Data collection survey on the promotion of safe, globally-inclusive digital economies

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Summary

1. Background and objectives of this survey

The spectacular spread of mobile phones and the internet over the past 30 years has driven global computerization and the rise of digital economies, and because of this, emerging countries are expected to achieve what has come to be known as "leap frog-style" economic development. However, the "digital divide," in which some people are unable to enjoy the benefits of mobile phones, the internet and other digital technologies, continues to impede sustainable, fair economic development. Several important questions arise, including how to close the digital divide, and how to ensure safety and reliability in cyberspace so that people can carry out digital activities. Behind this assessment is JICA's belief that there are five priority topics to be addressed in the development of digital economies that will lead to prosperous societies: (1) strengthening the capacity for making and implementing policies; (2) enhancing telecommunications infrastructure; (3) developing digital-related talent; (4) setting up innovation ecosystems; and (5) improving cybersecurity.

This assessment was conducted with the objective of examining the form which assistance programs should take for the above five priority topics in five countries: Cambodia, Laos, Mongolia, Thailand, and the Philippines. Regarding (5) improving cybersecurity, the assessments in Mongolia and Cambodia were carried out with the objective of specifying the content of their request to JICA, since both are already discussing the formation of projects in this area.

To meet the above objectives, we gathered basic information on the current status of each target country, and identified their assistance needs. As a part of the process, we also assessed other countries to use as examples, such as Singapore and Malaysia. This report reflects on what was learned in these comparisons, and describes the implications for the formation of future JICA projects.

Since improving cybersecurity had different assessment objectives than the other priority topics (promotion of inclusive digital economies), we selected approaches that would correspond to each respectively. For this reason, the present report is also divided into sections.

2. Approaches for considering assistance programs for promoting inclusive digital economies

This section explains the consideration of assistance programs for promoting inclusive digital economies taken up in Chapter 2 of this report.

Promoting inclusive digital economies means achieving inclusive and sustainable economic growth through digitizing economic activities, while closing the digital gap. To achieve this, we conducted this study in three stages, as a procedure for clarifying what needs to be done: first arranging an orientation toward digitalization, followed by identifying potential issues, and then formulating assistance programs that would fall under the 5 priority topics mentioned above.

What distinguishes this approach is its “orientation toward digitalization” for each target country; that is, the attempt to identify key strategic sectors for digitalization. We found this step to be necessary because in order to identify the assistance needs and the format of assistance programs at a detailed level in each target country for each of the five priority topics, it was essential to understand the orientation each country should take toward digitalization.

The following is a summary of each country based on the above approach.

Cambodia

In arranging the orientation toward digitalization in Cambodia, we discovered the following ten sectors as focus areas, based on documents such as the “Rectangular Strategy,” which indicates the orientation of Cambodian government’s economic growth strategy. These sectors are tourism, agriculture, manufacturing, textiles, pharmaceuticals, wholesale/retail, public services, transportation, oil and gas, and entertainment. We then evaluated these sectors from three points of view: degree of priority and consistency of assistance in JICA, digital divide potential, and the size of impact on the economy/society as a whole. As a result, we identified agriculture and public services (healthcare) as the two key strategic sectors for digitalization in Cambodia.

Digitalization is progressing more slowly in agriculture than in other sectors in Cambodia, and given the small amount of GDP per capita, it is highly likely that this is an area with a digital divide. Furthermore, considering its large GDP component ratio (21%) and employment population component ratio (35%), digitalizing the agriculture sector may have a large impact on the economy and society.

On the other hand, Cambodian agriculture faces the following challenges. The first is that producers have weak ties to the market, and the sector is not very commercialized. The second is the low level of productivity. The third challenge is that agricultural production is not very versatile, with much of it occupied by rice, which has a low unit price by surface area of farmland. The fourth is the need to care for the environment, with issues like exhausted water resources and worsening soil quality. The fifth challenge is that the distribution infrastructure (roads, etc.) is not fully in order, and the power supply is unstable, making it difficult to safely store food.

To resolve these issues, some of the areas in which there is room for the use of digital solutions for visualizing supply chain information include establishing and popularizing platforms that give essential information (e.g. on seeds, agrochemicals, fertilizers, sustainable cultivation methods, crop prices, and markets) to farmers, introducing smart agriculture (precision agriculture, soil sensors, drones, etc.), and RFID (Radio-frequency identification, a system that allows users to remotely read and write tag data using radio waves).

Like agriculture, Cambodia’s public service (healthcare) sector is progressing slowly, and it is highly likely that this is an area with a digital divide. Since this is a sector that provides services to the entire population, making progress in digitalization would lead directly to a shrinking of the digital divide, and should be effective for realizing an inclusive digital economy.

Cambodia's Ministry of Health states that its vision is to provide high-quality healthcare to all citizens as a part of sustainable socioeconomic development. However, the following challenges will be involved along the way to achieving the above vision. First, the number of physicians, hospital beds, and other healthcare resources is insufficient; second, there is a large disparity in healthcare between urban and rural areas; third, digitalization of healthcare data is lagging behind; and fourth, a large amount of healthcare costs are paid at the expense of the individual. With the spread of COVID-19, there is an even greater need to resolve these issues.

Some digital-based solutions to these challenges would include reducing the regional healthcare gap by using urban doctors more efficiently with telemedicine, setting up a centralized healthcare database for sharing clinical records, and curtailing medical expenses by promoting preventive medicine with digital applications.

When identifying potential issues, we kept the above-mentioned digitalization orientation in key strategic sectors in mind, and assessed the degree of maturity of the priority tasks (enablers) that would drive this assistance, using publicly available documents and interviews with specialists and our counterparts' government agency employees.

In terms of capacity in making and implementing policies, the government has formulated a vision for ICT, and ICT regulations are assessed as being largely similar to other countries. However, potential issues have come up in that policies do not match with digital healthcare in the key sector of the public healthcare system, and in that policy implementation capacity is insufficient.

As for telecommunications infrastructure, the 4G network is being put into place, and 74% of the populace now has smartphones, but we found that in rural areas the mobile networks are slow, and the rate of smartphone use is still low.

The proportion of talent in the ICT sector, which forms the basis of digital talent, is only 0.2% at present, lower than other countries. To supply the number of workers needed in this area for future economic development, they will need to prioritize training traditional IT talent. The challenges in this area are the quality of math and science education, and the difficulty of using online educational content due to low proficiency in English.

Regarding the innovation ecosystem, on the startup side of things, the corporate tax rate is lower than other countries, at 23%, but the number of days needed to start a business is 99, longer than the other countries assessed in this study. Furthermore, since there is little funding for research and development, academic institutions do not have sufficient mechanisms to secure outstanding talent as knowledge contributors. Additionally, since VC investment is a small percentage of GDP, there is no funding for startups to scale. As for market access, the digital market that facilitates independent innovation is lacking.

To examine the format of assistance programs, we conducted an assessment of the above-mentioned potential issues based on three different perspectives: (1) impact anticipated from solving the issue; (2) our counterparts' level of interest; and (3) JICA'S interest. The resulting conclusion was that we should

prioritize two challenges: the low rate of smartphone use in rural areas (Challenge 1) and the low quality/amount of IT engineering education (Challenge 2).

Initiatives for Challenge 1, the low rate of smartphone use in rural areas, might include giving subsidies or low-interest-rate government-guaranteed bonds or loans to promote the purchasing of devices, setting up device terminals in public institutions, and providing free or low-cost broadband access plans.

Challenge 2, low quality/amount of IT engineering education, could be met with initiatives to first improve accessibility to online content. Being able to train many people simultaneously would be a method suited to Cambodia's situation, in which the overall number of ICT personnel is low. The second initiative would be to improve the quality of training in educational institutions. In efforts such as this, it would be important to strengthen ties between the government, universities, and industry.

Based on the above, JICA's assistance programs for these priority topics would be as follows.

Program 1

Figure 1. Overview of Cambodia assistance program: Improve proliferation of devices

Program Components	Objectives of this program	Cost estimate via outside-in study
Institutions receiving assistance: • MPTC (Ministry of Post, Telecom and Communications) • Each ministry (may become future assistance recipients) **Target assistance activities:** • Improve device proliferation • Familiarize/educate how to use devices	**Stimulate economic/social activity, especially in rural areas** • Agriculture: Essential production information will be accessible to farmers, improving productivity • Healthcare: With telemedicine, healthcare access will improve in rural areas Expand digital services through the spread of devices: Digital services will increase in other areas Develop sustainable digital economies after the assistance period: The use of digital services will continue even after the assistance period, due to improved income from stimulated economic activity and more convenient digital services	**Total project cost estimate 1: Several billion JPY** • Device proliferation improvement: several billion JPY – Number of devices: ~900,000 – 16.5 million (population) × 26% (smartphone ownership: 74%) × 20% (people per household: ~5) = ~900,000 – Device unit price: JPY 20,000~30,000 • Familiarize/educate how to use devices: JPY tens of millions – Labor costs and overhead – Training expenses (teaching materials, venues, etc.)

1. These are estimates of all costs needed to implement the project, and do not necessarily align with JICA assistance amount

Program 2

Figure 2. Overview of Cambodia assistance program: IT engineer training

Program Components	Expected impact of this program	Cost estimate via outside-in study
Institutions receiving assistance: • MPTC (Ministry of Post, Telecom and Communications) **Target assistance activities:** • Improve accessibility of online content • Improve quality of IT education in universities	Provide IT talent needed by the economy/society (agriculture, healthcare, etc.): Achieve this by improving the quality of online content and university IT education **Stimulate digital economic activity by supplying IT talent**	**Total project cost estimate[1]: ~several 100 million JPY** • Online content: ~JPY 100 million – Number of trainees: several thousand – Number of ICT personnel in 2019 was approx. 16,000 – Demand for ICT personnel in 2030 is estimated between 33,000 and 134,000 – 1,500~11,000 ICT personnel will need to be trained every year • Participation fee per person: ~JPY 15,000 – JPY 5,000/month × 3 months = JPY 15,000 • Improve university education: ~JPY tens of millions

1. These are estimates of all costs needed to implement the project, and do not necessarily align with JICA assistance amount

Laos

In arranging the orientation toward digitalization in Laos, we discovered the following ten sectors as focus areas, based on documents that indicate the orientation of the Laotian government's economic growth strategy. These sectors are agriculture, wholesale and retail, tourism, energy, mining, finance, education, infrastructure and distribution, public services, and manufacturing and processing (including the handicraft industry). We then evaluated these sectors from three points of view: degree of priority and consistency of assistance in JICA, digital divide potential, and the size of impact on the economy/society as a whole. As a result, we identified agriculture and education as the two key strategic sectors for digitalization in Laos.

Digitalization is progressing more slowly in agriculture than in other sectors in Laos, and given the small amount of GDP per capita, it is highly likely that this is an area with a digital divide. Furthermore, considering its large GDP component ratio (15%) and employment population component ratio (61%), digitalizing the agriculture sector may have a large impact on the economy and society.

On the other hand, Laotian agriculture faces the following challenges. The first is that productivity is low. Compared with other countries, most farmers are engaged in subsistence agriculture. In order to achieve the competitive agriculture production and modern agriculture economy the Laotian government

seeks, they will need to commercialize these subsistence farming operations and raise productivity. The second issue is that the agriculture market lacks transparency. Many farmers do not produce crops based on demand and price information. The third issue is that of sustainability. In Laos, there has always been a lot of organic farming, and the government also promotes clean agriculture in line with Good Agriculture Practice (GAP). The fourth challenge is the need to strengthen not only productivity but also the processing and distribution parts of the supply chain, to improve the competitive edge of agriculture. In Laos, roads and other distribution infrastructure components are not fully in order, and storage facilities are also lacking. This results in greater food loss than in other countries.

Digitally-enabled solutions to the above challenges could take two orientations: improving the environment for farmers to access information, and introducing equipment and software based on the latest technology. Specific options would include building and popularizing a platform for farmers to get the information they need, introducing smart agriculture, and reducing food loss by visualizing supply chain information using RFID or similar solutions.

Regarding education in Laos, the government states its vision as "By 2030 all Lao population equally and equitably have access to quality education in order to become good citizens, disciplined, healthy, knowledgeable, highly-skilled with professionalism in order to sustainably develop the country, to align, and be compatible with the region and the world." However, the current dropout rate for elementary school is 20%, and for junior high school the rate is 40%, showing that children do not necessarily have full access to compulsory education. The context for this high dropout rate includes causes like poverty and low-quality education at the elementary level, and the additional factor for long school commutes for junior high school. There is also the issue of disparities in education quality between urban and rural areas.

A digitally-enabled solution to the above challenges might be effective remote education. To start, students would have an easier time balancing their classes and family business by being to set their own hours. Secondly, it would allow rural students to use remote facilities to take classes with licensed teachers in urban areas, which would likely improve the quality of their education. Thirdly, this solution would cut the long commute times, making it easier for students who had given up on commuting to continue learning.

When identifying potential issues, we kept the above-mentioned digitalization orientation in key strategic sectors in mind, and assessed the degree of maturity of the priority tasks (enablers) that would drive this assistance, using publicly available documents and interviews with specialists and our counterparts' government agency employees.

Regarding the capacity to make and implement policies, although the importance of ICT is increasing in the government, Laos scored 36 points out of 100 on the 2020 ITU ICT Regulatory Tracker which examines ICT regulations, showing room for improvement when compared with other countries. We also found that there is the issue of insufficient budget and authority to promote digital economies.

The telecommunications infrastructure is troubled by insufficient 4G network establishment and low smartphone ownership. Given the context of the country's mountainous regions, Laos's 4G coverage is at 43%, which is insufficient. Smartphone proliferation has only reached 35% as of 2021, lagging behind.

The proportion of talent in the ICT sector, which forms the basis of digital talent, is only 0.3% at present, lower than other countries. To supply the number of workers needed in this area for future economic development as projected for 2030, they will need to prioritize training IT engineers. The challenges in this area are the low quality of math and science education, and the difficulty of using English-language online content due to low proficiency in English.

Regarding the innovation ecosystem, on the startup side of things, the corporate tax rate is lower than other countries, at 24%, but the number of days needed to start a business is 173, the longest among the countries assessed in this study. As for knowledge contributors, there do not seem to be sufficient universities or budgets to assist technological innovation. Regarding investors and supporters as well, there is little VC investment, leading to little funding to allow startups to scale and few mentorships by local digital entrepreneurs.

To examine the format of assistance programs, we conducted an assessment of the above-mentioned potential issues based on three different perspectives: (1) impact anticipated from solving the issue; (2) our counterparts' level of interest; and (3) JICA'S interest. The resulting conclusion was that we should prioritize three challenges: the low rate of smartphone use in rural areas (Challenge 1), the low 4G coverage and slow network speeds (Challenge 2), and the lagging development of ICT regulations (Challenge 3).

Initiatives for Challenge 1, the low rate of smartphone use in rural areas, and Challenge 2, the low 4G coverage and slow network speeds, might include giving government subsidies or low-interest-rate government-guaranteed bonds or loans to promote the purchasing of devices, setting up device terminals in public institutions, and providing free or low-cost broadband access plans. It will also be crucial to spread understanding of usage methods when promoting the use of devices. When users recognize the convenience of using the devices and reap economic or social benefits from them, they will likely continue to use them.

An initiative to solve Challenge 3, the lagging development of ICT regulations, would be to identify and establish regulations essential for executing the government's vision. The scope of regulations in the ICT area is expansive, running from regulations on building infrastructure, to securing a competitive environment for digital services, protecting data, and digital taxation. For this reason, it is important to brainstorm with a wide range of players such as technology companies, and grasp the needs in the country, when examining the regulatory system.

Based on the above, JICA's assistance programs for these priority topics would be as follows.

