

# Digital Transformation for Inclusive and Sustainable Growth: A Study of Taiwan SMEs

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## Abstract

**Purpose:** This paper has the objective of assessing impacts during the COVID-19 pandemic on firms' performance. The independent variables are social, technological, economic, and government factors. This study examines the impact of social, technological, economic, and government factors on firm performance. **Design/methodology/approach:** The study focuses on primary data and applied stratified sampling method. Using a sample of 48 firm leaders were collected from enterprises in Taiwan. Data analysis was generated with IBM SPSS Statistics version 22. **Findings:** In this paper, the Cronbach's Alpha for the variable is excellent with no autocorrelation and multicollinearity problems. Based on the results from multiple regression analysis, economic factor had a significant impact on Taiwan firms' performance. **Implications:** To improve the firms' performance, the firm can continue to adapt to the online platform, improve productivity and train their employees with fintech and Artificial Intelligent (A.I). Taiwan's economy growth is recovering; nevertheless, the consumer price index of Taiwan is hiking. As for the government, it should also provide supporting programs that embrace digital economy and 2050 Net Zero Agenda. **Originality/value:** Firm performance was significantly affected by the economic factor. The initiatives led by the government assisted by the technological change brought by the fourth industrial revolution has moderated the social economic impact faced by the firms.–The implications of the current study will provide Taiwan businesses to take digital investment decisions in various technologies that will boost performance of the firm and implement strategies towards Environmental, Social and Governance (ESG).

**Keywords:** Economic Factor, Firm Performance, Government Policy, Social Factor, Technological Factor

## Introduction

According to the IMD World Digital Competitiveness Ranking 2024, Taiwan was ranked 9<sup>th</sup> among the 67 major economies studied (IMD, 2024). Taiwan's scale of digital economy reaches US\$203.1 billion, and digital economy to GDP increases to 29.9%. Taiwan's digital lifestyle services penetration rate of the public reaches 80% that the economy's individual digital competitiveness reaches 60%. All these are backed by an excellent broadband infrastructure with high-speed broadband services and 5G network coverage in urban reaches 85%. Chunghwa Telecom's 5G network spreads to 97.6% of sites, on top of the fact that 5G network in Taiwan had a median download speed of 263.35 Mbps, outdoing neighbouring countries, including China, Hong Kong, Japan, the Philippines, and Vietnam in the third quarter of 2023 (Johan, 2023). Refer to the Figure 1. In recent development, the surge in demand for digital applications due to the COVID-19 pandemic. The 100M-and-below account number has shown a decline trend in past three years; those of 100M-and-above account number become dominant, increased from 48.6% to 59.8%. It shows a climbing demand for high-speed internet, especially 500M to 1G accounts (NCC, 2023).

More than 60% of the semiconductors globally, with more than 90% of the most advanced semiconductors are made in Taiwan, mainly manufactured by Taiwan Semiconductor Manufacturing Corporation (TSMC), and the success in the high-technology spreads to the

banking and finance sector, where 90 per cent of banks in Taiwan have initiated their digital transformation such as Artificial Intelligence (AI), big data, and Robotic Process Automation (RPA) applications, and almost 80% of Taiwanese banks use blockchain technology to certify letters of credit, though not more than 30% of banks have implemented augmented reality (AR) or virtual reality (VR) technologies (Santosdiaz, 2024).

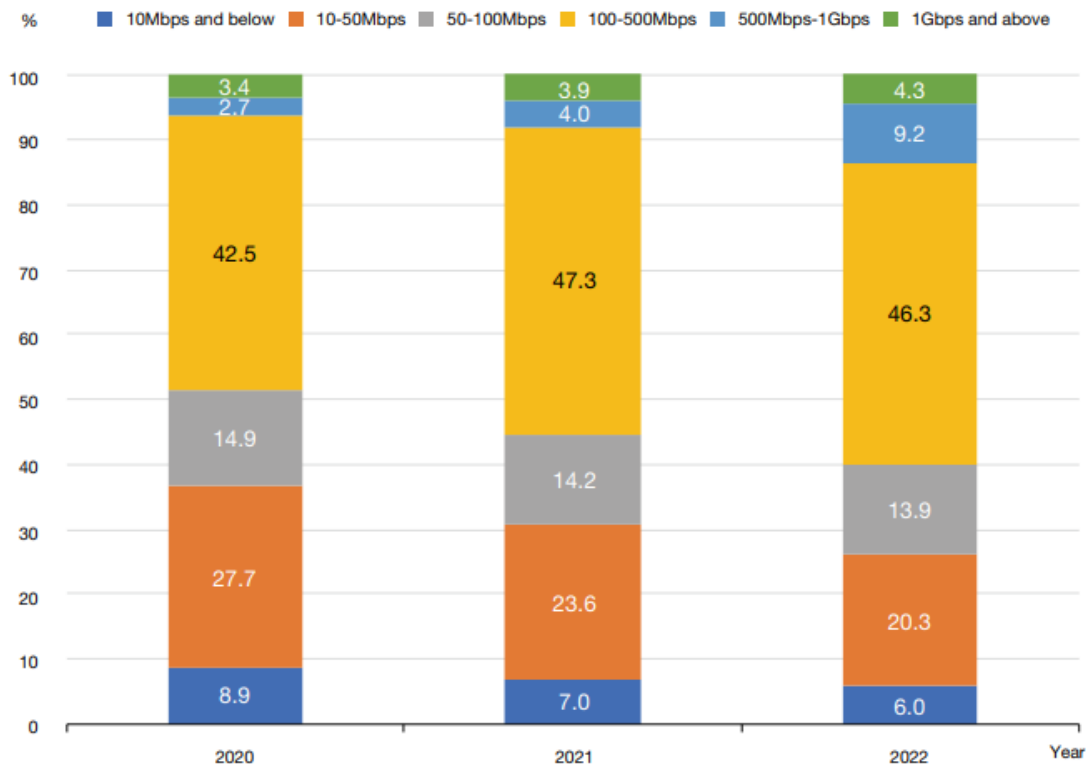


Figure 1: Changes in Fixed Broadband of Various Speeds  
Source: NCC (2023)

According to Small and Medium Enterprises (SMEs) White Paper 2023, the number of SMEs in Taiwan will exceed 1.674 million, accounting for more than 98.88% of all enterprises. Small and Medium Enterprises employed 9.2 million people (more than 80%) of the total workforce and achieved revenue of more than NTD28 trillion. The operations of Taiwan's SMEs are mainly in the service industry, nearly half (45.52%) is "wholesale and retail industry"; the number of SMEs in the industrial sector was 19%. The export volume of SMEs was NTD319.024 billion, accounting for 23.52% of the total export volume of all enterprises (經濟部中小及新創企業署, 2024)。 According to the Small and Medium Enterprise Startup Administration, 87% of SMEs have less than 30 employees (Chung & Hiciano, 8 November 2024).

