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The Digital Transformation of the Singapore Economy

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Abstract

In this paper, we trace the evolution of Singapore's journey in digital transformation of the economy. The aim to transform into a smart nation has evolved with the drive towards ubiquitous digitalization of the economy to launch the economy into a new phase of growth. Digitalization can be as simple as adopting some Information and Communication Technologies (ICT), but can be as complex, and sometimes confusing, to include many new aspects like AI, machines learning, big data, IOT, 5G, blockchain and analytics. Singapore started the journey with computerization drive in the civil services to increase labour productivity and service quality. Subsequently, via many national IT plans launched over the years, she has developed a solid foundation for the establishment of a smart nation and digital economy with many aspects of the complexities included. The paper describes and analyzes the strategies and schemes adopted by the Singapore government to develop the digital business ecosystem, especially the assistance rendered to SMEs. We attempt to trace and record the effectiveness of the digitalization drive as Singapore aspires to be a Global-Asia node for technology, innovation and enterprise. The digital economy of ASEAN is estimated to have a potential value of S\$2.7 trillion (US\$2 trillion). The experience of Singapore as a fore-runner in digitalization will be useful reference for learning and adaptation by other member countries in ASEAN.

Keywords: Smart nation, Digital transformation, e-commerce, Artificial Intelligence (AI), Automation, Digital economy, SME, Industry 4.0, Global value chain, IoT, 5G, Singapore

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1. Introduction

The global economy is undergoing tectonic changes. Countries have not only to cope with climate change but also the deluge of new technologies and information. Data has become the new primary factor of production besides the familiar land, labour capital and entrepreneurship. Processed data-knowledge brings competitive advantage and creates an ecosystem that sustains market leadership through both creative destruction and

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disruptive innovation. According to McKinsey Global Institute¹, global cross-border data flows have soared 45 times since 2005. Soaring flows of data and information now *generate more economic value than the global goods trade*. Data flows in 2014 contributed to an estimated US\$2.8 trillion in global GDP, and will continue to create both immense opportunities and challenges in the world. The digital economy of ASEAN is estimated to have a potential value of S\$2.7 trillion (US\$2 trillion). The recent ASEAN Economic Ministers' (AEM) meeting in August 2023 had endorsed a study on the ASEAN Digital Economy Framework (DEFA) to enable member countries to negotiate Digital Economy Agreement (DEA) which will be no less important than the ASEAN Free Trade Agreement (AFTA) signed in 1993.

The digital revolution has altered the economics of doing business by lowering barriers and bringing down costs of cross-border interactions, and enabling the virtual and instant creation and trade of digital goods and services. With the blurring of sector and national boundaries in the digital realm, competition has also been redefined globally. Singapore's economic survival has been premised on being relevant to the global economy. Her dependence on trade and foreign investments for economic growth remains significant and would like to have digitalization drive fostering smooth restructuring and transformation of the economy. Unsurprisingly, concerted efforts are made by the government to ensure Singapore remain a leading participant in the digital economy-seizing new opportunities and capturing value that arise from this global trend.

Digitalisation is vital to the businesses in terms of raising productivity, driving topline growth, reaping value in adjacencies, harnessing new ecosystems and accessing new markets overseas. It takes more than just using the latest technologies – it involves transforming business models and rethinking operating approaches to take full advantage of the capabilities that digital offers.

The value of digitalisation is immense – Microsoft estimates that the digital economy will contribute an additional US\$10 billion to Singapore's GDP by 2021. The Committee on the Future Economy (CFE), which was formed in 2016 to chart the next phase of Singapore's economic growth, has affirmed the importance for Singapore to join the leading countries to shape and grow the global digital economy. The Singapore government reckons that digitalization will be crucial for continued economic growth, and has expended substantial resources and sturdy determination to assist digital transformation in the business sector and economy as a whole.

In this chapter, we begin with a clarification of several commonly seen terms like IT, Digitalization, Analytics, AI, Blockchain and Users' experience (UX), before reviewing the concept of the digital transformation and tracing the emanation of the digitalization drive as a continuation of the momentum of industrialization started more than two centuries ago. The main features and the benefits that can be derived from digitalization of the economy are discussed. Following that, we investigate how Singapore began its digitalization journey with the objective of using technology, especially information technology, to computerize public services and support economic growth. We review the IT plans were put forth by the government at regular interval, that help to digitalize the various economic clusters, to become digital business ecosystems powering the economy into a new phase of growth. The next section considers the digitalization of Small and Median Enterprises (SMEs) in Singapore. In particular, we consider the various schemes, incentives and action plans that are crafted to help the SMEs which made up 99% of total enterprises in the economy, to transform their business models into one that make best use of digital technologies. We report on the progress of digitalization based on the surveys done recently before concluding the chapter with some remarks on the challenges faced in digitalization of the economy.

2. Effects of Digitalization and Digital Transformation

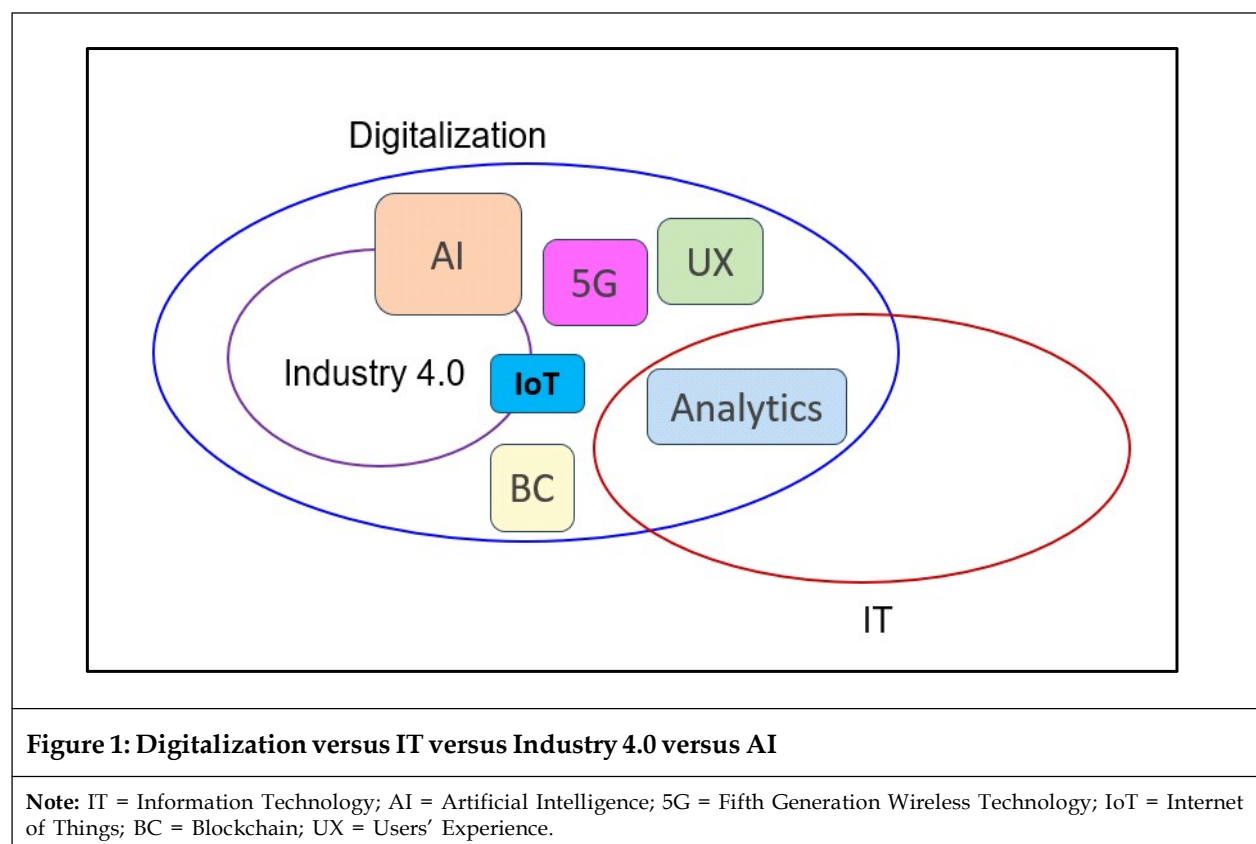
2.1. Whether IT, Digitalization, Digital Transformation, Industry 4.0 and AI are One and the Same Thing?