Program 1

Figure 3. Overview of Laos assistance program: Install 4G mobile networks and improve use of devices

Program Components	Expected impact of this program	Cost estimate via outside-in study
Institutions receiving assistance: • MPT (Ministry of Post, Telecom and Communications) • Each ministry (may become future assistance recipients) **Target assistance activities:** • Set up structures/systems • Set up infrastructure to improve 4G coverage • Improve device proliferation • Familiarize/educate how to use devices	**Stimulate economic/social activity, especially in rural areas** • Agriculture: Essential production information will be accessible to farmers, improving productivity • Education: Improve educational quality and access with remote learning, and reduce the dropout rate for elementary and junior high school education Expand digital services through the spread of devices: Digital services will increase in other areas Develop sustainable digital economies after the assistance period: The use of digital services will continue even after the assistance period, due to improved income from stimulated economic activity and more convenient digital services	**Total project cost estimate[1]: JPY 50 billion ~ 150 billion** • 4G network: Setup JPY 50 billion ~ 130 billion – Number of towers, equipment, and transmissions: ～4,000 – Unit price of towers and equipment: JPY 12 million ~ 30 million – Unit price of transmissions: JPY 1.5 million ~ 2 million • Improve device proliferation: JPY 15 billion ~ 25 billion Number of devices: ~800,000 Device unit price: JPY 20,000~30,000 • Familiarize/educate how to use devices: JPY tens of millions – Labor costs and overhead – Training expenses (teaching materials, venues, etc.)

1. These are estimates of all costs needed to implement the project, and do not necessarily align with JICA assistance amount

Program 2

Figure 4. Overview of Laos assistance program: Review and reform ICT regulations

Program Components	Expected impact of this program	Cost estimate via outside-in study
Institutions receiving assistance: • MPT (Ministry of Post, Telecom and Communications) **Target assistance activities:** • Survey domestic needs • Benchmark analysis • Draft tentative regulatory system	Environment for economic development of domestic industries Preparation: Prepare ICT/digital regulations, and create an environment in which domestic companies can develop and provide ICT/digital services in a fair competitive environment Participate in international digital economies: Take part in making frameworks for international data use by meeting international ICT/digital regulations	**Total project cost estimate[1]: JPY tens of millions** • Labor costs and overhead for sending in specialists

1. These are estimates of all costs needed to implement the project, and do not necessarily align with JICA assistance amount

Mongolia

In arranging the orientation toward digitalization in Mongolia, we discovered the following eight sectors as focus areas, based on documents that indicate the orientation of the Mongolian government's economic growth strategy. These industries are mining, agriculture, transportation, public services, IT, energy, tourism, and creative occupations (culture, the arts, film, music, design, architecture). We then evaluated these sectors from three points of view: degree of priority and consistency of assistance in JICA, digital divide potential, and the size of impact on the economy/society as a whole. As a result, we identified public services and the IT industry as the two key strategic sectors for digitalization in Mongolia.

Public services in Mongolia are not a large portion of GDP (4%) nor are they a major employer (8% of the population), but since this sector provides services to the entire population, making progress in digitalization in applicable sectors would directly help shrink the digital divide, and should be effective for achieving an inclusive digital economy. The Mongolian government states the following as the mission for the public sector. "To promote an effective and efficient transition to e-governance, to optimize the nation's administrative functions and authority, and to implement government services that are specialized, competent, transparent, effective, and smart." Meanwhile, they face the following challenges in achieving this vision. The first is that citizens have limited access to public services. E-Mongolia, an e-governance service for citizens, was launched in October 2020, but according to a survey conducted by the Mongolian Statistics Bureau and the UN, only 31% of the population has basic IT skills. The second challenge is government transparency. According to a 2020 survey by Transparency International, Mongolia's Corruption Perception Index ranked 111 out of 180 countries, with 69% of respondents stating that they were aware of corruption as a major issue. The third challenge is that government operations are not efficient enough. Many government ministry procedures are done on paper. The fourth challenge is that

data usage is limited. Currently, although the National Data Center collects various kinds of data, the laws necessary for promoting data use have not been established, so government authorities and businesses cannot fully use this data.

Effective solutions to the above challenges would include improving citizen IT literacy, preparing a platform to facilitate disclosure of government activities, promoting e-governance by standardizing administrative systems and improving the digital capabilities of government employees, and creating an environment for facilitating data use by strengthening data governance.

The Mongolian IT industry is one of the Mongolian government's targets for reinforcement, and it plays a role in their vision for contributing to economic growth. However, the following challenges remain. The first is that the small scale of the domestic market is impeding IT industry development. The second is its relative lack of appeal in the country, compared with other industries. Mining is the biggest growth industry in Mongolia, accounting for roughly one quarter of GDP. Additionally, the mining industry's average annual GDP growth is extremely high, at 8% (2015-2019). Meanwhile, the IT industry is only 2% of GDP (2019) and has a sluggish average annual growth of -4% (over the same period), causing it to fall behind other industries in terms of appeal.

One effective solution to the above challenges would be to grow the parts of the industry oriented toward the overseas market, thus increasing the appeal of the industry. Specifically, we would expect this approach to involve cultivating the industry through offshore IT centers for overseas companies, and developing IT companies that are internationally competitive, assisting them as they advance into the international market.

When identifying **potential issues**, we kept the above-mentioned digitalization orientation in key strategic sectors in mind, and assessed the degree of maturity of the priority tasks (enablers) that would drive this assistance, using publicly available documents and interviews with specialists and our counterparts' government agency employees.

Regarding the capacity to make and implement policies, although the government is giving greater priority to ICT, we discovered these challenges: Their vision does not have enough specific policies and measures established according to experts; IT systems and data are not linked across ministries to help implement policies; and citizens and government employees do not have enough IT literacy.

As for telecommunications infrastructure, given that smartphone and broadband proliferation is at a high level, and network usage fees are affordable, this is not a major potential area assistance.

In terms of digital talent, 1.1% of the employed population works in the ICT sector, a relatively high rate on par with Thailand (1.1%) and Japan (1.5%). However, since the overall population is low, in absolute numbers this only reaches a level of about 20,000 people, the lowest among Asian countries. Highly talented personnel go overseas to work, spurring on the shortage in human resources.

Regarding the innovation ecosystem, Mongolia compares favorably with other countries in metrics such as the number of days needed to start a business, the number of procedures that need to be done to start a business, and the corporate tax rate. On the other hand, we found that there are few entrepreneurs, higher

education can hardly be said to be sufficient, and there is little investment from domestic, foreign, and government sources.

To examine the format of assistance programs, we conducted an assessment of the above-mentioned potential issues based on three different perspectives: (1) impact anticipated from solving the issue; (2) our counterparts' level of interest; and (3) JICA'S interest. The resulting conclusion was that we should prioritize three challenges: preparing e-governance systems (Challenge 1), improving the digital capabilities of government employees (Challenge 2), and educating citizens in IT literacy.

Specific initiatives for Challenge 1, promoting the preparation of e-governance systems, could include developing middleware to link existing systems, rebuilding the systems themselves, and establishing guidelines that would act as indicators for developing or expanding new systems in the future.

We can expect the following kinds of difficulties in strengthening e-governance. The first is that execution speed may suffer as there would need to be cooperation and coordination between multiple ministries. The second is that some of the on-site employees that actually use these systems may not have incentives to improve government administrative transparency with digitalization, and in some cases it may be difficult to get on-site cooperation. With these difficulties in mind, we believe that it will be essential to build a strong driving structure underneath strong leadership in order to implement, and that an approach using deliver units would be effective.

A delivery unit is typically set up across multiple ministries, working directly under the prime minister. It is a group that directs implementation in major transformations, acting to ensure reliable implementation by giving progress reports to the prime minister and running highly frequent PDCA cycles to solve problems. These units have been put to practical use in government transformation programs in over 20 countries globally, and this approach has proven results. In Mongolia's case, since the action plan includes mention of setting up an "e-government committee (council)" directly under the prime minister, we believe that it will be important to plan the appropriate authority, personnel, governance, operations, and budget so that this organization can fulfill the role of a delivery unit.

Initiatives for Challenge 2, improving the digital capabilities of government employees, could include hiring highly skilled professionals, setting KPIs that incorporate digital capabilities into performance review items to then motivate government employees to learn, and exchanging personnel with IT companies through temporary transfers.

Based on the above, JICA's assistance programs for these priority topics would be as follows.

Figure 5. Overview of Mongolia assistance program: Strengthen E-Government, improve the digital capabilities of government employees, and encourage citizens to use E-Mongolia

Program Components	**Expected impact of this program**	**Cost estimate via outside-in study**
Institutions receiving assistance:	Improve accessibility, efficiency, and convenience of administrative services	**Total project cost estimate[1]: Several billion JPY**

Program Components	Expected impact of this program	Cost estimate via outside-in study
• CITA and CITA-led Delivery Unit • Each ministry (may become future assistance recipients) **Target assistance activities:** • Strengthen governance of E-Government, prepare platform, train government employees for promoting use of the platform • Trainings for government employees with the objective of improving digital/IT capabilities • Trainings for citizens with the objective of facilitating their use of E-Mongolia	• Raise the E-Mongolia usage rate from 31% to 95% of citizens • Raise the rate of government employees capable of using E-Government to 100% • Have 95% of administrative operations completed electronically Strengthen and develop inclusive digital economies by strengthening the capability to make and implement government digital and IT policies **Stimulate the Mongolian IT industry** • The scale of the Mongolian IT industry will expand if the government orders large-scale development, operations, and maintenance projects for the E-Government platform and related applications • By transferring know-how with this assistance, the capabilities of the Mongolian IT industry will improve	• E-Government systems integration: JPY several billion — E-Government platform development: JPY several billion — E-Government platform maintenance and operations: Approx. 20% of development costs annually • E-Government systems training: JPY tens of millions — Labor costs and overhead for sending in specialists — Training expenses (teaching materials, venues, etc.) • Citizen digital literacy training: JPY hundreds of millions — Labor costs and overhead for sending in specialists — Training expenses (teaching materials, venues, etc.)

1. These are estimates of all costs needed to implement the project, and do not necessarily align with JICA assistance amount

Philippines

In arranging the orientation toward digitalization in the Philippines, we discovered the following seven sectors as focus areas, based on documents that indicate the orientation of the Philippine government's economic growth strategy. These sectors are manufacturing, tourism, finance, agriculture, IT BPM/KPO (Business Process Management/ Knowledge Process Outsourcing), public services, and transportation/logistics. We then evaluated these sectors from three points of view: degree of priority and consistency of assistance in JICA, digital divide potential, and the size of impact on the economy/society as a whole. As a result, we identified agriculture and manufacturing as the two key strategic sectors for digitalization in the Philippines.

Regarding agriculture, the Philippine government mentions an aim of "expanding economic opportunities for farmers, and increasing access to economic opportunities to that end." However, the following challenges remain. The first is that the country lacks mutual assistance structures for farmers in the form of agricultural cooperatives, making it difficult for synergy and bargaining power to take off. The second challenge is that production costs such as electricity and seeds are expensive, and that productivity

is low because the industry is not very mechanized. The third challenge is the geography of the country, composed of a large number of islands. This impedes distribution times and makes transportation costs expensive. The fourth challenge combines the above factors to result in high crop prices in the Philippines.

Effective digitally-enabled solutions to the above challenges would include building an online information-sharing and services platform to assist mutual assistance between farmers. This platform could include content such as joint purchases of agricultural materials, tutorials on highly productive farming methods, acquisition of market value for crops, shared use of agricultural equipment, access to financial products and services, cooperative transport, transport management and tracking, and sales of agricultural produce.

Manufacturing accounts for a high amount of GDP in the Philippines (19%) as well as a high proportion of the employed population (9%), suggesting that it has a large impact on the economy and society as a whole. There are roughly 120,000 companies in the country, of which 96% are small to medium or micro-enterprises with 200 or fewer employees. While 58% of manufacturing workers are employed at these small enterprises, they only account for 13% of added value. Therefore, if labor productivity can be raised through digitalization at small, medium and micro-enterprises that employ such a large number of people, this will not only stimulate the economy, it will likely also improve inclusion in the digital economy.

Meanwhile, the Philippine manufacturing industry, and particularly small enterprises, face a few challenges. The first is the high sales costs. One primary factor in this is the high cost of electricity, which pushes manufacturing costs up. The second challenge is low productivity. Since there are many suppliers with different strong points, and a low level of mechanization, there is a tendency toward build-to-order manufacturing in a workshop type of setting. The third challenge is the shortage of highly skilled professionals. Highly skilled workers leave the country in search of better working conditions, and it is difficult to get high-level talent in the country. The fourth challenge is that there are few opportunities to make management decisions based on data. In areas such as performance reviews, procurement planning, and demand forecasting, decisions are often made without a basis in objective facts. The fifth challenge is product competitiveness. Since manufacturing costs are high, product prices are sometimes higher than those of foreign products, and products are less competitive due to poorer technical prowess and marketing skills compared with large companies in the country.

Some effective solutions for the above challenges would include optimizing electricity use with smart grids, developing and popularizing an online information-sharing and service platform that matches manufacturers with those placing orders, developing and popularizing a platform for easily finding highly skilled professionals, and familiarizing people with digital software that assists objective business management.

When identifying **potential issues**, we kept the above-mentioned digitalization orientation in key strategic sectors in mind, and assessed the degree of maturity of the priority tasks (enablers) that would drive this assistance, using publicly available documents and interviews with specialists and our counterparts' government agency employees.

Regarding capabilities in making and implementing policies, the government is raising the level of priority of ICT, and compared with other countries, there are no issues with the level of regulation. However, there is not enough activity to promote the domestic-oriented IT industry, and there are challenges with policy consistency.

The challenges in telecommunications infrastructure include low network coverage in rural districts and a low rate of smartphone ownership. Reasons for this include the fact that smartphone prices are high relative to farmers' average income, and farmers do not have the skills to use smartphones well, or they are not interested in using them in the first place. In the manufacturing industry, most facilities are centered in the Manila capital city area, which has an increasing level of broadband coverage. For this reason, the manufacturing industry does not seem to have challenges in this area.

As for digital talent, the bulk of this is made up of IT personnel, an industry that is third-largest in the country, with many workers involved in offshore IT services. We did not find any challenges in this area, but few people are capable of providing solutions for agriculture grounding in an understanding of both agriculture and digital technology. We also found that highly skilled professionals tend to leave the country, and that there is not enough advance education in digital technologies.

Regarding the innovation ecosystem, few businesses are started relative to the population, the context for which may be due to the greater number of procedures necessary in comparison with other countries (16) and the high corporate tax rate (43%). The low number of investors and supporters is also an issue.

To examine the format of assistance programs, we conducted an assessment of the above-mentioned potential issues based on three different perspectives: (1) impact anticipated from solving the issue; (2) our counterparts' level of interest; and (3) JICA'S interest. We came to the conclusion that the following three challenges should be prioritized: the shortage of personnel that understand the agriculture business as well as digital technologies (Challenge 1); the shortage of advanced education in digital technologies (Challenge 2); and the shortage of startups that offer digital solutions to farmers and small enterprises (Challenge 3).

Effective initiatives for Challenge 1, the shortage of personnel that understand the agriculture business as well as digital technologies, might include holding a hackathon to have agricultural workers, businesspeople, and technology professionals develop solutions together; and professional exchanges between large-scale agricultural or manufacturing firms and IT companies.

Effective initiatives for Challenge 2, the shortage of advanced education in digital technologies, might include having personnel with a background in technology learn to use the latest technologies, and establishing digital learning academies as educational institutions for improving performance. We believe that the approach that should be taken here is one that goes beyond classroom learning. It will be important to have students apply what they are learning concurrently, and provide them with opportunities to get feedback.

Effective solutions for Challenge 3, the shortage of startups that offer digital solutions to farmers and small enterprises, might include holding events to raise awareness for entrepreneurs, farmers, and small

enterprises, setting up a solutions development accelerator focused on developing solutions for agriculture and manufacturing, and offering incentives for startups.

