

Thailand's Digital Entrepreneurship and Digital Health and Wellness

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Thailand's Digital Entrepreneurship and Digital Health and Wellness

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I. THAILAND'S SYSTEM OF DIGITAL ENTREPRENEURSHIP

As a founding member of the Association of Southeast Asian Nations (ASEAN), Thailand is positioned as the second-largest economy in Southeast Asia. At the center of the Greater Mekong Subregion, Thailand is strategically well-located, sharing borders with Myanmar, Cambodia, the Lao People's Democratic Republic, and Malaysia. With a logistics system and six international airports, the country is well-connected to its regional and international neighbors. Moreover, it is ideally positioned to be a regional logistics hub.

Initially, Thailand had invested early and heavily in developing agricultural and manufacturing efficiencies. Moreover, Thailand has garnered efficiencies for businesses and the opportunity for entrepreneurs to serve a large single domestic market of about 68 million people and reach international markets. Then, Thailand shifted its focus toward industries such as tourism, medical tourism, automotive manufacturing and supply, agriculture, and processed food exports.

Through several circumstances, Thailand has developed a 20-year plan to guide the future of Thailand and launched the Twelfth National Economic and Social Development Plan to translate the prior strategy into action. With an approximate internet penetration rate in 2020 of about 76%, Thailand is speedily moving into the digital economy, as can be observed from several of the profiled companies (Statista 2021). To take advantage of these trends, the Government of Thailand is increasing its subsidy to start-ups, intending to modernize the economy through their vision of "Thailand 4.0," an economic model that aims to unlock the country from several economic challenges. Moreover, Thailand has drawn a significant focus on innovation by launching four strategies: strong innovation system, catalyst for changes, nurturing future value, and innovation organization.

Thailand offers an adequate and sufficient digital framework for digital entrepreneurship at all stages; namely, stand-up, start-up, and scale-up, with the country's Asian Index of Digital Entrepreneurship Systems (AIDES) scores being higher than the averages of regional ASEAN and global (Table 1).

Table 1: Thailand's Asian Index of Digital Entrepreneurship Systems Scores

	Digital Entrepreneurship Stand-up	Digital Entrepreneurship Start-up	Digital Entrepreneurship Scale-up
ASEAN	35.45	34.20	36.44
Global	31.96	31.91	31.96
Thailand	43.14	41.69	44.34

ASEAN = Association of Southeast Asian Nations.

Source: Asian Development Bank.

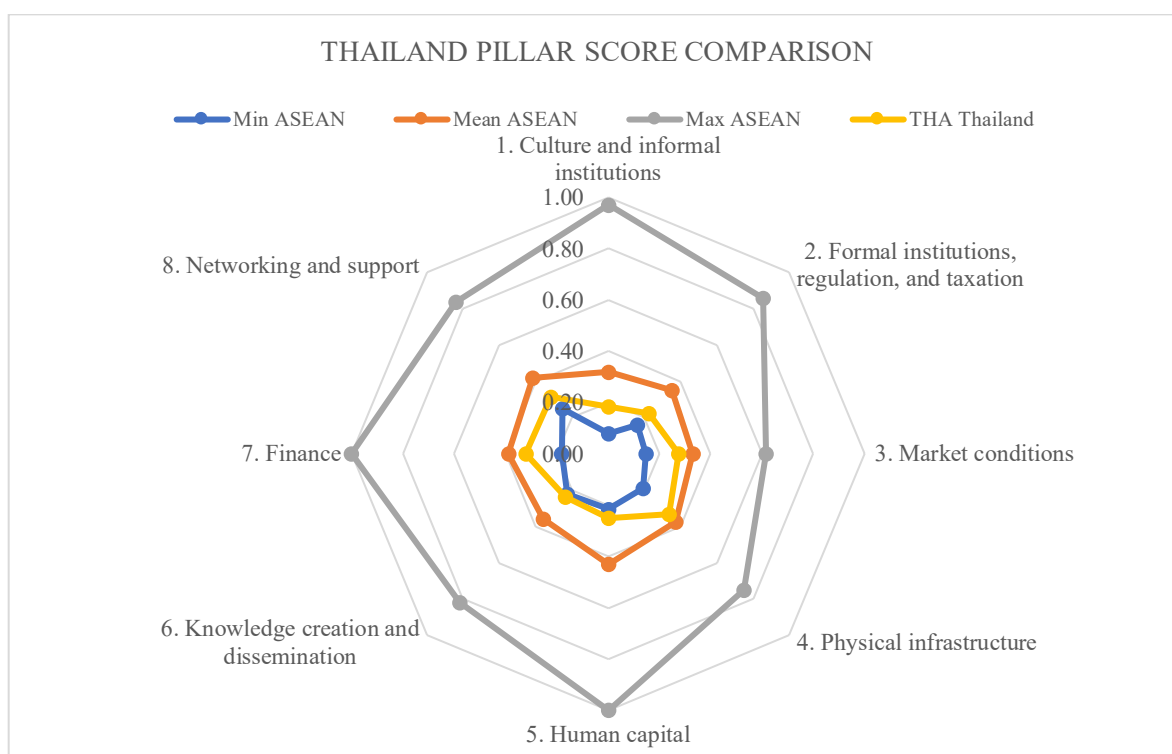
Thailand is particularly strong in physical infrastructure, finance, and networking and support (Figure 1). First, the Government of Thailand heavily invests in physical infrastructure, supporting Thailand's digital transformation and connectedness in responding to Thailand's national development plan, "Thailand 4.0". In 2020, the number of internet users in Thailand accounted for about 76% and was expected to increase to 84% by 2026 (Statista 2021). Moreover, another critical factor in digital penetration and connectedness is electricity. Thailand has strong management of the national electricity. Responding to the growing demand for electricity, the Ministry of Energy, the Electricity Generating Authority of Thailand, the Provincial Electricity Authority, and related government agencies plan a gradual increase in electricity generation as well as slowly implement the B142 billion fund in the green energy to raise the national "energy security and competitiveness for the sustainable energy future" (International Trade Administration 2021).

Second, Thai entrepreneurs have sufficient access to a relatively wide variety of financing options, from government grants, bank loans, and venture capitalists to angel investors. In the Thai entrepreneurial ecosystem, corporates such as Siam Cement Group and Singha lead the Thai start-up investments rather than the government, making Thailand different from other ASEAN countries (Russell 2021). In addition, regional venture capitalists, such as the Saudi-based Inspire Ventures, have entered Thailand, providing more funding alternatives for Thai entrepreneurs.

Last, networks and support in the Thai entrepreneurial ecosystem are created and led mainly by corporates and entrepreneurs to share and cultivate knowledge on the successes and failures of different business models and support stand-up entrepreneurs, who are at the stage of turning their ideas into actual business models. Entrepreneurs come together to form associations specific to their industries. Examples include the Thai Animation and Computer Graphics

Association, founded to boost Thai animation and collectively negotiate and demand necessary support from the Government of Thailand. Thai HealthTech Association, a collaboration of HealthTech start-up companies in Thailand, was established to bring technology to improve and transform health services through cooperation in the ecosystem and facilitation for the growth and expansion of HealthTech start-ups. With solid associations of entrepreneurs, stand-up and start-up talents benefit significantly in knowledge and wisdom.

**Figure 1: Thailand's Pillar Scores in Comparison to ASEAN's
Maximum, Minimum, and Mean**



Source: Asian Development Bank.

Thailand faces challenges in terms of cultural and informal institutions and formal institutions, regulation, and taxation (Figure 1). First, in terms of cultural and informal institutions, Thailand suffers from a relatively high level of corruption, having been ranked 104th among 179 countries in the Corruption Perceptions Index by Transparency International in 2020 (Transparency International 2020). The relatively high level of corruption entails a poor quality of governance, a low acceptance of entrepreneurial risks, the undermining of the law, and the unpredictability of economic status and relationships, all of which have adverse effects on the entrepreneurial ecosystem. Last, Thailand suffers from the unconnectedness of the country's formal institutions

and entrepreneurship. In the Thai business realm and among Thai entrepreneurs, it is common knowledge that government agencies are not seamlessly connected, resulting in an unavoidable lag time and an unnecessary effort to arrive at the desired outcomes. However, the government is committed to addressing this connectedness issue seriously. As a result, the Digital Government Agency has been assigned to take a focal role in driving and implementing initiatives with solid support from various stakeholders, including government agencies, the private sector, and academic institutions.

Building Thailand's current ecosystem is an interplay of government and venture capitalist actors. On the side of the government, three agencies—National Innovation Agency (NIA), Digital Economy Promotion Agency (DEPA), and the National Science and Technology Development Agency—play a crucial role in supporting new start-ups from ideation to funding and launch. NIA has developed a conceptual framework, Innovation Diplomacy, based on strategic cooperation with innovative organizations worldwide. Their missions are to enhance Thailand's National Innovation System to the international level and promote Thailand's image to become an "Innovation Nation." DEPA aims to accomplish things never done before in Thailand. They look at both the details and the big picture so that the digital economy can provide a stable, sustainable path toward a better future. The National Science and Technology Development Agency is entrusted with an important task to accelerate science, technology, and innovation development in Thailand in response to the need of the industry and enhance the country's competitiveness in the global economy and, as a result, contributing to national economic and social development. Thailand also has venture capitalists and accelerators to invest in and build Thai start-ups. These include 500 Tuk Tuks, SCB 10X, Krungsri Unicorn and Krungsri RISE, Bangkok Bank InnoHub, and Invent by InTouch. Unlike the government agencies, venture capitalists focus on accelerating the start-ups in their unique specialization. To demonstrate, SCB10X specializes in investing in fintech firms.