IT, which represents information technology, a phrase coined in 1958, means a technique by which information can be systematically used to aid decision-making and higher order thinking. IT encompasses software (codes),

¹ McKinsey Global Institute (2016). Digital Globalization: The New Era of Global Flows. Accessed at: <https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/digital-globalization-the-new-era-of-global-flows>

hardware (computer) and a bunch of other tools and systems that support internal operations, compliance and legal issues. Digitalization is about acquiring a set of technological capabilities, architectures and mindset that provide coverage beyond computer systems. In particular, digitalization involves connecting devices and equipment to the Internet of Things (IoT), in order to collect performance data and readings of key process parameters. Once collected and analysed, they can help to drive productivity, reduced equipment downtime and enhanced production and profitability. Digitalization is the integration of digital technology into all areas of a business resulting in fundamental changes to how businesses operate and how they deliver value to customers. If this is done for every area of a business, extending further into every economic sector in the economy, then the spark of Digital Transformation (DT) of the economy has ignited. DT refers to the process of the transformation of an organization (be it a company or an economy) with little, or no, digital capability, to one having substantially more digital capability (Leinward *et al.*, 2021).

An essential aspect of digitalization is analytics, which refers to actionable insights distilled from the systematic analysis of the data to deliver quantifiable benefits. Digitalization is also inextricably linked to AI. When we use insights derived from machine data and systems to formulate analytics, and influence and enhance the behaviour of the machine—such that the Machine Learns (ML) over time—we have injected machine intelligence, or AI, into our technology. Some of the largest companies in the world, including Volkswagen, Siemens, GE, Intel, NVIDIA and Microsoft, are using AI/ML approaches to improve their manufacturing performance and service delivery. This brings us to the concept of Industry 4.0 which relates to the automation of manufacturing. Of course AI application and automation have also pervaded the services industry. Digitalization covers, in addition to AI, end user experience (UX), blockchain (BC) and analytics. The illustration in Figure 1 would probably help to clarify the confusion. Both AI and Industry 4.0 are subsets of digitalization, and AI does have a significant role in Industry 4.0. Analytics may be considered to be the overlap between digitalization and IT (Mishra and Ranjan, 2019).



Historically, digitalization can be considered as the continuation of the momentum of industrialization that first started around 1760. This was epitomised by the harnessing of steam power for production and transportation. This era lasted for about a hundred years till 1870, when the second industrial revolution is said to begin with a collection of innovations related to railroads, telecommunication, electric lighting, internal

combustion engines, and all types of electro-mechanical machinery including road vehicles, aircraft, radio and televisions, washing machines, industrial chemicals as in fertilizers and plastics. Manufacturing of such products forms the basis of industrialization program in many aspiring developing economies. This lasted for another hundred years till 1970 when the era of Industry 3.0 emerged with the use of electronic and IT systems that automate production and other processes becomes increasingly pervasive in industries. With the advent of the internet, advancement in data processing power, machine learning, data analytics, blockchain, automation and artificial intelligence, another industrial shift, Industry 4.0 is reckoned to have evolved. Businesses of different industries are connected via Internet, and expanded the business outreach and prospects significantly. The availability of automation technologies, communication, artificial intelligence, and accessibility to BIG data greatly facilitate the adaptation (digitization) and creation of the products that offer disruptive competitive advantage and higher returns (Baldwin, 2019).

Digitalization affects entire ecosystems, their business models and the underlying business functions of a company's value chain. By digitalizing business functions, data can be provided to enhance and develop each of these functions – and thereby the entire value chain. The well-known online book seller, Amazon, digitizes by launching the Kindle e-book reader at the expense of its physical books sales. It basically digitizes the content. Meanwhile Whats-App used a lean operating model approach in digitization of its business processes. Hospitals are collaborating with IT companies to build platform that will transform and optimize the way healthcare is delivered. It will help to set up a new ecosystem of developers with healthcare applications that will support collaboration between patients, doctors and pharmaceutical companies.

Digital products, digital services and digital solutions are becoming common and penetrating markets and production space associated with many industries. Businesses have to rise up to the challenge and adapt to the change. In the new digital business ecosystem, the relations between companies (competition/cooperation) increasingly depend on this decision. According to the report by McKinsey, in 2017 Europe was a net importer of US digital services, running a digital trade deficit amounting equal to nearly 5.6% of total services trade between the EU and the US. However, if its laggards double their digital intensity, EU can add €2.5 trillion to GDP in 2025, boosting GDP growth by 1% a year over a decade.

2.2. Benefits of Digitalization

The benefits of digital transformation are many. Firstly, it can help companies to increase profits. In a recent Gartner survey, 56% of CEOs said that digital improvements have already led to increases in profits (Gartner, 2017). In another study of companies that undergo digital transformation, the SAP Center for Business Insights and Oxford Economics reported that 80% of organizations that have completed digital transformation report increased profits. Secondly, efficiency of companies is increased with main benefits of digital transformation is the streamlining of business operations and processes. This leads to increased efficiency in many aspects of business.

Digital transformation can help business maintain a lead over competitors and stand out amongst the rest with unique offerings. A digitalized business can reach wider markets, and even launch new business models. For businesses that are facing rising labour cost, pursuing digital solutions and modification to production function and processes can increase the productivity and efficiency of employees to increase the value and production of manpower and allow business to remain competitive and stay one step ahead of the curve. Digitalizing the business may not be costly, especially when the government of the country is investing resources and providing financial grants and loans to businesses for digital transformation.

Many scholars have reported that new digital technologies often facilitate changes in products and processes and thereby reshape business models or even entire industries (Porter and James, 2014; Digital Vortex, 2015; Björkdahl, 2009). Software platform is considered as one of the important precursors to intensive adoption of digitalization in business. Using a case-based analytical approach, Evans *et al.* (2006) investigated the economic role of software platforms. Platform technologies can help to transform industries and how to develop the strategies that will create value and drive profits. Digitalization is currently frequently reported as an enabler for various changes in company operations, offerings and the overall competitive landscape, for example (Rymaszewska *et al.*, 2017; Porter and James, 2014; World Economic Forum, 2016). Companies can use digital

technologies to change a business model and provide new revenue and value producing opportunities. Digitalization induces transformation rather than supporting and developing traditional ways of working (Treutiger *et al.*, 2017). Matt *et al.* (2015) share the same view. They noted digitalization may affect large parts of the organization by impacting “products, business processes, sales channels, and supply chains.” Very often, digitalization in manufacturing companies leads to an increased emphasis on services, an aspect worthy of attention by the management. A well-known example is the case of Rolls Royce company famed for its sale of aero-engines, has turned into a service company that leases engines to airlines. By embedding sensors and other digital assets right across its product lines and manufacturing facilities, Rolls Royce becomes a data-rich company with data capability ranging from predicting equipment issues and maintenance requirements to showing airlines how to optimize their routes to minimise operation cost.

Internet has promulgated e-commerce, starting with B2B transactions before the proliferation and popularity of B2C transactions in recent years. Dinlersoz and Pereira (2007) discuss the viability of adoption of e-commerce by retailers. They analyse and identify how consumer loyalty, differences in firms’ technology and consumers’ preferences can affect the timing and sequence of adoption by firms, as well as the post-adoption evolution of prices. A more recent study by Amornkitvikai and Lee (2020) reports that social media and website are significantly drivers of e-commerce utilisation levels, and smartphones are found to be a cost-effective tool for e-commerce transactions. New, scalable, digitally networked business models – for example those of Amazon, Google, Uber, and Airbnb – are impacting on growth, scale, and profit potential for companies in every industry (Aagaard, 2019; Libert *et al.*, 2016).

3. Singapore Digitalization Journey

3.1. Information Technology (IT) as a Starter

The successful industrialization program that started in the 1960 powered by low-cost labour began to experience manpower shortage and limited scope for further growth by the late 1970s amidst rising competition from larger regional economies. In response the government leveraged on initial economic gains to deepen the industrial based by attracting more capital and technology intensive foreign investments that can produce higher value-added commodities for export. For the private sector, it pushed for greater application of technology, especially Information and Communication Technologies (ICT) to solve problems, increase efficiencies, develop new products and services, and create new knowledge. In the public sector, e-Government initiatives proliferate with the aim to use ICT as a tool to achieve better government. Thus, began Singapore’s infotech journey which has closely mirrored international eco-techno trend, domestic economic development and social needs.