Based on the above, JICA's assistance programs for these priority topics would be as follows.

Figure 6. Overview of assistance programs for the Philippines: Training digital translators and digital talent, and promoting the development of solutions for farmers and small manufacturing enterprises

Program Overview	Expected impact of this program	Cost estimate via outside-in study
Institutions receiving assistance: • DICT **Target assistance activities:** • Train digital translators and digital talent at digital learning academies • Promote digital solutions for farmers and small manufacturing enterprises	Improve the quality and quantity of educational institutions that train digital talent in the Philippines, and improve the quality and quantity of digital talent there Improve the competitive edge of Philippine industries • Reinforce the competitiveness of IT/IT BPO industries • Propel the development of advanced, industry-oriented digital solutions (e.g. smart agriculture) **Establish excellent digital solutions for farmers and small manufacturing enterprises** • Encourage higher quality and lower prices through competition between companies • Offer different options at several steps along the supply chain Promote digitalization and improve productivity for farmers and small manufacturing enterprises • Solve the issues that tended to arise in traditional manual labor by promoting digitalization • Eventually increase income	**Total project cost estimate[1]: JPY billions** • Labor costs and overhead • Training expenses (teaching materials, venues, etc.)

1. These are estimates of all costs needed to implement the project, and do not necessarily align with JICA assistance amount

Thailand

In arranging the orientation toward digitalization in Thailand, we discovered the following seven sectors as focus areas, based on documents that indicate the orientation of the Philippine government's economic growth strategy. These sectors are manufacturing, tourism, agriculture, transportation, public services, energy, and healthcare. We then evaluated these sectors from three points of view: degree of priority and consistency of assistance in JICA, digital divide potential, and the size of impact on the economy/society

as a whole. As a result, we identified agriculture and manufacturing as the two key strategic sectors for digitalization in Thailand.

The Thai government's vision for agriculture there is "to ensure stable livelihoods for farmers, thriving agriculture, and sustainable agricultural resources." Their objective is to secure an income of over USD 13,000 for farmers by 2036.

However, Thai agriculture faces the following challenges. The first is that although mechanization is moving forward, productivity is not particularly high. The second is that the added value of agriculture is low. Primary industry workers (34% of total workers) contribute to only 8% of GDP. The third challenge is the need for production that takes the environment and sustainability into consideration. The fourth is supply chain issues. Thailand's infrastructure is relatively well-maintained in comparison with other target countries, but one of the government's policies is to improve efficiency throughout the entire supply chain. They also consider the weak positioning of farmers and agricultural cooperatives in price negotiations to be a supply chain issue. The fifth challenge is the lack of market knowledge and information. Many farmers do not fully understand how their own agricultural production is linked to processing and sales.

The first digitally-enabled solution to the above challenges would be to improve the information access environment for agricultural workers. This information could include topics such as seeds, agrochemicals, fertilizers, sustainable cultivation techniques, crop prices, and markets. Secondly, it would be effective to introduce devices and software based on the latest technology. Some specific options would include managing agricultural land using drones or optimizing moisture, pH, and NPK using soil sensors; visualizing supply chain information using RFID or smart agriculture technology such as precision agriculture; and digital marketing solutions.

The Thai manufacturing industry is the largest sector there, accounting for 26% of GDP. The Thai government has stated its course of action on industry sector expansion as (1) developing/strengthening industries that are already competitive by basing them on advanced technology; and (2) building foundations for new industries in the future. They list one approach to this as establishing new industries related to robotics and automation, to shift industry structures to ones that use advanced technology (including automation) for item (1), and to improve productivity in existing manufacturing industries for item (2).

However, Thai manufacturing faces the following challenges. First is the sudden jump in labor costs. Thailand has many factories that work to construct finished products, and the manufacturing industry there is labor-intensive. Up to now, the industry's source of competitiveness was its low cost of labor. However, the average manufacturing industry wage rose by 57% from 2011 to 2020, and now that competitive edge is being lost. The second challenge is the high degree of dependence on exports. Exports account for as much as 43% of GDP, and lowered demand for exports has an enormous impact on the domestic industry. The third issue is that of sustainability. In recent years, there is a greater need to work with SDGs, out of concern for the environment.

To confront the above challenges, the use of smart factories is thought to be the direction digitalization will take. Examples include improving production effectiveness through powerful HR development using AR/VR glasses for virtual trainings, as well as options like robotics and automation; and optimization of operations using advanced analytics.

When identifying **potential issues**, we kept the above-mentioned digitalization orientation in key strategic sectors in mind, and assessed the degree of maturity of the priority tasks (enablers) that would drive this assistance, using publicly available documents and interviews with specialists and our counterparts' government agency employees.

Regarding capabilities for making and implementing policies, the government has increased the priority of ICT and has constructed a vision to that end. Relative to other countries, ICT regulations are not an issue. Therefore, we have decided that there are no potential issues in this area.

Regarding telecommunications infrastructure, Thailand has high levels of broadband spread, 4G network coverage, and smartphone use. Therefore, we have decided that there are no potential issues in this area.

Depending on the industry, some of the challenges in terms of digital talent include the small number of people capable of becoming digital translators, educational institutions that are unable to fully teach students the skills needed, the portion of highly skilled professionals who leave the country, and difficulties in bringing in foreign talent due to strict visa regulations.

As for the innovation ecosystem, there is not enough government assistance to promote startups, opportunities to cultivate the entrepreneurial spirit in the education system, funding for innovation in educational institutions, and assistance from investors and other advocates.

To examine the format of assistance programs, we conducted an assessment of the above-mentioned potential issues based on three different perspectives: (1) impact anticipated from solving the issue; (2) our counterparts' level of interest; and (3) JICA'S interest. From the perspectives of (1) and (3) to start, we discovered the following assistance programs: Creating digital learning academies to train digital translators and model use cases of digital solutions for agriculture; setting up an appealing environment for highly skilled digital engineers and entrepreneurs; reevaluating entrepreneur education and R&D budget allocation; and improving fundraising and mentoring.

Based on the above assistance programs, we conferred with our counterpart the Digital Economy Promotion Agency (DEPA) to ask about their interest in assistance, and they showed interested in the following two assistance programs.

- Provision of Japanese educational content for digital learning academies set up for the purpose of training digital translators and engineers
- Technical assistance for establishing digital solution use cases for manufacturing and healthcare

Regarding the other assistance programs, DEPA already has similar initiatives, and did not indicate any particular interest in assistance.

Survey results on assistance frameworks and arrangements with other donors

With the goal of finding hints about points for improvement in JICA's assistance, we conducted a survey on other donors' (e.g. the World Bank, USAID, the EU) assistance schemes, resource acquisition, contract status, and specific assistance content.

The following items were noteworthy regarding assistance schemes. The first is that all assistance agencies start by drafting a long-term plan in the applicable country, before considering individual assistance programs. The second is that some agencies have simplified their decision-making. For strategy formulation and budget allocation, all of these agencies need decisions from HQ, but also have a structure that gives local offices or field mission offices the authority to execute/approve individual projects.

The following items were noteworthy regarding resource acquisition and contract status. First, many assistance agencies maximize their use of individuals, organizations, and outside networks to ensure that they have the necessary resources. Secondly, to quickly secure the resources needed, they have structures in place to deploy specialists to the field who have the authority to recruit people, and to flexibly hire resources from companies that have been approved in advance under a certain set of conditions.

Proposed improvements for JICA's assistance frameworks and arrangements

Through this survey, we found the following challenges that JICA's office for STI and DX may encounter.

One challenge in forming proposals and turning them into projects is the difficulty of completing enabler-oriented assistance programs individually (Challenge 1). In terms of digital enablers under the office for STI and DX, it is difficult to estimate or control the economic and social impact of the assistance given to those enablers. To reliably generate specific economic and social impacts, JICA will have to have multiple departments working together to formulate projects.

The next issue is the difficulty of formulating cross-sector projects in new fields like ICT and DX (Challenge 2). There needs to be agreement between the interests of the managing department and related departments to formulate a cross-sector project, but in some cases it may not be possible for the priority level of the project formulation to match with other issue areas or regions.

The challenge in assistance schemes is above all the difficulty of building schemes with lasting development results (Challenge 3). As with assistance in other areas, assistance for digital solutions can end with the effects of development not persisting because the target country has not gained the capabilities to move forward on its own after the assistance period is over, or because there is no funding for outsourcing. Secondly, it is difficult to apply existing financial assistance schemes in areas with rapid technological progress, such as systems development (Challenge 4). In free financial assistance situations, when the project is expected to be completed in about two to three years, sometimes it is impossible to accurately predict the time of completion for systems development projects, and other cases in which development takes a long time. On the other hand, for loan assistance, the current process requires several years to reach contractor agreements. In the digital sphere, where technological progress is fast, it is highly

likely that there will be major changes to the system that needs to be introduced by the time the contract is made, making it difficult to put these schemes into practice.

The challenge with securing implementation resources is that when using local or third-country resources, even with untied assistance it is sometimes difficult for third-country resources to actually be used in practice (Challenge 5).

The following are suggestions for improvement on the above challenges.

The first improvement for Challenge 1 (the difficulty of completing enabler-oriented assistance programs in a single department) and Challenge 2 (the difficulty of formulating cross-sector projects in new fields like ICT and DX) would be to introduce structures and activities that promote the formulation of projects that coordinate with ICT and DX. It would be useful to raise the priority level of ICT and DX within the organization, to promote cross-sector project formulation. The second suggestion is to introduce structures and create an organizational culture through model job assignments, to encourage the launch and implementation of cross-sector assistance programs.

Then the improvement proposal for Challenge 3 (the difficulty of building schemes with lasting development results) is to start by thoroughly improving the counterparts' capabilities. Since contractors are not generally strongly motivated to build on-site capabilities, it would be useful to plan incentives to have them to commit to that. The second task would be to create mechanisms to have the counterparts continue to stick to the budget. Some ways to achieve this would be to have the counterparts stick to the budget by mandating related budget contributions through laws, and clarifying in writing that there will be efforts to maintain the budget in government policies.

For Challenge 4 (difficulty applying existing financial assistance schemes in areas with rapid technological progress, such as systems development), the proposed improvement is to start by using schemes that can respond flexibly to demands for funding. This would involve coordinating with other donors, and having them supplement assistance in areas where it is difficult for JICA's scheme to be applied. The second step would be to reevaluate procurement guidelines to make procurement more flexible.

The improvement proposal for Challenge 5 (difficulty using local or third-country resources flexibly) is to set up guidelines for using third-country resources. Barriers need to be removed here, by defining rules and simplifying procedures.

3. Approach for considering assistance programs to assist better cybersecurity

This section explains the consideration of assistance programs for promoting cybersecurity taken up in Chapter 3 of this report.

Cyberattacks have become an increasing threat in recent years, making it imperative that both private companies and government agencies address them as quickly as possible. Cybersecurity threats pose particular risk to the safety and security of everyday life in developing countries, and although they are one

of the primary factors inhibiting corporate economic activities, most of these countries do not have sufficient human resources or skills at home to handle these threats.

The use of information and communication technology (ICT) is rapidly spreading to all parts of life, with nearly every sphere of human activity--from daily life and socioeconomics to national and public security--increasingly dependent on online spaces. Meanwhile, the attacks that target these activities transcend national borders, and are increasingly sophisticated and complex. At the same time, smartphones, tablets, and other devices are rapidly increasing in popularity among the general public. As more people use technologies like social media and cloud services, there is more malware targeting them, causing new threats to emerge. Cyberattacks come in all varieties, going beyond those that go after state secrets to target personal information and funds as well. Government agencies, therefore, need to reach beyond themselves and implement public awareness campaigns that reach general users of smartphones and other devices, making everyday people more aware of the dangers as well.

Taking the above as background, this survey targeted five countries, and was conducted in three phases, to identify cybersecurity needs and assistance programs. Below are the objectives defined for each phase.

- Phase 1: Diagnose the maturity of cybersecurity in the target countries
- Phase 2: Identify JICA's areas of concern and counterparts' priority areas
- Phase 3: Evaluate the developmental and economic impact of assistance programs

Phase 1: Diagnose the maturity of cybersecurity in the target countries

In addition to the five countries targeted for JICA cybersecurity assistance that were within the scope of this survey, we also added Japan and Singapore (two countries leading cybersecurity in Asia for which information was easy to obtain) as benchmarks when conducting our government cybersecurity maturity assessment. We assessed 12 items in 4 areas based on a diagnostic framework that combines indicators from outside research organizations, such as the ITU's GCI. We then roughly categorized the seven countries into three groups: those with low maturity (Cambodia, Mongolia, and Laos), those with moderate maturity (Thailand and the Philippines), and those with high maturity (Japan and Singapore).

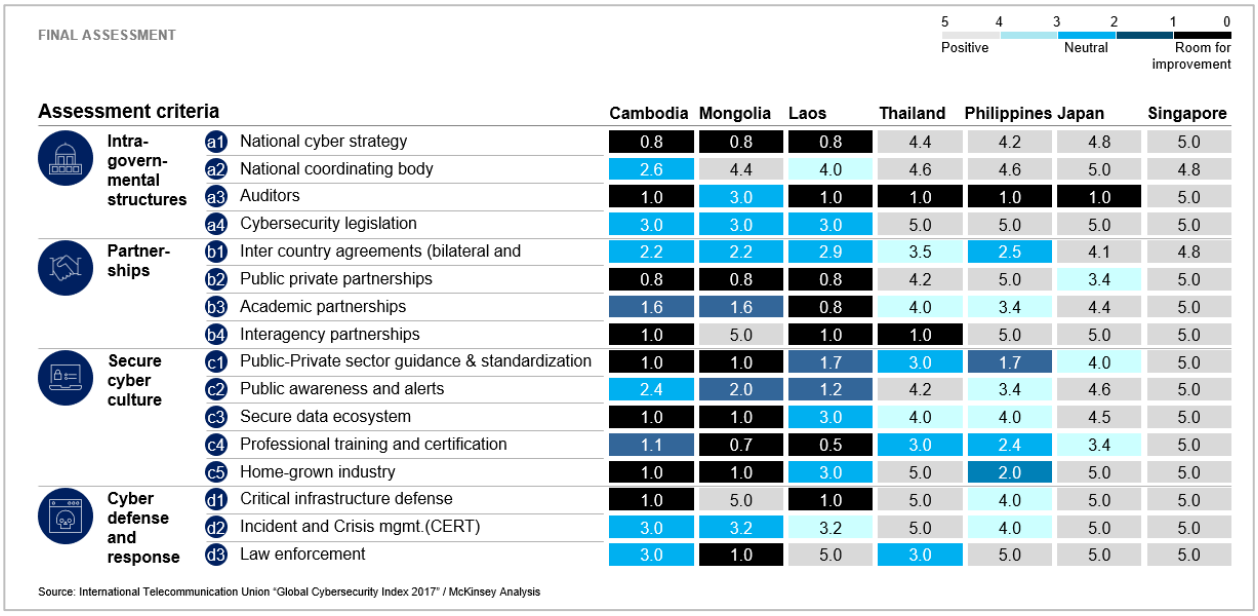


Figure 7. Results of the national cybersecurity maturity assessment

In addition to the maturity level of governments, we assessed the maturity level of private companies in the target countries. We assessed 27 companies in the telecom sector and the financial sector that possess large and important information assets. Based on input from interviews with 40 individuals, we quantified the results using NIST framework standards and found that similar to the results for the assessment of government maturity level, Cambodia, Mongolia, and Laos, private companies were found to have a maturity level far below the global average. This assessment revealed that Cambodia and Mongolia, as countries under review to receive assistance, do not have enough cybersecurity personnel either in government organizations nor in the private sector. The results also imply that there is a low level of maturity among organizations and government agencies that assist in HR training.