Apart from venture capitalists, private incubators and accelerators and government agencies, University Business Incubators (UBIs) are also incubators set up by universities to provide workspaces, necessary equipment, mentoring services and administrative support required to form new start-ups by students, professors, university personnel, and alumnus. Although the UBI policy was created in 2004, Thai UBIs truly started supporting their start-ups in 2008 (Yamockul, Pichyangkura, and Chandrachai 2019). Thai UBIs were divided into nine networks (i.e., Upper North, Lower North, Upper Northeast, Lower Northeast, Upper Central, Lower Central, East, Upper South, and Lower South), totaling 63 UBIs supported by the Office of Higher Education

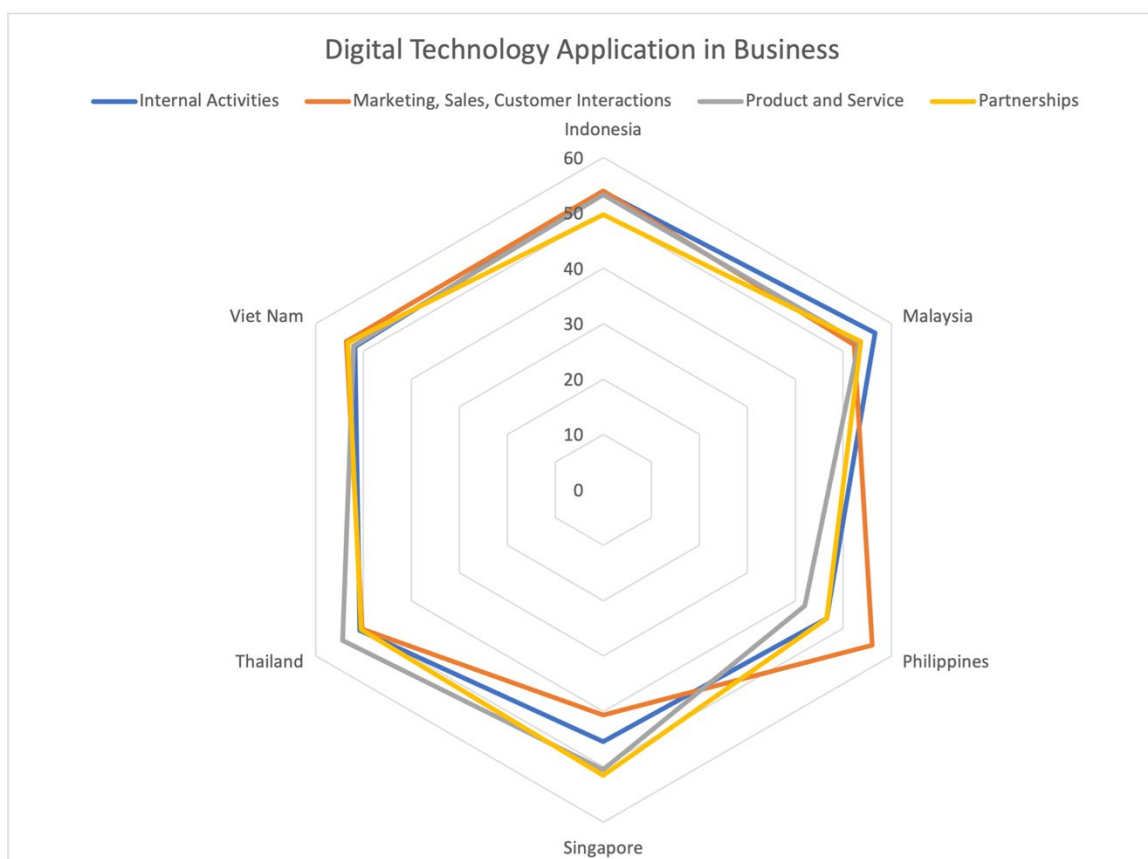
Commission. In response to the policy by the Office of Higher Education Commission, numerous universities nationwide set up their UBIs, notably CU Innovation Hub by Chulalongkorn University, Center of Intellectual Property and Business Incubator by Thammasat University, Sripatum University Business Incubator, Science and Technology Park by Chiang Mai University, Business and Startup Incubator by Rangsit University, and Student Entrepreneurship Development Academy by the Suranaree University of Technology. Each focuses on incubating different innovations. For instance, Student Entrepreneurship Development Academy focuses on medical and health technologies and agricultural technologies. However, not all the UBIs function well and create a sufficient incubation environment for university personnel, students, and business ideas. Students and academic personnel are also encouraged to seek initial funds from the Technology and Innovation-Based Enterprise Development Fund (TED Fund), NIA's Youth Startup Fund, and other government grants.

In response to Thailand's 20-year plan and the famous "Thailand 4.0" strategic plan, NIA began developing 10 innovation districts nationwide, six of which are in Bangkok and another four in the Eastern Economic Corridor in 2015 (Sittipun and Anantsuksomsri 2018). Its objective is to promote creations, harness and cultivate talents, nurture start-ups and business spin-offs, and foster uses of innovation. The first three were established in Bangkok; namely, Yothi, Klong San, and Siam Centre One. The first venue, Yothi Medical Innovation District, focuses on medical innovation and government and city technologies. The second area, Klong San Innovation District, emphasizes community-based innovation allowing district members to generate sustainable solutions to drive competitiveness in local businesses (Asawametikapong and Budthimedhee 2018). In addition, the third, Siam Innovation District at Siam Centre One, concentrates on financial technologies and the Internet of Things (IoT). In 2019, NIA, together with the Faculty of Medicine of Chiang Mai University, developed Suandok Medical Innovation District, focusing on deep tech and health technologies despite the initial plan for Chiang Mai to concentrate on smart tourism, food technologies, and education technologies. Interestingly, Chiang Mai has been named Thailand's "Silicon Valley" as digital nomads, and foreign tech talents choose the city over Bangkok to reside and work in over a long period of time. The main reasons include lower living expenses and excellent digital infrastructure making Chiang Mai the second most famous city in entrepreneurship and start-up.

II. THAILAND'S DIGITAL ENTREPRENEURSHIP

Figure 2 shows the degree of digitalization in the business models of the interviewed companies. Thailand's entrepreneurs exhibit an excellent degree of digitalization in their business operations. Digital technologies are used most in businesses' products and services. Businesses offer products and services that are fully digitalized, connected to mobile applications, and/or tested on digital platforms to get user feedback. The entrepreneurs place more value on digitalizing products and services where the other aspects of internal activities (e.g., human resource process, accounting system), sales and marketing, and partnership communication were all to the same degree and slightly less than the product and service digitalization. The interviewed firms mainly represent the digital entrepreneurs who innovate their core products and services as digital solutions; thus, the entrepreneurs embody digital mindsets and capabilities which highly reflect their digitalized business operations.

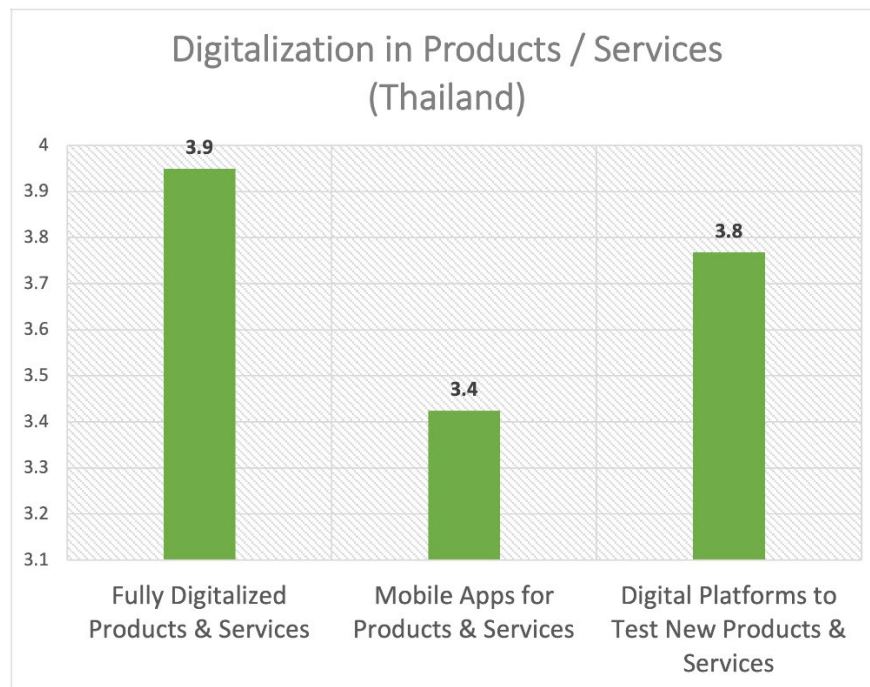
Figure 2: Degree of Digitalization in Business Models



Source: Interview results.

Figure 3 shows the patterns of digitalization in products and services. Most products and services are fully digitalized and tested on digital platforms to get user feedback. Mobile applications are used less by Thai start-ups as they do not want to rely on specific mobile platforms to operate their main products and services. In terms of digital technologies in marketing, sales, and customer interactions, Thai start-ups mainly advertise their products and services through digital channels, monitor activities through websites and social media, communicate with customers through social media, and webpages have online ordering in place and payment channels. However, the interviewed Thai start-ups do not focus on monitoring online ratings and reviews or operating their customer communities.

Figure 3: Digitalization in Products and Services



Source: Interview results.

Figure 4 shows the extent to which the interviewed companies changed their business models. Figure 5 illustrates the number of totally new product and service ideas that the interviewed entrepreneurs have implemented in the last 12 months. Thai businesses have experienced business model changes during the past 12 months, especially in terms of changes in business opportunities, interaction with customers and changes in products and services offered to customers. More efforts in the business model changes have been put largely on changing the existing products and services over developing completely new innovation. This is explained

primarily by the changes in consumer behaviors during the coronavirus disease (COVID-19) lockdowns and disruptions in normal business operations. Thus, Thai start-ups are excellent at utilizing their digital technologies to pivot their business models and products to cope with the apparent adverse impacts of the pandemic.

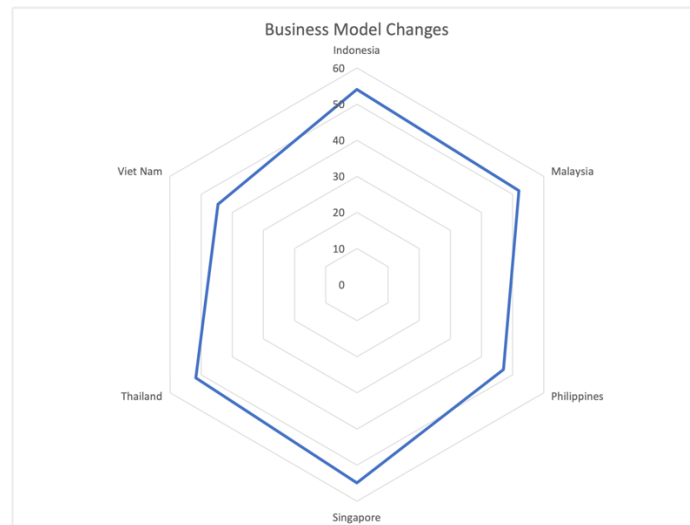
In general, the interviewed entrepreneurs reveal a strong pattern of entrepreneurial dynamic where they managed to turn the COVID-19 crisis into opportunities by changing their business models mainly in the form of refocusing or finding new customer segments and adjusting current products or services to meet new demand patterns. Entrepreneurs were able to discover new customer segments by taking their core digital services, realigning business operations, and offering to new customer segments. Importantly, they could adapt their business operations in a very short period of time, reflecting entrepreneurial resilience. Some examples to elaborate on:

- (i) **QueQ**, an online queuing platform, mainly focuses on lifestyle segments such as restaurants. The company experienced a sudden and extended lack of demand in this lifestyle segment. It thus quickly turned to expand into a government facility and health care segments that will continue to grow in years to come.
- (ii) **Horganice** provides cloud-based rental properties management solutions for apartments, dormitories, and markets in response to the demand drop in current markets. The company quickly discovered new opportunities to apply its solutions for rental space management, while it volunteered to use its solutions to manage field hospitals.
- (iii) Offering an artificial intelligence-based chatbot, **Aiya** reprioritized, revised its products, and organized its operations to target more business-to-consumer (B2C) segments. This segment is growing, and the business-to-business (B2B) segment requires intense physical interaction during the implementation process, which cannot be done effectively during COVID-19 constraints.

