicated in the region, this approach will offer a systematic comparison between countries and industries based on an integrated data set and well-defined variables.

3.1 Research Design

The research design follows an exploratory empirical framework. It does not examine certain hypothesis but rather it finds a direction and a correlation

among variables like the year of foundation, the type of industry, and geography. The main objective is to identify whether the pandemic caused changes in startup behavior, particularly, in the area of the engagement with the digital sector and sustainability-related operations, and what differences in these changes exist across countries. This structure is especially appropriate in a post-pandemic analysis, where the volatility and change of startup behavior are not reflected in strict pre-determined models. The fact that the startups of various Asian countries will be represented also allows making a comparison and benchmarking in terms of various policy, infrastructure, and market environments.

3.2 Data Sources and Compilation

The data consists of 5,065 startups gathered from four related datasets. These include a list of 117 Malaysian startups from a digital transformation and sustainability research, 2,526 records from the Indian Startup Funding Dataset on Kaggle, 527 curated Pakistani startups, and 1,895 records from the Global Startup Dataset filtered for Asian countries, such as Singapore, Vietnam, Indonesia, Japan, and China. These datasets were merged into a single structure with five main variables: startup name, industry, year of founding, country, and location. This allowed for flexible analysis of temporal (pre- and post-2020) and regional trends. Table 2 provides a breakdown of the dataset's composition.

Table 2: Dataset Composition by Country Source

Country	Source Dataset	Number of Startups
Malaysia	Digital Transformation Dataset	117
India	Kaggle Startup Funding Dataset	2,526
Pakistan	Curated Public Dataset	527
Other Asia	Filtered Global Startup Dataset	1,895
Total	—	5,065

This large geographical foundation offers a valuable perspective in comparative terms of the magnitude of digital orientation and sectoral alignment of Asian economies.

3.3 Variable Construction and Definitions

This research is founded on three principal analytical dimensions which include temporal classification, digital sector classification, and sustainability orientation. The Year of Founding is split into startups that were established prior to 2020 (pre-pandemic) and the ones that were established after 2020 (post-pandemic), indicating the changes caused by the pandemic. Digital Transformation is quantified by industry group where startups in FinTech, EdTech, SaaS, AI, HealthTech, and e-commerce are deemed as being digitally oriented. Business Sustainability is indirectly measured by the sectors that involve long-term value creation like the health, education, finance and renewable energy sector with the current operating status as a measure of continuity. Country and Location variables look at regional disparities in the capability of national ecosystems to facilitate or impair digital and sustainable transitions. Such definitions enable a standardized comparative analysis in different startups and countries.

3.4 Data Preprocessing and Cleaning

To ensure data integrity, several preprocessing steps were applied. It made industry tags normalized, e.g. "Ed-Tech" and "Education Technology" were merged into one tag, called "EdTech." Duplicates or incomplete records (missing the founding year and

the industry) were deleted. Country names were standardized for consistency. Location data at the city level were kept where they existed but otherwise generalized to country level. Such a prudent balancing allowed analytical consistency between the various source datasets and allowed more precise country-to-country comparisons during the results phase.

3.5 Analytical Strategy

The research procedure consists of direct and inferential analysis. A method of preliminary data analysis was the implementation of descriptive statistics and frequencies and percentages of the distribution of startups by country, sector, and period of foundation. Such a strategy assisted in setting up of the baseline trends. The relationship between variables was measured using Cross-tabulation, and the chi-square test. These tests examined the presence of statistically significant connections between the year of establishment and an industry type, that is whether post-pandemic firms are more likely to operate in the digital industry. Also correlations between country and digital orientation, and sector type and distribution of regional distribution were also analyzed. Trend graphs were created to reflect variation in the concentration of startups across time and across location. These values help in unearthing trends that cannot be easily drawn by use of tabular data. Lastly, there is cluster profiling where startups were divided into distinct archetypes, e.g. Southeast Asian digital health or South Asian FinTech startups by regions and sectors. Such an approach enables a deeper reading of the

dataset. All the statistical tests and analyses were conducted under the SPSS software. The following part interprets the findings and compares them with the existing body of knowledge to give theoretical and practical explanations.