Figure 8. DRA (Digital Resilience Assessment) Results of private company maturity assessment

Based on the status of cybersecurity initiatives in Cambodia and Mongolia, as revealed in the government and private-sector cybersecurity maturity assessments, we identified areas recommended for priority initiatives in both countries. Of the twelve evaluation items, the two most critical are formulating a national cybersecurity strategy (a1) and setting up a national organization for cybersecurity strategy (a2). Neither of these are sufficiently functioning in Cambodia or Mongolia, and they are also priority areas where JICA would do well to focus its efforts. Items that are included in national strategy are of similarly critical importance and the team recommends that these be promptly targeted assistance as well. Specifically, these are international agreements (bilateral and others) (b1), public-private partnerships (b2), government-academic partnerships (b3), public awareness and alerts (c2), professional training and certification (c4), and incident/crisis management (CERT: Computer Emergency Response Team) (d2).

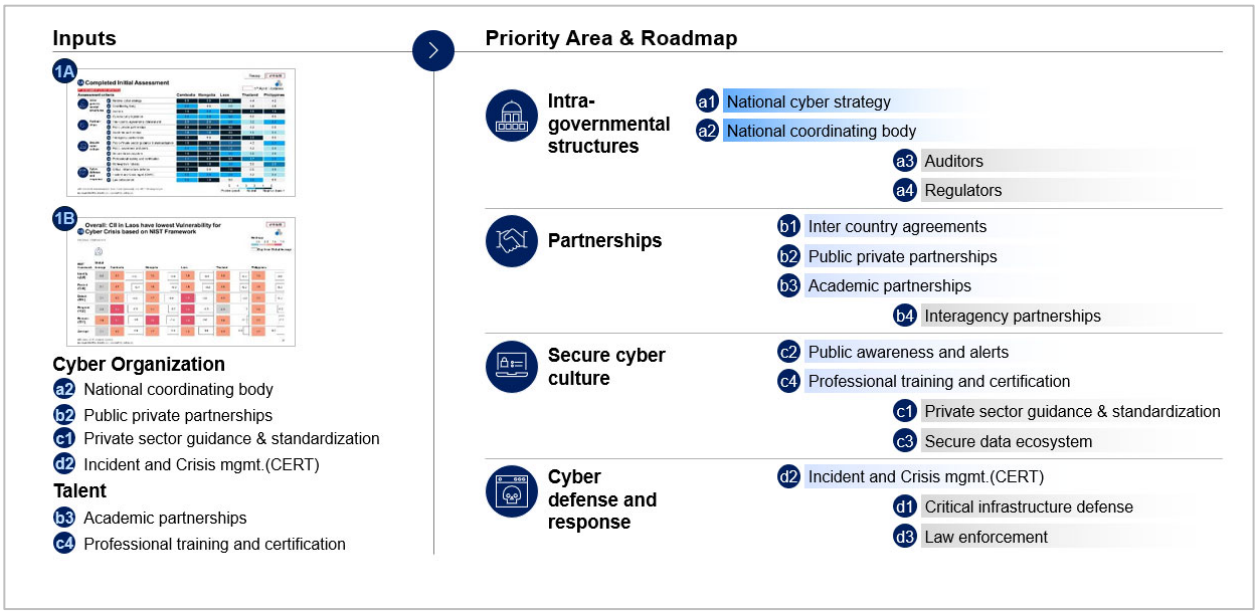


Figure 9. Priority area roadmap for addressing cybersecurity

Phase 2: Identify JICA's areas of concern and counterparts' priority areas

The survey team conducted multiple interviews on the issues and assistance needs in Cambodia with the Cambodian counterparts (MPTC [Ministry of Posts and Telecommunications] and CamCERT managed by MPTC) in priority assistance areas for cybersecurity in the Phase 1 assessment. Issues were concentrated in three areas: high-level strategy, human resource development, and CamCERT assistance. Of those, it was determined that the need for direct assistance for CamCERT was the most pressing.

As in Cambodia, the survey team conducted interviews on the issues and assistance needs in Mongolia with its counterpart, the Communications and Information Technology Authority (CITA), in priority assistance areas for cybersecurity as defined in the previous section. The interviews revealed that the lack of a national cybersecurity strategy/vision was resulting in a limited number of organizations for training cybersecurity professionals in Mongolia, and the team determined that for the need human resource development is particularly urgent.

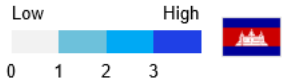
Phase 3: Evaluate the developmental and economic impact of assistance programs

The assessment of each assistance program's impact revealed that in Cambodia, the greatest impact can be achieved by assisting incident/crisis management (CERT) (d2). As in Cambodia, the impact assessment for Mongolia revealed that the greatest impact can be achieved by assisting incident/crisis management (CERT) (d2).

The evaluation results obtained in Phases 1 through 3 led to the consideration of cybersecurity assistance programs based on discussions with JICA's office for STI and DX, interviews with counterparts (to determine interest and assistance needs), and other data. This led us to the following cybersecurity assistance programs for Cambodia.

Initiative overview

d2: Incident/crisis management



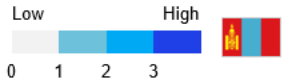
Overall target	• Strengthen cybersecurity capabilities as a way of achieving inclusive digital economics (shared across all forms of cybersecurity assistance)
Objectives	• Work toward greater maturity for CamCERT in order to improve cybersecurity incident management
Outcomes	• Upgrade CamCERT activities (basic training, meetings, collaboration, number of reports, etc.) • Upgrade technical devices • Give CamCERT staff members more mature skills • Increase the number of cyberthreat reports and detections
Actions	1. **Have the MPTC define a new scope and level of authority for CamCERT** 1. Define CamCERT's roles and core responsibilities under normal conditions, when cyber incidents occur, and after they have occurred 2. Identify the gaps in technology and human resource capabilities between CamCERT now and its ideal state 3. Draft an innovation roadmap and timeline for CamCERT based on the ENIST Framework 4. Define, establish, and document standards and processes for providing core services 2. **Have the MPTC develop cybersecurity professionals for CamCERT** 1. Identify human resource needs and provide education and training 2. Work with external partners to secure a human resource development ecosystem (job matching schemes, scholarships, academic institutions, professional organizations) 3. **Have the MPTC address CamCERT's technical and facility needs** 1. Set up software and hardware, provide the necessary education and training 4. **Set up a CamCERT financing/funding scheme** 1. Establish an organization that has the authority and responsibility to supply CamCERT with sufficient funding for its activities
JICA's scheme	• Technology cooperation
Timeline/ Schedule	• 3 years
Resources required for these initiatives	• JICA: Cyber experts • CERT: CamCERT
Overall assessment	• 2A: Comments from NISC • 2A: Comments from JPCERT • 2B: Insights from JICA KH • 2C: Priority items at CamCERT • 2C: Priority items at MPTC • 3A: Impact • Feasibility assessment

Figure 10. Assistance program overview: Incident/crisis management (CERT)

Similarly, the evaluation results obtained in Phases 1 through 3 led to the following cybersecurity assistance programs for Mongolia based on discussions with JICA's office for STI and DX, interviews with counterparts, and other data. The analysis in the basic survey indicated that CERT assistance would be most preferable, but Mongolia had not established a national CERT at the time of the study, and both organizations that the team initially thought corresponded to national CERTs (MNCERT/CC and MONCERT) turned out to be private organizations. For this reason, it was decided to postpone CERT assistance. However, it was also determined that initiatives aimed at expanding courses that contribute to better cybersecurity skills among private sector and government employees by strengthening the existing IT department at the Mongolian University of Science and Technology would help raise the bar for cybersecurity capabilities throughout Mongolia. For this reason, the assistance program focuses on strengthening the capabilities of professionals in the private and public sectors at the Mongolian University of Science and Technology.

Initiative overview

d2: Incident/crisis management



Overall target	• Strengthen cybersecurity capabilities as a way of achieving inclusive digital economics (shared across all forms of cybersecurity assistance)
Objectives	• Work towards greater maturity for a national CERT organization in order to improve cybersecurity incident management
Outcomes	• Upgrade national CERT activities (basic training, meetings, collaboration, number of reports, etc.) • Upgrade technical devices • Give national CERT staff members more mature skills • Increase the number of cyberthreat reports and detections
Actions	**1. Have CITA define a new scope and level of authority for a national CERT** 1. Define the roles and core responsibilities of a national CERT under normal conditions, when cyber incidents occur, and after they have occurred 2. Identify the gaps in technology and human resource capabilities between the national CERT now and its ideal state 3. Draft an innovation roadmap and timeline for a national CERT based on the ENIST Framework 4. Define, establish, and document standards and processes for providing core services **2. Have CITA develop cybersecurity professionals for a national CERT** 1. Identify human resource needs and provide education and training 2. Work with external partners to secure a human resource development ecosystem (job matching schemes, scholarships, academic institutions, professional organizations) **3. Have CITA address the national CERT's technical and facility needs** 1. Set up software and hardware, provide the necessary education and training **4. Set up a national CERT financing/funding scheme** 1. Establish an organization that has the authority and responsibility to supply CamCERT with sufficient funding for its activities
JICA's scheme	• Technology cooperation
Timeline/ Schedule	• 3 years
Resources required for these initiatives	• JICA: Cyber experts • CERT: National CERT organization or future organization
Overall assessment	• 2A: Comments from NISC • 2A: Comments from JPCERT • 2B: Insights from JICA MN • 2C: Priority items at CITA • 3A: Impact • Feasibility

Figure 11. Assistance program overview: Incident/crisis management (CERT)

Pilot activities and local seminars

The first PoC was a workshop on professional development in cybersecurity held June 28–29, 2021 for more than 30 participants from fourteen organizations in Cambodia, including government agencies, academic institutions, and private companies. The PoC discussion addressed measures to train cybersecurity professionals in Cambodia in all three sectors--public, academic, and private. The agenda started with a presentation on a six-item framework for formulating measures to train cybersecurity professionals (why, what, who, where, how, and when). Participants were then split into groups of ten or so to give them an opportunity to discuss with the instructors the professional development strategies Cambodia needed. Given that the discussions were held remotely and that participants had limited English ability and uneven knowledge of professional development in cybersecurity, the main purpose of the discussions was not to generate output, but to give attendees as much input as possible.

The second PoC was a workshop on formulating national cybersecurity strategy for key government players, particularly those in the MPTC. Presentations were given on pivotal discussion items for national cybersecurity strategy, in a total of 10 sessions and 20 hours of presentation time from July 19th to 28th. The presentations included case examples from cybersecurity leaders like the US and Singapore so that participants could see for themselves the lack of cybersecurity maturity in Cambodia and be more motivated to prioritize stronger cybersecurity measures in their respective departments and agencies.

Lastly, local seminars were held on June 23, June 25, and July 7 of 2021 for counterparts in Laos, Cambodia, and Mongolia, respectively. The sessions targeted all government players with an interest in cybersecurity. Participants included eight staff members from LaoCERT in Laos, around 70 Mongolian government officials, and more than 330 members of various Cambodian government agencies, resulting in an incredibly lively discussion and Q&A session.

Cybersecurity development assistance suggestions for JICA

The following section presents suggestions in areas where it would appear that JICA needs to transform in order to flexibly generate significant impact through its assistance initiatives. These suggestions are based on the basic survey, which was conducted with a specific assistance area (cybersecurity) in mind.

First, it will likely be necessary for JICA to review its systems and rules for development assistance in the area of cybersecurity (general IT). As an example, in comparison to social infrastructure development, an area with which JICA has been heavily involved, cybersecurity and IT constantly demand cutting-edge expertise and innovation. As a result, there may be situations in which JICA would do well to partner with vendors with whom it would normally be difficult to sign contracts under its current external vendor procurement and contracting standards, which impose limitations on things like service term, unit price, percentage of Japanese nationals, and reemployment. In order to deliver truly meaningful assistance to the countries receiving it, JICA is urged to flexibly reconsider new procurement and contracting standards for the IT sector. At the same time, fast-changing sectors like IT require that partner country governments review their strategies frequently. If JICA sticks to its conventional two- or three-year cycle for determining assistance details as outlined in its existing basic survey/field survey procedures, it may be difficult to keep

pace with those changes and implement the kind of assistance that is truly needed. As indicated in the case examples from other donors presented earlier, delegating decision-making authority to local offices is ideal as it can greatly reduce the deliberation time leading up to assist implementation.

Secondly, JICA is urged to clearly define the assistance goals and significance of providing assistance to the cybersecurity sector and the specific areas in which it intends to do so. There are many reasons to strengthen a country's cybersecurity, among them national defense, the growth of private industry, human resource development, tightening regulations, stronger diplomatic and internal relations, and so on. The areas that JICA and Japan should primarily get involved in this need to be defined, while also paying attention to trends among other donors. For example, as mentioned earlier, NATO has been helping Mongolia strengthen its cybersecurity as a form of national defense to keep the country democratic. Meanwhile, the Chinese government assists the overseas expansion of its private IT companies in the context of cybersecurity. The Korea International Cooperation Agency (KOICA) is extending assistance to several Asian countries to address cybercrime as well as policing and intelligence. Having each donor clarify the areas in which its organization is strongest and has the greatest interest will make it possible to provide ongoing, end-to-end assistance. Going forward, JICA will need to define the significance of cybersecurity assistance, strengthen its internal capabilities in its areas of focus while securing external resources, and accumulate project experience in those areas as well. This will allow it to provide assistance with the greatest developmental impact in the area of cybersecurity.

Overview of examples and surveys referenced in the process of formulating assistance programs

The overview is as follows. Please see the main section on this topic for details.

- Reference cases from other countries
- Overview of delivery units
- Recent trends in cybersecurity
- Overview of general-purpose cybersecurity organizations
- Overview of cybersecurity assistance from other donors
- Identifying cybersecurity startups (Cambodia/Mongolia)
- Local resource candidates in the cybersecurity sector (Cambodia/Mongolia)

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List of abbreviations

ADB	Asian Development Bank
API	Application Programming Interface
AR	Advanced Reality
ASEAN	Association of South-east Asian Nations
BPM/KPO	Business Process Management/Knowledge Process Outsourcing
CEO	Chief Executive Officer
CIDCA	China International Development Corporation Agency
CII	Critical Info-communication Infrastructures
CITA	Communications and Information Technology Authority, Mongolia
DA	Department of Agriculture, Philippines
DEPA	Digital Economy Promotion Agency, Thailand
DICT	Department of Information and Communications Technology, Philippines
DIFD	Department for International Development, UK
DOTC	Department of Transportation and Communications, Philippines
DU	Delivery Unit
EBPM	Evidence-based Policy Making
ENISA	European Network and Information Security Agency
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FDI	Foreign direct investment
GDP	Gross Domestic Product
ICT	Information and Communications Technology
IDB	Inter-American Development Bank
IFC	International Finance Corporation
ILO	International Labor Organization
IMF	International Monetary Fund
IT	Information Technology
ITU	International Telecommunication Union
JV	Joint Venture
KOICA	Korea International Cooperation Agency
KOTRA	Korea Trade-Investment Promotion Agency
KPI	Key Performance Indicator
MAF	Ministry of Agriculture and Forestry, Laos
MAFF	Ministry of Agriculture, Forestry and Fisheries, Cambodia
MOES	Ministry of Education and Sports, Laos
MoH	Ministry of Health, Cambodia
MPT	Ministry of Post and Telecommunications, Laos
MPTC	Ministry of Post, Telecom and Communications, Cambodia
ODA	Official Development Assistance
OPIC	Overseas Private Investment Corporation, US
PDM	Project Design Matrix
PoC	Proof of Concept
R&D	Research and Development
RFID	Radio Frequency Identifier
SME	Small and medium-sized enterprises
SPV	Special Purpose Vehicle
TF	Task Force
TVET	Technical and Vocational Education and Training
UNDP	United Nations Development Programme
UNESCO	The United Nations Educational, Scientific and Cultural Organization
USAID	United States Agency for International Development
VC	Venture Capital
VR	Virtual Reality
WB	World Bank

Chapter 1. Summary of commission

1.1 Survey background and context

The spectacular spread of mobile phones and the internet over the past 30 years has driven global computerization and the rise of digital economies, and because of this, emerging countries are expected to achieve what has come to be known as "leap frog-style" economic development. However, the "digital divide," in which some people are unable to enjoy the benefits of mobile phones, the internet and other digital technologies, continues to impede sustainable, fair economic development. With the Covid-19 pandemic still raging, there has been an acceleration in the development and deployment of digital government services and economic activities that has only made it more important to close the digital divide and ensure the safety and reliability of cyberspace, where digital activities take place. In this context, this assessment is backed by JICA's belief that there are five priority topics to be addressed in the development of digital economies that will lead to prosperous societies: (1) strengthening the capacity for making and implementing policies; (2) enhancing telecommunications infrastructure; (3) developing digital-related talent; (4) setting up innovation ecosystems; and (5) improving cybersecurity. JICA launched an office for STI and DX in June 2020 as part of its emphasis on digitalization and DX in development cooperation, and this survey is one of the most important items within that initiative.