Among all cities in Taiwan, Taichung has led in over half of the 8 key indicators for company and business registrations for 14 consecutive quarters since 2019, showcasing its stable economic growth. Amid the Artificial Intelligence (A.I.) boom, the city plays a crucial role, supported by strong industries like machine tools and optoelectronics, and a complete semiconductor supply chain with companies like Taiwan Semiconductor Manufacturing Company (TSMC), Micron, and Tokyo Electron (Economic Development Bureau, 2024).

According to the OECD survey, approximately 70% of SMEs in member countries increased their utilization of digital technologies during the pandemic (Lin & Wu, 2024). Similarly, the study by 思科 (2000) specifically points out that almost 70% of SMEs in Asia-Pacific have accelerated their digitalization due to the COVID-19 epidemic; 86% of the companies surveyed believe that digitalization can help strengthen the company's capability to respond to major crises. In the post-epidemic recovery era, 91% of SMEs in Taiwan have invested in digital transformation, that most companies have realized that they will not be competitive without transformation (PwC Taiwan, 2023). In response to the pandemic, 35% of business leaders in Taiwan said they would significantly intensify their firms' investments in digital transformation, followed by 33% in R&D and product innovation and 31% in leadership and talent development (PwC Taiwan, 2022a).

Research results indicate that cloud services (15%) are the foundation of digitalization and are the top technology investment projects for small and medium-sized enterprises in the Asia-Pacific region, followed by information security (12%) and the purchase or upgrade of IT infrastructure software (12%). For Taiwanese SMEs, they mainly invest in the purchase or upgrade of IT infrastructure hardware (14%), followed by cloud services (13%) and information security (11%). In Taiwan, the digital development of SMEs is expected to bring an increase of up to US\$27 billion to Taiwan's GDP by 2024 (思科, 2000).

Based on CPA Australia's Asia-Pacific Small Business Survey, Taiwanese small businesses rendered continual development on digital transformation. 52% made more than 10% of their sales via online and digital payment choices e.g. LINEpay and ApplePay in 2022 (SME Horizon.Com, 2023). Furthermore, the digital transformation process of export enterprises involves the following: 1) Technology application and innovation, 2) Buyer-oriented strategy, 3) Cultural and organizational changes (新興市場情報誌, 2024) .

In Taiwan, 74% of small and medium-sized enterprises seek digital transformation to introduce new products and services so that they can stand out from the competition and continue to grow; 51% of small and medium-sized enterprises realize that competition is changing and must therefore keep pace with the times; 16% of SMEs seek digital transformation due to customer demand for change (思科, 2000). WEF (2018) suggests the 5 main enablers to maximize the digital ROI: 1) Agile and digital-savvy leadership, 2) Data access and management, 3) Ecosystem thinking, 4) Forward-looking skills agenda, and 5) Technology infrastructure readiness.

Recent insights from the Taiwan Institute of Economic Research and the Institute for Information Industry revealed that 60% of businesses across seven key industries find digital transformation essential for increasing revenue, attracting new customers, and boosting transaction value (Chu 2024). The results show that small and medium-sized enterprises with high digital maturity have twice the revenue and productivity of enterprises that do not focus on digital transformation (思科, 2000).

In Taiwan, the Second Digital Transformation Dingge Awards 「鼎革獎」, co-organized by SAP and Harvard Business Review Global Traditional Chinese Edition, were awarded yesterday. In addition to large companies in the manufacturing, electronics, and financial industries such as CTCI, Makalot, and Wistron, it also includes small and medium-sized enterprises such as retail logistics and hospitals are also digitally transformed successfully 自由財經 (2022) . The biggest highlight of the Fourth Dingge Award 「鼎革獎」 is that many

companies or hospitals have begun to introduce generative AI applications and have seen concrete results (Chang, 2024).

The most high-performing companies are currently using data analysis platforms to understand the value brought by data, especially for wholesale and retail businesses and manufacturing industries. For instance, efficient wholesale and retail companies prefer to use sales and customer management systems, trailed by data analysis platforms. Among high-performing manufacturers, half of them said they are using data analysis platforms and large-scale integrated management systems (PwC Taiwan, 2023). Furthermore, 41.3% of companies said their companies' main digital and cloud tools in the future in cloud storage, followed by 37.5% in customer experience and 37.5% in integrated operations (PwC Taiwan, 2022b).

Various industries aspire for digital transformation. For example, 68.8% of the electronic parts manufacturing industry hopes to "improve operational efficiency" through digital transformation, 63.9% of the machinery and equipment industry hopes to "improve human resource management", and 58.1% of the wholesale industry hopes to "improve operational efficiency" through digital transformation. Retail companies believe that they can achieve the goal of "expanding market growth". In addition, 58.1% of the metal products manufacturing industry wants to "reduce operating costs" through transformation; 53.1% of the agriculture, fishery and animal husbandry industries want to "reduce operating costs", and 45.3% of accommodation and catering companies hope to achieve "better customer experience" through transformation. (PwC Taiwan, 2022b).

Nevertheless, the majority businesses said they had faced the main challenges including afraid of investing money without expected results (37%), inexperience of carrying out digital transformation by stages (30%) and not knowing the best practices of their industries (27%). Nearly 80% of companies believe that information security issues are important. Although most have established basic information security defenses, they are unable to withstand major network threats. Therefore, there is still room for strengthening information security protection. 60% of companies still need government subsidies, while external expert guidance and talent cultivation are the focus of their future needs (PwC Taiwan, 2023).