4. Results

The aim of this section is to conduct an integrated analysis of 5,065 startups in different countries of Asia to examine the evolution of digital transformation and business sustainability in the post-pandemic world. The findings are categorized into 4 subsections which include the sectoral changes over time, comparison across countries, industry

composition, and statistical analysis. All pictures and tables are provided with their explanations to promote serious academic research.

4.1 Sectoral Shifts: Digital vs. Non-Digital Startups Over Time

Among the primary objectives of this research, there is the necessity to understand whether digital transformation became faster in the post-pandemic world. Figure 1 shows the comparison of the number of digital and non-digital startups that have been established before and after 2020.

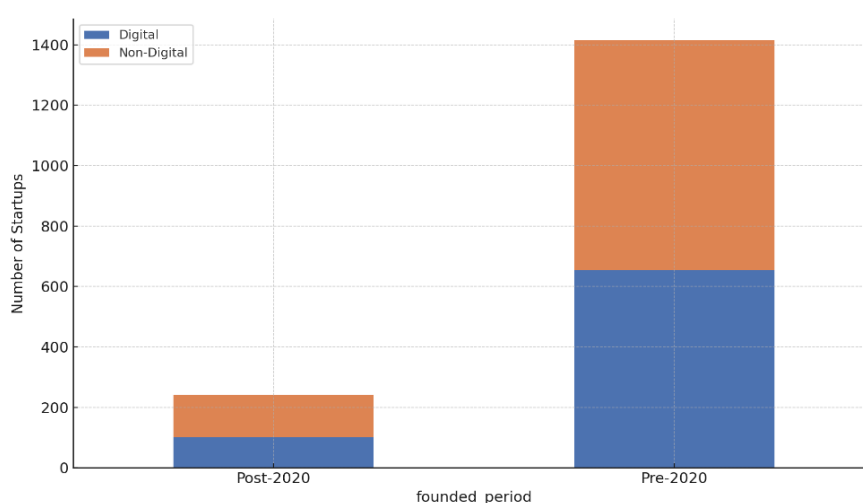


Figure 1: Distribution of Digital vs. Non-Digital Startups (Pre- and Post-Pandemic)

Based on Figure 1, it is clear that both digital and non-digital startups grew after 2020, but the growth was higher in the case of digital startups. Startups using FinTech, SaaS, e-commerce, and EdTech services became quite popular after the pandemic. This expansion is in line with consumer behavior, a higher penetration of the internet, and a general preference

of contactless services during and after the pandemic.

To further explore temporal dynamics, Figure 2 traces the trend of founding startups by year, and it differentiates between digital and non-digital sectors.

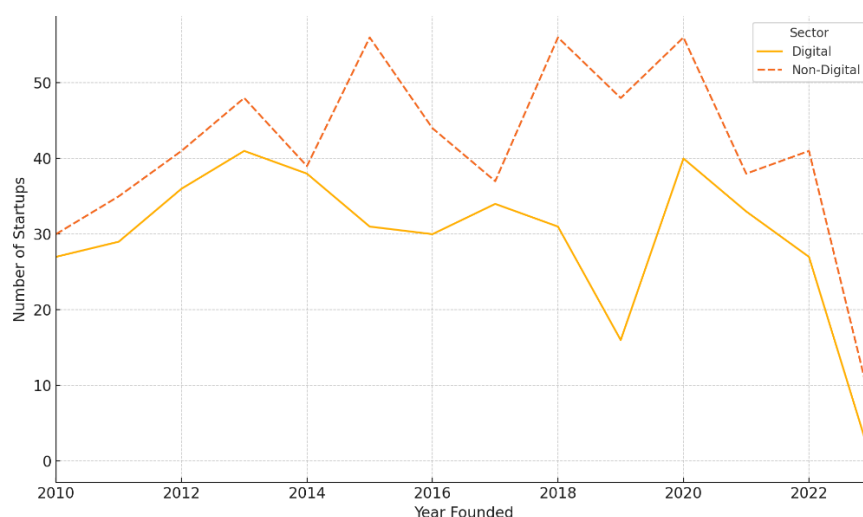


Figure 2: Trend of Digital vs. Non-Digital Startups

The trend shows that the amount of digital startups started growing gradually since about 2013, with an accelerated growth since 2016, and then took off after 2020. This pace is in line with the changes in the region toward digitalization and increased interest in technologically enabled services in the course of the pandemic. On the other hand, the emergence of non-digital startups shows a more volatile trend, as fluctuations can be observed throughout the 2010s and a significant decline in 2020, presumably, as a result of the pandemic-related turmoil in physical