1.2 Survey Objectives

The objectives of this survey are outlined below. It was conducted in countries where JICA has not conducted ICT cooperation in recent years: Cambodia, Laos, Mongolia, Thailand and Philippines.

- Consider assistance programs in five focus areas for the survey target countries
  - **Priority topics other than cybersecurity:** After identifying the assistance needs in each of the above five countries, draft assistance programs that contribute to promoting inclusive digital economies
  - Cybersecurity: JICA has recently been working on formulating projects in this field in Mongolia and Cambodia. As such, the objective in those two countries will be to draft assistance programs and specify request content through discussions with counterparts
- Create a template for survey approaches that can be referred to when JICA runs similar surveys in the future
- Collect basic information on domestic and foreign resources involved in implementing assistance programs
- Consider ideas for improvement for JICA’s assistance framework, through a comparative analysis with other donors

1.3 Task Implementation Schedule

To meet the above objectives, we gathered basic information on the current status of each target country, and identified their assistance needs in each of the above five priority topics. In this process, we surveyed other countries as examples (such as Singapore and Malaysia) and reflected on the lessons found there. We

also ran seminars and pilot activities based on the survey results, linking these to and understanding of the capabilities of our counterparts as well as to the formulation of future JICA projects.

Detailed activity content is as follows.

- Survey basic information on telecommunications
- Consolidate information on Japanese ODA in ICT, and summarize results and challenges
- Confirm activities of relevant Japanese institutions (including private-sector companies)
- Country assessment covering priority topics
- Preparatory survey for the development of projects in the cybersecurity area
- Survey of assistance by other governments, donors and international initiatives; potential for coordination; methods of coordination
- Confirm assistance frameworks and mechanisms of other governments, donors and international initiatives; compare against assistance frameworks in Japanese ODA
- Conduct on-site seminars
- Implement pilot activities
- Assistance activities related to JICA project formation in recipient-country governments
- Study potential coordination with Japanese companies involved in technologies and areas where Japan has comparative advantage
- Study and make recommendations concerning Japanese assistance and priorities

In carrying out the above activities, we divided them into the following three areas. Detailed survey procedures and results are mentioned in the relevant chapters listed below, in this final report.

- Chapter 2: Drafting assistance programs to promote inclusive digital economies
- Chapter 3: Drafting assistance programs in the cybersecurity (CS) field to achieve safe digital economies, and pilot activities (PoC) for implementing assistance programs

Figure 12 below shows the agenda of items to be submitted, including review schedules and operational plans for each sphere of activity, interim reports, detailed pilot activity plans, and final reports.

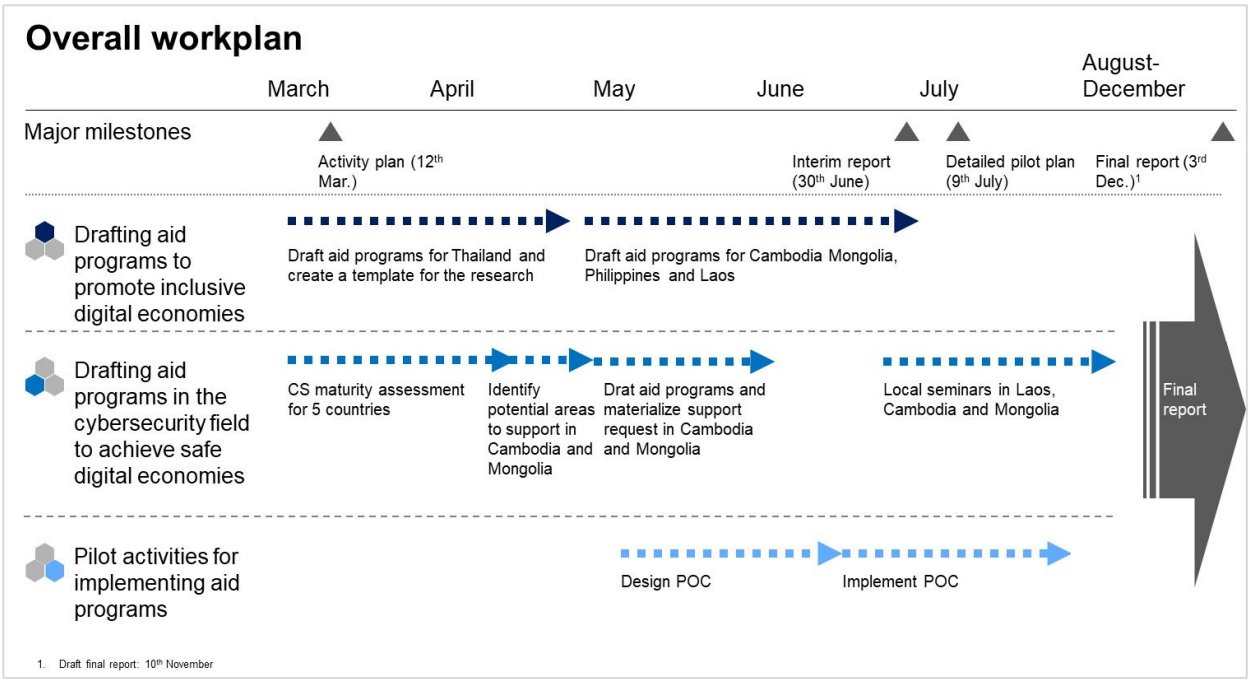


Figure 12. Overall workplan for this commission

Chapter 2. Considering assistance programs for promoting inclusive digital economies

2.1 Overview of approaches

2.1.1 Consideration framework

Promoting inclusive digital economies means achieving inclusive and sustainable economic growth through digitizing economic activities, while closing the digital gap. This survey used the structure below as a framework for considering what needs to be done in order to get there.

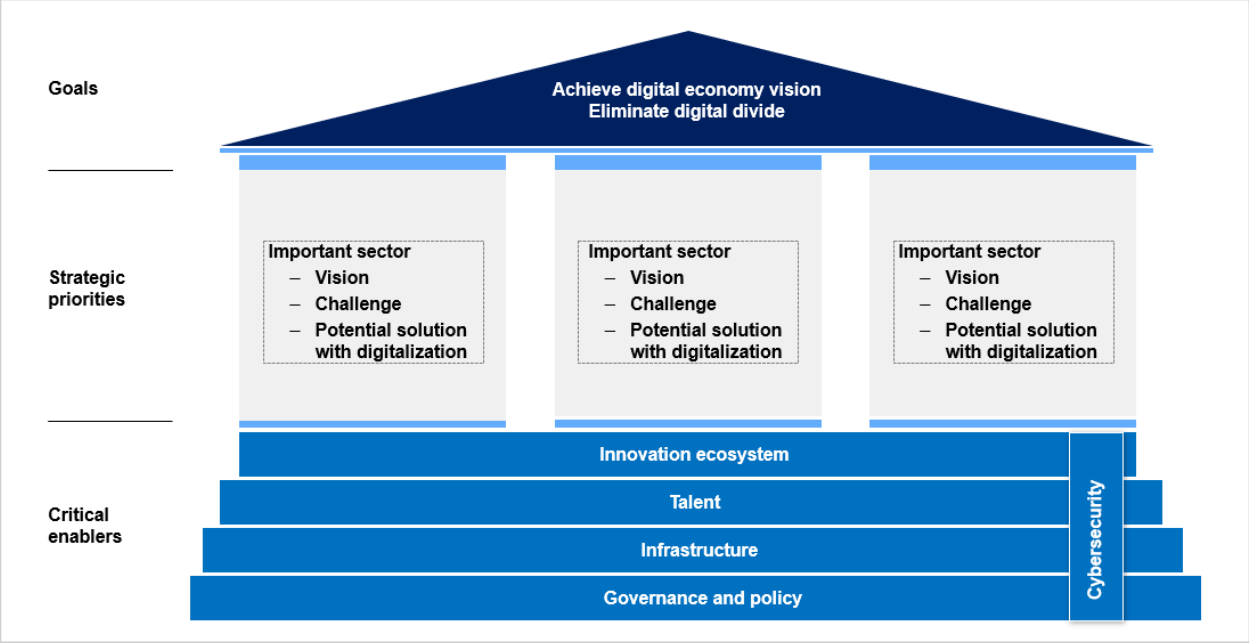


Figure 13. Consideration framework: To promote inclusive digital economies, enablers must be in assistance of the country's vision and strategic priorities

The following insights, gathered through similar past surveys and other resources, provide context for the team's decision that this would be an appropriate framework.

The OECD's "Roadmap toward a Common Framework for Measuring states that the digital economy "incorporates all economic activity reliant on, or significantly enhanced by the use of digital inputs". Given this definition, the digital economy is the sum of all digitalization in the various industries that make up the core of economic activity. This means that achieving the goal of "promoting inclusive digital economies" requires that the strategic priorities that assist the achievement of targets in each of these must be defined and further, that there are enablers that assist those targets. In other words, because enablers ultimately exist for the purpose of achieving strategic priorities, they should not be strengthened indiscriminately. A more effective approach is to get a clear picture of the kind of digitalization that needs to be pushed forward in order to achieve the goal of promoting safe, inclusive digital economies, and then strengthen the enablers that are essential to getting there.

In this context, we will consider the following five enablers.

① Governance and policy: Government capabilities related to the drafting and implementation of policies, laws, strategies, and roadmaps for developing and spreading the digital technologies that drive digital economies

② Communications infrastructure: Broadband connections and device access

③ Talent: People with the skills and capabilities to effectively and sustainably introduce and utilize digital technologies

④ Innovation ecosystem: The environments that lead to the emergence of innovations that drive the development of digital economies

⑤ Cybersecurity: Public and private cybersecurity capabilities

The above list basically corresponds to the four JICA priority issues that were behind the implementation of this survey, whose main purpose is to look at assistance programs that can help resolve issues with these enablers. (Note that the third JICA priority issue--the development of digital-related companies/talent--is here divided into "talent" and "innovation ecosystems" to account for the stepwise nature of development.) Note also that because the fifth enabler (cybersecurity) is analyzed separately in Section 3, this section will only consider the first four.

2.1.2 Review process

The team started by selecting one of the five target countries--Thailand--and using the creation of assistance programs for it as a kind of prior research, taking the lessons learned from that survey and using them to form a template for the review process as a whole. This template procedure is described below. (Note that certain parts of the template do not exactly match the review process that was used for Thailand.)

Considerations for this survey followed these three steps:

(1) Organize digitalization approaches

- (1)-1 Confirm strategically important sectors of the country
- (1)-2 Select potential target sectors
- (1)-3 Understand the vision and challenges in each potential target sector, and identify candidates for digitally-enabled solutions

(2) Identifying potential issues to assist

- (2)-1 Survey maturity in capacity to formulate and implement policies
- (2)-2 Survey communications infrastructure maturity
- (2)-3 Survey HR maturity
- (2)-4 Survey maturity of the innovation ecosystem

(3) Formulate assistance programs

- (3)-1 Assess potential issues
- (3)-2 Draft assistance and solution proposals for potential issues

(3)-2-A Formulate JICA assistance programs for priority issues

(3)-2-B List initial solution proposals for potential issues that are outside priority issues

(1) Organizing the orientation of digitalization

As mentioned above, although one of the primary objectives of this survey was to define the assistance needs in each target country and formulate assistance programs, it was essential to understand the approach each country should take toward digitalization in order to specify enabler issues. The most effective way to deepen this understanding is to select from among the given sectors those will best contribute to the promotion of inclusive digital economies and look at the approach towards digitalization that should serve as a focal point for pushing that sector forward. These considerations followed three steps.

(1)-1 Confirm strategically important sectors of the country: The team reviewed government strategy documents to confirm key sectors in countries being considered assistance (in cases where there are no accessible government strategy documents, or where the accessible documents do not provide sufficient information, this step could be replaced by meetings with government agencies, for example, to determine key sectors).

(1)-2 Select potential target sectors: The team then evaluated the key sectors determined in step (1)-1 from three perspectives in order to determine which should be targets of consideration in this survey: (1) JICA assistance priority ranking and consistency, (2) digital divide potential, and (3) the impact of each sector on the economy/society as a whole.

(1)-3 Understand the vision and challenges in each target sector and identify candidates for digitally-enabled solutions: The team reviewed government documents and met with experts to confirm the vision and issues facing realization of that vision in each potential target sector. The team then conducted another survey, and listed potential candidates for digitally-enabled solutions to the challenges being faced.

Step (1)-2 (select potential target sectors) employed the following three perspectives.

- **JICA assistance priority ranking and consistency:** Because one objective of the survey was to formulate proposals for JICA assistance, the team made sure that the sectors were in alignment with JICA policy. More specifically, the team looked at JICA's country-specific development cooperation policies and project development plans as well as met with regional offices to confirm JICA assistance policies in the countries being considered assistance in order to make sure that JICA had a strong interest in assisting digitalization in those sectors.
- **Digital divide potential:** Because one objective of the survey is to promote inclusive digital economies, the team assessed digital divide potential to see whether there was significant room for improving the inclusivity of the digital economy via digitalization of the sector being considered. More specifically, the team started by looking at the progress of digitalization throughout the world, making sure that there was a correlation between digitalization in the strategically important sectors it selected and per-capita GDP. It then looked at whether per-capita GDP of employees in that sector was low compared to other sectors.

- **Impact of each sector on the economy/society as a whole:** In light of the objectives of this survey, the team assessed the economic and social impact of candidate sectors in terms of their potential to push the digital economy of their country forward with increased digitalization. More specifically, the team looked at the GDP of each sector and its share of the working population to determine the ripple effects of digitizing it.

(2) Identifying potential issues to assist

Given the digitalization approaches in the target sectors that were considered in the previous section, the team then looked at maturity level for the enablers required to drive this digitalization.

As a basic premise, the four enablers (capacity to formulate and implement policy, communication infrastructure, talent, and innovation ecosystems) must be positioned to mutually assist one another. The team conducted expert interviews to clarify the steps involved in achieving a certain amount of development (as described below) during the process of foundation building.

(2)-1 Capacity to formulate and implement policies: The government first must establish basic policies and create business conditions that encourage private companies to invest and grow the digital economy

(2)-2 Communications infrastructure: Once investment is triggered by basic policies and favorable business conditions, the communications infrastructure (e.g. 4G networks) must be developed nationwide to lay the foundation for the expansion of an inclusive digital economy.

(2)-3 Talent: Developing local talent (rather than relying on foreign companies and talent) is critical to promoting digitalization in individual sectors and industry as a whole while ensuring that they continue to hone their competitive edge.

(2)-4 Innovation ecosystems: Once their policy, infrastructure, and talent foundations are in place, countries are ready to further accelerate their digital economies through innovation ecosystems.