To promote the use of technology in production, as well as to direct and guide resources into R&D and innovation, Singapore do have rolling 5 years technology plans. The first one is in 1995, and the latest (sixth) is in 2020. However, in addition to these National Technology Plans (NTPs), there are also masterplans specifically for the development and use of ICT. In fact, the earliest masterplan in ICT predates the first NTP. The Committee on National Computerization (1980) crafted and published the National Computerization Plan (NCP). This initiated the computerization of the major functions in all the government ministries to deliver better and efficient services to the public.

Subsequently, a series of infotech plans titled as IT2000, Infocomm 21, Connected Singapore, iN2015, Smart Nation Initiatives and Infocomm Media 2025, leveraging ICT not only as an enabler of economic competition and social development but also to build a globally competitive infotech industry and a knowledge-based economy. Such an economy is reckoned to thrive with talented manpower and creative enterprises in various digital business ecosystems. Table 1 provides a chronological record of these infotech plans.

Coordinated efforts arising from these national techno plans have also emphasised infotech manpower development, infotech awareness and literacy of the populace and businesses. No less important for successful outcomes are investments in domestic and international infotech infrastructure and connectivity supported by efficient regulatory policies that are conducive for business transformation.

One prominent example of use of ICT in business economics and helps Singapore maintain its premier port status is the TradeNet. Launched in 1989, TradeNet is Singapore’s National Single Window for trade

Table 1: Singapore Information Technology Related Plans

S/No	Period	Names of Plan	Main Focus
1	1980 - 1985	The National Computerisation Plan	Civil Service Computerisation program: Developing IT industry and IT manpower.
2	1986 - 1991	The National IT Plan	Extending government systems to private sector, e.g., TradeNet, MedNet, LawNet.
3	1992 - 1999	IT2000	Transforming Singapore into an intelligent island. Expanding e-Government.
4	2000 - 2003	Infocomm 21	Developing Singapore as global Infocomm Capital, e-Economy and e-society.
5	2003 - 2006	Connected Singapore	Unleashing potential of Infocomm to create new values, realize possibilities and enrich lives.
6	2006 - 2015	iN2015	Leveraging Infocomm for innovation, integration and internalization.
7	2015 - 2020	Smart Nation Initiatives	Developing Singapore as a Smart Nation.
8	2020 - 2025	Infocomm Media 2025	Transforming Singapore into a Service and Digital Economy.

Source: Collated by author

declaration. It allows various parties from the public and private sectors to exchange trade information electronically. It integrates import, export and transshipment documentation processing procedures and enables trade and logistic communities to fulfil their trade formalities efficiently. This sort of one-stop services portal has also been extended to the legal and health sectors with LawNet and MedNet.

Another well known example of the use of ICT technology – Radio Frequency Identification (RFID) – is the Electronic Road Pricing (ERP) system installed in 1998 to manage road traffic. Singapore is the first city in the world to implement an electronic road toll collection for purposes of congestion pricing. The ERP system is already scheduled for upgrading to include Global Positioning System (GPS) which allows greater flexibility in the location of use. The same technology has been used on the Electronic Parking System. Furthermore, Singapore authorities spare no effort to use the latest ICT navigation equipment and software at its airport and seaport to ensure safety of the people and assets, as well as maintaining the high level of efficiency and international competitiveness.

Infrastructure like the broadband network was established in 2009 to enable businesses and households to immerse into networks that speed up business transaction, support supervision and coordination, and extraction of information for human capital and knowledge development. Soon the broadband capabilities were extended to provide an infrastructure that supported wireless and wired networks and value-added mobile services. By 2015, the sixth NTP had digital technologies adoption as the main focus with the aim to develop Singapore into a global ICT capital e-economy, and e-society. To achieve the latter, an ultra-high-speed network on the order of one gigabit per second was developed to link every home and office. The fifth generation (5G) mobile wireless technology will soon be ubiquitous, offering higher upload and download speeds, more consistent connections, reduced latency and improved capacity. The latest national techno plan, contains all the essential strategies to support the digital transformation of the economy.

3.2. Public Sector–Main Driver of Digital Transformation

Digital transformation is recognized as a national campaign to upgrade the society and economy. The government plays a key role in driving the campaign. In the annual budget statement of the government in 2021, digital transformation of the economy is a key concern. The Singapore government has set aside S\$1 billion for a string of new schemes and enhanced support to co-fund mature enterprises' adoption of

digital solutions and new technologies. Singapore is allocating more than SG\$500 million to support local businesses in their digital transformation efforts. Specifically, the funds will go towards facilitating companies in their adoption of e-payments, e-invoicing, as well as more advanced digital tools. Half of the SG\$500 million has also been earmarked to help businesses digitalise alongside with digital platform application providers.

Three main public agencies are providing the leadership and charting the course of digitalization. Under the charge of the Prime Minister Office (PMO) is the Smart Nation Digital Government Office (SNDGO) (2018) which directs the various Smart Nation initiatives. Economic Development Board (EDB) and Agency for Science Technology & Research, both statutory boards of the Ministry of Trade and Industry (1991) oversees the development of AI and Industry 4.0. The Future Economy Council (FEC) hosted by MTI is in-charge of the implementation of Industry Transformation Plans². The statutory board, Infocomm Media Development Authority (IMDA) under the Ministry of Communication and Information (MCI, 2015) focuses its effort in getting SMEs go digital³ (Table 2).

Many analysts believe that digital transformation in Singapore began in 2014, when the Smart Nation Program Office was established. This program was initiated by the Prime Minister who was inspired by the changes brought about by the Fourth Industrial Revolution⁴. The Smart Nation Program spawned several projects and initiatives to support the vision and mission of building a smart city-state.

Important to note that the Smart Nation Program is not simply about transforming the economy into a digital one. In fact the Smart Nation Initiative is underpinned by three key pillars: Digital Government, Digital Society and Digital Economy. The latter is often highlighted and discussed extensively. However, the other two pillars are no less important for country to achieve country-wide digital transformation.

In Digital Government⁵, the ideal is to create a government that is “digital to the core, and serves with heart”. This pillar is built on the Singapore government’s earlier efforts to digitise public service delivery

Table 2: Public Institutions Driving Digital Transformation

Prime Minister Office (PMO)	Ministry of Trade and Industry (MTI)	Ministry Communication and Information (MCI)
Smart Nation Program Office (2014) and Government Technology Agency (GovTech) in 2016 to form Smart Nation and Digital Government Office (SNDGO)	Future Economy Council (FEC) Set up in 2017; EDB, A*STAR	IMDA—a statutory board of MCI. Set up in 2017—merger of IDA and MDA.
Smart Nation Initiatives	Digital Industry Transformation	Services & Digital Economy Technology Roadmap (SDE-TRM)
Transforming Singapore thru’ Technology – 3 Pillars: - Digital Economy - Digital Government - Digital Society	FEC - implement the \$4.5 billion Industry Transformation Map (ITM) programme 7 sub-committees oversees 23 ITMs. EDB and A*STAR - Industry 4.0 - AI	SMEs Go Digital (2017) ➤ Helps SMEs digitalise their business and seize opportunities in the digital economy; ➤ Offers advisory support such as CTO-as-a-Service and access to pre-approved market proven solutions ➤ Service 4.0—new growth engine.

² Future Economy Council: <https://www.mti.gov.sg/FutureEconomy/TheFutureEconomyCouncil>

³ IMDA, SMEs Go Digital: <https://www.imda.gov.sg/how-we-can-help/smes-go-digital>

⁴ Industry 4.0—also called the Fourth Industrial Revolution or 4IR—is the next phase in the digitization of the manufacturing sector, driven by disruptive trends including the rise of data and connectivity, analytics, artificial intelligence (AI), human-machine interaction, and improvements in robotics.

⁵ Digital Government Blueprint: <https://www.tech.gov.sg/digital-government-blueprint/>

through its 'e-government' drive that began with a 'Civil Service Computerisation Programme'. While these earlier e-government initiatives tended to focus on increasing efficiency in public service delivery, the Smart Nation Initiative was much more comprehensive, reflecting a broader 'digital transformation' that aimed to digitise the all aspects of urban life in Singapore, often through collaborations with non-state actors such as businesses, citizens, and NGOs (Woo, 2017). Digitalization of public services will facilitate policies and services that are accessible and easy-to-use for citizens. Many e-Government services ranging from making an appointment at a government clinic, application for public housing, paying taxes and applying license for setting up a business – all can be done electronically online.