In order for the companies to realize digitalization in the future, the companies need government programs for talent development (26.8%), followed by comprehensive transformation case studies (23.8%) and talent-matching support (18.8%) (PwC Taiwan, 2022b). In response, Taiwan Cloud Marketplace (Tcloud) offers financial aids for diverse sectors to effortlessly embrace cloud tools. For the high-performing manufacturing sectors, 50% suggest that they are now employing data analytics platforms and large-scale integrated management systems (Energy-omni.com, 21 August 2021). A preferential loan program was announced to offer subsidies of up to NT\$100,000 (US\$3,102) for these SMEs that are undergoing digital transformation, focused on helping SMEs expand their access to domestic and international markets, and support their transition to a digital economy and net zero emissions (Chung & Hiciano, 8 November 2024). The Ministry of Digital Affairs (MODA) established on 27 August 2022, is taking a three-pronged ("People-Public-Private-Partnerships) approach to deepening digital resilience: social inclusion, industrial transformation, and cybersecurity response toward a resilient digital governance infrastructure, driving Taiwan's digital development to improve Taiwan's global digital competitiveness (Tang, 2022). For instance, Facebook (臉書) has launched a digital transformation plan for SMEs, creating online courses and providing resources specifically for SMEs in Taiwan. When

it comes to connecting businesses and consumers, Facebook provides guidance for different industries, including e-commerce, retail and travel (黃慧雯, 18 May 2020) .

Post-pandemic, the recent trend is to achieve Net-Zero carbon emissions in order to enhance transition competitiveness. The Taiwan government has tabled a new plan to increase the overall competitiveness of SMEs (2022-2026) with four strategies: 1) Net zero carbon emissions, 2) Digital transition, 3) Value-added innovation, and 4) Regional co-prosperity (Ministry of Economic Affairs, 2022). In addition, Taiwan government regulations and customer targets for 2050 net-zero carbon emissions will force companies to accelerate their transformation. About 40% of SMEs are aware of the target. SMEs are mostly use digital inventory and calculation tools to conduct carbon emission assessment and energy conversion when promoting net-zero carbon emissions (PwC Taiwan, 2023).

### ***Problem Statement***

This global lockdown due to the pandemic has had an impact on sectors such as education, food and healthcare. The pandemic causes huge impacts on the global economy. For the evolution of the technology, firms have to transform into digital enterprises. Beside E-commerce, social media is another digital technology used by the businesses. There were changes of lifestyles. The first issue was working from home. The practice of working from home may cause mental and physical health issues. Government supporting policies would be helpful to the economic recovery. Firms experienced hurdles since the beginning of the pandemic. Company human resource (HR) professionals and leaders may have to sort out these new challenges.

### ***Significance of the Study***

Although small businesses are receiving the government's monetary support, some of them are still unable to sustain, as the support is not able to continue for a long period. Therefore, this research to study firms in Taiwan. There are SMEs affected by the social, economic, digital transformation technology and government factors in the pandemic. There companies found the ways to counter the challenges in another crisis. Consequently, the government also needs to provide support based on situations.

### ***Literature Review***

Firm performance is determined by the financial perspective of the company's profit maximization. Firms' performance can be examined to monetary performance calculated by return on assets, return on equity, return on investment, etc. (Aifuwa, 2020).

The social factors also affect the firms' performance as businesses were in a Work From Home (WFH) mode in the pandemic. Based on Zhang et al. (2021), he stated that WFH had impacted business performance depending on industries. The same author also found out that WFH improves firms' performance during the pandemic. In another study, Bai et al. (2021) also stated that the firms might be able to maintain firm value via digital solutions and job arrangement flexibility during the pandemic. Businesses with WFH offer better employee safety, and also enhance business resilience (Bai et al., 2021). The use of contactless delivery, delivery of food, and others linked with logistics will be developed into a trend since the community has adapted the coexistence with the pandemic (Jiang et al., 2023). In addition, Tu, Chan and Chen (2020) proposed an enterprise recycling model with the benefits of green management that could reduce costs, exercise corporate social responsibility, and thus, add value to the firm's brand.

Based on Zulkiffli et al. (2022), there was a significant relationship between eco-innovation and firms' performance. Eco-innovation capabilities are advantageous on sustainable enterprises in cross-functional coordination, market emphasis, regulation, supplier engagement and technology (Fernando et al., 2021). Among the factors that will affect the firms' performance are digitalization transformation during the pandemic. Amankwah-Amoah et al. (2021) reported that reduction in communication costs, computers/devices, and information storage, along with the firm's capabilities development, firms now have more digitalization options. To maximize their competitive advantages and business sustainability, they are paying attention to the digital value-chain (Amankwah-Amoah et al., 2021). Sugianto et al. (2023) concluded that the firms' performance had a significant relationship with digitalization technologies, and resulted in business resilience (Sugianto et al., 2023).

In Taiwan, Ho and Hsu (2022) conducted a study on mobile apps of convenience stores. The study reports that the 7-11 Open Point mobile apps is required to improve on software quality, service quality and information quality, while the Family Mart mobile apps is required to improve software quality, customer experience, service quality and information quality. In short, the study concludes customer dissatisfaction is mainly due to software and information quality. On the other hand, mobile apps' convenience, ease of use, and practicability generate customer satisfaction. Specifically, Hu et al. (2023) studied an incorporates the two-stage model from adoption to adaptation of digital transformation and A.I. integration, of which it was suggested that firms could initially a foundation for digital transformation by digitizing business processes, equipment, and technology with 3 readiness assessments, i.e. to comprehend the AI technology's benefits, requirements, and potential changes, then, adopt A.I. technologies in the subsequent phase. In addition, Yen et al. (2023) commented that during digital transformation, the firm is required to improve communication, as well as communication with the consumers. Besides, Kao et al. (2024) features customer experience, training on digital transformation, and allocation of resources, and illustrates the dynamic relationship among business operations, digital transformation technology, and optimization of processes.

For the use of digitalization to expand overseas, Tsao, Koong and Lin (2020) suggests that the firms' internal factors are the most importance factor to ascertain the success of adoption of business-to-business electronic commerce (B2BEC), however, factors relating to IS/IT investment evaluation and benefits realization, and government support are less significant. The said author further reports that integration of internet with marketing are the most significant factor for the satisfaction of adoption of B2BEC, trailed by the firm's readiness, employee's resistance, and top management support. Furthermore, Chen et al. (2023) suggests 5 types of enterprises with capabilities in cross-border potential, cross-border start-up, knowledge-based enhancement, marketing enhancement and product enhancement. Subsequently, technology advancement has an effect on the firms' performance during the pandemic.