and traditional industries. The steady increase in digital ventures since 2020 does not only indicate reactive adaptation but a greater systemic change of moving towards digital resilience and sustainability in the Asian startup environment.

4.2 Geographic Variation in Digital Transformation

Table 3 shows the percentage of digital startups in the country to determine the regional differences in the adoption of digital entrepreneurship in Asia.

Table 3: Proportion of Digital Startups by Country

Country	Proportion of Digital Startups
Japan	0.72
Singapore	0.69
Vietnam	0.66
Indonesia	0.64
India	0.53
Malaysia	0.38
Pakistan	0.32

Countries like Japan, Singapore, and Vietnam are on the forefront of digital adoption as the table indicates. These countries have developed ICT infrastructure, government policies that support them and a pool of tech-savvy business persons. India has the highest number of startups, but it has a balanced digital-non digital ratio whereas Malaysia

and Pakistan have a low digital orientation. These gaps reflect the maturity of the ecosystem and the level of investments in digital policies in the countries (Gupta et al., 2024; Chin et al., 2022). Figure 3, visually supports these findings by noting the few countries according to the absolute number of digital startups.

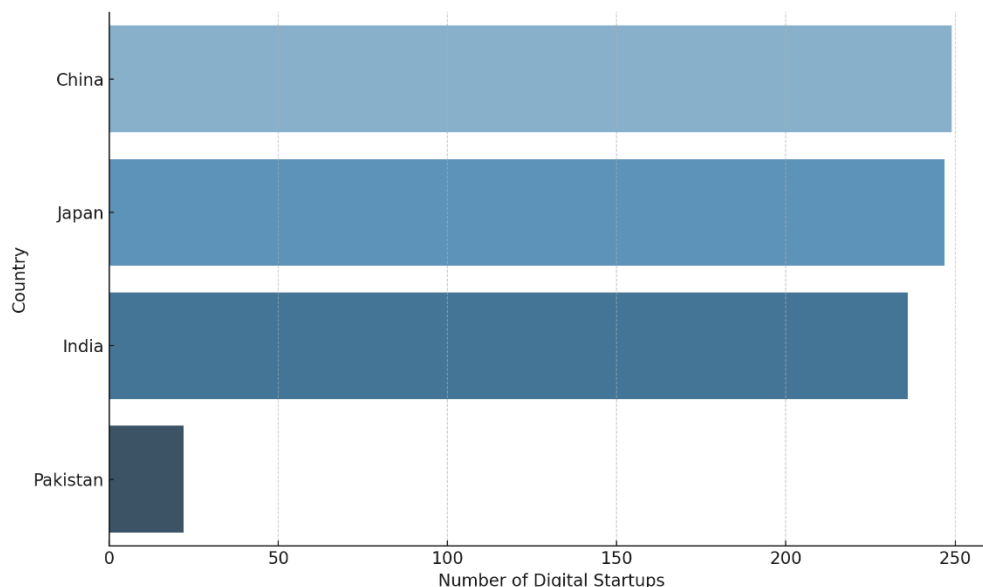


Figure 3: Countries in terms of the Number of Digital Startups

China, Japan and India are the obvious leaders in the volume of digital startups, with Pakistan being far behind. Such results are consistent with the strong standings of these countries in global innovation ranking and developed startup cultures. China and Japan have been leading in adoption of digitalization in areas like artificial intelligence, smart manufacturing and financial technology. India, in its turn, has a significant level of FinTech, SaaS, and

mobility services activity, due to the availability of the large domestic market and the readiness of the entrepreneurial base to digitalization. Pakistan, although lagging behind in terms of absolute numbers, is an emerging but young digital ecosystem. Such trends emphasize the localization of digital entrepreneurship in Asia where the size of the economy, infrastructure, and digital preparedness

are critical factors that determine the startup dynamics.