The key concern of Digital Society is to increase digital access, literacy and participation among Singaporeans. One of noteworthy feature of the Digital Society is the emphasis on e-payment. It has redefined the way consumers interact with businesses, namely how they pay and transact in online and offline settings. This has also helped to place citizens on the path of learning more about digital technologies and capabilities available in their mobile handphones. Citizens become more digital ready as time advances. A real-time payment system by the local bank DBS known as PayLah! went live in 2014. This soon attracted other similar competing systems. The real-time fund transfer service now has more than 80% of residents and businesses onboard, and the number continues to be on the rise. In tandem with that the society as a whole has to be educated and vigilant about rising occurrence of cyber frauds and scams.

A Digital Economy takes advantage of the latest technology to digitalise processes and drive business growth. Singapore as a city-state has adopted a somewhat different approach from its international counterparts. Its smart city programs and strategies focus on building on sustainable economic capabilities amongst the private and public sectors. The Data Innovation Programme Office (DIPO)⁶ and the Networked Trade Platform⁷ allow the government to actively partner with firms to solve real-time business concerns, while the Smart Nation Co-Creating with People Everywhere (SCOPE)⁸ programme gathers public feedback for feasible tech products.

IMDA is the merger of Infocomm Development Authority and Media Development Authority in 2016. It is tasked to foster growth in Infocomm Technology and Media sectors in concert with progressive regulations, harnessing frontier technologies, and developing local talent and digital infrastructure ecosystems to establish Singapore as a digital metropolis. Singapore intends to build deep capabilities and stay at the forefront of global technology trends, so that she can tap into growing markets and build new solutions that are globally scalable and exportable. A series of programs and initiatives were crafted and launched with earnest and urgency.

Strategic investments in both hard and soft infrastructure (such as Wireless@SG and the Nationwide Broadband Network) were made by IMDA to help to accelerate digital economic growth in the country. Singapore has achieved nationwide standalone 5G coverage (over 95%) three years ahead of schedule, and IMDA has rolled out digital utilities such as TradeTrust, which streamlines the exchange of electronic documents.

IMDA also plays a central role in creating a strong digital talent pipeline and a progressive regulatory framework to foster innovation. By enhancing the credibility and trustworthiness of digital products and services, it aims to spur growth in the digital economy. In June 2022, for instance, it launched a S\$50 million Digital Trust Centre⁹ as part of the country's R&D efforts focused on enhancing the legitimacy of digital systems.

To support the digitalization drive, in 2019 IMDA officially launched the Services & Digital Economy Technology Roadmap (SDE TRM) which incorporates main suggestions in the Digital Economy Framework for Action to sharpen Singapore's digital edge by accelerating the digitalisation of industries and businesses, improve international competitiveness, and transform the infocomm and media sector via frontier technology.

⁶ DIPO: <https://www.smartnation.gov.sg/initiatives/business/dipo/>

⁷ NTP: <https://www.smartnation.gov.sg/initiatives/business/networked-trade-platform/>

⁸ SCOPE: <https://www.smartnation.gov.sg/initiatives/business/networked-trade-platform/>

⁹ Digital Trust Centre: <https://www.imda.gov.sg/about-imda/emerging-technologies-and-research/trust-tech>

The Technology Roadmap has identified nine key trends¹⁰ that will move the digital economy significantly over the next three to five years. They may be viewed either as challenges or opportunities. The biggest impact will be on the services sector as it forms the bulk of the global economy and Singapore's GDP. Importantly, roadmap reiterates the importance of two fronts: Service 4.0 and getting the bulk of the nation's Small and Medium Enterprises (SMEs) digitalize their operation.

Services 4.0 was identified through the SDE Technology Roadmap as a potential growth engine for Singapore's digital economy. Services 4.0 is the vision of a fully digitalised service sector. The Services sector contributes almost 70% to Singapore's GDP, and employs up to 75% of the workforce. As a key enabler of the economy, the digitalised services sector will support and complement the expansion of digitalized manufacturing sector.

IMDA is the lead agency overseeing the regulation and development of the Infocomm Media (ICM) industry. The growth the latter is no less dependent on the demand for infocomm services and expertise by other service industries such as finance and insurance, healthcare, education and legal services. Fintech encompasses digital banking, digital wallets, crypto investing, buy now pay later scheme and green financing. This has great potential in fostering Singapore to become a regional green financial hub characterised by sophisticated use of blockchain technologies and AI, supported by prudent regulatory policies of the central bank. MedTech and EdTech are two recent tech activities that have emerged and expanding. Singapore is home to more than 60 multinational MedTech manufacturing, R&D and technology companies. Edtech has grown to include learner data analysis, gamification, social learning, and personalised learning solutions to help students learn more efficiently. There are more than 520 EdTech startups in Singapore.¹¹

In Services 4.0, businesses will need to meet changing customer needs quickly, innovate and create new value in order to differentiate themselves from competitors. Emerging technologies will make it possible for businesses to automate repetitive tasks and achieve higher productivity. However, as customers still demand human interactions and pleasant users' experience (UX), businesses can unlock growth by offering customer-centric services enabled by emerging technologies. Both worker augmentation and automation will ultimately lead to the creation of new and enhanced job opportunities. Programmes to help businesses meet a new services industry that is enabled by emerging technology were launched. Some programmes include GoCloud for ICT SMEs, PIXEL and Digital Services Laboratory (DSL).¹²

The SMEs Go Digital programme by the IMDA is a structured and inclusive approach to make going digital simple for SMEs. More of this will be covered in the next section.

4. Digital Transformation of SMEs in Singapore

The Small and Medium Enterprises (SMEs) account for 99% of enterprises, contribute 50% of GDP, and provide jobs for two-thirds of the workforce. Wary that the SMEs, may be lagging behind in the digital transformation, particular efforts are made to help them. Launched in April 2017, the SMEs Go Digital programme by IMDA aims to make going digital simple for SMEs. Several schemes and support measures are available for SMEs to use digital technologies and build stronger digital capabilities to seize growth opportunities in the digital economy. Figure 2 provides an infographic summary of SME-GD program.

The digitalization supporting schemes include Digital Consultancies (CTO-as-a-Service), Industry Digital Plans, Pre-Approved Solutions and schemes that provide assistance for startup, linkage to business platforms, and internationalization of business. These schemes and their main functions are described in Table 3.

Worthy of highlighting in the digitalization push is the sector-specific Industry Digital Plans (IDPs). IDPs provide SMEs with a step-by-step guide on the digital solutions to adopt and relevant training for their

¹⁰ The nine key trends are: Pervasive adoption of AI; More empathic, cognitive and affective AI; Greater human-machine collaborations; More natural technological interfaces; Greater use of codeless development tools; More seamless services enabled by everything-as-a-service (XaaS); Cloud deployment matures with hybrid and multi-cloud; Blockchain decentralizes trust; and Application Programming Interfaces (API) economy takes off.

¹¹ Tracxn, 'Edtech Startups in Singapore'. Accessed at: <https://tracxn.com/explore/EdTech-Startups-in-Singapore>

¹² SDE TRM identifies Service 4.0 as future of services: <https://www.digitalnewsasia.com/digital-economy/singapore-technology-roadmap-identifies-services-40-future-services>