Below is a description of how the team assessed the maturity of each enabler. After conducting a quantitative benchmark evaluation for each enabler, the team identified potential issues through interviews with employees at counterpart government agencies, experts, and others in order to dive deeper into the relevant challenges and contextual factors. Below is a description of the indicators used to quantitatively evaluate each enabler.

(2)-1 Survey maturity in capacity to formulate and implement policies

The following evaluations were critical to assessing the maturity of governments in terms of their capacity to formulate and implement policy.

- The extent to which the country prioritizes information and communications technologies and whether it has formulated a national vision

- Whether the country has established the required regulations and systems based on that vision and whether they are being implemented properly

The qualitative evaluations employed approximate substitute values for the two items above based on surveys that had already been conducted.

- The extent to which executives in each country felt that their governments were prioritizing information and communications technologies
- Progress in ICT regulations in each country

It is difficult to determine whether regulations and systems are being properly implemented with external evaluations, so the team looked at this metric via interviews with employees at counterpart government agencies, experts, and others rather than conducting a quantitative study.

(2)-2 Survey communications infrastructure maturity

The team used a variety of indicators to look at communications infrastructure maturity. Mobile and fixed broadband were benchmarked from three perspectives.

- Coverage (access)
- Quality
- Price

(2)-3 Survey HR maturity

The team assessed people with the skills and capabilities to effectively and sustainably introduce and utilize digital technologies across three categories.

- **Digital translators:** Those who know how to apply advanced technology to fulfill business needs in their own fields
- **Digital engineers:** Those who have advanced digital skills, such as advanced analytics, machine learning, and agile development
- **IT engineers:** Those who are comfortable with longstanding applications and IT infrastructure, including Java, SQL, Windows Server, and networks

The team then tallied the total number of ICT professionals (digital engineers and IT engineers) in each country in 2019 and used it to estimate (1) the number of people in each of the three categories above in 2019 and (2) the likely demand in 2030. The size of the gap between the two figures was used to assess the need for strengthening HRD. Estimates were made based on analyses that considered the two scenarios described below.

- **Analysis of the total number of ICT professionals:**
  - Total number in 2019 identified via national statistics
  - Total number in 2030 estimated based on the number of ICT professionals in 2019 plus likely demand growth under each scenario

- **Determining the ratio of people in each category:**
  - Ratio of digital engineers to IT engineers:
    - Ratios in 2019 estimated based on hiring information posted in LinkedIn
    - 2030 ratios were set based on each scenario
  - Ratio of digital translators to digital engineers:
    - The ratio of digital engineers to digital translators on general development teams (6:1) was used for both 2019 and 2030
    - This was because it is typical for digital translators to work on development alongside digital engineers

Scenarios

- **Scenario 1:**
  - Total number of ICT professionals: Demand for ICT professionals continues to grow at the same rate it has in recent years
  - Ratio of ICT professionals: Same as 2019
- **Scenario 2:**
  - Total number of ICT professionals: The percentage of ICT professionals in the workforce increases to levels seen in countries with more advanced ICT professional development than the target country
  - Ratio of ICT professionals: Same as the ratio in countries with more advanced ICT professional development

(2)-4 Survey maturity of the innovation ecosystem:

The team conducted a benchmark evaluation, employing a variety of metrics to look at the maturity of each player in the five innovation ecosystems listed below.

- Startups
- Corporate
- Knowledge contributors
- Investors, supporters
- Market access

Figure 14. Evaluation metrics for enabler maturity

Enablers	Categories	Sub-category	Indicators
Governance and policy	Vision		Importance of ICT to government vision
	ICT regulations		Progress of ICT regulations
Communications infrastructure	Mobile Broadband Networks	Coverage	4G coverage
		Quality	Download speed
			Performance latency
		Price	Usage fees/per-capita GDP
	Mobile Broadband Devices	Coverage	Smartphone penetration
		Price	Smartphone price/per-capita GDP
	Fixed Broadband	Coverage	Household coverage
		Quality	Download speed
			Performance latency
		Price	Usage fees/per-capita GDP
Human resources	Digital translators		Future demand (estimated)
	Digital engineers		Future demand (estimated)
	IT engineers		Future demand (estimated)
Innovation ecosystems	Startups		Average # of startups founded/population
			Number of days to business start
			Number of procedures to business start
			Tax rate % profit
	Corporate		Investment in emerging technologies
			R&D expenditure by businesses
			Creation/merger/acquisition of joint ventures
	Knowledge contributors		Number of scientific and technical journal articles
			R&D expenditure by government and higher education institutions
	Investors/supporters		VC investment/GDP
			Government promotion of investment in emerging technologies
			FDI restrictiveness
	Market access		Intensity of domestic market competition

(3) Formulating assistance programs

After identifying the potential issues to assist for each enabler in the previous section, the team looked at assistance and solution proposals using the two basic steps described below.

(3)-1 Evaluate potential issues to assist: To ensure the formulation of effective assistance programs, the team evaluated potential issues from the following three perspectives, selecting priority issues for JICA assistance programs.

- Impact expected from solving the issue (see details below)
- Counterpart interest
- JICA's interest

(3)-2 Draft assistance and solution proposals for potential issues: The team then used global best practices identified through reviews of reference projects (from other international donors, for example) and expert interviews to do the following.

(3)-2-① Formulate JICA assistance programs for priority issues

(3)-2-② List initial solution proposals for potential assistance issues that are outside priority issues

The "impact expected from solving the issue" in 3-(1) was estimated using the method described below. Details on the considerations for (3)-2 will be discussed in the sections describing individual country inquiries.

The impacts expected from solving each potential issue targeted assistance were evaluated on a scale from 1 to 3 from the following perspectives, based on which enablers were facing that particular problem.

- More inclusivity by eliminating the digital divide (communications infrastructure)
- Economic growth through digitalization (talent, innovation ecosystems)
- Implementing the above (capacity to formulate and implement policies)

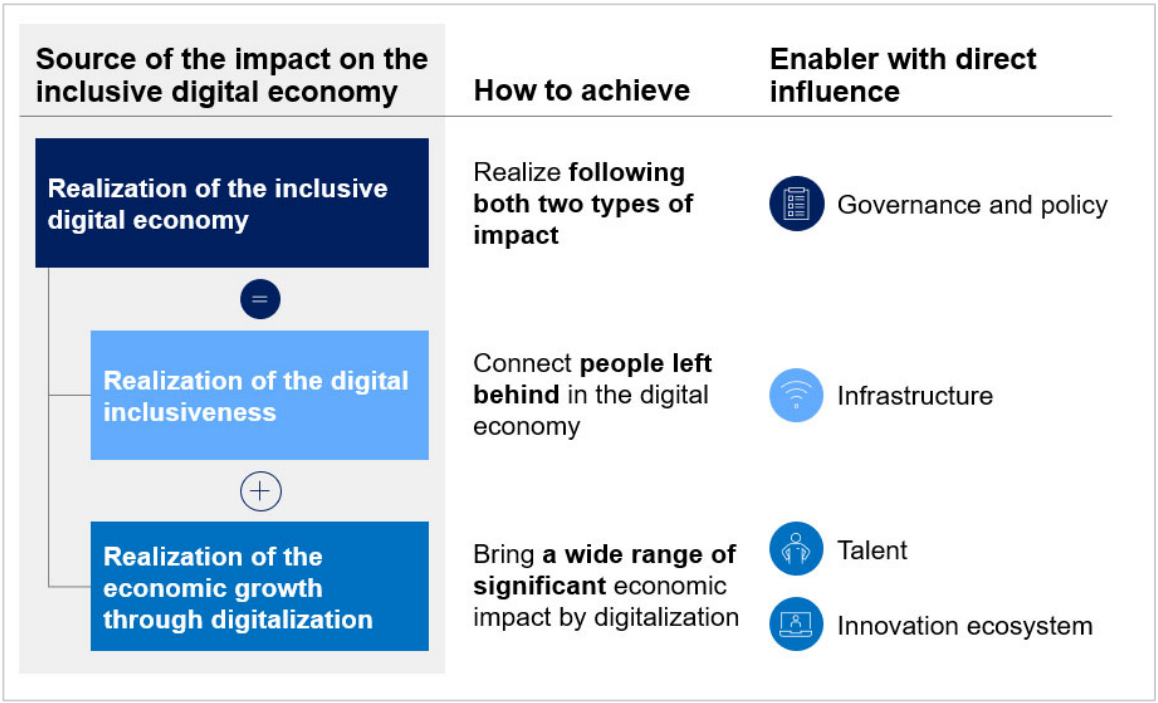


Figure 15. Relationship between individual enablers and inclusive digital economies

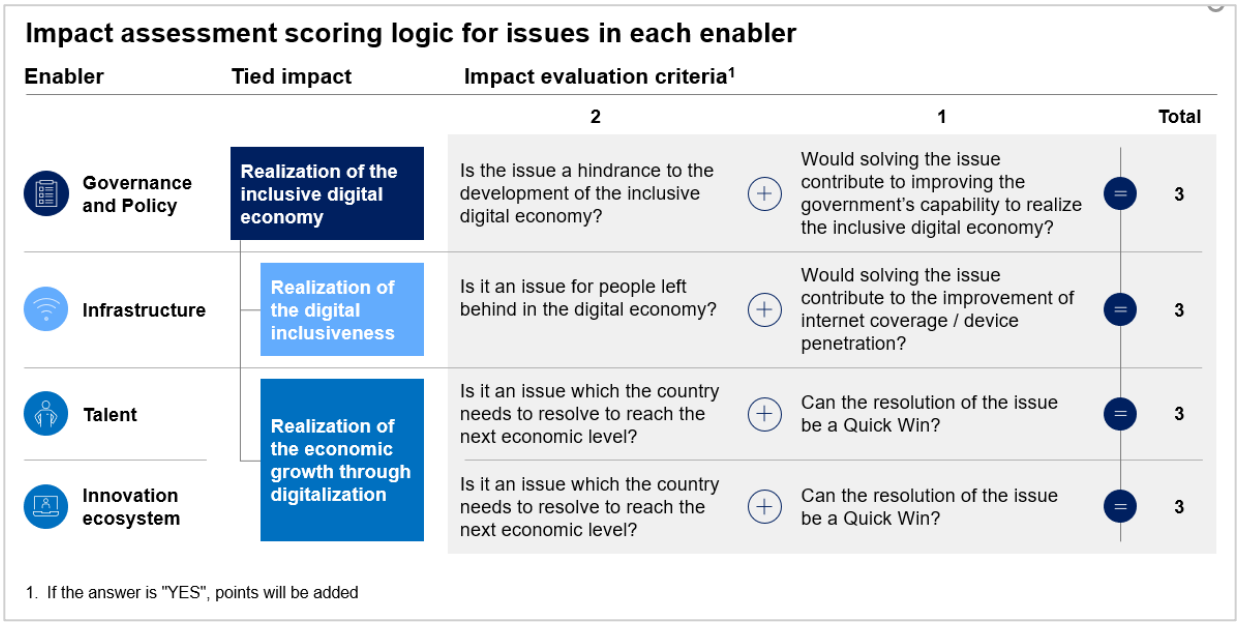


Figure 16. Impact assessment metrics for issues facing each enabler

The following provides context for the team's decision to use the evaluation tools described above.

Because the purpose of the study is to promote inclusive digital economies, determining the impact of solving particular problems is a core evaluation metric that is in line with that aim and thus needs to be measured. A solution's ability to impact inclusive digital economies has two components: (1) more inclusivity by eliminating the digital divide and (2) achieving economic growth through digitalization. Proper impact assessments must therefore work from these two perspectives as well.

It is likely that the approaches needed to maximize each of these components will be different, so in general, the impacts resulting from solving any given problem are likely to be directly tied to one or the other of them. Here is an example of these differing approaches. If "more inclusivity by eliminating the digital divide" is left up to the economic activity of the private sector, there will likely need to be some kind of intervention to help those who are left behind in the digital economy. In this case, a narrower target will tend to result in a more effective intervention. With economic growth through digitalization, on the other hand, having a broader target is likely to deliver greater impact. The nature of this aim is such that maximizing impact requires an approach that focuses on a much different target than "more inclusivity by eliminating the digital divide."

Each enabler also tends to be directly impacted by one or the other of these two components. This means that the impact of solving any given problem should be evaluated in terms of the potential impacts stemming from the enabler tied to that problem. As an example, solving problems tied to communications infrastructure tend to impact the "more inclusivity by eliminating the digital divide" component, while solving problems tied to talent or innovation ecosystems tend to impact the "achieving economic growth through digitalization" component. By its nature, the capacity to formulate and implement policies indicates an ability to create favorable business conditions, which is itself a prerequisite for developing communications infrastructure, talent, and innovation ecosystems. In this way, we can define the capacity

to formulate and implement polices as something that impacts “achieving inclusive digital economies”; in other words, it addresses both of the above two components.

Next, the team set out to assess the magnitude of impacts expected from solving any given problem. In order to assign priorities based on a side-by-side comparison of the enablers, the team defined a core evaluation metric for each desired impact and used it to score the impacts expected to result from solving certain problems. Specifically, two evaluation items were assigned to each problem based on its characteristics, and points were awarded to solutions that fit the description. Points were then totaled for each solutions in order to compare them. Points were allocated such that solutions that delivered the primary impact out of the two evaluation items were awarded two points, and those that delivered the other impact were awarded one point, for a maximum possible score of three points. Each evaluation item is described in more detail below.

- More inclusivity by eliminating the digital divide (communications infrastructure)
  - Two points: Solving the issue targets those left behind by the digital economy
  - One point: The issue directly relates to internet and mobile device access
- Economic growth through digitalization (talent, innovation ecosystems)
  - Two points: The issue must be solved in order to take the country to the next economic level
  - One point: Solving the issue may provide quick wins (within five years)
- Implementing the above (capacity to formulate and implement policies)
  - Two points: The issue is a hindrance to the development of an inclusive digital economy
  - One point: Solving the issue would help improve the government’s ability to achieve an inclusive digital economy

The figure below lists the detailed criteria used to determine whether the description in each evaluation item applied.