Interestingly, the study found some entrepreneurs managed to change business models or offer new services radically. For example, Locanation changed its business model to provide information, special deals, and reservations for visitors and Thai people returning to Thailand who are seeking Thailand Alternative State Quarantine hotels. It is important to note that digitalization and entrepreneurial dynamics help create resiliency for businesses to cope with crises, as evident in the COVID-19 pandemic. A great example is Hungry Hub, primarily a website and application-based buffet deal offerings and reservations in the pre-COVID-19 era. Within less than a month

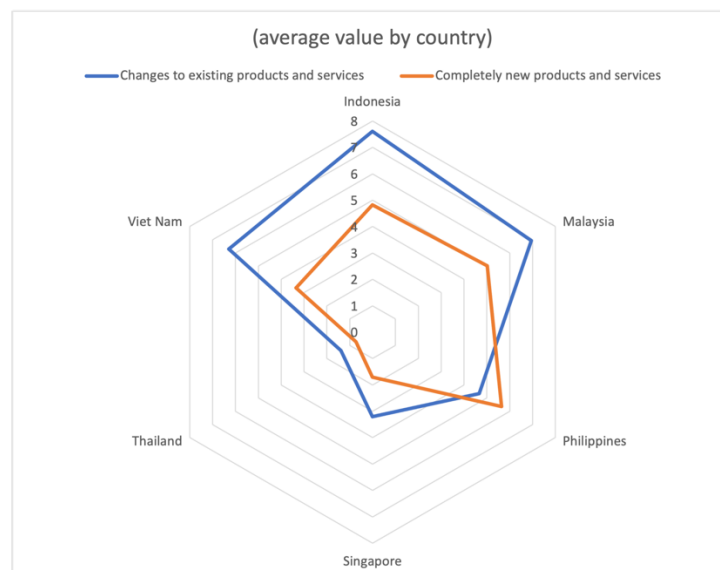
of the COVID-19 outbreak in Thailand, Hungry Hub launched meal set deliveries at special prices and later staycation deals in collaboration with various hotels around Bangkok. Another great example is Locanation, which specialized in providing real estate information services to online customers in the pre-COVID-19 era.

Figure 4: Degree of Business Model Changes



Source: Interview results.

Figure 5: Number of New Products and Services Ideas Implemented in the Last 12 Months

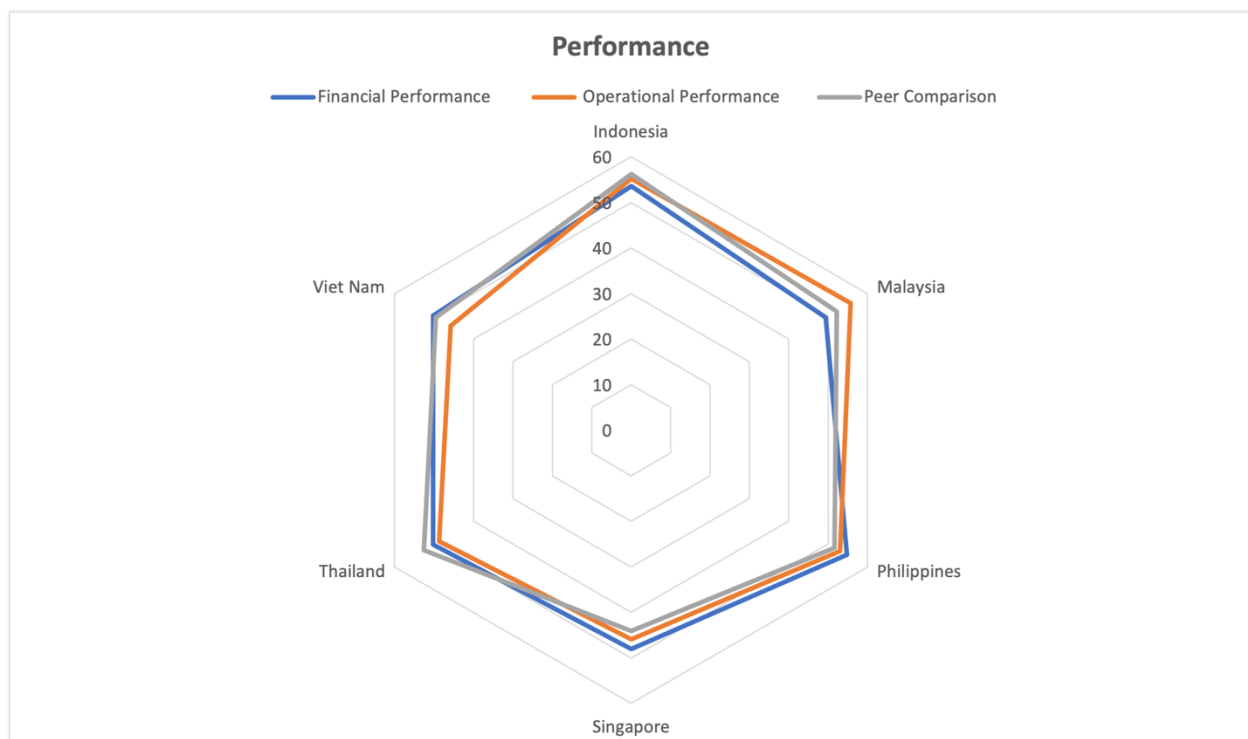


Source: Interview results.

Figure 6 shows the business performance regarding financial and operational aspects, and performance compared to peers. Thai businesses have performed the best compared to their competitors and not so well in operational performance. This is mainly because of the multiple months-long lockdowns throughout 2020 and 2021 that created difficulties in operating businesses. During the past 12 months, Thai start-ups have performed better than their competitors in terms of new products and services development, ability to cope with the COVID-19 crisis, and social sustainability. They have been developing and launching more new products and services than their competitors.

With the business model changes, Thai start-ups have incorporated the consideration of social welfare when pivoting their businesses. A great example is the Pedthaisupai project, a collaborative effort between Thai tech start-ups and the Medical Council of Thailand to apply the start-ups' technological innovation and capabilities in supporting field hospitals and medical staff in combating the COVID-19 pandemic. Not only that these start-ups could come up with new ways of using their existing products and services, but they are also known for being generous and socially responsible.

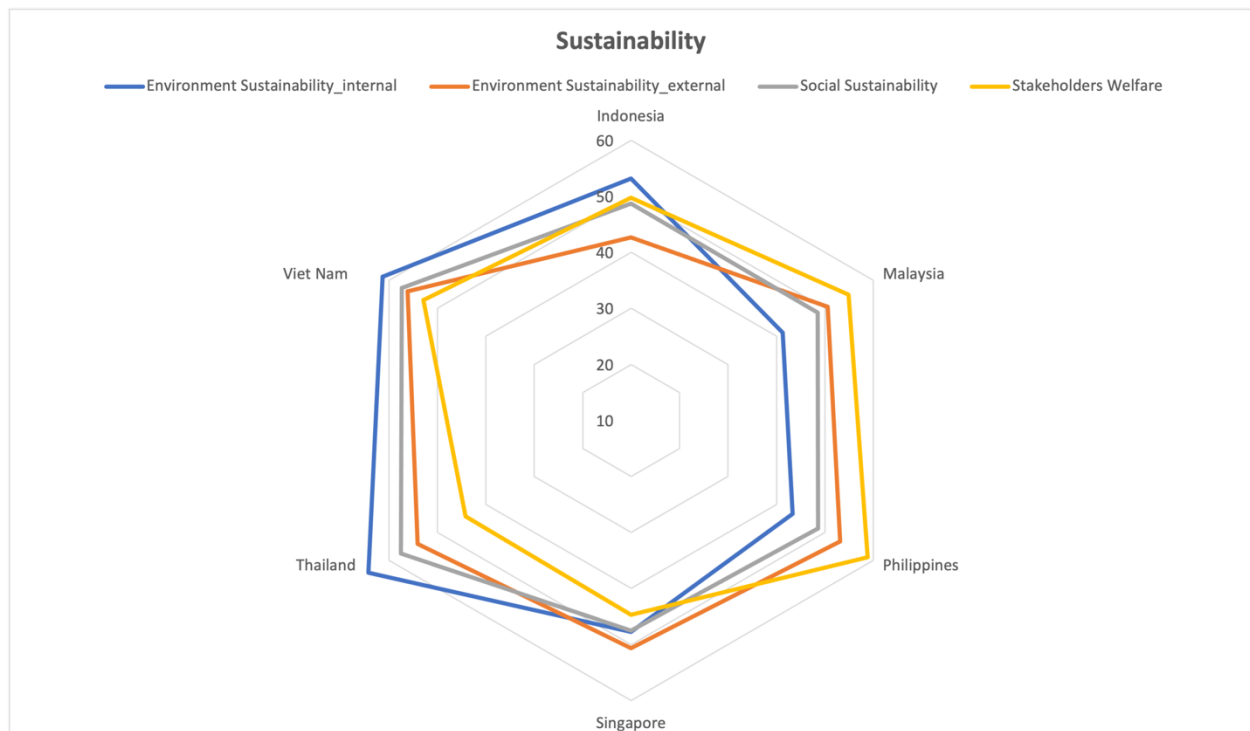
Figure 6: Business Performance



Source: Interview results.

Figure 7 shows how the firms consider the sustainability aspects of their business operations. Thailand excels in environmental sustainability, especially internal environmental aspects. Thai businesses go beyond the minimum legal requirements and go out of their ways to ensure environmental sustainability. However, their environmental mission is not boldly spelled out in firms' formal missions, certifications, or business partners' required standards. According to the interview, most entrepreneurs are personally aware of such environmental value and believe that digitalization contributes hugely to this environmental aspect. Thai entrepreneurs are relatively strong in considering the social mission in their business operations. However, Thai businesses have the least sustainability in ASEAN regarding stakeholders' welfare.

Figure 7: Sustainability



Source: Interview results.

III. DIGITAL HEALTH AND WELLNESS LANDSCAPE: RISING DEMAND FOR HEALTH TECH AND HEALTH SERVICES

The concept of health and wellness has recently been redefined into a much broader term than before. Now, health and wellness covers physical, mental, spiral, nutrition, and social. The focus on both mind and appearance is increasingly valued. Therefore, the main aspects of the health and wellness ecosystem include personal care, fitness, nutrient products, wellness tourism, health care products, and other products or services that are used to promote healthy lifestyles and wellbeing. According to market studies, the global health and wellness market has been valued at US\$4,428 billion in 2019 and is expected to reach a value of US\$6,033.2 billion by 2025, which indicates a 5.3% compound annual growth rate over the forecast period (Gough 2021). Health and wellness in Southeast Asia are thriving even faster than in the past decade, supported by the upsurge of health care expenditure in Southeast Asia, which is even faster than gross domestic product.