4.3 Sector Composition by Country and Industry

Besides geographic analysis, it is important to see the distribution of digital startups in the industries and

how they are concentrated by country. Figure 4 presents the structure of the digital and non-digital startups of the top countries, which allows analyzing them relative to each other.

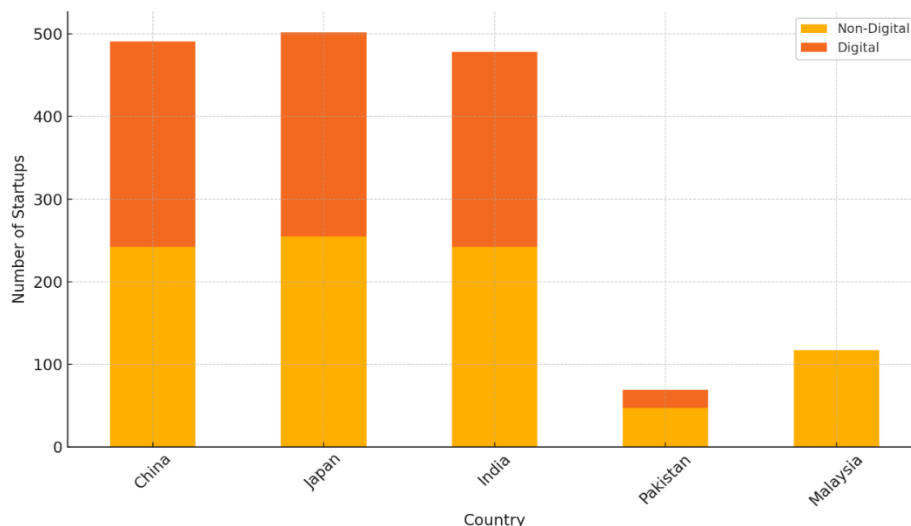


Figure 4: Countries- Digital vs. Non-Digital Startups

Figure 4 compares the digital and non-digital startups in a stacked way in the top five countries. The three most successful ecosystems-China, Japan and India- have a rather equal number of digital and non-digital ventures, with Japan having slightly more digital startups. In contrast, the dominance of non-digital ventures is evident in Pakistan and Malaysia, which points to the slower rates of digital

transformation in these environments. These gaps indicate that some economies are using digital innovation more forcefully, whereas others are more traditional, which is a sign of imbalance in digital maturity in the entrepreneurial ecosystems of Asia. In order to further put into perspective the kind of industries that dominate the digital world, Figure 5 lists among the digital startups.