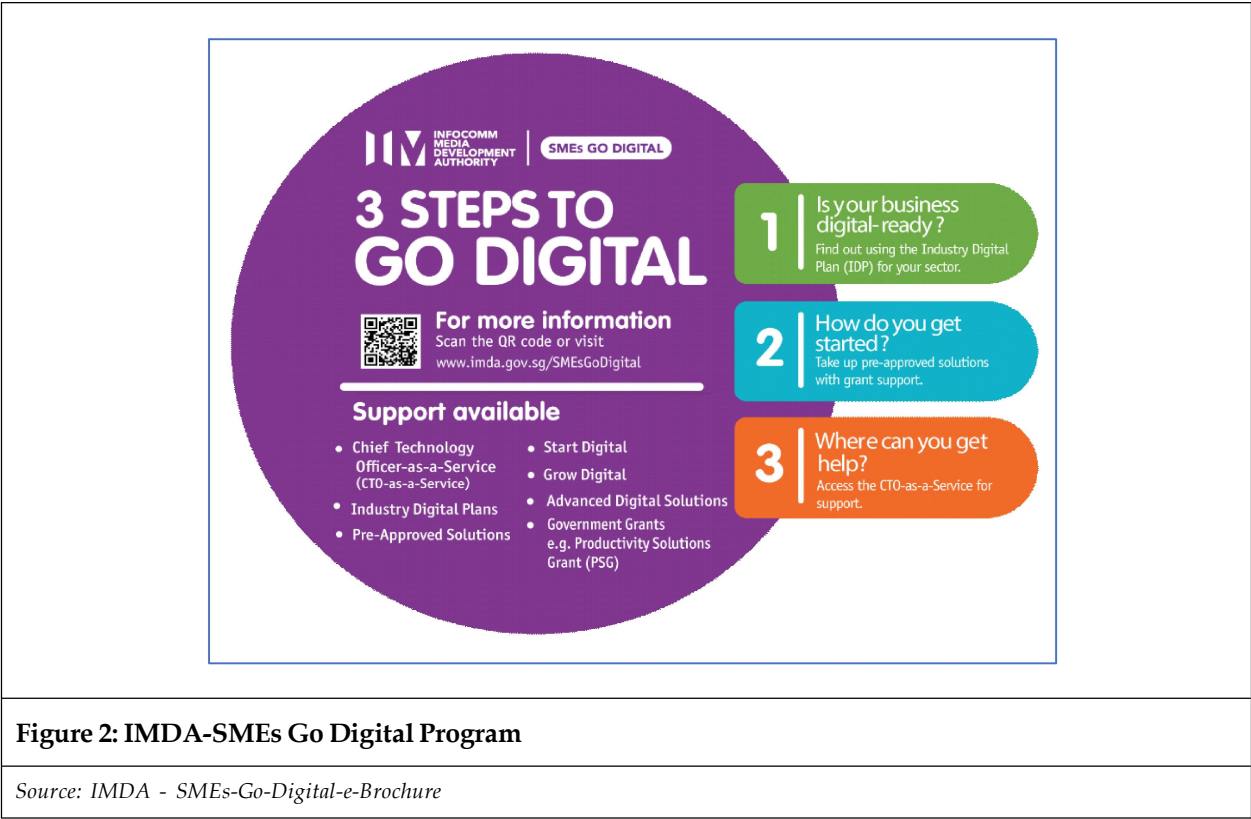


Table 3: Supporting Schemes Under SMEs Go Digital Programme		
	Supporting Schemes	Description
1	CTO-as-a-Service https://services2.imda.gov.sg/CTOaaS/	CTO – Chief Technology Officer. Assess company digital readiness, explore digital solutions and request for digital advisory and project management services.
2	Industry Digital Plans https://www.imda.gov.sg/how-we-can-help/smes-go-digital/industry-digital-plans	Step by step guide on digital solutions and training required at each stage of company business growth.
3	Pre-Approved Solutions https://www.imda.gov.sg/how-we-can-help/smes-go-digital https://www.gobusiness.gov.sg/productivity-solutions-grant/	Proven SME-friendly digital solutions pre-approved by IMDA to meet company business needs. Government grants, e.g. Productivity Solutions Grant (PSG), are available for the adoption of these solutions.
4	Start Digital https://www.imda.gov.sg/how-we-can-help/smes-go-digital/start-digital	Start your business right with these foundational and competitively-priced digital solutions. Program targeted to help newly incorporated SMEs and those with no digital solutions adopted before.
5	Grow Digital https://www.imda.gov.sg/GrowDigital	Connect to Business-to-Business (B2B) and Business-to-Consumer (B2C) e-commerce platforms that have regional or global reach, to sell overseas without a physical presence there.
6	Advanced Digital Solutions (ADS) https://www.imda.gov.sg/programme-listing/smes-go-digital/Advanced-Digital-Solutions	Advanced and integrated digital solutions to help company strengthen business continuity and build longer term resilience. Connect multiple firms digitally and enable advanced capabilities in the ecosystem.

employees at different stages of their growth. This makes it easier for SMEs to adopt digital technology to boost growth and productivity.

The IDPs serve as a common reference for SMEs and they are aligned with the Industry Transformation Maps (ITMs) for each sector.¹³ To date, IMDA has rolled out IDPs for the following 14 sectors–Retail, Logistics (including Air Transport), Environmental Services, Security, Food Services, Wholesale Trade, Media, Land Transport, Sea Transport (Bunkering, Harbour Craft and Ship Agency), Accountancy, Hotel, Construction and Facilities Management, Early Childhood as well as Training and Adult Education.

To make it easy for SMEs to adopt digital solutions recommended in the IDPs, IMDA provides a list of pre-approved solutions assessed to be market-proven, cost-effective and supported by reliable vendors. SMEs interested in adopting these solutions can start by visiting the website, GoBusiness, a platform for businesses in Singapore to assess Government e-services and resources such as applying for the Productivity Solutions Grant (PSG).¹⁴ PSG can help to offset up to 80% of the costs of adopting these solutions.

When a SME has attained greater confidence and skill in digitalizing its operation, it will be in good stead to consider business growth, expanding its operation in markets beyond Singapore. Schemes like Growth Digital will help. On the other hand, if the SME is considering the need for greater resilience and business continuity in times of crisis, it can make use of assistance and advice available in the Advanced Digital Solutions (ADS) scheme.

Twenty IDPs have helped more than 85,000 companies so far take advantage of the SMEs Go Digital programme. These companies are in the following industries: early childhood, environmental services, food services, logistics (including air transport), media, retail, security, wholesale trade, sea transport (bunkering, harbour craft, and ship agency), accounting, hotel, construction and facilities management, training and adult education, land transportation, marine and offshore engineering, energy and chemical (process construction and maintenance), as well as precision engineering (computational fluid dynamics).

According to a 2021 SME survey by the IMDA, the digital solutions suggested by the IDPs have improved overall process efficiency, with nearly 85% of respondents noting time savings. The ability to be less reliant on physical labour, which in turn allowed them to retain and develop in-house expertise for other roles, was mentioned by 75% of responses.

5. Digital Issues and Challenges

5.1. Private Sector Involvement in Digitalization

While digitalization of the SMEs is an oft cited program, the non-SME segment of the economy is not neglected. The private business sector and trade associations are also keen in getting their members digitalised. For example, SMECEN, a wholly-owned subsidiary of Association of Small and Medium Enterprises (ASME), has developed DashBod, a cloud-based integrated software solution to help businesses streamline their accounting and human resources processes. Local bank, UOB, introduces UOB-BizSmart, a platform which offers a comprehensive suite of tailored digital solutions to help SMEs manage their business processes more efficiently. UOB believes that its “ecosystem approach” help to empower SMEs pivoting to operate in a more digital manner, to achieve continued business growth and resilience.

The big enterprises are more sensitive to the need to digitalize by virtue of their greater exposure to international trends and competition. Their experience and expertise are sought after by the government to help the SMEs. To facilitate that, a new Digital Industry Singapore, or DISG, office had been established.¹⁵ DISG will work with private companies to address issues on needs for securing talent and market access, building capabilities, and internationalising. An example to illustrate this is DISG’s collaboration with SAP, one of the world’s largest providers of enterprise application software. Singapore is home to the first SAP Leonardo Centre in Southeast Asia, a digital innovation platform focusing on areas such as AI, analytics, the

¹³ See Annex A for list of ITMs assigned to 7 clusters consisting of 23 industries.

¹⁴ For more details, please refer to <https://www.gobusiness.gov.sg/productivity-solutions-grant/>

¹⁵ DISG) is a joint office of the Economic Development Board (EDB), Enterprise Singapore (ESG), and Infocomm Media Development Authority (IMDA).

IOT and blockchain to help their customers to innovate and scale their businesses. Through the centre, SAP collaborates with Singapore-based small and medium ICT enterprises to develop solutions based on SAP technology which they can also scale and sell internationally. DISG is also working with other companies to capture opportunities in areas like ride-hailing, e-commerce, fintech, cybersecurity, AI and cloud. A holistic approach is used in engaging the foreign tech companies and, bringing them into Singapore to create a vibrant ICT ecosystem and exciting job opportunities for Singaporeans. As many as ten thousand new jobs are expected to be created over the next three years.