In the recent decade, most demographics, technology, economy, and lifestyle have entirely changed, which brought the shift in human health and well-being in both positive and negative routes. The health and wellness industry has grown because of the population becoming older and sicker, two main growth drivers, especially in Southeast Asia (World Health Organization 2021a). The aging population has increased over the past decade. Most ASEAN countries have either negative or close-to-zero growth for their age between 0 year old and 14 years old. While the working population is growing slowly, the retirement age population has outpaced them rapidly with a higher rate than the working population. These are driven by the increased life expectancy of the elderly and a decline in fertilization rate. As chronic disease rises sharply with age and most patients with the chronic ailment are over 65 years, the importance of maximizing a healthy life span becomes the primary concern of these individuals. The middle-income to high-income aging population became an important market pusher of the health and wellness industry.

Nowadays, noncommunicable diseases have become more prevalent in society and are a leading cause of death. It was responsible for the death of 41 million people each year, equivalent to 71% of deaths (World Health Organization 2021b). Overweight, obesity, and smoking are highly common in Southeast Asia and continue to increase, and these lifestyles would lead to type 2 diabetes and cancer. Individuals became more aware of these diseases and invested more time and resources in personal health and wellness.

Meanwhile, the aging population and growing demand for chronic and noncommunicable diseases are shaping the current health and wellness industry trends. Despite the tremendous growth potential, there are also many key challenges, including capacity shortage and fiscal constraints. In Southeast Asia, the lack of medical infrastructures, such as hospital beds and qualified medical personnel, will challenge the industry. This challenge leads to long wait times and short consultant time with medical personnel, which drops the quality of service. In the end, most ASEAN countries have substantially below-the-world average government health expenditure per capita, which indicates the likelihood for the government to have enough support and spending to increase demand for the industry with its health care spending.

Even with the challenges the industry faces, many opportunities are laying around. The industry's growth driver and challenge lead to the growing demand for better quality health care or wellness service. Technology can play a major role in delivering less expensive, cost-effective, and more accessible while lowering costs, increasing speed, higher treatment quality, and enabling flexibility in the service. With telehealth, people in remote areas can access an online diagnosis and other digital resources to address their needs. People can talk with their doctors through a smartphone application instead of visiting a clinic, which would reduce the time and cost of traveling. In addition, technology provides more standardized health care services within the industry while reducing the workload of qualified medical personnel.

The technology infrastructure in ASEAN countries is ready for introducing health and wellness tech. Digital penetration, the receptiveness of medical personnel, and government support are drivers of this opportunity. The digital penetration in this region has become higher than ever. The health care professionals open and accept the technology, including data from applications and IoT devices, for their future treatment. In addition, several governments in Southeast Asia, especially Thailand and the Philippines, have introduced the measure to incorporate these digital technologies to support the health care ecosystem.

A. Thailand's Digital Health and Wellness: Digital Entrepreneurship for Health Resilience

The growth of the private sector, rising demand for health services, international reputation for highly skilled medical professionals, and international standard health services have all pushed the Thai health and wellness industry to a new height. In responding to such high potential, Thailand has set the national strategic goal of becoming “a hub of wellness and medical services,”

boldly explained in the Ministry of Public Health's 2016–2015 Strategic Plan. The Government of Thailand has introduced various measures to incorporate digital technology into the health care system, reflected in the Ministry of Public Health's eHealth strategy 2017–2026, and provides incentives for research and Innovation in technology and innovation. For example, Thailand's Board of Investment offers a wide range of incentives for investment projects that support the national development objective in terms of tax and non-tax incentives. Tax incentives include exemption of corporate income tax and import duty on machinery, raw material, and essential material for the project. For non-tax incentives, the Board of Investment grants permission to remit foreign currency abroad, own land for use, and bring in expatriates (Board of Investment 2020).

Thailand's digitalization journey through the eHealth strategy is committed to developing adequate information technology infrastructure and promoting collaboration between tech companies, entrepreneurs, and health care institutes. The collaborative funding model focusing on public–private partnership initiative is strongly encouraged in various government-funded health tech projects to develop digital infrastructure and scalable reference care models. One large-scale funding project is the collaboration among the Faculty of Medicine Siriraj Hospital, National Telecom PLC, and Huawei to develop a Siriraj 5G smart hospital with a series of 5G-based health solutions, including teleconsultation in the ambulance, blockchain-based personal records, vital sign monitoring, artificial intelligence pathology, artificial intelligence platform for glucose monitoring system, and telemedicine for diabetes patients.

The growth potential of health tech and the rising demand for health services present strong opportunities for the digital health and wellness industry. Thailand's aging society and increasing cases of chronic lifestyle diseases, including cancer, diabetes, blood pressure, and respiratory diseases, are key drivers. The unhealthy lifestyle and busy daily life schedule have encouraged the masses to search for and adopt various health and wellness-related activities and technologies such as nutrition, fitness, yoga, meditation, personal health tracker, and remote health care service.

Given the increasing health care cost, all stakeholders across the health and wellness sectors, including health care providers, consumers, and the government, realize the benefit of keeping individuals healthy and shift more focus on preventive and self-management measures. The consumer trend in preventive health behaviors provides greater opportunities for the health tech market, especially for direct-to-consumer models. The COVID-19 pandemic has strengthened the role of digital technology in health services as it helps reduce physical contact risks. As a result,

health care professionals are becoming more receptive to digital health solutions. For example, the virtual wards (i.e., digitalization of ward process management), once considered a remote concept, were quickly developed and adopted widely to address home isolation by several health care providers.

As a result of the COVID-19 pandemic, consumers and businesses place more importance on health and wellness than ever. The rise of customer interest in personal wellness and spending power would represent the opportunity and growth of the industry. Consumers are turning more attention to traditional Thai medicine for long-term wellbeing. This rising interest is aligned with the globally increasing demand for traditional and complementary medicine for the wellness economy, according to the study by Global Wellness Institute 2018, representing tremendous opportunities for Thailand to excel in this wellness market. Siriraj Applied Thai Traditional Medicine is experimenting with applying artificial intelligence technology for Thai medicine diagnosis, enabling personalized medicine, including individualized herbal nutrition, diet, and drug, for preventive and curative measures.

B. Digital Business Models and Partnership Ventures in Thailand's Health and Wellness

The health and wellness sector operates mainly in the B2B space with great potential for digitalization in health care-providing organizations, especially in the public sector. The emerging players in the B2B space include nonhospital businesses such as nursing homes and retirement communities (Kasikorn Research 2021). The senior-friendly real estate has shown potential growth in Thailand to serve the aging society and rising demand from international residents as Thailand is considered a preferred destination for retiring. The B2C players targeting the senior segment and working-age adults with significant spending power are expected to grow in several years. The direct-to-consumer space is mainly attracted by the working-age people who are health conscious and digital savvy using their devices like smartphones and smartwatches for exercises, health monitoring, health content consumption, and online health community engagement.

In the B2B space, the interesting phenomena and the business model are worth highlighting. The alternative business models such as business-to-business-to-consumer (B2B2C) and business-to-business-to-government (B2B2G) are promising. Start-ups in Thailand have started to adopt the B2B2C business model in their operation because of the country's market condition. Their

products need to accommodate the integration and adaptation into purchasing health care organizations' infrastructure. The partnership ventures or contracts with established business operators to gain access to public sector users enable the health tech firms to grow and expand the market.

Regarding the revenue models, the general trend of software-as-a-service that several service-oriented operators have adopted may not be applicable for health care, particularly in Thailand. Most public organizations' budget policy sets technology adoption as investments rather than operational expenses. As a result, health tech firms have to offer flexible revenue and contract options to accommodate varying procurement and financial policies of health care service buyers for different segments.

Health tech ventures are mainly in the form of investment partnerships of large corporations and health tech firms to scale digital health as the large corporations can scale technology utilization and expand their core business operations. Numerous large organizations and corporations have turned their focus on the health and wellness sectors. The Petroleum Authority of Thailand, a Thai state-owned oil and energy company with the largest market capitalization on the Stock Exchange of Thailand, focuses on investments in life science businesses, which consist of pharmaceutical, health, nutrition, and advanced materials, to respond to the aging population and the world's economic and social change.

Further, telecommunication giants, namely Total Access Communication Public Company Limited, Advanced Info Service Public Company Limited, and True Corporation, with their affiliated ventures, realize the rising opportunities and needs of modern-day consumers in this sector, and thus focus their invested accelerator and incubation efforts on digital health and wellness start-ups.

In recent years, Thailand has witnessed a lineup of digital health and wellness entrepreneurs showing outstanding performance, aiming to tackle the challenges in health care, and create a strong presence in the market. Various attractive digital solutions and novel digital-based health and wellness services models have flourished and showed great potential to capture the growing demands and lucrative ventures. Some examples include:

1. Telehealth and Remote Care

Telehealth is beneficial for improving the accessibility of quality care for underserved populations and serving the trend of care-close-to-home and self-management. Telehealth could be delivered in the B2C standalone solution; for example, Doctor A to Z offers telehealth services for individuals to access a large pool of local physicians and international medical professionals for teleconsultations targeted at domestic and international medical tourism. Another model is in the form of B2B through contracts with hospitals. Dietz provides telemedicine technology for hospitals to integrate with electronic health record systems, allowing patients to access medical consultations and physicians to access patients' medical information in real time. The COVID-19 pandemic and social distancing policy have quickly elevated the telehealth adoption rate, benefiting from reduced hospital visits and hospital congestions.

2. Digital Health Platform

The digital health platform is another model applicable to the health care sector. The open platform can benefit various players in the industry, including small and medium-sized players, and give better access to consumers, pharmacies, insurance, medical consultants, and health food vendors. For example, Doctor A to Z offers a telemedicine platform that connects all stakeholders, such as medical instructors, patients, insurance, and pharmacies in an identified ecosystem. Smile Migraine is the platform connecting patients, nearby physicians, and drug providers, specifically targeting migraine disease. The platform offers online artificial intelligence-based diagnosis and performs as a migraine-specific community.

3. Medical Diagnosis

One growing area of artificial intelligence application is in diagnostics as decision support for medical professionals. According to the Ministry of Public Health, lung cancer, pneumonitis, and tuberculosis are listed in the top 10 causes of death among Thai people. Most patients are first diagnosed only when it is too late to cure. Like many countries in ASEAN, Thailand is facing a shortage of health care professionals, and thus an artificial intelligence-powered diagnostic medical imaging service is an impactful area to tap on. Perceptra, a Thai medical diagnostics start-up, launched Spectra, an artificial intelligence-driven precise medical image diagnosis using deep neural networks to help screen abnormal conditions in chest X-ray images. The solution is positioned as a radiologist assistant to reduce workload, increase productivity, and

improve clinical quality. Spectra is a cloud-based solution that generates diagnosis reports in real time and is fully integrated into hospital workflow.