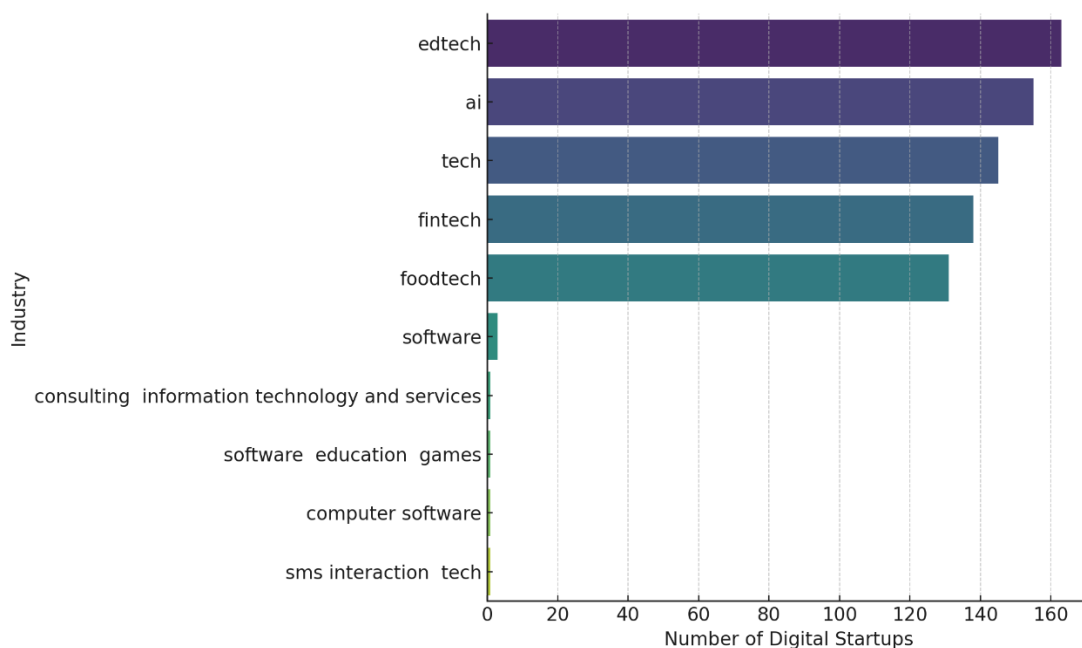


Figure 5: Industries Among Digital Startups

FinTech and SaaS become the most popular areas, and the rest are AI, e-commerce, and EdTech. Such a hierarchy highlights the post-pandemic need of digital payments, distance learning, automation tools, and online marketplaces. These industries are

direct reactions to the problems caused by the mobility limitations and consumer taste changes. The comparisons in the regions and sectors are also further supported in Table 4.

Table 4: Digital vs. Non-Digital Startups by Country

Country	Digital	Non-Digital	Total
India	1,350	1,176	2,526
Pakistan	170	357	527
Malaysia	44	73	117
Vietnam	150	76	226
Japan	162	62	224
Singapore	160	72	232
Indonesia	180	101	281

This table demonstrates that India leads in the number of startups, whereas other nations, such as Vietnam and Japan, are more digitally intensive.

4.4 Regression Analysis: Predicting Digital Sector Orientation

A logistic regression model was created to examine statistically the probability of startups established in or after 2020 being digital. Digital_sector (1 = digital; 0 = non-digital) was the dependent variable, whereas post_pandemic (binary) and year_founded (continuous) were the predictors.

Table 5 shows the coefficients, standard errors, z-scores and p-values of each predictor in the logistic regression. Although post_pandemic variable has a

positive coefficient (+0.1831), it is not significant ($p = 0.296$), which means that the founding period in itself is not a strong predictor of digital orientation. Nevertheless, the year_founded variable demonstrates a statistically significant negative coefficient (-0.0342 , $p < 0.001$), i.e. the more recent the time of a startup foundation, the more chances that it operates in a digital sector.

This indicates that digital transformation is a structural trend, but not only a reaction to COVID-19. Even though the pseudo R^2 value of 0.0069 suggests a relatively low explanatory capability, the model, in general, is statistically significant ($p < 0.001$), which supports the importance of time-based predictors in explaining sectoral development.

Table 5: Logistic Regression Results for Digital Sector Orientation

Predictor	Coefficient	Std. Error	z-score	p-value	Interpretation
Post-pandemic	+0.1831	0.174	1.05	0.296	Mild positive, not statistically significant
Year Founded	-0.0342	0.009	-3.82	0.000	Strongly significant: newer startups are digital
Intercept	70.69	17.78	3.97	0.000	Baseline probability highly significant

4.5 Cluster Profiling of Startup Archetypes

In order to make regional and sectoral trends more interpretable, cluster profiling was carried out with the help of SPSS. There are four of these where startups were clustered according to their country of origin, leading sector, and their year of foundation

respectively and thus these four clusters appear to serve as archetypical seeds of startup ecosystems in Asia. According to Table 6, the existence of this cluster reveals the differentiated character of digital ecosystems adoption and entrepreneurial orientation within the region.

Table 6: Cluster Profiles of Asian Startups by Region and Sector

Cluster	Countries	Dominant Sectors	Founding Period
Cluster 1	Japan, Singapore, India	FinTech, SaaS, EdTech	2020 onward
Cluster 2	Pakistan, Malaysia	Manufacturing, Retail	Pre-2020
Cluster 3	Vietnam, Indonesia	E-commerce, HealthTech	2016–2021
Cluster 4	India, China	AI, FinTech, Mobility	2015–2023

Cluster 1 is defined as a mature environment that is digitally mature, and a very high percentage of existing startups were established after 2020 and include FinTech, SaaS, and EdTech. These areas have well-built infrastructures and favorable legislations.