Enabler	Primary impact evaluation		Secondary impact evaluation	
	Criteria	How to assess	Criteria	How to assess
		2		1
Governance and Policy	Is the issue a hindrance to the development of the inclusive digital economy?	Yes: If there's a particular policy or situation which is a road blocker of the promotion of the Inclusive digital economy No: If not (e.g., If the issue is about a lack of promotion policy for Inclusive digital economy)	Would solving the issue contribute to improving the government's capability to realize the inclusive digital economy?	Yes: If the issue is about the government capability No: If not
Infrastructure	Is it an issue for people left behind in the digital economy?	Yes: If the issue is related to the high digital divide potential segment, people in rural areas or lower-income households, senior No: If not	Would solving the issue contribute to the improvement of internet coverage / device penetration?	Yes: If the issue is about the coverage / device penetration No: If not (e.g., speed, affordability)
Talent	Is it an issue which the country needs to resolve to reach the next economic level?	Yes: If the similar issue does not seem to exist any more in Thailand (Details to follow) No: If not	Can the resolution of the issue be a Quick Win?	Yes: If the resolution of the issue can bring the economic impact in the next 3-5 years No: if not
Innovation ecosystem	Is it an issue which the country needs to resolve to reach the next economic level?	Same as above	Can the resolution of the issue be a Quick Win?	Same as above

Figure 17. Specific evaluation criteria used to determine applicability

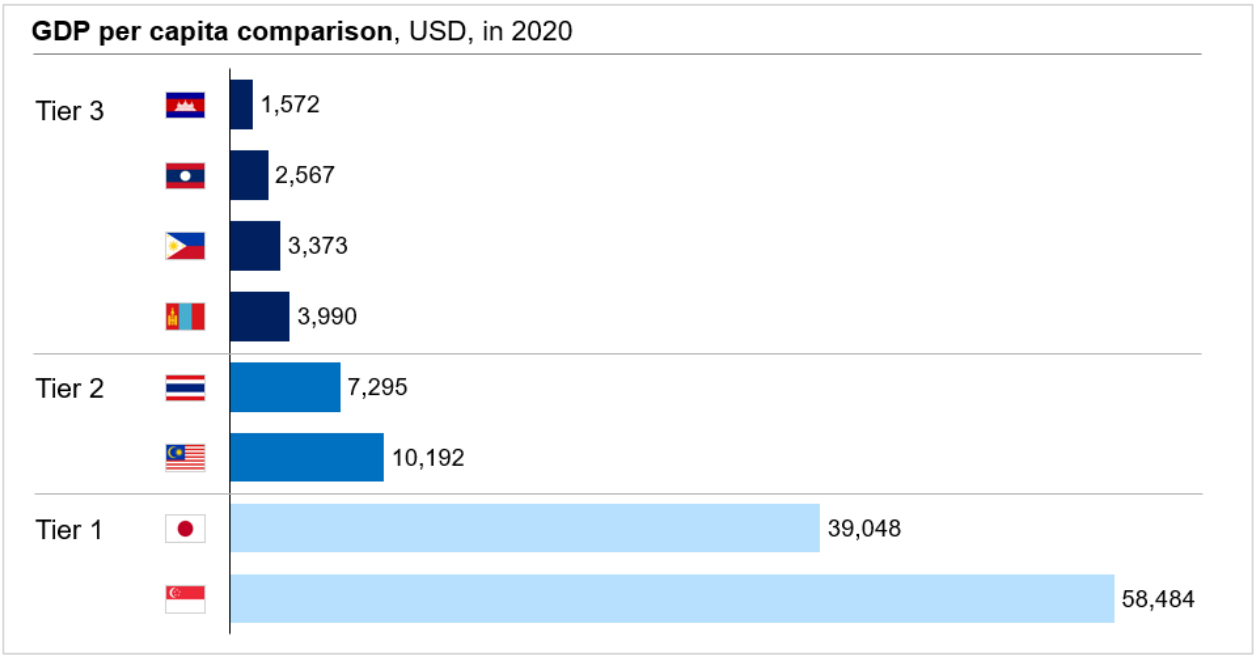


Figure 18. Economic development benchmarks for Cambodia, Laos, Mongolia, and the Philippines

Below are two examples of how point evaluations were applied to specific potential issues to assist.

Example 1: The team scored the following two problems affecting Cambodia's communications infrastructure: (1) low smartphone penetration in rural areas and (2) slow internet connection speeds in rural areas. Out of three possible points, problem (1) earned three points and problem (2) earned two points. Below is a breakdown of the point totals.

- Both problems (1) and (2) were awarded two points, since they affect rural communities and meet the two-point criterion, “solving the issue targets those left behind by the digital economy”.
- Only problem (1) was awarded an additional one point, since it is the only one that meets the criterion, “the issue directly relates to internet and mobile device access”.

When it comes to achieving inclusive digital economies, network coverage and device penetration are more fundamental than network speeds, so solutions should prioritize these problems. It is fitting, then, that problems (1) and (2) ended up with different scores.

Example 2: The team scored the following two problems affecting innovation ecosystems in Laos: (1) business regulations do not address digital economies and (2) there is a lack of mentorship. Out of three possible points, problem (1) earned three points and problem (2) earned one point. Below is a breakdown of the point totals.

- Only problem (1) was awarded two points, since it is the only one that meets the criterion, “the issue must be solved in order to take the country to the next economic level”. This core evaluation metric, which is based on whether a problem can also be seen in countries at the next economic level, is used to determine how urgent resolving that problem is. Compared to the other six countries targeted by the survey (Cambodia, the Philippines, Mongolia, Malaysia, Singapore, and Japan), Laos has a per-capita GDP that puts it in Tier 3 (USD 5,000 or less), so the determination was made based on whether the same problem is seen in Thailand (a Tier 2 country with a per-capita GDP of USD 5,000–30,000). Problems that are present in Thailand can be considered low priority in the process of moving a country from a Tier 3 to a Tier 2 level of economic development. Problems that are not present in Thailand can be considered high-priority, since they are ones that Thailand has resolved in the course of its economic growth.
- Both problems (1) and (2) were awarded one point, since they each could be resolved in 3–5 years and thus meet the one-point criterion, “solving the issue may provide quick wins (within five years)”.

Developing countries in particular can suffer from numerous problems that hinder the development of digital economies, so referring to the development history of other countries can be an effective method of charting a path forward. The above scoring evaluation can provide hints as to how problems (1) and (2) should be prioritized, while also perhaps revealing superior tools for getting there.

In sum, the team used steps 1.1 through 1.3 to identify the potential enabler issues to assist based on the digitalization approach that should be promoted in each target country. This in turn allows JICA to clarify which of those issues it should consider assistance programs for. The team then used global best practices identified through reference project surveys and expert interviews (from other international assistance agencies, for example), and then used them to consider specific assistance and solution proposals.

2.2 Considering assistance programs for Cambodia

2.2.1 Basic country information

Cambodia, located on the Indochinese Peninsula, is a Southeast Asian country bordered by the Socialist Republic of Vietnam, the Kingdom of Thailand, and the Lao People's Democratic Republic. The total land area of the country is 176,520 km^2, and with a population of about 16 million, its population density is 96.26/ km^2.

Over 90% of the population is Cambodian (Khmer), and while there are a few minorities, the main religion is Buddhism. Due to the effects of the civil war in the 1970s and the massacre of fellow citizens under the government of Pol Pot, the population of those ages 40 and over is extremely small.

Cambodia's 2019 nominal GDP was USD 27 billion, with a real GDP growth rate of 7.0%. Its key industries are tourism, agriculture, and manufacturing, with tourism in particular accounting for over 30% of GDP. In manufacturing, the textile industry is large, and it is also a large share of exports. In 2019, USD 2.4 billion worth of knit sweaters were exported. Per capita GDP in 2019 was USD 1,620, the lowest of all the survey target countries.

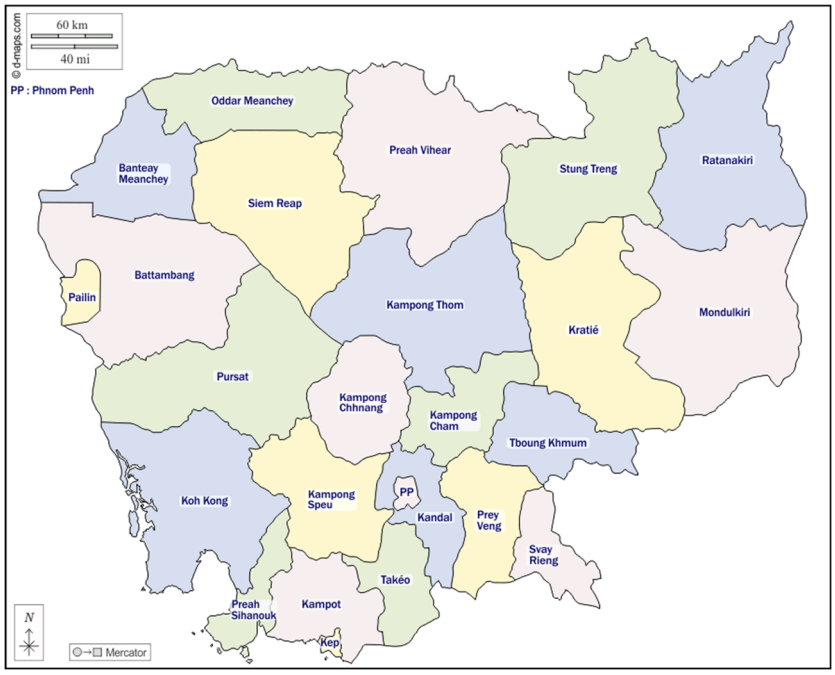


Figure 19. Cambodia (Source: d-maps.com)

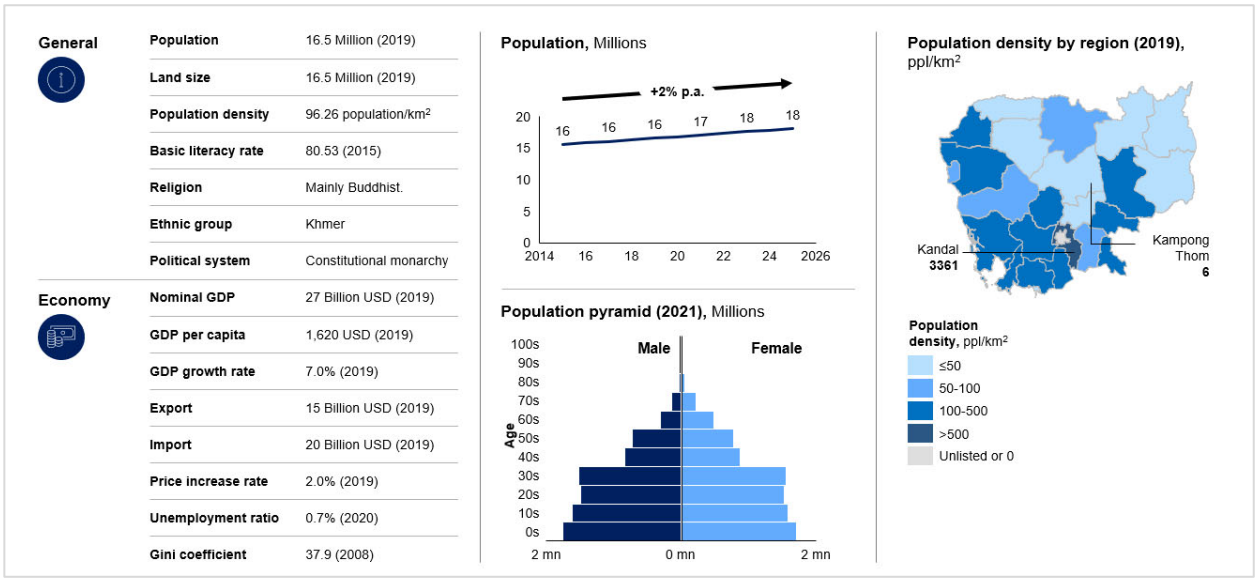


Figure 20. Overview of Cambodia (1/2)

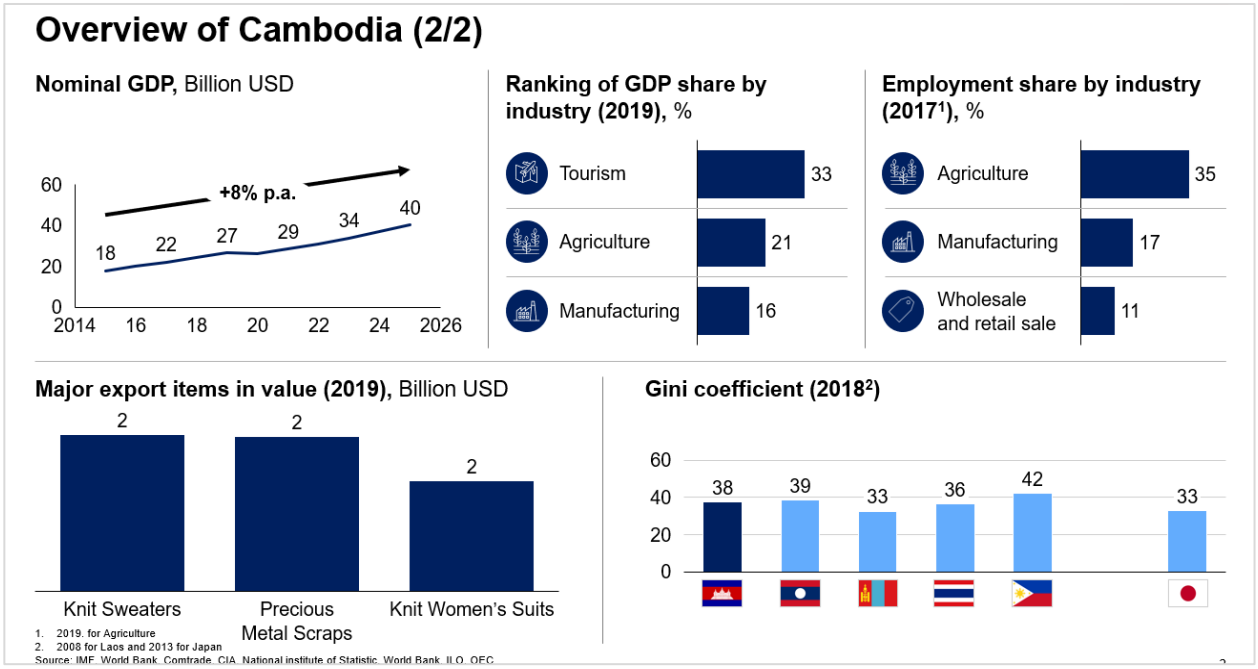


Figure 21. Overview of Cambodia (2/2)

2.2.2 Organizing the orientation of digitalization

(1) Confirming strategically important sectors of the country

We first identified ten industries as key strategic sectors for Cambodia, after referring to the Cambodian government's "Rectangular Strategy," "National Strategic Development Plan (NSDP) 2019-2023," and "Cambodia Industrial Development Policy 2015–2025": Tourism, agriculture, manufacturing, textiles, pharmaceuticals, wholesale/retail, public services, transportation, oil and gas, and entertainment. The

specific procedure for identifying these sectors was as follows. We started by using the industries mentioned individually in the Rectangular Strategy's section on economic growth as the basic targets (excluding the ICT industry because of its position as a digitalization enabler in all industries). We then added the priority sectors listed in the section on the Cambodia Industrial Development Policy 2015-2025, because this policy's implementation is considered to be one strategy. We also added public services to the list, because it was mentioned as a part of promoting digital government in the Rectangular Strategy and the National Strategic Development Plan (NSDP) 2019-2023.

(2) Selecting study target sectors

We evaluated these sectors on the basis of the following three perspectives, and selected the target sectors to be taken up in this survey.

- Consistency with JICA's assistance priorities
- Digital divide potential
- Each sector's overarching impact on the economy/society

Following the above selection criteria, we analyzed Cambodia's key strategic sectors, and confirmed that the high priority sectors for JICA assistance were agriculture, public services (healthcare), textiles, and wholesale/retail. The reasons are as follows.

- Agriculture/textiles: Large share of GDP and employment, highly important to the economy (agriculture: GDP 21%, employment 35%; textiles: GDP 14%; employment 11%)
- Wholesale/retail: As e-commerce grows in Cambodia, JICA is interested in finding out if it has assist potential.
- Public services (healthcare): Initiatives driving areas like healthcare and social security are crucial for achieving universal health coverage (UHC). With to the spread of COVID-19, assistance in this area is even more important.

Then, we selected agriculture and public services (healthcare) as the current survey's targets for their consistency with JICA's assistance policies as well as for their appropriateness from two other perspectives.