Perceptra pursues a partnership model to collaborate with the Faculty of Medicine Siriraj Hospital, Mahidol University, Thailand's top medical school, with a huge volume and variety of cases to strengthen artificial intelligence precision. Of course, the COVID-19 crisis has allowed Perceptra an opportunity to apply artificial intelligence-Imaging services to help the government handle spike volumes of X-ray cases.

4. Devices and Monitoring

The IoT devices and monitoring technology are helpful for remote clinical monitoring, assisted living for the elderly, and chronic disease management. In response to the demands from the elderly in society, Atapy has innovated Sookjai, a fall detection and activity tracker, to monitor activities and detect a fall incident of the elderly and send the notification to alert caregivers and family members. Atapy collaborates with hospitals to integrate its solutions as part of the hospital service to send emergency alerts for proper care in case of a fall incident. NEF is another health tech start-up specializing in artificial intelligence-driven monitoring and alarming systems. NEF has invented on-bed movement monitor and alarm as artificial intelligence-powered sensor beds to enable caregivers to locally and remotely visualize how their patients move to prevent pressure sores, which are common concerns in the elderly. NEF has adopted various market penetration models, including B2B2G to access the public health care facilities and B2B2C to partner with property developers targeting the senior residents.

5. Robots in Health Care

Care robots and hospital robots have shown great potential to improve the standard of care delivery both in the B2C and B2B settings. Robots used to provide care and support to the elderly are expected to grow significantly. Hospital robots are also used to deliver medication and conduct hospital tasks and services. CT Asia, known for its iconic robot Dinsaw, has a strategic plan that targets the health care sector. The company has launched a series of Dinsaw robots, such as Dinsaw for outpatient department service (e.g., greeting, health screening and triage), and Dinsaw for the elderly to engage patients with daily medical activities and social activities.

6. Hospital Management

Hospitals and health care organizations are complex, and their internal operations are generally inefficient and costly. Internal digital transformation is required to enhance the organization's backend to reduce and eliminate inefficiencies and miscommunication, thus resulting in a reduced amount of resources used for each patient. Mutrack is a start-up that tackles this hospital management problem with IoT technology. Mutrack offers a tracking and analytics platform used for tracking employees and equipment to eliminate waste from the system. The IoT and system platform eliminates the problem of asset losses, underutilization of assets, and high waiting times. Adasoft, specializing in artificial intelligence-empowered vending machines, offers artificial intelligence unmanned stores and expands into novel services to hospitals for drug and medical supply dispensers to patients and internal staff for frequent transactions. The solution helps hospitals save internal logistics costs, previously relying on humans, and serves social-distant situations.

7. Finance and Insurance for Health

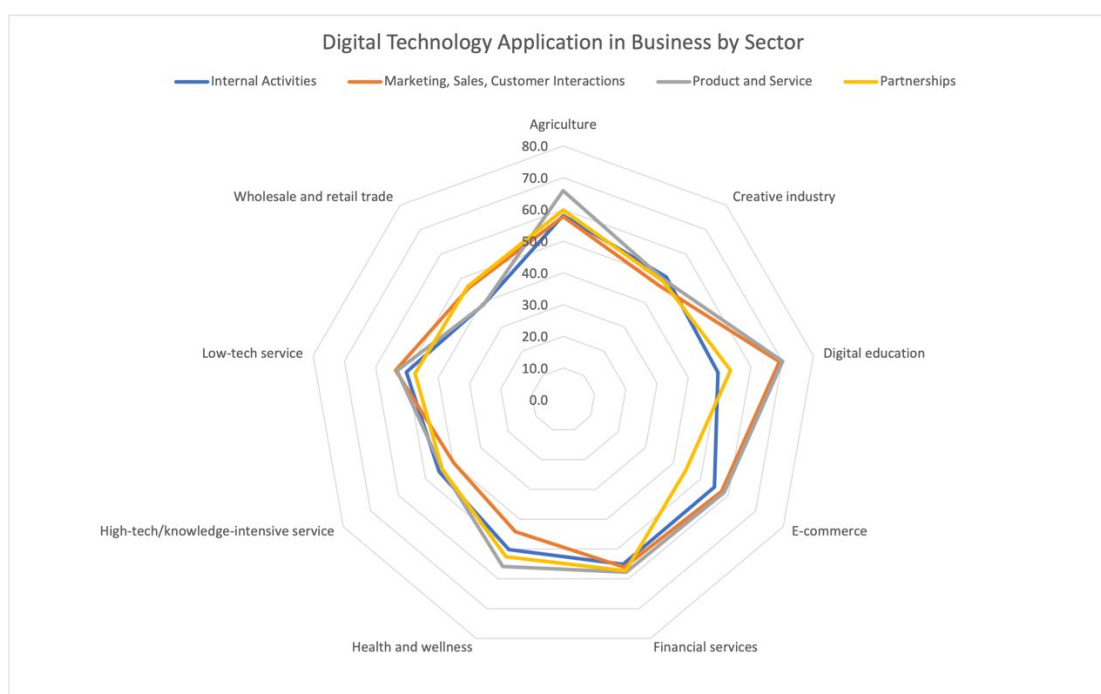
Financial and insurance services also participate in the promising road in the health and wellness sector with novel offerings. Wealthi, a fintech start-up, offers multipurpose personal loans and recently launched a novel product targeting the health care spending segment. Wealthi has partnered with hospitals to provide patients with personal loans, which are directly tied to health care bills. This direct hospital-to-Wealthi process without money contact by borrowers could help address the typical issue among borrowers when the loaned money may never go to the health care bills as initially intended. Thaivivat Insurance values the preventive care trend, and thus offers a novel health insurance product that uses wearable devices and fitness monitoring technology. Customers are offered a smartwatch for free to promote exercise and motivate user engagement in a healthy lifestyle.

IV. THAILAND'S DIGITALIZATION IN HEALTH AND WELLNESS: COMPARING WITH OTHER SECTORS

Thailand focuses on becoming the world's leading health and wellness hub. Thus, it is essential to understand the industry picture compared to other industries in the country. Nine sectors are categorized: health and wellness, agriculture, creative and gaming, education, e-commerce, financial services, high-tech/knowledge-intensive service, low-tech service, and wholesale and retail trade.

Figure 8 shows the degree of digitalization in business operations across sectors. When comparing the digital technology application in the health and wellness sector to those of other sectors, the level of digital technology application in internal activities, marketing, sales and customer interactions, products and services, and partnerships are above the country's average. Health and wellness entrepreneurs focus the digital technology application more on products and services and less on marketing, and sales and customer interactions. In this health and wellness sector, comparing other sectors like education and low-tech service, the partnership is another key aspect that needs to be digitalized and well-integrated with business partners' infrastructure.

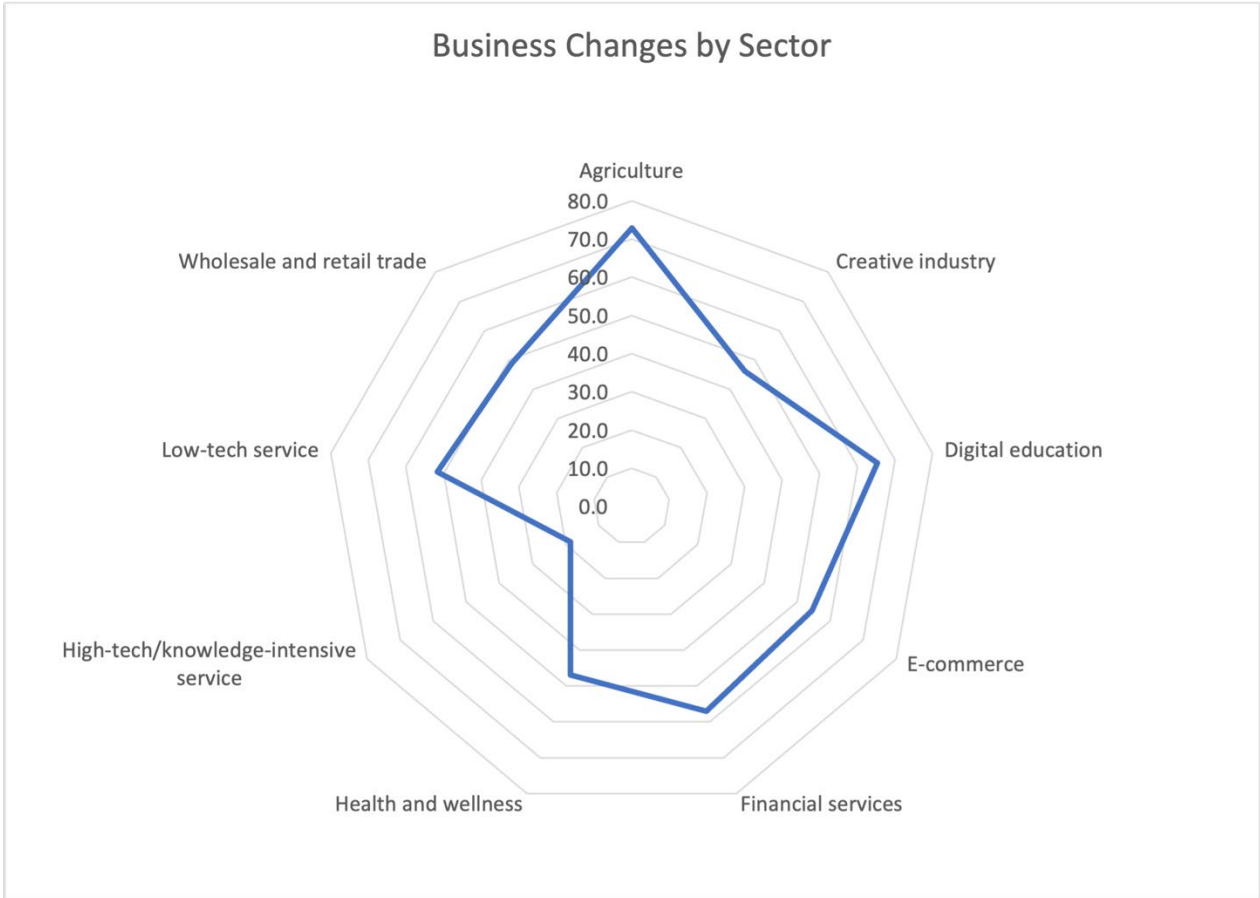
Figure 8: Degree of Digitalization in Business Models Across Sectors



Source: Interview results.