During the pandemic, economic factors include, for instance, firms' shutdown temporarily, shortage in labor, cost inflation, demand affected. Aifuwa (2020) reported that firms' performance caused the shutdown of the business activities. It led to a sudden reduction in revenue, which then resulted in shortage of cash flow, financing, and investment decisions. Piling inventory reduced its valuation. Firms eventually suffered shut down with reduction in revenue and caused an increase of jobless. Furthermore, Saad (2021) found a positive relationship between the unemployment and the pandemic in 7 economies, particularly in Hong

Kong, Malaysia and the Philippines. One crucial question encompassing the is whether a temporary closure will cause permanent closure of businesses (Balla-Elliott et al., 2020). The same author opines that the government restrictions regulated (lock down) implies that the financial losses of extended lockdowns, especially small businesses; as the restriction during the pandemic being extended, the possibility of firms' endurance will be intensified.

Based on Turkson et al. (2021), the impact of the pandemic has been massive because it has affected all sides of the society, existing after the pandemic and works that manage it. Governments are demanded to reduce the consequences on their peoples. Shah et al. (2020) and Donthu and Gustafsson (2020) reported that the pandemic policies e.g. Health Protocols and new norm recovery measures are significant towards the decline in the infection and recovery of the economy. Alessa et al. (2021) also found that many businesses are turning to internet medium to operate. In the current study, the framework indicates that during the pandemic, a firms' performance is controlled by economic, social, technology, and government factors.

### **Method**

In this study, the primary data is the data source. The researcher will collect data using questionnaires physically and / or via the Internet. Ideally, there are at least 10 observations per variable. The respondents must possess senior designations within the companies, such as chief executive officers, owners, senior executives and supervisors. The location of the sampling in this study is Taiwan, data collected from November to December 2024.

An evaluation diagnostic questionnaire was designed in helping to evaluate the current situation, make the best decision at the moment (Decide), and put it into action (Act). In this questionnaire, the key strategies used are the following three:

- (1) Multi-faceted approach: distinguish four major aspects that correspond to the company's overall situation.
- (2) Accurate demand identification: Distinguish the company's needs and find the most urgent unmet needs.
- (3) Complete evaluation scale: Use the 5-scale operational definition to completely present the continuous process for firm performance.

The survey questionnaire comprises 5 sections, collecting the respondents' demographic information, and regarding the independent variables, i.e. social, economic, technology and government factors. The measurement is assessed via a 5-point Likert scale. The questions were adapted from Zurlo et al. (2020), Johnson and Moorman (2022), Sugianto et al., (2023) and Verma and Gustafsson, (2020). To perform the test, 48 sets data collected. Reliability assessed by Cronbach's alpha, exists in the range of 0.919 and 0.923, considered excellent in reliability which is above the 0.70 threshold. In a multiple linear regression, multicollinearity appears when there are strong correlations between two and above variables in a multiple linear regression (Hayes, 2023). Based on Kim (2019), in the case of VIF is higher than 5 to 10 and the tolerance value is lower than 0.1 to 0.2, there occurs multicollinearity. The analysis was made using SPSS 22.0. SPSS software can be used to conduct tests, i.e., reliability tests, multicollinearity analysis, multiple linear regression analysis.

### **Findings**

The data collection process started in November to December 2024. A total of 48 responses were received from owners (18.8%), supervisors (50%), chief executive officers (10.4%) and senior executives (20.8%) throughout Taiwan. 43.8% (21 responders) were female, males made

up 56.3% of the total (27 responses). 8.3% (4 respondents) are in the range of 26 and 30. 8.3% (3 responses) are in the range of 18 and 25 and 16.7% (8 respondents) are in the range of 31 and 40. 33.3% (16 responses) each are in the range of 41 and 50, and 51 to 60. There is only 1 response (2.1%) ages more than 60 years old. Most of the participants 52.1% (25 respondents) have a bachelor's degree, 31.3% (15 respondents) have postgraduate degrees, and 8.3% (4 respondents) each have diploma or equivalent qualifications or completed high school education, indicate very high level of education attainment among the business leaders.