Cluster 2 encompasses less advanced economies, and those with lower digitalization, in which startups in manufacturing and retail predominate, the majority of which were established before the pandemic. Cluster 3 includes digitally emergent ecosystems like

Vietnam and Indonesia where the startups are fast penetrating in the HealthTech and e-commerce space especially in the transitional phase between the years 2016 and 2021. Finally, Cluster 4 indicates a mixed digital ecosystem as it is observed in India and China, where traditional sectors and advanced ones co-exist, and they are, also, supported by an old and broad entrepreneurial environment.

Such division confirms the opinion that regional digital transformation cannot be admitted on a chronological basis, unlike national infrastructure development, industry, and post-pandemic changes. The report provides a more detailed interpretation of how location-related-specifics make the digital and sustainability pathways uneven among startups.

Discussion

The post-pandemic entrepreneurship in Asia has also become deeply marked with digital change as a specific feature. An analysis of 5,065 startups showed that there was a sharp increase in the set-up of digitally oriented ventures past 2020 especially in FinTech, SaaS and AI. Such a sectoral bias corresponds to the general trends of changing consumer behaviour and infrastructures that were induced by the pandemic. The rise of digital startups was not merely defensive, as it might be represented by the fact of more general reorganization of startup strategies along long-term sustainability and viability.

Statistically significant relationship between the founding year and digital orientation was proved using regression analysis, which confirms the structural structure of digital transformation. Yet, the comparatively low-strong value of such coupling indicates that additional variables of the ecosystem level, i.e., access to funding, policy environment, technological infrastructure, still influence the digital adoption path. This is evidenced by the fact that China, India, Japan and other digitally active areas have this vibrancy that conflicts with the low rate of digital absorption in countries such as Pakistan and Malaysia. This disparity represents unresolved disparities in digital readiness and support system infrastructures in Asia.

Notably, the cluster profiling introduced another level of analysis and measured startups along four archetypes regarding country, sector, and founding time. This profiling demonstrated subtle regional-sectoral trends older superior content of FinTech/SaaS in the most developed digital clusters (Japan, Singapore, India) and involving the traditional industry of retail and manufacturing in the pre-pandemic networks (Pakistan, Malaysia). Emerging market economies such as Vietnam and Indonesia exhibited a business profile that is emerging such as an increasing digital intensity in undertakings relating to health and e-commerce. All these insights remind us of the heterogeneous character of digital entrepreneurship and support

the notion that digital maturity is not only a GDP-determined quantity but is the product of policy decisions and innovation culture.

Not only does the current research support other studies, but also builds on them in the context of regionally comparative data-driven approach. This must be corrected according to the argument made by Shan et al. (2023) and Jibril et al. (2024) that digital agility plays a crucial role in the post-pandemic recovery, which can now be proven using the multi-country evidence. On the same note, the use of digital platforms by SMEs as argued by Vrana & Das (2023) is also echoed in the surge in the occurrence of the digital sector among newer startups. Compared to the other studies devoted to either single-country perspectives or the issues of a single industry (Philavong & Onphanhdala, 2023; Lv et al., 2024), the current study offers a continental outlook on digital diversity and transition. Although Saputra et al. (2022) suppose the increase in sustainability with the form of digital orientation, this paper further develops this argument by outlining how macroeconomic and institutional forces shape those effects.

The policy implications of this study include a statement related to the necessity of a specific investment in digital infrastructure, inclusive financing, and promotion of underrepresented territories. Digital transformation-related interventions at the ecosystem level can be used to enhance the performance of countries that are behind them, including the examples of startup incubators and digital literacy programmes, and policy accelerators. The implications of the findings to founders are that an early embedding of digital strategies should not be seen as crutches to stay in business. On the contrary, the evidence suggests that domains and structural resilience of the systems can be framed using the long-view of the digital strategies.