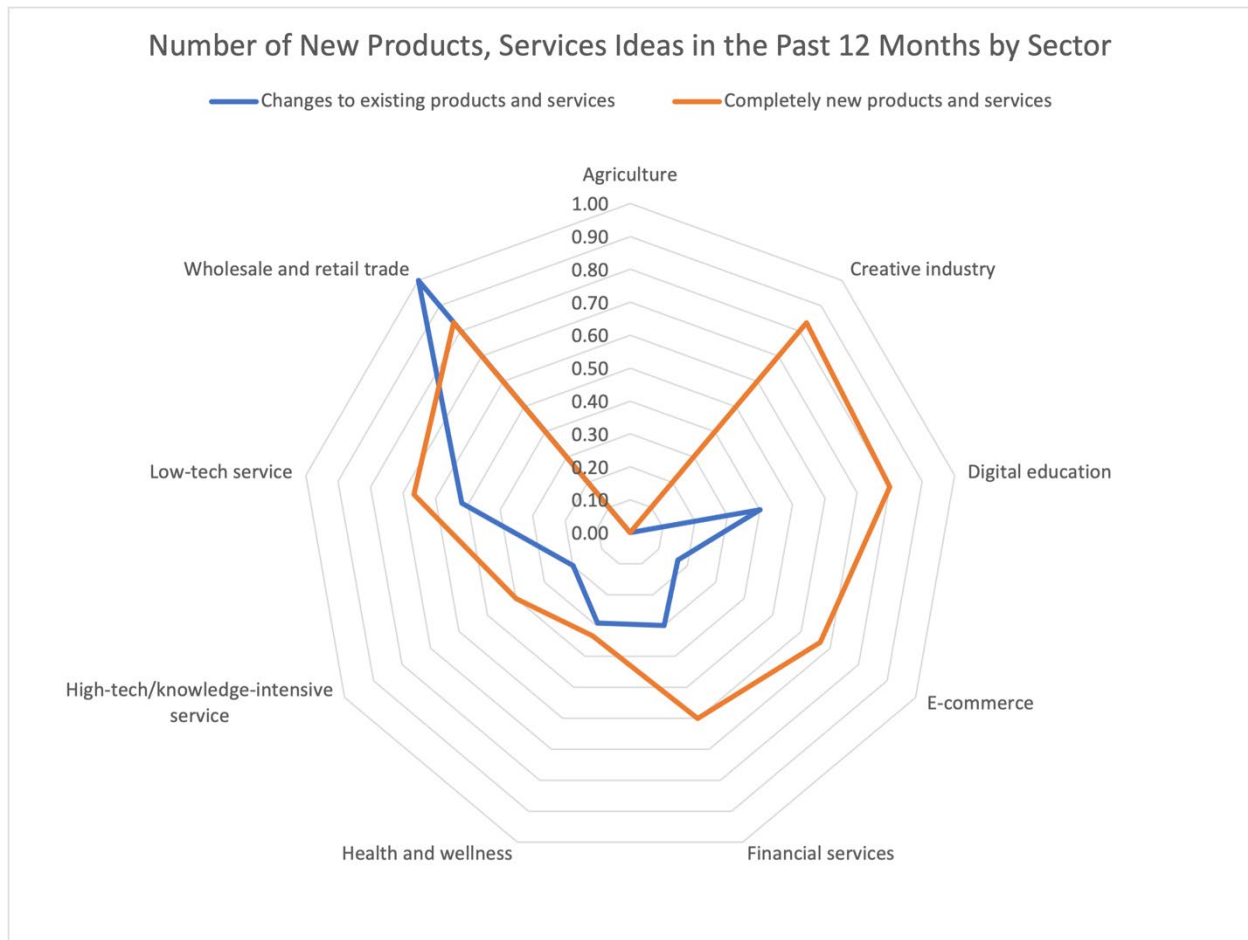
Referring to Figure 9 and Figure 10, for the past 12 months, the health and wellness start-ups experienced relatively less business change on average. Agriculture and digital education are the top two industries that experience the most business changes. Health and wellness start-ups prioritized developing and launching new products over making changes to existing products and services. With the limitation on physical interactions, businesses with physical presence were nudged towards launching new products and services online instead. The COVID-19 pandemic has positively increased the demand for digitalization in the health care industry; thus, most start-ups received such benefits and opportunities and can take their existing products or services to serve the market needs with minor modifications to fit each individual subsegment.

Figure 9: Degree of Business Model Change by Sectors



Source: Interview results.

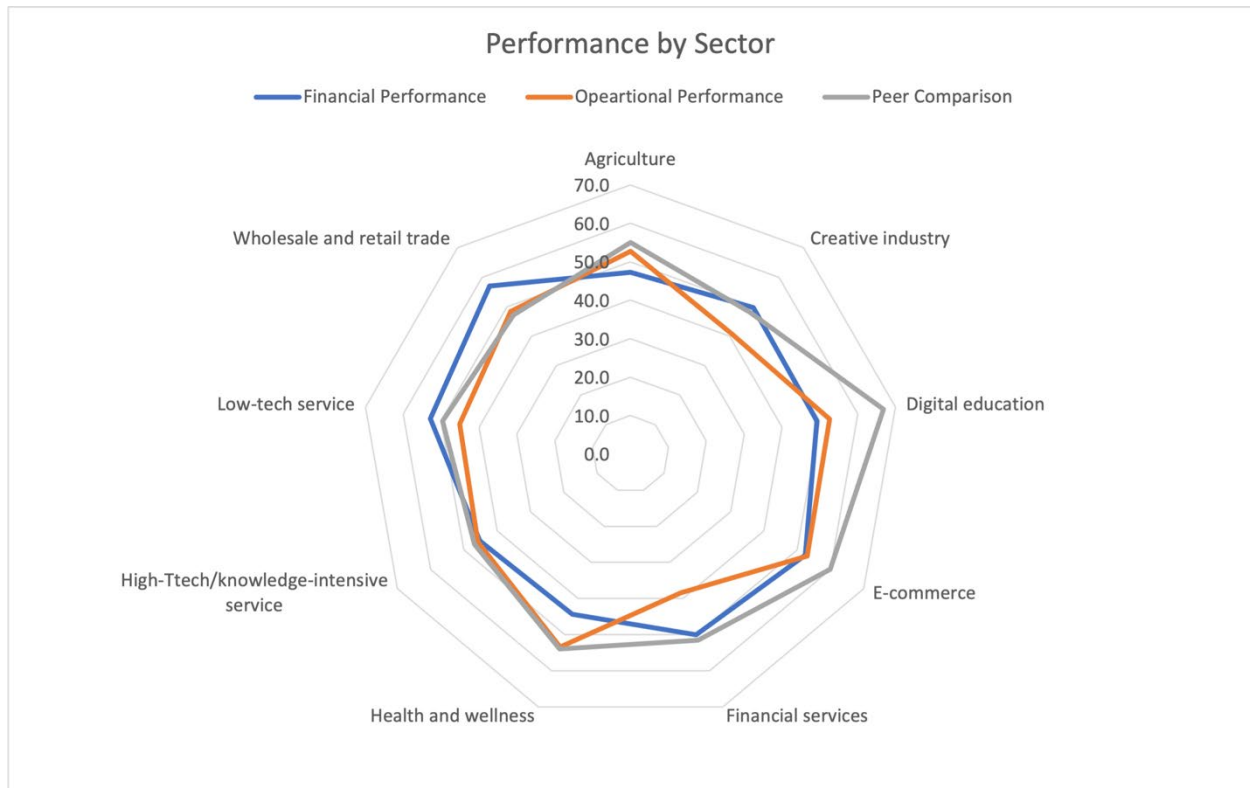
Figure 10: Number of New Products and Services Ideas Implemented by Sectors



Source: Interview results.

According to Figure 11, health and wellness start-ups have done well with respect to operational performance and performance compared to their competitors. This coincides with business model changes and the new products and services offered by these start-ups. However, such satisfying operational and peer comparison performances did not translate into equally high financial performance. With the COVID-19 pandemic and the slowdown in the economy, it is understandable that the financial performance might not be as good as other aspects. Also, several interviewed start-ups are not yet in the well-established stage. The health care institutions' adoption stimulated by the COVID-19 crisis is still in the early phase where the firms, as service providers, may not yet realize the solid financial performance.

Figure 11: Business Performance by Sectors



Source: Interview results.

Referring to Figure 12, when considering the Sustainable Development Goals, health and wellness start-ups have performed the best in terms of social sustainability and relatively less in stakeholders' welfare sustainability. The high score on social sustainability is partially contributed by these entrepreneurs that utilize their digital capabilities and assets to help society combat the COVID-19 pandemic. The notable example mentioned in section II is the Pedthaisupai project. In addition, other industries have the same sustainability pattern, with the highest score in social sustainability and the lowest score in stakeholders' welfare sustainability.

Figure 12: Sustainability by Sectors



Source: Interview results.

V. THAILAND'S INNOVATION IN DIGITAL HEALTH AND WELLNESS: CASE VIGNETTES

A. Mutrack: Tracking for More Productivity and Fewer Wastes in Health Care

Mutrack, a modern tracking and analytic platform, was founded by Mr. Piyorot Piyachan in 2018 with three co-founders. With his background in software engineering and project management igniting his entrepreneurship spirit, he found Mutrack with a strong aspiration to tackle the business operation problem he has witnessed for years. He has seen that most big hospitals lose a lot of linen because of poor inventory management and cannot track the loose linen, accounting for a huge amount of money, about up to B10 million loss for some hospitals.

Mutrack aims to eliminate inefficiency and miscommunication within an organization. Digitalization is used to improve the backend of the organization. Hospitals face these management problems, including asset losses, underutilization of assets, high waiting times, and many more to come. Mutrack came up with two main products that revamp the traditional backend of hospital management, including Linen Management and Job Dispatcher. Mutrack provides a management solution based on RFID technology that helps hospitals manage their linen stock for linen management. Regarding the job dispatcher, the platform allows the hospital to manage an internal job request, especially patient transportation, to reduce wait time and increase staff productivity. The platform will assign the job via mobile application by considering the present staff's location and availability. It would keep track of the jobs and notify the porter when they picked up and escorted the patient to their destination. The time spent and job history would be recorded for further improvement and staff evaluation.

After the COVID-19 pandemic outbreak, health care sectors are forced to shift their resources and attention to curing and managing disease; therefore, some new implementation projects with the hospitals are inevitably delayed. However, Mutrack has managed to find new opportunities by shifting its focus to research and development of contract tracing by applying its core tracking technology, which would be useful during pandemic and post-pandemic. Further, this technology would support Mutrack's new project, "Things," the tracking platform used for movable devices such as infusion pumps, wheelchairs, and beds. With a great opportunity of joining Sinwattana crowdfunding, the company could successfully close a fundraising deal with well-known local investors for further research and development. Mutrack was successfully partnering with Aruba Networks, which the organization can integrate Mutrack platform with the world-class network

device. This partnership could further expand Mutrack into the international market with Aruba users.

Mutrack believes in open innovation, where part of its solution offers an open IoT platform where digitalization in all business sizes could accelerate. To foster a long-term partnership with clients, the company is ambitiously working on experimenting with the offer of an innovative revenue model as an outcome-based pricing model where the revenue is based on shared cost savings derived from the clients' implemented solution.

Mutrack aims to expand its service to become a true one-stop service for hospitals to keep track of people and their assets. Its goal is to digitally transform the hospital to become more competitive and enhance its efficiency exponentially. Mutrack is not just the tracking platform. It is positioned as the business solution for digital transformation in health care, focusing on process transformation and operational excellence. To continue on a growth journey, Mutrack is to expand the core tracking and asset management platform into other industries, such as the agriculture industry, for smart farm solutions since potential benefits and areas of adoption are promising and similar to hospital management.