To catalyse 5G development and adoption in the economy, Singapore has identified six strategic clusters which are believed to have the potential to generate the most value for Singapore.¹⁶ One of the clusters is the maritime sector, which IMDA is working on together with the Maritime and Port Authority of Singapore, PSA, and telcos (Singtel and M1) to conduct 5G trials for Smart Port operations. The trials will allow our ports to experiment with cutting-edge technology in areas such as remote crane operations, tele-operations of port equipment and automated ground vehicle port navigation.

Overall, the government has set aside \$40m to grow the 5G ecosystem in Singapore. That includes developing open 5G test beds, and conducting R&D for 5G in Singapore. Other than enhancing its digital infrastructure and cybersecurity environment¹⁷, Singapore has also invested significantly in R&D in frontier technologies, targeting areas like AI and cybersecurity. AI Singapore (AISG) is a national AI programme launched by the National Research Foundation (NRF) in 2019. It is public-private partnership to anchor deep national capabilities in AI, grow local talent, and build the AI ecosystem in Singapore by looking at actual use cases and application for AI. Local banks, such as OCBC Bank, have enabled customers to access stock recommendations online powered by AI.¹⁸ It has also used AI to power back-end functions to increase productivity and accuracy. Another local bank, DBS Bank has launched a new framework that include AI, machine learning powered platform to provide personalised career development advice and recommendations to its employees.

Innovation and entrepreneurship are especially critical for businesses in a digital economy. They are essential for maintaining competitiveness and sustainability. The government has some SG\$285 million will be set aside in venture capitalism, to provide financial support for promising startups to sustain innovation. This is in addition to an earlier SG\$300 million committed to help deep tech startups gain access to capital, expertise, and industry networks. Singapore government had enhanced the Productivity Solutions Grant (PSG) – Job Redesign by raising the government co-funding ratio to 80%, from 70% previously, till end-March 2022. This is to help businesses redesign jobs. A new Emerging Technology Programme has been established to co-fund the costs of trials and the adoption of frontier technologies such as 5G, artificial intelligence and trust technologies.

5.2. International Dimension of Digitalization

Singapore has been through many changes in the past, be it industrialisation, automation, internationalisation. As a small, open economy, Singapore has nurtured the instincts to be flexible, adaptable and stay relevant. It is not abandoning the development philosophy based on having Singapore as an important node in the Global Value-Chain (GVC). Digital transformation is considered as a means to strengthen the function of the GVC and enable Singapore continue to be a relevant node in the GVC. Nonetheless, digitalisation poses fundamental and far-reaching challenges.

There is also an international dimension of digitalization that cannot be ignored. Singapore is a strong proponent of an integrated, global digital economy. Indeed, a strong domestic digital business ecosystem will help to attract investment from abroad. It can help in elevating an industry's digital standards and practices which can possibly replace legal requirements of physical documentation, and increase the velocity and volume of trade. For example, Hong Kong Shanghai Bank HSBC had indeed worked on digitalization of letter

¹⁶ These are: maritime operations; urban mobility; smart estates; Industry 4.0; Government applications; and consumer applications.

¹⁷ The Cybersecurity Act was passed in 2018 in tandem with the Cybersecurity Code-of-Practice governing protection of Critical Information Infrastructure (CII). CII Owners are also required to submit their cybersecurity risk assessment reports and perform detailed cybersecurity audits once every two years.

¹⁸ Cheow Sue-Ann (2023). OCBC Taps AI to Power Investing Tips and Increase Output. *Straits Times*, 31 July.

of credit process using blockchain technology and has managed to reduce transaction times from 5 to 10 days to under 24 hours. The same technology can be applied to other trade processes heavily reliant on paper and couriers. Across the border, Singapore has teamed up with Indonesia to build the Nongsa Digital Park (NDP) on Batam Island which is just 40 minutes ferry ride from Singapore (Goh, 2021). In fact, plan had already been made to expand NDP into a Digital Town that includes a residential village, tech campuses, a town plaza, and a commercial centre and is set to house 8000 tech talents when completed. There are currently about 1000 tech talents at the existing NDP working for tech companies and start-ups from Singapore and Indonesia.

Participation in free trade agreements has always been important for Singapore to secure and expand its trade linkages. Growing volume of digital trade in tandem with growth of cross border e-commerce require appropriate rules and governance for it to flourish. Singapore has participated in several regional and international initiatives, to raise awareness of and build consensus on the rules of Responsible State Behaviour in cyberspace. The ASEAN Digital Integration Framework Action Plan and the ASEAN Framework for Digital Data Governance are two examples of platforms which, if implemented, could bring about greater ease of business in the region. At the ASEAN Economic Ministers' (AEM) meeting held on 19-20 August 2023, the ministers had endorsed a study on the ASEAN Digital Economy Framework Agreement, paving the way for the 10 countries to start negotiation on the Digital Economy Agreement (DEA). A DEA is a treaty that establishes digital trade rules and digital economy collaborations between two or more economies. DEA fosters interoperability of standards and systems and support businesses, especially SMEs, engaging in digital trade and electronic commerce. It encourages cooperation between Singapore's economic partners in nascent areas such as digital identities, Artificial Intelligence (AI) and data innovation. In a recent empirical research using CGE model (Lim *et al.*, 2023), it is estimated that ASEAN DEA will positively increase the output of the ICT sector and has downstream benefits for the services and financial sector, increasing their output by an average of about 7%.

Singapore has concluded negotiations on four DEAs. The first one with Chile and New Zealand, followed by one with Australia, and another with South Korea. The latest addition to the DEAs is one with United Kingdom.¹⁹ The European Union (EU) and Singapore had also begun negotiation on a DEA in July 2023. This gives organisations the scope to trial use-cases and technologies across different countries.

Singapore pushes the boundaries of digitalisation for global trade as IMDA partnered industry players (such as ExxonMobil) to promote the use of paperless, electronic Bill of Ladings (eBLs) for cross-border transactions. The introduction of eBLs has enabled greater efficiency by streamlining and automating existing processes. The benefits include shorter waiting times and reduced costs. Using the TradeTrust framework, eBLs can be issued, transferred, and surrendered between multiple stakeholders in a trusted manner, across different digital platforms, which is necessary in the context of cross-border trade.

5.3. Manpower Training-Digital Skills

Emphasis on technology is important for digitalization. However, the best digitalization plan will not succeed if the workers are deficient in skill and knowledge required in the new digital economy. People need to have the requisite skills to take full advantage of the new jobs that are being created. Singapore government is working with industry partners to enhance training and placement opportunities for ICT jobs across the economy via the SkillsFuture²⁰ initiative known as TechSkills Accelerator (TeSA)²¹, launched in April 2016. The Infocomm Media Development Authority (IMDA), which drives TeSA for ICT professional development, takes an integrated approach/framework to ICT skills acquisition and practitioner training—in core ICT skills and in sector-specific ICT skills—and enhance employability outcomes through place and train programmes, and career advisory services. The skills identified in the framework can support emerging areas such as cyber security, Internet of Things (IoT), immersive media, artificial intelligence and data analytics.

¹⁹ Ministry of Trade and Industry (2020). Digital Economy Agreements. <https://www.mti.gov.sg/Improving-Trade/Digital-Economy-Agreements>

²⁰ Skillsfuture is a national movement to provide Singaporeans with the opportunities to develop their fullest potential throughout life, regardless of their starting points. Through this movement, the skills, passion and contributions of every individual will drive Singapore's next phase of development towards an advanced economy and inclusive society.

²¹ For more details, please refer to <https://www.imda.gov.sg/imtalent/about-us/national-talent-development-initiatives/techskills-accelerator>—tesa

More than 80 ICT skillsets and more than 100 job roles have been identified. Interest in TeSA, has been very encouraging. Since April 2016, over 74,000 training places have been taken up or committed.

Another programme that can help companies to upgrade and reskill the workers under their payroll is the SkillsFuture Funding Support for Employers.²² Eligible companies can receive up to 90% subsidy on training fees and absentee payroll while attending courses.

In August 2020, AISG launched two new initiatives (AI for Everyone; AI for Industry) in partnership with the IMDA targeted at enabling 12,000 more people to acquire AI knowhow, under the TechSkills Accelerator (TeSA) initiative. The latter aims to develop a pipeline of skilled tech professionals to drive Singapore's local tech ecosystem, especially in the AI space. It helps to ensure that businesses and workers can effectively use AI to be more competitive.