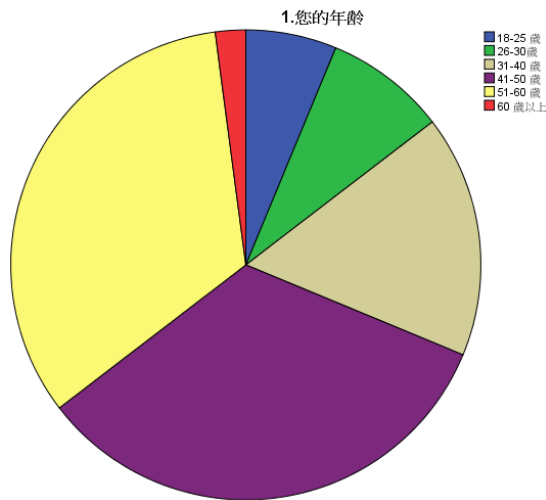


Figure 2: Age of Respondents

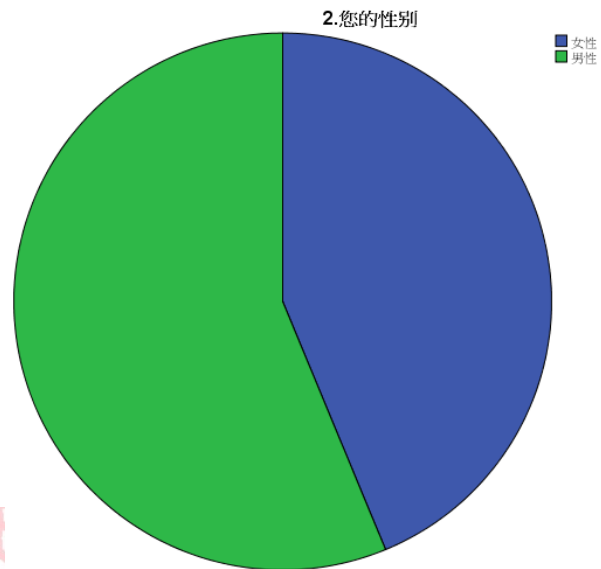


Figure 3: Gender of Respondents

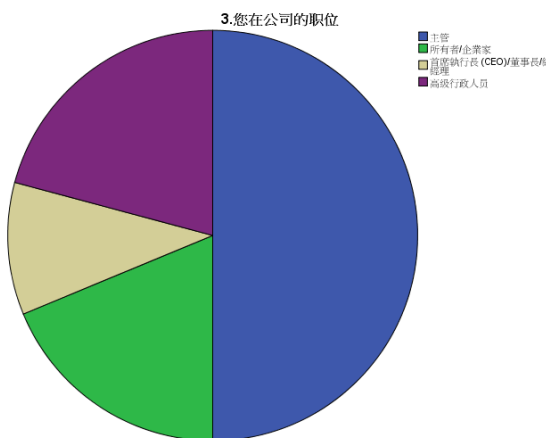


Figure 4: Position of Respondents

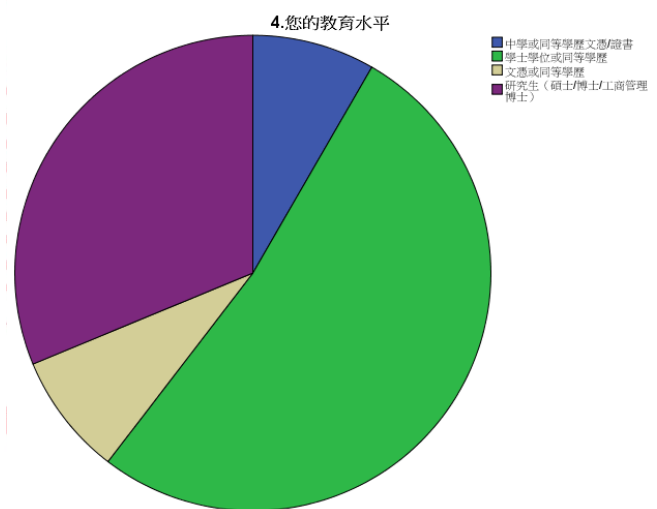


Figure 5: Education Level of Respondents

Most of the respondents (70.9%) are based in the central Taiwan, i.e. Taichung City (66.7%), Changhua (4.2%), followed by 20.8% from northern Taiwan (Hsinchu, Taipei, Xinbei, Taoyuan), 4.2% from southern Taiwan (Kaohsiung, Tainan) and 4.2% from eastern Taiwan (Taitung). 47.9% (23 respondents) are involved in the services, others are from manufacturing (41.7%), construction (6.3%) and agriculture (4.2%).