B. Doctor A to Z: An Industrial Estate for the Medical Industry

Doctor A to Z is the leading health care Software-as-a-Service (SaaS) platform offering solutions to health businesses to expand and grow digitally. Thanks to their medical and hospitality service background, all three founders understand the local health care problems and foresee solutions to tackle health care service issues in Thailand and the region.

Doctor A to Z initially began its operation with the concept of medical tourism, trying to address a big pain point of foreigners when they plan to get medical services in Thailand. The COVID-19 pandemic has challenged Doctor A to Z to rethink its business model fundamentally. Doctor A to Z repositioned as a medical hub of medical expertise, hospitals, and virtual hospital systems. As a result, Doctor A to Z launched the telemedicine platform that connects all stakeholders, such as medical instructors, patients, insurance agencies and pharmacies, in an identified ecosystem. Doctor A to Z aims to develop health care services to improve patients' access to care, contribute to more effective use of time for doctors and patients, reduce unnecessary costs, enable high-quality communication with patients, and enhance doctor-patient relationships and customer satisfaction.

Doctor A to Z has managed to achieve its resiliency with a strong focus on Health Business Transformation and Health Digital Innovation. To fill in the gap in health care transformation, Doctor A to Z positions themselves as business consultants for medical services, allowing other new corporate players to dive into the medical industry with ease. Doctor A to Z offers four main products: Health Apps, Clinic Management, Health Marketplace, and Referral System. For Health Applications, Doctor A to Z provides telemedicine that consults with our expert doctors through mobile phones seamlessly. Patients can also ask for another doctor's opinion to get the proper outcomes and book the right expert doctor through online booking. Concerning the Clinic Management segment, Doctor A to Z aims to provide a SaaS telemedicine platform for a clinic to provide digital infrastructure to improve their time efficiency and reduce workload. Customer health records support the management of the confidential compilation of pertinent facts of an individual's health history during the entire episode of care. A white label also allows the clinic to easily create its brand, logo, and corporate identity (CI) within just one month. For the Health Marketplace, Doctor A to Z has gathered up to 1,000 special health packages with the medical standards online. The health packages are various from health screening services, Human papillomavirus vaccine, weight loss programs, insurance programs, Dental programs, etc. Finally, for the referral system segment, Doctor A to Z facilitates the transferring of patients from Hospital A to Hospital B with adequate health records from the Health Apps segment and ensures a user-friendly interface.

Doctor A to Z is committed to improving their clients' health care access to have a good living standard. With the social mission in the health care context, Doctor A to Z offers its telemedicine solution with a network of volunteer doctors to help the Thai government manage the health care crisis during the COVID-19 pandemic at no cost. To continue on its growth journey, Doctor A to Z receives strong support from Thailand's Board of Investment, with the benefits focusing on attracting a highly skilled workforce to come to Thailand. Recently, Doctor A to Z successfully raised funds from the two major corporate venture capitalists with telecom-based and banking-based backgrounds. This partnership provides Doctor A to Z with strong business synergies and the ability to achieve the international standard for medical infrastructure. With its health care technology infrastructure, Doctor A to Z supports its partner in sustainable growth and transforming health care services for people. Ultimately, Doctor A to Z can fully position itself as "an industrial estate for the medical industry."

C. QueQ – No more Queue Line

Queuing and long unoccupied waiting times have long been problems for businesses of all sizes because time is precious to everyone. QueQ was founded in 2014 as a lifestyle platform specializing in queue reservation and management with the ease of application adoption. Through the QueQ platform, consumers can easily find their desired shops, restaurants, or hospitals, see how long the queues are, and reserve their queues 2 kilometers before arrival. With the founding belief of "no more queue line," QueQ allows businesses to better manage their capacities and demands by utilizing useful statistical data and providing seamless services to their customers. To entice consumers to adopt QueQ, gamification and rewards are being used to provide privileges to users.

Before QueQ, Mr. Rungsun Promprasith, one of the key founders, ran a successful software house, sBox. QueQ was a research and development project of sBox. Because of the potentially high frequency of application usage, Mr. Promprasith and his team chose the restaurant businesses to guarantee a sizable demand for QueQ. In 2014, QueQ was founded as a spin-off company and entirely bootstrapped. With an innovative business model, QueQ received incubation and acceleration support from various institutions such as the university-based innovation program by Chulalongkorn University, National Innovation Agency (NIA) with StartUp of the Year 2018 Award Winner, and DEPA with Digital StartUp of the Year 2019 Award Winner. QueQ successfully raised a series A funding in 2019 from notable venture capitalists, True Incube and Bon Angels, and achieved business synergies to expand its digital entrepreneurship journey further,

QueQ does not focus only on monetary returns but emphasizes sustainability for both the company and society. QueQ utilizes the application to support social distancing between individuals, service providers, and government institutions to reduce the over-crowded issue in tourism successfully. The notable examples are digitalizing the queues for Railay Bay ferries in Krabi in the post-lockdowns and assisting with reservations for national park entries. Through the digitalization of queue management, responsible consumption and production and carbon footprint reduction are achieved through efficient use of natural resources.

With the widespread impact of COVID-19 on businesses, QueQ subsequently experienced a shrinking demand in the lifestyle and restaurant sectors. However, the company could identify

untapped opportunities in the government, banking, and medical industries and thus expand its business.

To pursue a social mission, QueQ takes part in the Pedthaisupai project, an initiative by a group of Thai Tech Startups to apply their technological innovation and capabilities incorporation with the Medical Council of Thailand to support field hospitals and medical personnel in fighting the COVID-19 situation. QueQ has applied its platform of the queuing system at various COVID-19 vaccination units in Thailand and abroad, namely the Thai Embassy in the United Kingdom, reducing crowding and infection risk. Through the Pedthaisupai project, QueQ demonstrated the versatile capability in adapting its platform to the specific needs required by different types of businesses and being more than just a queue solution. QueQ foresees the changes in consumer behaviors post COVID-19 that will increase demand for advance queue reservations.

Throughout the years, QueQ has shown continuous growth through the extension to other industries, such as hospitals, banks and government agencies, the introduction of new features (i.e., QueQ Next Door Delivery, QueQ To Go and QueQ Hospital Solution) and the expansion to Japan, Malaysia and Taiwan. Essentially, QueQ has proven that finding opportunities amidst the crisis and adaptability create resiliency and sustainability in surviving any obstacles. Digitalization allows the company to respond to any change in the business environment promptly.

D. Cloud Eatery: Landlord as a Platform Service

Cloud Eatery, a fully equipped rental kitchen space, was founded by Mr. Kovit Katapasara following his position as the CEO of General Electric in 2019. With his strong professional management background in the innovation-focused business, Cloud Eatery attracted a business partnership with LINE MAN Wongnai, Thailand's leading food delivery service and lifestyle platform, to form "LINE MAN Kitchen" with the interesting business model as 'Landlord as a platform service.' This start-up venture lies in the business concept of renting out space for the restaurant for delivery service only, also known as a "cloud kitchen or virtual kitchen." Mr. Kovit Katapasara believed this business model as a great opportunity since food delivery had started to become a trend in Thailand. This business model had a high potential for scalability.

Cloud Eatery is a shared kitchen space equipped with professional kitchenware available for rent to small and medium-sized restaurants and starter chefs under the coworking space concept known as "cloud kitchen," where tenants lease out kitchen area to cook ordered meals and deliver

them via online food delivery services. As a space master, Cloud Eatery emphasizes two main value propositions: store expansion with relatively low cost for existing restaurant businesses and utmost convenience to consumers regarding less delivery time and cost because of larger basket size. Cloud Eatery has a competitive edge over its competitor. It has partnered with Lineman Wongnai, which eliminated the problem of riders and has the analytic data to choose the location for further expansion.

All in all, Cloud Eatery adopts “the more for less” or “the same for less,” allowing tenants to the same or even higher sales revenue plus extra support and services, while ultimately investing relatively less than opening an entirely new store. The core of Cloud Eatery has digitized most parts of the business model as there is no front store, which creates a less direct interaction between customers and tenants. In addition, the company's backend has implemented several IoT to increase its efficiency and lower the cost for the company, such as implementing a smart liquefied petroleum gas optimizer in the kitchen. Most of Cloud Eatery's business is digitalized in both front and backend, creating business resilience during the pandemic.

During the past year, dining out was not an option for many people globally. With the pandemic spread all over, food delivery services became a common choice among consumers. The demand for Cloud Kitchen was increased along with the food delivery service. The impact of the COVID-19 pandemic caused the shrinking demands in the central business district as fewer people were working in the office building around central business district areas. However, in general, the benefit of increasing demand for food delivery still exists and outweighs the negative impact from the pandemic. The digital nature of Cloud Eatery allows the company to leverage the analytics data to suggest the next optimal location to open to maximize sales and optimize costs.

Cloud Eatery has proven to be a successful cloud kitchen platform in Thailand. Because of the fast-growing online food delivery and the rise of delivery-only restaurants post-COVID-19, the future expansion of Cloud Eatery is certain. Cloud Eatery has held the exclusive contract in many certain locations with LINE MAN Wongnai. The Cloud Eatery has planned to expand to those areas to capture the post-pandemic market further. Further, the company plans to invest more in Cloud Eatery Selected, its sub-brand, as a channel to sell unique snack items such as cheesecake, popcorn, and chocolate, to further build the brand and increase basket size and build the alternated revenue.

E. Sinwattana: Empowering the Crowd to Fund Together

Sinwattana was founded by Ms. Hong Sin Kwek, a Singaporean woman entrepreneur, aiming to become the “gateway to Asia through Thailand” for driving innovation and uplifting potential small and medium-sized enterprises (SMEs) to the world. During her time in Thailand, Ms. Kwek observed a significant gap in that Thai SMEs lack support from financial institutions despite focusing on Thailand’s backbone. Her ever-present entrepreneurial spirit, coupled with her love of Thailand, made her think about using her experience to help budding local entrepreneurs. After getting rejected by local banks to fund her prior business idea, she was committed to learning more about alternative funding options, particularly the crowdfunding concept, in detail. After her study trips to the United States, Sinwattana was established.

Sinwattana started the belief that, if there is social unrest, the economy will inevitably get affected. Therefore, creating a donation-based crowdfunding platform will gain reputation and trust from conservative Thai terrain. Sinwattana continues a strong road map and has since developed a full-scale investment crowdfunding platform with the approved first license to operate in Thailand. Sinwattana has demonstrated and successfully raised funds for several projects. Most importantly, Sinwattana ensures that its platform is a global platform with localized Thai essence of services by organizing a series of road shows to attract and gain trust among Thai investors. Extensive curation, validation, and valuation help provide clarity for investors and support the business owner in refreshing their branding and positioning in the market.