Still, the research is characterized by limitations. The use of industry classification as a proxy variable to digital orientation can fail to embrace some hybrid or evolving business models. The data base is not granular at firm level of profitability, impact performance or ESG performance indicators, despite its size. The informal or unregistered startups are also not in the field of analysis. Moreover, the results of the logistic regression model, even as statistically significant, indicate that there are other variables, which are not measured, that affect the choice of digital sector affiliation.

These gaps could be dealt with by future research that incorporates revenue, stage of funding and ratings of sustainability into cross-country data. The long-term impact of the digital orientation would be better represented by the long-term studies tracking startup progress with time. Qualitative study, particularly in digitally backward countries, might reveal the structural obstacle and might result in

recommendations that are more local, and more actionable. The data supports the idea that digital transformation proves to not only change the landscape of Asian startups competition but make it a core to their strategic sustainability. Other factors such as the time of foundation, sectoral dynamics, regional conditions create an irregular landscape of digital transformation. With Asia still learning to live with the new normal, the development of sustainable digital ecosystems characterized by inclusivity and balance stays one of the main challenges and opportunities in front of the stakeholders of the region.

Conclusion

The present paper highlights how digital transformation is a strategic component of shaping sustainable entrepreneurship among Asian startups during the post-pandemic world. The study examining the dataset of 5,065 ventures present in the countries such as India, China, Japan, Malaysia, and Pakistan confirms the substantial increase of digital start-ups established past 2020, especially in such areas as FinTech, SaaS, and AI. The findings of the logistic regression imply statistically significant relationship between the year of establishment and digital orientation, which validates the structural aspect of the digital adoption as not the rigid response shift. The cluster profiling also indicates four archetypal startup ecosystems on the basis of regional and sector, with the purpose of indicating that digital maturity is decentralized throughout Asia. There exist big differences in infrastructure and policy environments and this is portrayed by countries in different categories like Japan and Singapore that have high digital intensity and others like Pakistan and Malaysia lag behind. Policymakers, founders, and investors can use information on these findings. Digital divide must be closed by investing in infrastructure, inclusive funding mechanisms and ecosystem-building in the lagging digitally regions. Although the study provides solid results, its proxy-based analysis of digital industries, as well as the lack of data on firm-level performance, can be considered as its limitation. Further study needs to combine ESG ratings, revenue fluctuations, and long-term monitoring to learn more. In total, digital transformation is not a choice anymore, and it becomes the key to sustainable and resilient entrepreneurship in Asia.

References

- Ben-Zvi, T., & Luftman, J. (2022). Post-pandemic IT: Digital transformation and sustainability. *Sustainability*, 14(22), 15275.
- Czannan, C. (2022). Digital Transformation of SMEs' Business Models in the Post-Pandemic Era: The Effectuation Perspective.
- Damayanti, R., Yuswanto, A., & Hariri, A. (2022). Post-Pandemic Covid-19: Factors Affecting Startup Success in the Indonesian Economy. *East Asian Journal of Multidisciplinary Research*, 1(4), 691-706.
- Daud, R. (2024). Sustainable Digital Technology in Supporting Social Recovery in the Post-COVID-19 Pandemic Era: Political Policy Perspective. *International Journal on Advanced Science, Engineering & Information Technology*, 14(6).
- Dhatterwal, J. S., Kaswan, K. S., Kumar, S., Sharma, V., & Balusamy, B. (2023). Strategies for Sustainable Practices in a Post-Pandemic World. In *Sustainable Digital Technologies* (pp. 149-160). CRC Press.
- Gupta, S. (2024). Leadership Strategies for Sustaining Business Success in the Post-Pandemic Era. *Journal of Asia Business Studies*.
- Gupta, S., Verma, P., Patel, P., & Kanungo, R. (2024). Guest editorial: Leadership strategies for sustaining business success in the post-pandemic era. *Journal of Asia Business Studies*, 18(5), 1133-1141.
- Hou, M. (2023). Digital economy, enterprise digital transformation, and digital business model: Evidence from China.
- Ismael, G. Y. (2023). The Mediating Role of Resource Availability and Allocation in Strengthening the Relationship of Change Strategies in the Growth and Development of Entrepreneurial Projects after Covid 19: Change Management Strategies in the Post-Pandemic Business Landscape. *Koya University Journal of Humanities and Social Sciences*, 6(1), 104-120.
- Jibril, A. B., Amoah, J., Panigrahi, R. R., & Gochhait, S. (2024). Digital transformation in emerging markets: the role of technology adoption and innovative marketing strategies among SMEs in the post-pandemic era. *International Journal of Organizational Analysis*.
- Kaftan, V., Kandarov, W., Molodtsov, I., Sherstobitova, A., & Strielkowski, W. (2023). Socio-economic stability and sustainable development in the post-COVID era: lessons for the business and economic leaders. *Sustainability*, 15(4), 2876.
- Khawas, S., Faaiz, M. A., & Tiwary, A. (2021, December). Entrepreneurship Footprints Post-Pandemic. In *Proceedings of the International Conference on Advances in Management Practices (ICAMP 2021)*.
- Lv, B., Deng, Y., Meng, W., Wang, Z., & Tang, T. (2024). Research on digital intelligence business model based on artificial intelligence in post-epidemic era. *Management Decision*, 62(9), 2937-2957.
- Madzik, P., & Sieber, J. (2024). The strategic path to success: key aspects of business digital transformation in the post-pandemic era. *IEEE Access*.
- Philavong, V., & Onphanhdala, P. (2023). The post-pandemic green economic recovery, livelihoods, and adaptations in ASEAN. In *Post-Pandemic*