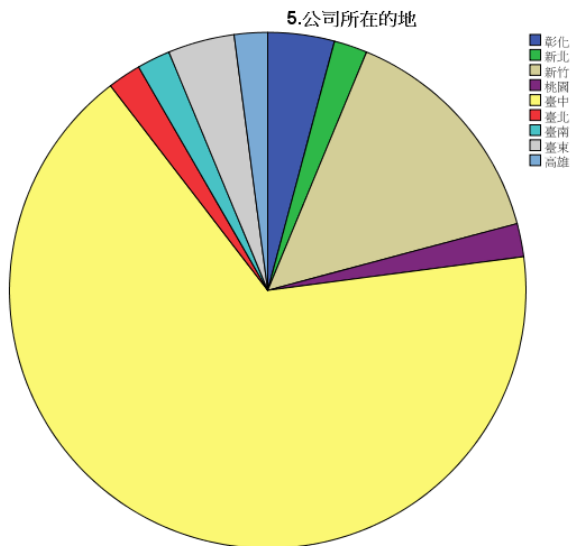


Figure 6: Location of Company

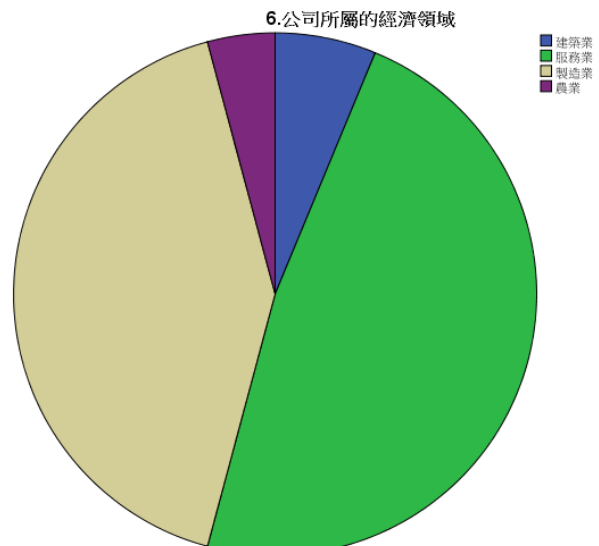


Figure 7: Economy Sector of Company

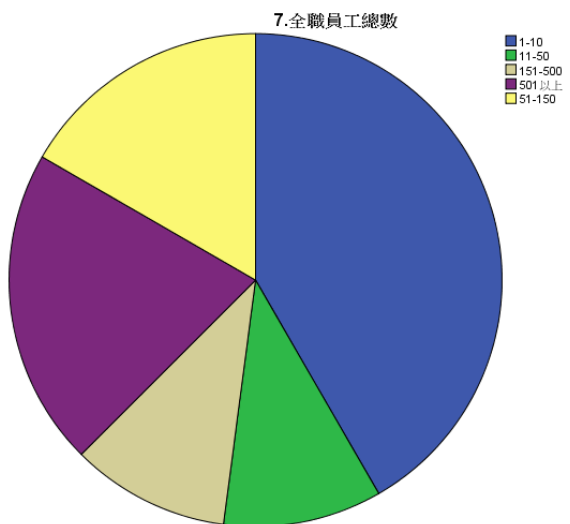


Figure 8: Employee Number of Company

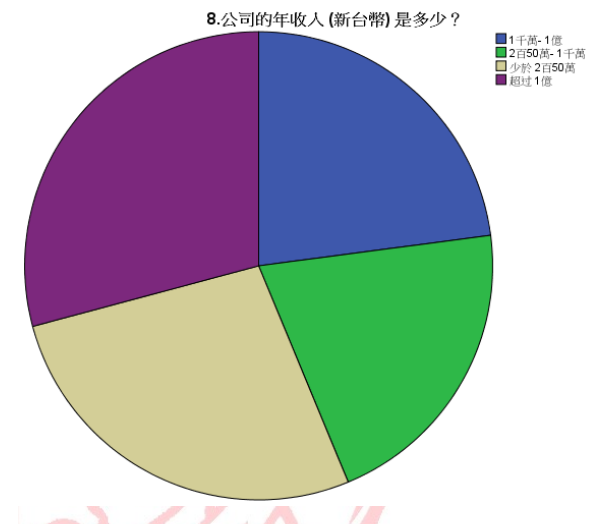


Figure 9: Annual Revenue of Company

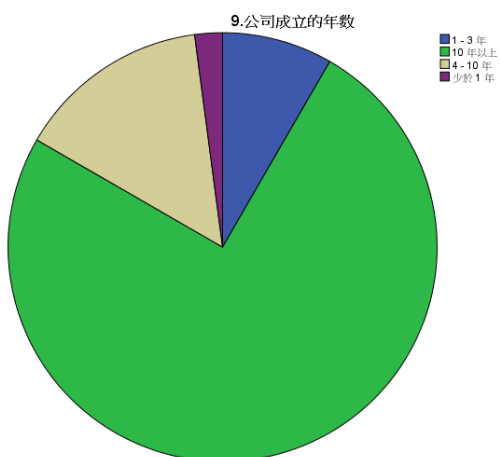


Figure 10: Establishment Years of Company

The respondents are 41.7% (20 respondents) from companies with 1 to 10 employees, 20.8% with more than 500 employees, 16.7% with 51 to 150 employees, and 10.4% each from

companies with 11 to 50 employees and 51 to 150 employees. Most of the companies (29.2%) have revenue above NTD100 million, 27.1% below NTD 2.5 million, 22.9% with revenue between NTD 10 million to NTD 100 million and 20.8% between NTD 2.5 million to NTD 10 million. 36 respondents (75.0%) report their companies established for 10 years and above, 14.5% between 4 to 10 years, 8.3% between one to three years, and only 2.1% below one year.

Refer to **Table 1**. For companies with revenue above NTD100 million, it is highly represented by companies located in northern Taiwan (Hsinchu, Taoyuan), central Taiwan (Taichung) and southern (Tainan), covering the main population in west coast of Taiwan.

**Table 1: Crosstab of Companies Employees and Revenue**

Location	Company Revenue				Total
	<NTD 2.5M	NTD2.5M – NTD10M	NTD10M – NTD100 M	>NTD100M	
Changhua	1	1	0	0	2 (4%)
Xinbei	0	0	1	0	1 (2%)
Hsinchu	1	0	4	2	7 (15%)
Taoyuan	0	0	0	1	1 (2%)
Taichung	9	8	5	10	32 (67%)
Taipei	0	0	1	0	1 (2%)
Tainan	0	0	0	1	1 (2%)
Taitung	2	0	0	0	2 (4%)
Kaohsiung	0	1	0	0	1 (2%)
	13 (27%)	10 (21%)	11 (23%)	14 (29%)	48 (100%)

Refer to Table 2. It can be observed that even though manufacturing is the second largest industrial sector, most of the large companies with annual revenue above NTD100M are from the manufacturing sector (40%), while agriculture seems to be the weakest sector, all of them earning revenue less than NTD2.5M.

**Table 2: Crosstab of Economic Sectors and Revenue**

Location	Company Revenue				Total
	<NTD 2.5M	NTD2.5M – NTD10M	NTD10M – NTD100M	>NTD100M	
Services	5	5	8	5	23 (48%)
Manufacturing	5	4	3	8	20 (42%)
Construction	1	1	0	1	3 (6%)
Agriculture	2	0	0	0	2 (4%)
	13 (27%)	10 (21%)	11 (23%)	14 (29%)	48 (100%)

Refer to Table 3. It can be observed that even though most of the companies 42% with 10 employees and below, but some of them even achieve revenue above NTD100 million, meaning that the employees in Taiwan are knowledge workers who have high productivity and generate high value-added products and services.

**Table 3: Crosstab of Companies Employees and Revenue**

Company Employee Numbers	Company Revenue				Total
	<NTD 2.5M	NTD2.5M – NTD10M	NTD10M – NTD100 M	>NTD100M	
1-10	8	6	5	1	20 (42%)
11-50	0	2	2	1	5 (10%)
51-150	2	1	1	4	8 (17%)
151-500	0	1	2	2	5 (10%)
>500	3	0	1	6	10 (21%)
	13 (27%)	10 (21%)	11 (23%)	14 (29%)	48 (100%)

Refer to Table 4. 67% companies (2 out of 3) in the construction sector agreed that they were affected in revenue by the pandemic, followed by 65% companies (15 out of 23) in the services sector. On the contrary, 50% companies (1 out of 2) in the agriculture sector disagreed that they were affected in revenue by the pandemic, followed by 30% companies (6 out of 20) in the manufacturing. Meaning that the manufacturing sector are competitive and proven more business resilience through the pandemic.

**Table 4: Crosstab of Companies Affected and Economic Sectors**

My company revenue and income affected by the pandemic	Economic Sectors				Total
	Construction	Services	Manufacturing	Agriculture	
Strongly Disagree	1	0	3	1	5 (10%)
Disagree	0	4	3	0	7 (15%)
Neutral	0	4	4	0	8 (17%)
Agree	2	5	7	1	15 (31%)
Strongly Agree	0	10	3	0	13 (27%)
	3 (6%)	23 (48%)	20 (42%)	2 (4%)	48 (100%)

Refer to Table 5. On the contrary, 88% companies (7 out of 8) with between 51-150 employees were agreed they were affected in revenue by the pandemic, followed by 60% companies (12 out of 20) with between 1-10 employees, 60% companies (3 out of 5) with between 11-50 employees, 40% companies (2 out of 5) with between 151-500 employees. 40% companies (4 out of 10) with over 500 employees disagree that they were affected in revenue by the pandemic. Meaning that these large companies are competitive and proven relatively business resilience through the pandemic.

**Table 5: Crosstab of Companies Affected and Number of Employees**

My company revenue and income affected by the pandemic	Company Establishment Years					Total
	1-10	11-50	51-150	151-500	>500	
Strongly Disagree	2	0	0	1	2	5 (10%)
Disagree	4	0	1	0	2	7 (15%)
Neutral	2	2	0	2	2	8 (17%)
Agree	6	2	4	1	2	15 (31%)
Strongly Agree	6	1	3	1	2	13 (27%)
	20 (42%)	5 (10%)	8 (17%)	5 (10%)	10 (21%)	48 (100%)

Refer to Table 6. 86% companies (6 out of 7) established between 4 to 10 years agree that they were affected in revenue by the pandemic, followed by 56% companies (20 out of 36) established between above 10 years, followed by equally 50% companies (2 out of 4) established between 1 to 3 years were agreed and disagreed. Only companies established in less than one year are disagree that they were affected by the pandemic, as they established in new norm. Meaning that young companies established within three years are competitive and proven more business resilience through the pandemic.