Sinwattana operates with personalized facilitation to both business owners or issuers and funders or investors as a digital crowdfunding platform. Business owners or issuers are mainly SMEs with more than 2 years in operation and a track record to demonstrate the viability of the businesses. While funders or investors, who are interested in investing in SMEs, are served in three categories: retail investors, high-net-worth individuals and institutions.

Since the outbreak of the COVID-19 pandemic and lockdown with tight mobility measurement, it was a test of time for everyone globally; Thailand is not spared either. It was a time when people turned to crowdfunding as one of the options to seek out funding, both social and investment. Sinwattana leverages the changes and funding demand to get online to run workshops, training, education, and optimizing multichannel for major outreach. It was tough for them, but it did not deter their way of engaging customers creatively. Leveraging all technologies and digital media dynamics and capabilities, Sinwattana has changed several of its operations to cope with the

pandemic effectively by implementing technology in its operation. Moreover, Sinwattana takes a closer step toward its core value of helping the Thai people by creating a biodiversity fund and helping with social causes to relieve the COVID-19 pandemic as well as increase business visibility in several projects. As a result of such adaptation, its social crowdfunding platform successfully raised more than B2.8 million from 3,000 donors in a short period of time for the WIN-Masks Together Project. The project collaborates with the Thailand Center of Excellence for Life Sciences, Faculty of Medicine Siriraj Hospitals, and several research institutes to produce 100,000 pieces of advanced-technology masks for the health care personnel during the early hit by COVID-19. Another achievement during the pandemic, Sinwattana managed to complete major equity crowdfunding projects, such as Wealthi, a P2P fintech pico finance, and 2Read, an education technology start-up.

Sinwattana expansion plans will help deep dive into full-fledged crowdfunding, including real-estate crowdfunding and move into digital assets on securities tokenization. The vision is to open a “secondary market” that will allow investors to trade shares of successful crowdfunded companies on the Sinwattana platform. This would allow investors to buy into more mature, fast-growing companies. The increased market breadth would enhance the vibrancy of the crowdfunding scene. Sinwattana aspires to open the possibility for great SMEs of Thailand to meet global demand and standards. Sinwattana offers a great platform for foreign entrepreneurs who wish to expand their businesses into Thailand for strategic purposes and market share.

VI. RECOMMENDATION FOR POLICY AND PRACTICE

A. Strengthening Thailand's Digital Entrepreneurship Dynamics

The study has confirmed the important role entrepreneurs play as economic resilience enablers. Thai start-ups are founded and led by dynamic entrepreneurs who adapt to different changes and crises. When the COVID-19 pandemic first broke out in Thailand in early 2020, most Thai start-ups and entrepreneurs used digital technologies, innovation, and assets to pivot their business models. Their ability to adapt to the adverse impacts of the pandemic in a relatively short time is the best proof of their entrepreneurial dynamic. Additionally, the digitalization of their business model elements greatly helps lessen the negative impacts of the pandemic. Their digitalized assets enable the entrepreneurs to adapt and revise their business quickly and effectively respond to all the conditional changes.

The entrepreneurship mindsets and capabilities, combined with their digitalized business models, are the keys to turning crises into opportunities, finding new markets, adapting their products and services, and continuing to create economic values. Some interviewed firms took this crisis opportunity to streamline their human and workflow operations to become more efficient. Some reveal that they changed their business models. To name a few, Locanation changed from an online real estate influencer serving foreigners who want to buy property in Thailand to Online Travel Agent. Hungry Hub changed from offering application-based buffet deal offerings and reservations to a food delivery model that targets unique meal sets and special prices deal segments.

Opportunities to access digital technologies and the ability to integrate them into business models and drive business performance are all important to the digital entrepreneurship journey. We have referred to entrepreneurial resilience mechanisms. Thus, the national policies and relevant stakeholders in the entrepreneurship ecosystems have their role in facilitating and speeding up this digital entrepreneurship process and mechanisms. Considering the AIDES results that Thailand has challenging issues in human capital and knowledge dissemination pillars, the efforts and resources should focus on strengthening knowledge sharing, entrepreneurship skills, technology skills, and programs to lift entrepreneurs' capability to access technologies, foresee business opportunities from such technologies, digitalize their business models, and turn them into profits.

Another important insight we have witnessed is the role of digital entrepreneurs in driving social missions. As mentioned earlier, the Thai start-ups have united and pulled together their various digital solutions and entrepreneurship mindsets to help the country manage the health care crisis and lead economic recovery. Therefore, this phenomenon suggests that related stakeholders could leverage digital entrepreneurs for social impact and create platforms to tap into their social-oriented collaborative potentials.

B. Digitalizing Health and Wellness Further

The growth potential of health tech and the rising demand for health services present strong opportunities for the digital health and wellness industry. Highly skilled medical professionals and hospitality mindsets are the key assets that could strengthen Thailand's regional position in this sector when incorporated with the potential of advanced technology and innovation. As mentioned earlier, this industry is unique. The majority operates in the B2B space through health care provider organizations, and operational policy constraints of public sector organizations define the market conditions and viable operation models for business operators. The partnership among B2B players is the key to tapping into end customers' consumption of health tech. However, B2C is the potential that is waiting to be tapped as the COVID-19 pandemic has set new normal consumer behaviors to self-reliance, self-management, and care close to home.

In terms of the technology potential, various technologies such as artificial intelligence, blockchain, cloud computing, virtual reality, robotics, and 5G are all the keys to enabling various service applications and innovative business models. Some areas include medical diagnosis, devices and monitoring, telehealth and remote care, hospital management, mental health, and even finance and insurance for health are all promising and have a huge demand to innovate further. Thailand has great potential for health tourism, where digital technologies can offer value-added health and tourism services. As both the health and wellness and tourism sectors are working well on their digitalization journey, great opportunities lay in aligning digital technologies with business ideas and partnerships to offer innovative business models for this particular segment.

Another interesting phenomenon highlights the cross-sector collaborations to expand resource pool, market potential, and dynamic resource reallocation for entrepreneurs. The digital health and wellness industry is not necessarily confined to players that directly target this segment. Pressured by the pandemic crisis, start-ups in other industries have found opportunities to apply their digital technologies, products, and services to the health and wellness industry. One great

example is QueQ, which was and still is an online restaurant queue booking application. QueQ adapts its online queue booking system to help the COVID-19 vaccination service centers organize queues, lower traffic congestion, and ensure social distancing.

Further, in collaborating with the Medical Council of Thailand, start-ups from various industries apply their digital technologies and assets to assist the field hospitals and medical personnel during the COVID-19 pandemic. Their digital solutions help speed up Thailand's economic recovery. Importantly, in the process, start-ups have found new opportunities to expand and revise their products to serve this emerging health-related segment.

It is thus clear that Thai start-ups and their solutions are dynamic enough to fit in any market and industry. Thus, the entrepreneurs who have entrepreneurial dynamics in their operations and mindsets can help businesses have resiliency and great adaptability to fit into any market situation. Another important takeaway for entrepreneurs is that synergies between different start-ups can help create new business models with even larger positive impacts on all stakeholders.

One implication is that the Government of Thailand and related stakeholders could provide financial and nonfinancial incentives, supporting programs, or partnership matching for entrepreneurs to help them look beyond the single sector and adapt or pivot their business models to serve various industries to expand the market size. Of course, as the health and wellness industry is growing and Thailand is boldly aiming to excel in this segment, this industry is thus attractive enough for entrepreneurs to play their part in this space. The opportunities for start-ups and businesses from other industries to meet with those from the health and wellness industry to create synergies between different types of businesses are strongly encouraged and should be promoted. Digital technology synergies can help Thailand and Thai start-ups have unique and scalable digital assets and businesses. Engaging entrepreneurship communities in various sectors should be promoted. As one important pillar in the AIDES framework, networking and support could be strengthened by building entrepreneurship communities and cross-fertilizing across sectors. Coworking spaces, establishing associations and councils, and innovation districts pulling solutions seekers and providers in the region are some examples to drive this endeavor. Specifically, the health care innovation district could incorporate players and stakeholders that may not directly involve the health care industry but relate to the lifestyle behaviors of well-being consumers.

VII. KEY TAKEAWAYS

- (i) The entrepreneurial dynamic depends largely on entrepreneurship mindsets and digital assets.

Start-ups' ability to adapt to the adverse impacts of the pandemic in a relatively short time is the best proof of their entrepreneurial dynamic. The entrepreneurship mindsets and capabilities combined with their digitalized business models are the keys to turning crises into opportunities, finding new markets, adapting their products and services, and continuing to create economic values. Developing skill sets and knowledge to entrepreneurs regarding technology and business aspects is strongly encouraged.

- (ii) Entrepreneurial resilience mechanisms should focus on access to digital technologies and the ability to integrate them into business models.

Opportunities to access digital technologies and the ability to integrate them into business models and drive business performance are all important to the digital entrepreneurship journey. Considering the AIDES results, Thailand has challenging issues in human capital and knowledge dissemination pillars, which are the key quality of the entrepreneurship dynamic. Thus, the efforts and resources should strengthen knowledge sharing, entrepreneurship skills, technology skills, and programs to lift entrepreneurs' capability to access technologies, foresee business opportunities from such technologies, digitalize their business models, and turn them into profits.

- (iii) The social mission could mobilize digital entrepreneurs to recover the economy.

The Thai start-ups have united and pulled together their various digital solutions and entrepreneurship mindsets to help the country manage the health care crisis and lead economic recovery. Therefore, this phenomenon suggests that related stakeholders could leverage digital entrepreneurs for social impact and create platforms to tap into their social-oriented collaborative potentials.

- (iv) Innovative forms of B2B space and rising demand in B2C for digital health and wellness. As a key market condition that digital products need to accommodate the integration and adaptation into purchasing health care organizations' infrastructure. The alternative business models such as B2B2C and B2B2G are promising. The partnership among B2B players is the key to tapping into end customers' consumption of health tech. However,

B2C is the potential that is waiting to be tapped as the COVID-19 pandemic has set new normal consumer behaviors to self-reliance, self-management, and care close to home, especially with the working-age segment. Another promising segment for Thailand is health tourism, where digital technologies can offer value-added to bring together health and tourism services.

(v) Cross-sector collaborations to serve a healthy lifestyle.

Another interesting phenomenon highlights the cross-sector collaborations to expand resource pool, market potential, and dynamic resource reallocation for entrepreneurs. The digital health and wellness industry is not necessarily confined to players directly targeting this health care segment but rather a wider lifestyle segment. One great example is QueQ, which was and still is an online restaurant queue booking application. QueQ adapts its online queue booking system to help the COVID-19 vaccination service centers organize queues, lower traffic congestion, and ensure social distancing. We have witnessed start-ups from various industries collaborate and apply their digital technologies and assets to assist the field hospitals and medical personnel during the COVID-19 pandemic. Thus, the entrepreneurs who have entrepreneurial dynamics in their operations and mindsets can help businesses have resiliency and great adaptability to fit into any market situation. Promoting cross-sector networking and collaboration could uncover synergies between different start-ups, and thus innovate business models with even more significant positive impacts on all stakeholders.

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