Beyond the ICT sector, IMDA is collaborating with the Singapore Computer Society (SCS) to reach out to non-ICT Trade Associations and Chambers (TAC) to equip their businesses with digital skills and prepare them for a digital economy. For a start, IMDA and SCS are working with TACs in the Legal, Accountancy and Manufacturing sectors on an action plan to upskill professionals in these sectors with digital capabilities. Effort is also made to excite young Singaporeans about the new opportunities in the digital economy. All upper primary school students will go through a 10-hour programme, to develop an appreciation of the core computational thinking and coding concepts through simple visual programming-based lessons co-developed by MOE and IMDA. They will also be exposed to emerging technologies such as AI as part of the programme.

In another partnership with National University of Singapore (NUS) and Singapore Polytechnic, the Singapore 5G & Telecoms Academy is set to build a pool of talent in 5G and emerging technologies, with over 500 programmes to choose from. The academy sets out to attract and build talent capable of operating and maintaining 5G networks, as well as develop new 5G services. As jobs in the sector increase, the Academy has successfully equipped over 3000 Singaporeans with the relevant 5G skills for jobs in cloud computing, data analytics, and software development.

5.4. Monitoring Progress and Effectiveness of Digitalization

Presently, forty-two years after it launched its first national computerisation plan in 1980, Singapore – placed 64th among cities for its population size – has come up as the world's 12th top tech city. Eighty of the world's top 100 tech companies operate in Singapore and more than half have headquarters in the country. When the computerisation plan was launched, there were less than 1,000 computer professionals in Singapore. There are now more than 200,000 tech professionals, and more than 4,000 start-ups, translating into one young hustling venture for about every 1,000 Singaporeans.

As at March 2022, more than 80,000 SMEs have adopted digital solutions from the programme.²³ More than 2,000 enterprises have gained access to overseas market through e-commerce platforms under the Grow Digital initiative.

In a 2020 SME Digital Transformation Study²⁴ produced jointly by the Association of Small & Medium Enterprises (ASME) and Microsoft Singapore, reports that 83% of small and medium enterprises (SMEs) in Singapore have digital transformation strategies in place, more than half (54%) reported delays in their digitalisation plans due to COVID-19. Also, despite higher adoption of digital transformation, only two in five SMEs perceive their efforts to be successful. SMEs also faced barriers in their digital transformation journey. The barriers include high cost of implementation (56%), lack of digitally skilled workers (40%), low awareness of government support (30%) and not having the right technology partners (28%).

On a more positive note, the 2020 study also found that that more than three-quarters (80%) of Singapore SME leaders are now aware of the term 'digital transformation' – up from 57% since 2018. Overall, the adoption

²² For more details, please refer to: <https://www.ssg.gov.sg/programmes-and-initiatives/funding/funding-for-employer-based-training.html>

²³ IMDA: Factsheet on Helping SMEs Go Digital, 4 March 2022. <https://www.imda.gov.sg/how-we-can-help/smes-go-digital>

²⁴ SME Digital Transformation Study: Accessible at: <https://news.microsoft.com/en-sg/2020/10/22/over-80-of-singapore-smes-embrace-digital-transformation-more-than-half-report-slowdowns-due-to-covid-19-asme-microsoft-study-2020/>

rate of digital technology has also risen, as nearly all companies (99%) surveyed have adopted at least the most basic level of digital technologies such as office productivity tools and web-based email.

In a more recent survey involving 782 SMEs, conducted between November to December 2020 by the United Overseas Bank (UOB)²⁵, small businesses are lagging behind their larger peers in digital transformation. The survey found that 41% of SMEs that implemented digitalisation initiatives last year recorded revenue growth. Among SMEs that had not digitalised, only 24% saw their revenue improve. Those that had digitalised their entire business reported better revenue growth than those that digitalised only one area.

SMEs in business services, manufacturing and engineering, community and personal services, technology, media and telecommunications as well as consumer goods sectors saw the highest year-on-year percentage increases in productivity and efficiency, ranging from 22% to 49% (Table 4). Study demonstrates that close to one in two SMEs that proactively took steps to adopt digital tools last year are already seeing benefits, such as greater productivity and efficiency gains, improved customer experience and higher revenue, even in a volatile business environment.

Table 4: Productivity Increment Due to Digitalization	
Sector	Annual Percentage Increase in Productivity and Efficiency
Business Services	49
Manufacturing and Engineering	46
Community and Personal Services	44
Consumer Goods	42
Technology, Media and Telecoms	42
Construction and Infrastructure	37
Wholesale Trade	32
Professional Services	27
Real Estate and Hospitality	22

In the area of government support, the study revealed that majority of respondents were unaware of government schemes and initiatives available to SMEs, such as the Productivity Solutions Grant²⁶ and Start Digital.²⁷ However, it found that despite low levels of awareness of such initiatives, more than 3 in 5 SMEs would be keen to leverage these grants and schemes to support digital transformation in the next year. Existing government support also tends to benefit larger firms, with medium and medium-large companies stating that they are more likely to find government support useful (60% and 73% respectively).

There are substantial interests in whether government subsidies to SMEs to defray the costs of automating their business functions through IT have positive revenue impact. In addition, there is a question on the effectiveness of technologies adopted on the productivity of enterprises. Economists at the Ministry of Trade and Industry (MTI) have made econometric studies of the issues. To address the first question, MTI economists consider the sample data of 4,153 firms that had implemented 4,439 solutions under the iSPRINT scheme (MTI, 2016). The iSPRINT is a financial assistance scheme administered by the IMDA that aims to help local SMEs defray the costs of automating their business functions through information technology. The study indicates that iSPRINT scheme has a positive impact on the revenue of firms that adopted solutions under the scheme. For the median firm based on revenue size, its revenue was found to be 3.1% higher after adopting

²⁵ Digitalisation efforts pay off for Singapore SMEs with rise in revenue. Accessible at: <https://www.uobgroup.com/web-resources/uobgroup/pdf/newsroom/2021/Digitalisation-efforts-SMEs-revenue-rise.pdf>

²⁶ This is one of the initiatives in the SMEs Go Digital program. See Table 3.

²⁷ This is one of the initiatives in the SMEs Go Digital program. See Table 3.

iSPRINT solutions. By solution type, off-the-shelf solutions and sector-focused solutions were found to have increased the revenue of the median firm for that solution type by 4.6% and 1.9% respectively.

In the second econometric study (MTI, 2019) which focus on the impact of technology adoption on productivity and Value-Added (VA), it make use of the longitudinal datasets that comprises around 1,150 firms, with their digital adoption and performance tracked over the period of 2014 to 2016. Around 56% of firms in the dataset belong to the services sector, with the remaining firms roughly equally distributed between the manufacturing sector and the construction sector. In addition, around 83% of the firms in our dataset are SMEs. The study finds that digital adoption has a positive and statistically significant effect on the VA and productivity of firms, including SMEs. Notably, the adoption of an additional digital tool is associated with a statistically significant increase in firms' VA and productivity of 25% and 16% respectively on average (Table 5). These results are in line with the findings of other international studies, and provide further evidence that a higher level of digital adoption by firms is linked to better firm performance.

Table 5: Effect of the Adoption of an Additional Digital Tool on Firm-Level Outcome		
Outcome Variable	Overall	SMEs
Value-Added (VA)	25%**	26%**
Productivity	16%**	17%**
Note: *, **, and *** indicate significance at 90%, 95% and 99% level, respectively.		
Source: MTI (2019), Exhibit 6.		

6. Conclusion

As noted in the Committee on the Future Economy (CFE) report²⁸, the unexpected changes in the global order, may portend significant geopolitical and economic discontinuities. Subdued global economic growth, sluggish productivity growth, changing value chains, and rapid technological change with shortened innovation cycles are new realities to cope with. Whichever way the world goes, a small, open economy like Singapore will need to adapt. For Singapore stay open and relevant, it is essential that her workforce acquiring skills for future jobs and companies scaling up through innovation and transformation. CFE outlined seven broad and “mutually-reinforcing” strategies to fulfil this vision. These include deepening and diversifying Singapore’s international connections, strengthening enterprise capabilities and expertise to innovate and scale up, implement Industry Transformation Maps so that enterprises are equipped with strong digital capabilities to sustain competitiveness and growth. If these strategies are implemented well, the CFE envisions Singapore’s GDP growth at 2-3% for the next decade, offering a multitude of job opportunities. Among the strategies, digitalization features prominently.