**Table 6: Crosstab of Companies Affected and Establishment Years of Company**

My company revenue and income affected by the pandemic	Company Establishment Years				Total
	<1 Year	1-3 Years	4-10 Years	>10 Years	
Strongly Disagree	1	0	1	3	5 (10%)
Disagree	0	2	0	5	7 (15%)
Neutral	0	0	0	8	8 (17%)
Agree	0	1	1	13	15 (31%)
Strongly Agree	0	1	5	7	13 (27%)
	1 (2%)	4 (8%)	7 (15%)	36 (75%)	48 (100%)

### Digital Transformation

Refer to Table 7. Digital Technology such as A.I. and M.L. are largely adopted by 61% companies (14 out of 23) of the services sector, followed by 40% companies (8 out of 20) of manufacturing sector. It indicates that manufacturing and services sectors embrace digital transformation and possess competitive advantage.

**Table 7: Crosstab of Digital Transformation and Economic Sectors**

Economics Sector	Use of New Digital Technology (A.I., Machine Learning, M.L.)					Total
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Construction	1	0	2	0	0	3 (6%)
Services	3	2	4	6	8	23 (48%)
Manufacturing	2	2	8	7	1	20 (42%)
Agriculture	1	0	0	0	1	2 (4%)
	7 (15%)	4 (8%)	14 (29%)	13 (27%)	10 (21%)	48 (100%)

Refer to Table 8. Digital Technology such as A.I. and M.L. are largely adopted by 100% of the companies (1 out of 1) in Taipei, followed by 71% of the companies in Hsinchu (5 out of 7), and 50% companies in Changhua and Taichung. It indicates that northern and central Taiwan embrace digital transformation and possess competitive advantage.

Refer to Table 9. Digital Technology such as A.I. and M.L. are largely adopted by 70% of the companies (7 out of 10) with >500 employees, followed by 60% of the companies (3 out of 5) with 151-500 employees, and 50% companies (4 out of 8) with 51-150 employees. It indicates that larger companies with more than 50 employees embrace closely digital transformation and possess competitive advantage.

**Table 8: Crosstab of Digital Transformation and Cities**

City	Use of New Digital Technology (A.I., Machine Learning)					
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total
Changhua	0	0	1	0	1	2 (4%)
Xinbei	0	1	0	0	0	1 (2%)
Hsinchu	0	0	2	2	3	7 (15%)
Taoyuan	1	0	0	0	0	1 (2%)
Taichung	4	2	10	11	5	32 (67%)
Taipei	0	0	0	0	1	1 (2%)
Tainan	0	0	1	0	0	1 (2%)
Taitung	1	1	0	0	0	2 (4%)
Kaohsiung	1	0	0	0	0	1 (2%)
	7 (15%)	4 (8%)	14 (29%)	13 (27%)	10 (21%)	48 (100%)

**Table 9: Crosstab of Digital Transformation and Number of Employees**

Employees	Use of New Digital Technology (A.I., Machine Learning)					
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total
1-10	6	2	4	4	4	20 (42%)
11-50	0	1	3	0	1	5 (10%)
51-150	0	0	4	2	2	8 (17%)
151-500	1	0	1	1	2	5 (10%)
>500	0	1	2	6	1	10 (21%)
	7 (15%)	4 (8%)	14 (29%)	13 (27%)	10 (21%)	48 (100%)

Refer to Table 10. Digital Technology such as A.I. and M.L. are largely adopted by 57% of the companies with >NTD100M revenue, followed by 46% of the companies with revenue between NTD10M-NTD100M, and 60% companies with revenue between NTD2.5M-NTD10M. It indicates that larger companies with revenue over NTD2.5M embrace closely digital transformation and possess competitive advantage.

**Table 10: Crosstab of Digital Transformation and Revenue**

Revenue (NTD)	Use of New Digital Technology (A.I., Machine Learning, M.L.)					
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total
<2.5M	3	1	5	1	3	13 (27%)
2.5M-10M	1	0	3	4	2	10 (21%)
10M-100M	2	2	2	1	4	11 (23%)
>100M	1	1	4	7	1	14 (29%)
	7 (15%)	4 (8%)	14 (29%)	13 (27%)	10 (21%)	48 (100%)

Refer to Table 11. Digital Technology such as A.I. and M.L. are largely adopted by 67% of the companies established between 1-3 years, followed by 50% of the companies established over 10 years. It indicates that older companies with established more than 10 years and recent start-ups established between 1-3 years embrace closely digital transformation and possess competitive advantage.

**Table 11: Crosstab of Digital Transformation and Years of Establishment**

Years of Establishment	Use of New Digital Technology (A.I., Machine Learning, M.L.)					
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total
<1	1	0	0	0	0	1 (2%)
1-3	0	0	1	0	3	4 (8%)
4-10	3	1	1	0	2	7 (15%)
>10	3	3	12	13	5	36 (75%)
	7 (15%)	4 (8%)	14 (29%)	13 (27%)	10 (21%)	48 (100%)

**Digital Transformation and Revenue**

Refer to Table 22% of the companies (5 of 23) that adopted digital technology such as A.I. and M.L. strongly disagree / disagree that their revenue had been affected negatively, followed by 17% of the companies (4 of 23) that adopted digital technology were neutral (breakeven) in pandemic. It indicates that not all companies were affected in the pandemic, while companies closely embrace digital transformation possess competitive advantage

**Table 12: Crosstab of Digital Transformation and Years of Establishment**

My company revenue and income affected by the pandemic	Use of New Digital Technology (A.I., Machine Learning, M.L.)					
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total
Strongly Disagree	2	0	1	2	0	5 (10%)
Disagree	1	2	1	2	1	7 (15%)
Neutral	1	1	2	3	1	8 (17%)
Agree	0	0	8	5	2	15 (31%)
Strongly Agree	3	1	2	1	6	13 (27%)
	7 (15%)	4 (8%)	14 (29%)	13 (27%)	10 (21%)	48 (100%)

**Diagnostic Tests**

The data has exhibited Very Good Reliability of 0.922. The Cronbach's Alpha shows excellent reliability because it exceeds 0.90. Multicollinearity problems do not exist in the model as the VIF values are between 1.200 and 1.300, while the tolerance values are between 0.740 to 0.830 (Refer Table 13).