- Green Recovery in ASEAN* (pp. 191-212). Routledge.
16. Qian, X., Chen, M., Zhao, F., & Ling, H. (2024). An assessment framework of global smart cities for sustainable development in a post-pandemic era. *Cities*, 150, 104990.
 17. Saputra, Y. E., Worsito, S. B., & Firdaus, D. S. (2022). Bridging a resilient post-pandemic recovery through digital health transformation. *Indonesia post-pandemic outlook: Rethinking health and economics post-COVID-19*. Jakarta: BRIN Publishing, 13-43.
 18. Shan, B., Oh, I., & Rowley, C. (2023). Innovation and entrepreneurship in East Asia during the digital era: post-pandemic prospects. *Asia Pacific Business Review*, 29(4), 843-851.
 19. Sharma, A., Sharma, B. K., Rajput, S., Mehra, A., & Gulati, U. (2023). Digital branding adoption by specialty eatery start-ups in the post-pandemic environment in India. *Cogent Business & Management*, 10(1), 2196043.
 20. Smit, W., Salazar, L. J., Tate, Z., Saji, N., Sohn, J., & Polaki, I. S. P. (2022). Digital Entrepreneurship in Asia for Economic Resilience and Post-Pandemic Recovery: Country Report–Malaysia.
 21. Sulaiman, S., Abd Hamid, N., Rani, D. O., Saruji, S. C., & Aimullah, C. M. F. (2024). Determining the success factors of micro-businesses in the post-pandemic era: Empirical evidence from Asnaf entrepreneurship in Malaysia. *Journal of Asian Scientific Research*, 14(1), 38.s
 22. Taghizadeh-Hesary, F., Yoshino, N., Panthamit, N., & Phoumin, H. (Eds.). (2023). *Post-Pandemic Green Recovery in ASEAN*. Taylor & Francis.
 23. Vrana, V., & Das, S. (2023). Role of Enterprises and Their Digital Transformation in Post-pandemic Sustainable Development. In *New Normal in Digital Enterprises: Strategies for Sustainable Development* (pp. 137-157). Singapore: Springer Nature Singapore.
 24. Wang, J. (2023). *Analysis of Factors Influencing the Digital Transformation of Healthcare Enterprises During Post-Pandemic ERA of COVID-19*. Temple University.
 25. Wani, B. A., SAFI, Q., & DAHLAN, A. R. A. (2022). Making Malaysian university-of-the-future sustainable and relevant in the post-pandemic and digital era. *Journal of Information Systems and Digital Technologies*, 4(1), 103-128.s