Singapore has successfully ridden consecutive waves of ICT transformation, starting from the national computerisation efforts of the 1980s. This latest digital transformation will open up opportunities on three fronts: new industries, new markets and new jobs. New industries will be formed even as older ones start to evolve and transform. Technologies such as AI have the potential to completely rewire whole industries, from finance to shipping and manufacturing. Singapore’s scarce land resources and limited population have been the main constraints to growth. Digitalisation provides new options to overcome these constraints.

SMEs surveyed in the ASME-Microsoft (2020) alluded in other section, also indicated that high implementation cost was the biggest barrier they faced when it comes to digital transformation—a similar observation from the 2018 iteration of the study. Other significant factors include the lack of a digitally-skilled workforce, uncertain economic environment, low awareness of government support as well as the lack of appropriate technology partners. The positive externalities of digitalization may well justify greater public resources be invested to support and ease the burden of digital transformation of business enterprises, especially the small and medium size entities.

²⁸ MTI (2017). Report of the Committee on the Future Economy.

Singapore government is always very good in pushing out schemes, grants and programs, but the take up rate is not spectacular. Even with 80,000 signing up for government program by the end of March 2023, that is only about 27% of all SMEs. Though it is reckoned that some SMEs proceeded to digitalize without utilizing government schemes or grants. The take up rate is still low for an urgent nation-wide campaign. Some would blame it on application procedures that involve too complicated instructions and qualification criteria, or simply ignorance or low level of awareness of SMEs bosses. The resources of the micro enterprises – mainly family run shops in the heartland – are rather limited, and they would miss out from the digitalization process or just minimally involved in imitative such as e-payment exercise.

Nonetheless suggestions can be made to help the SMEs on their digitalization journeys. Easier access to funding or grants can be made available so that financial constraint less binding and budgeting for digitalization can be facilitated via deferred principal payment, bridging loan, and tax rebates on investment in digital equipment and software. A directory of accredited technology and solution providers can be compiled by the leading government agency such as IMDA, and this is made available to SMEs planning their technological solutions and digitalization journey. It will be very useful if digital ‘shepherd’ can be assigned to companies to help them to navigate the plethora of government initiatives, schemes and grants, to achieve the desired outcome faster. It is encouraging that the authority has taken note that micro enterprises may greatly lag behind in digitalization, and has recently upgraded and re-launched the Heartlands Go Digital (HGD) 3.0 initiatives which provides businesses in the heartland to expand their digital capabilities in areas such as digital marketing, visual merchandising, and service and financial management.²⁹ Eligible participating SMEs can receive a one-time support to defray up to 70% of their project costs, capped at S\$8,400. It was reported that since the launched of HGG, nine in ten heartland enterprises have adopted at least one e-payment solution. Two in three firms have also established a presence on digital platforms, including Google Business Profile and Carousell.

Singapore aspires to be a Global-Asia node for digital technology and innovation. It aims to be a choice destination where entrepreneurs consider their start-up projects, and where innovators will experiment with their latest ideas. The congregation of start-ups and interaction of innovation endeavours will help to establish an ecosystem for digital business. An enterprise is strengthened by having a vibrant and conducive start-up ecosystem in the country. Startups play an increasing role in driving innovation, especially as growing markets demand new solutions. The OECD predicts that Emerging Asia (i.e., ASEAN, China and India) will grow by an average of 6% over the next five years. With Asia poised to account for more than half of global GDP by 2050, Singapore can be the gateway for start-ups to develop, test-bed solutions and expand into the region. Enterprise Singapore, a government agency, helms the Startup SG program that helps start-ups build track record, and provide access to mentors, funding and workspaces. Through close to 100 partners, Startup SG programmes supported the growth of over 3,690 start-ups across key sectors such as health, urban solutions, fintech and digital services in March 2020. Cross border e-commerce involving Micro, Small and Medium Enterprises (MSMEs) is given a boost recently. The new Amazon Global Selling Singapore Cross-border Launch-pad program launched in collaboration with Enterprise Singapore (2019) and Singapore Business Federation will help more than 100 local Singapore MSMEs launch and scale their brands through the Amazon platform.³⁰

Digital transformation is not necessarily an easy experience. Some companies may encounter difficulties in the transformation process. One commonly cited difficulty is how to get employees digitally ready. Companies will need to pay attention to hiring the right people and making sure existing employees are trained for using new digital tools. Important to have patience in identifying who needs more help in the transition, and set aside time for training. While government can made available the grants and training schemes for training, the success of reskilling and upgrading workers still depend very much on the willingness of employers allowing their employees time-off to attend courses and training.

Going digital can open gaps in cyber security. Getting the advice of security consultants when implementing wide ranging digital solutions can help businesses understand risks and adopting appropriate mitigating

²⁹ “More support for heartland shops to boost digital capabilities”. *Straits Times*, 12 July 2023. Heartlands refer to locations within residential housing estates where the bulk of the population has their homes.

³⁰ “Scheme to give firms a leg-up in cross-border e-commerce”. *Straits Times*, 25 July 2023.

measures. It can be very expensive in terms of tools and training to get everyone in the company up to speed. Hence government grants will help to offset some of the costs. The long-term benefits can more than outweigh the short term costs.

While the pandemic has accelerated the adoption of digital technology, it has also highlighted the gap in skill and literacy across people and countries. The risk is that individuals who lack the necessary financial or digital literacy may fall behind. From the perspective of the society, there is a risk that digitalization is a blocker rather than an enabler of prosperity. Government, the education sector and companies must work together to address the challenge and prevent a growing skills gap which creates greater inequality that is inimical to social stability. To get digital transformation right, the focus should not be solely on technology. Digital transformation is not about technology alone—it is about strategy and new ways of thinking. Transforming for the digital age requires business to upgrade its strategic mindset much more than its IT infrastructure (Rogers, 2016). Attention has also to be paid to inculcating a progressive and strategic mindset—an attitude of unlearning, relearning and adapting to the changes.

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ANNEX A

Singapore Government announced the S\$4.5b Industry Transformation Programme at Budget 2016. The programme will integrate different restructuring efforts, taking a targeted and industry-focused approach to address issues and deepen partnerships between Government, firms, industries, trade associations and chambers.

Under the programme, there will be Industry Transformation Maps (ITMs) developed for 23 industries under 7 clusters. The Future Economy Council (FEC) established in 2017 takes overall responsibility for the implementation of the ITMs.

Table 1: Sample Size for the Study

	ITM Clusters	Industries	Lead Agency
1	Advanced Manufacturing & Trade (AMT)	Aerospace, Energy & Chemicals, Electronics, Precision Engineering, Marine & Offshore, Food Manufacturing, Logistics and Wholesale trade	Economic Development Board (EDB)
2	Connectivity	Air, Land and Sea Transport	Ministry of Transport (MOT)
3	Human Health & Potential (HHP)	Healthcare and Education	Ministry of Health (MOH) and Ministry of Education (MOE)
4	Urban Systems	Construction, Real Estate, and Security	Building Construction Authority (BCA)
5	Resource & Environmental Sustainability	Environmental Services	Ministry of Sustainability and the Environment (MSE); Ministry of Trade & Industry (MTI)
6	Modern Services	ICT & Media, Financial Services, and Professional Services	Ministry of Communication & Information (MCI)
7	Lifestyle	Food Services, Retail and Hotels	Enterprise SG

Each ITM will consist of a growth and competitiveness plan, supported by four pillars:

- **Productivity:** Strategies to support companies especially our Small and Medium Enterprises (SMEs) to move to higher Value-Added (VA) activities and raise operational efficiency.
- **Jobs and Skills:** Investing in our people, to equip them with deep skills to support the shift to greater value creation.
- **Innovation:** Strategies to leverage R&D to develop new products and services.
- **Trade and Internationalisation:** Supporting companies in expanding to overseas markets.

Aligned with the Industry Transformation Maps (ITMs) for each sector, IDPs in Singapore provide SMEs with a step-by-step guide to identify suitable digital solutions and training programmes to equip employees with the right skillsets at each stage of their digitalisation journey. The new generation of IDPs include:

1. Refreshed solution suite offered under the Digital Solution Roadmap.
2. Integrated and advanced digital solutions to improve digital connectivity and deepen SMEs' digital capabilities.
3. A roadmap on Cybersecurity and Data Protection measures.
4. Expansion and updating of Digital Training Roadmap to be aligned with the refreshed solutions under the Digital Roadmap and include Change Management.

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