**Table 13: Collinearity Statistics**

Items	Collinearity Statistics	
	Tolerance	VIF
Social Factor	0.747	1.338
Technology Factor	0.753	1.328
Economy Factor	0.828	1.207
Government Factor	0.801	1.249

From Table 14, it can be concluded that the order of correlation between the influencing factors and the target parameter is as follows: Economy Factor > Social Factor > Technology Factor > Government Factor. The results show the linear relationship between Economy Factor and Firm Performance is significant level of 1%, between Social Factor and Firm Performance is significant level of 10%, between other factors and Firm Performance is not significant. Therefore, the Economy Factor is the main factor affecting Firm Performance.

**Table 14: Pearson Correlation Coefficient among Parameters with Firm Performance**

Parameter	Social Factor	Technology Factor	Economy Factor	Government Factor
Pearson Correlation Coefficient	-0.229	-0.093	-0.394	-0.048
Sig.	0.059	0.265	0.003	0.373
Sample Size	48	48	48	48

Table 15 shows that Economic Factor is significant with t-statistics of -2.758 at p-values below 0.01 when the significant level is at 1%. The regression model is significant with the F-test's p-value < 0.05. The Adjusted R-squared is 0.120. This reflects that 12% of the variance in the Taiwan firm performance is credited to a blend of economic, government social and technology factors. The Durbin Watson (DW) statistic is a test statistic used in statistics to detect autocorrelation. A value of DW = 2.012 indicates that there is no autocorrelation.

**Table 15: Multiple Regression Analysis**

	Unstandardized Coefficient			
	Beta	Std. Error	t-statistics	P-value
(Constant)	5.396	1.107	4.738	<0.001
Social Factor	-0.319	0.282	-1.130	0.265
Technology Factor	0.030	0.257	0.117	0.907
Economy Factor	-0.893	0.324	-2.758	0.009
Government Factor	0.191	0.192	0.995	0.325
R-squared				0.195
Adjusted R-squared				0.120
F-test				2.608
P-value				0.049
Durbin Watson				2.012

## **Discussion and Conclusion**

Among the urban centers, most of the respondents are from Taichung, a city with leading new business registration in past five years including the pandemic period indicates its enduring economic growth as a smart city riding on A.I., strong industries i.e. machine tools, optoelectronics, and semiconductor. The strong and productive SMEs and manufacturing sectors are the backbone of the Taiwan in terms of employment and economic contribution.

Among the economic sectors, services sector is the top economic sector implementation digital transformation, followed by manufacturing sector, which brought to higher productivity or competitive advance in high value-added operations in the services sector (e.g. banking and finance) and manufacturing sector (e.g. semiconductor).

Companies closely embraced digital transformation as almost two out of five (39%) companies were either break even or increase their revenue despite the pandemic indicating their competitive advantage. The findings also indicate that companies located in northern or central Taiwan, or companies with revenue over NTD2.5M or established more than 10 years or having more than 500 employees embrace closely digital transformation and possess competitive advantage.

In relation to this, the negative effect of social factor is similar with the study by Zhang et al. (2021) stated that WFH had affected revenue, and supply chain, and the study of Jiang et al. (2023) that the implementation of contactless delivery approaches is associated is being developed in a general trend for improved firms' performance. This discovers of positive impact of technological factor is aligned with past studies. Sugianto et al. (2023) found that more digitalization was related to better business resilience. Hence, the technology factor affected on the firms' performance in the pandemic. This result of negative economic factor impact is reported by the researchers such as Aifuwa (2020) who explained that the pandemic can affect the firms' performance and subsequent competitive advantage post pandemic. Besides, this paper is in line with the literature such as Saad (2021).

Balla-Elliott et al. (2020) stated that the government's physical control measures did not mean is improper, but it caused the costs of doing business that greatly impacted the small businesses. When the restriction period is long, the more the costs incurred and thus, the firms' endurance will be reduced. This result is similar with Shah et al. (2020) and Donthu and Gustafsson (2020) that testify that government schemes to reduce infection rate and permitting the return to business as usual.

### ***Implications***

In this paper, it was found out that economic factors were the essential factors impacting the firms' performance. Economic factor has a significant but negative effect on firm performance. Taiwan's economy is growing progressively from the shock of the pandemic. Though, Taiwan's inflation rate is climbing, and this will affect the cost of doing business.

Result shows that social factor has a negative effect on firms' performance. To improve the firms' performance, firms can revert to on-site functioning for the employees. Besides, firms must be agile and further transform towards achieving Environmental, Social and Governance (ESG) agenda.



Technological factors can enhance firms' performance. Firms that use the digital technology tend to have a competitive advantage to do better. Therefore, knowledge-oriented leadership can help organization employees to trust that knowledge through innovation is essential for an advantage over competitors (Rehman, AuYong & Choong, 2022). Firms should emphasize on digital technology that can be used in businesses to increase the effectiveness and productivity. Firms can provide more opportunities for their employees to learn about financial technology (fintech), Artificial Intelligence (A.I.) and Machine Learning (M.L.) as such their firms can effectively deploy the digital technology. For instance, firms can utilize automation to simplify the processes which will shorten turnaround time and labor cost.

Furthermore, government policies influence businesses with legislation issued to counter the pandemic, includes business operations, financial aid programs, etc. Additionally, the central Small and Medium Enterprise and Startup Administration and local governments can adapt new norm economic recovery activities with pro-business environment, providing continuous support in terms of training, loans, grants, crisis/disaster assistance and other financing schemes to young entrepreneurs / startups to progressively transform their businesses into digital economy and 2050 Net Zero agenda. Most importantly, these SMEs will need proper technology guidance by industry experts to invest in suitable digital technology that meets the needs of their operations to upgrade in the circular digital economy.

#### ***Limitation and Recommendation***

This study encountered with some limitation. This study focuses on quantitative data, without qualitative information. Hence, respondents may encounter restrictions in articulating their thoughts if their viewpoints do not ally with the given choices. It is suggested that future studies can plan collection of a mixed mode of both qualitative and quantitative data. There are open-ended questions that stimulus respondents to give extensive information. Another limitation is limited data collected in a short period. Given longer data collection period, more data is welcome.

#### ***Conclusion***

The foremost purpose of the paper is to understand how the pandemic has impacted Taiwan firms' performance in new norm. In relation to this, this can be denoted as economic factor has significant impact on the firms' performance.

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