- Agriculture:
  - ― Digitalization is progressing more slowly than in other sectors, and given the small amount of GDP per capita, it is highly likely that this is an area with a digital divide
  - ― Furthermore, considering its large share of GDP (21%) and its large share of the working population (35%), digitalizing the agriculture sector may have a large impact on the economy and society
- Public services (healthcare):
  - ― Digitalization is progressing more slowly than in other sectors, making it highly likely that this is an area with a digital divide
  - ― Public services (healthcare) are not a large portion of GDP nor are they a major employer (3% of the population), but since this sector provides services to the entire population, making progress in

digitalization in applicable sectors would directly help shrink the digital divide, and should be effective for achieving an inclusive digital economy

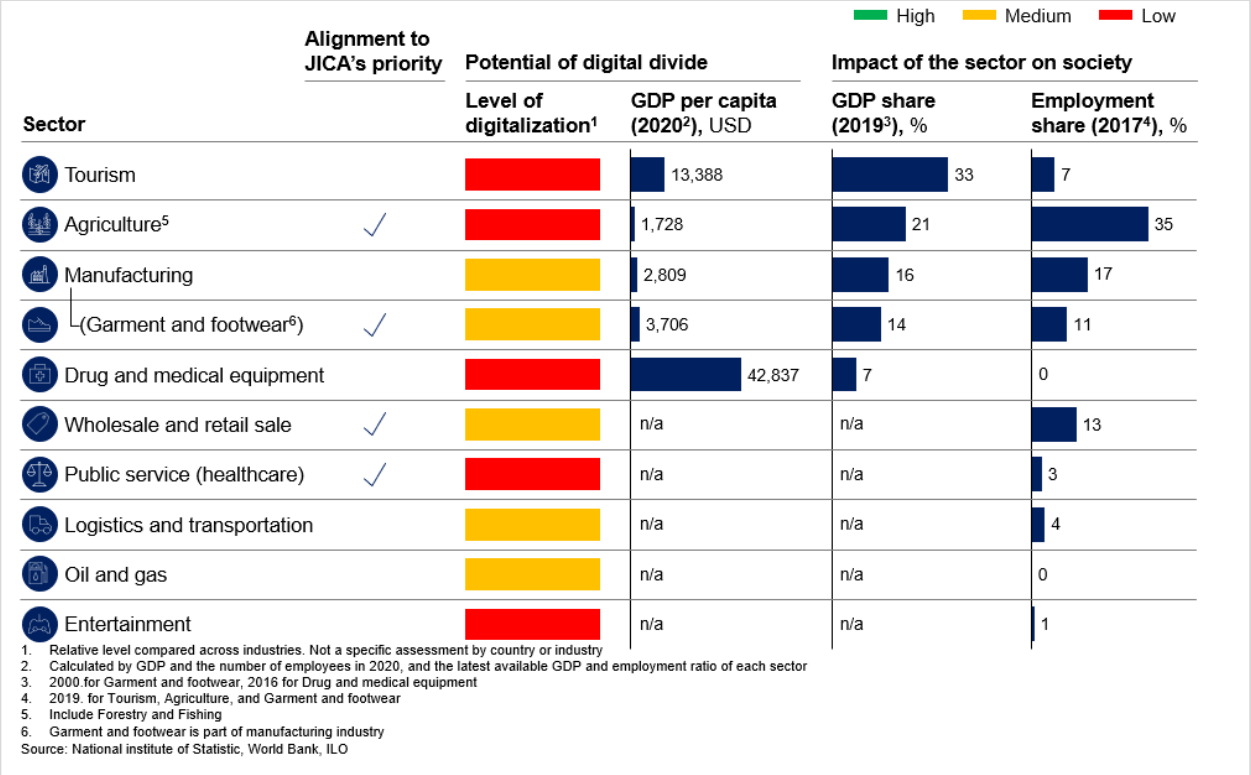


Figure 22. Selecting study target sectors

(3) Understanding the visions and challenges in each target sector considered, and identifying candidates for digitally-enabled solutions

We examined the orientation of digitalization in agriculture and healthcare, the target sectors under consideration for Cambodia. To sort out the digitalization orientation, we started by confirming each target sector's vision and challenges in achieving that vision, by reviewing government documents and holding interviews with experts. We then conducted another survey, and listed potential candidates for digitally-enabled solutions to the challenges in question.

(3)-1 Agriculture

According to the Five-Year Strategic Plan 2019-2023 for Agriculture Sector by the Cambodian Ministry of Agriculture, Forestry and Fisheries, Cambodia aims to have the agriculture sector move away from labor-intensive cultivation and strengthen competitiveness through modernization, and increase the industry's resilience to climate change.

Meanwhile, Cambodia faces the following challenges in achieving this vision.

The first is that producers have weak ties to the market, so primary industries are not commercialized enough. The Cambodian Supreme National Economic Council's agriculture sector analysis unit compiled

the "Report on Agriculture Policy Research Study 'MODERNIZING AGRICULTURE SECTOR: LONG-TERM VISION AND POLICY ORIENTATION.'" This report noted that the weak ties between producers and private business purchasers is an issue in aiming to modernize agriculture (Challenge 1).

The second challenge for Cambodian agriculture is that of productivity. In Cambodia, 76% of farmland is used to cultivate rice, but the productivity of the country's rice cultivation is only on par with 1970s China. From the 1960s to the 2000s, China's rice crop productivity tripled thanks to the development of fertilizers and high-quality seeds and seedlings, and the introduction of farm machinery.

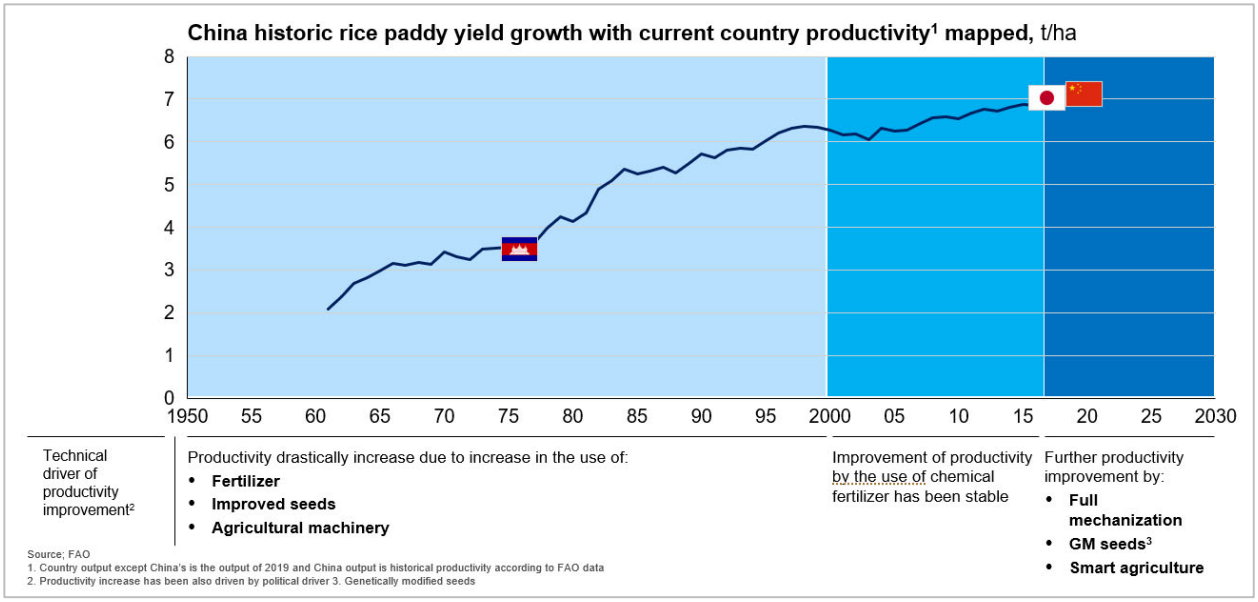


Figure 23. Rice crop productivity in Cambodia

On the other hand, the importance of high-quality seedlings is not fully recognized in Cambodia, and there is only limited investment in seedling production. Furthermore, since the industry is behind on the proper use of farm machinery and the introduction of modern farming techniques, the current situation is such that agricultural productivity is stuck at a low level.

Then, the working population continues to leave the agriculture sector in Cambodia, and there are fewer and fewer farmers. In these circumstances, improving productivity will be essential for maintaining and expanding agricultural output (Challenge 2).

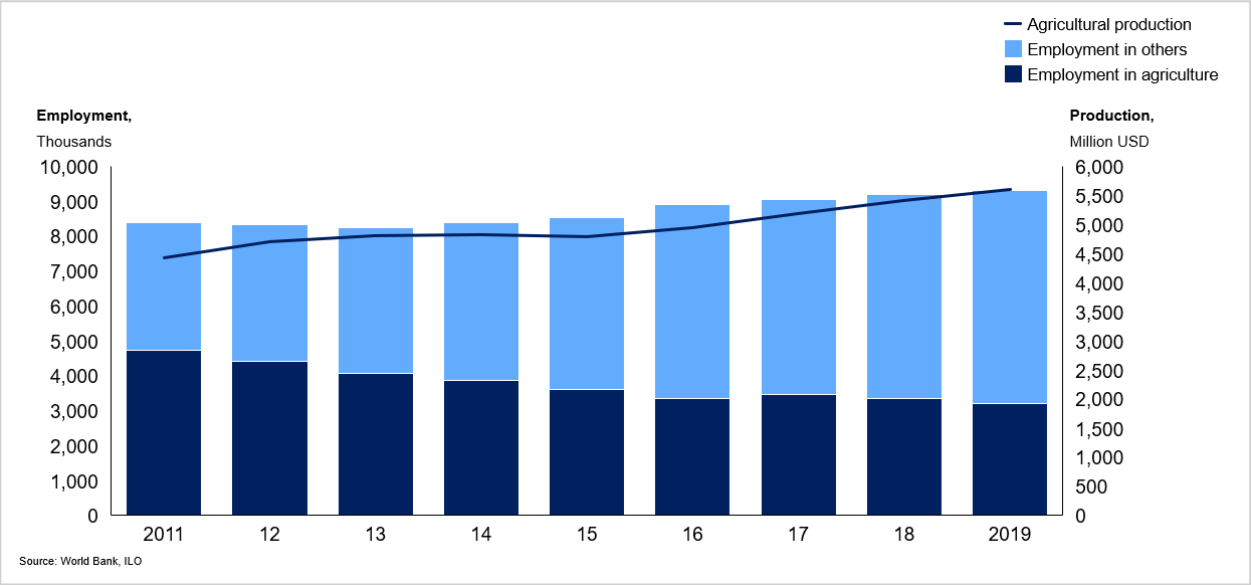


Figure 24. Shifts in the number of farmers in Cambodia

Thirdly, there is not enough versatility of agricultural crops. Over 70% of Cambodian farmland produces rice. Meanwhile, according to FAO, non-starch food products currently only account for 31% of food consumption in Cambodia, lower than the other survey target countries. However, as the economy continues to grow in the future, it is likely that demand will grow for diverse food products, including non-starch items.

The majority of Cambodia's agricultural crop exports are rice, but rice's productivity and its rate of increase in global demand are not as great as other types of crops. For these reasons, focusing on producing crops with better productivity and a more favorable market growth rate would likely be useful from the perspective of shoring up competitiveness of the agriculture sector (Challenge 3).

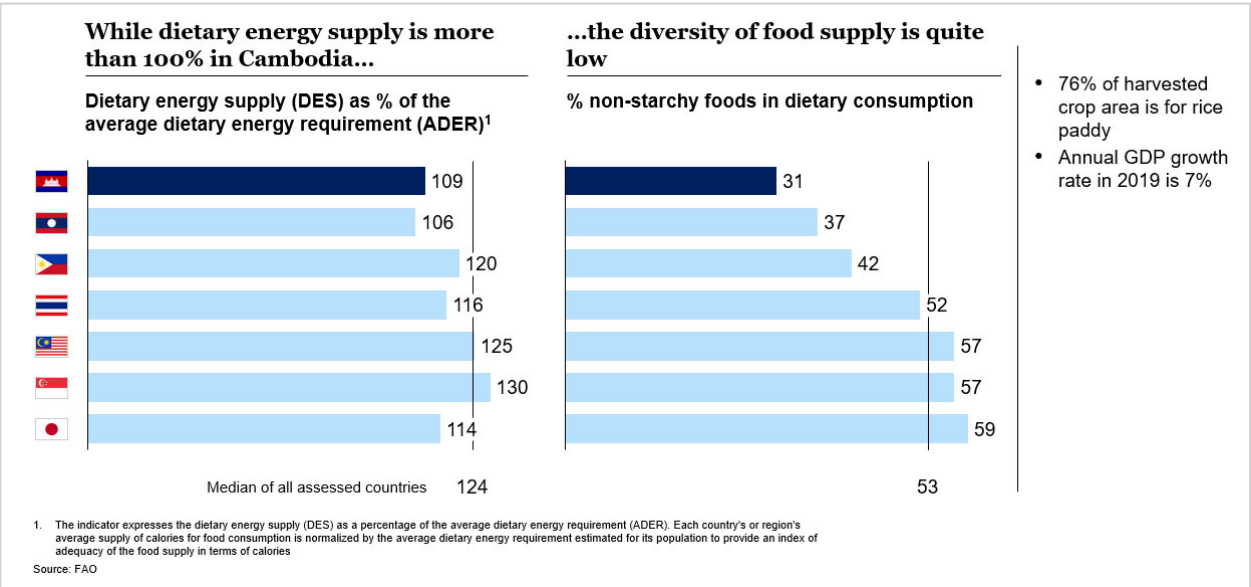


Figure 25. Non-starch share of food energy supply and food consumption amount

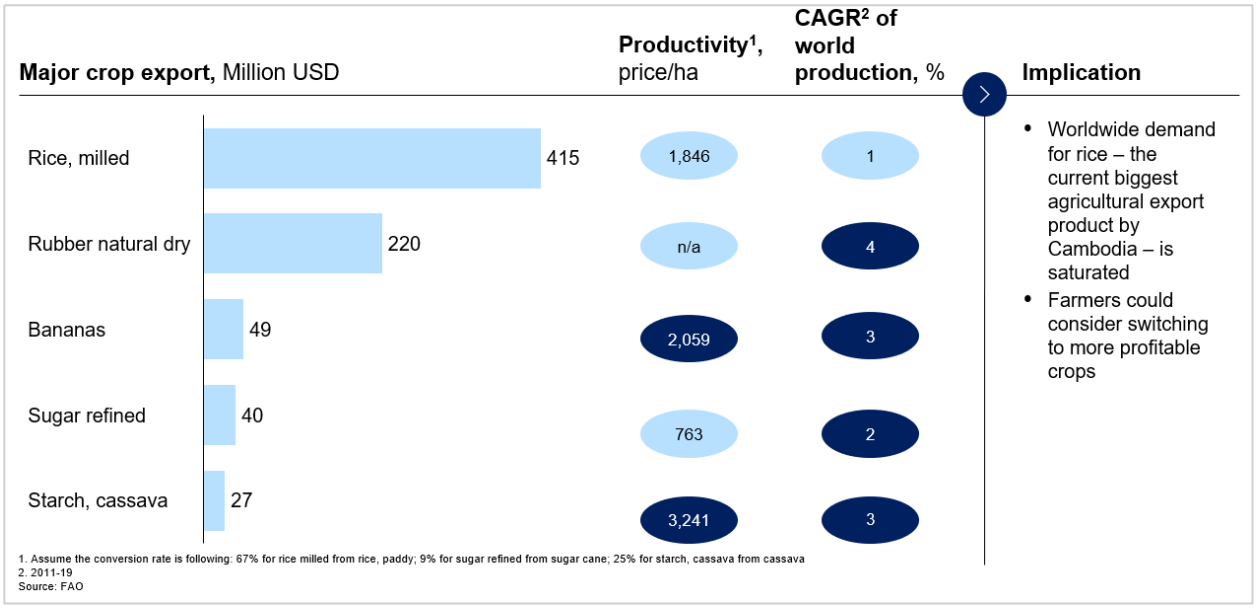


Figure 26. Key Cambodian export crop productivity and output growth rate of each globally

The fourth issue is that of sustainability. To achieve the resilient kind of agriculture Cambodia aims for, efforts will need to be made to improve productivity while taking proper care of the environment, to keep water sources from being depleted and the soil from deteriorating (Challenge 4).

The fifth challenge is the need to strengthen not only productivity but also the processing and distribution parts of the supply chain, to improve the competitive edge of agriculture. In Cambodia, the distribution infrastructure (roads, etc.) is not fully in order, and the power supply is insufficient, making it difficult to safely store food. This results in greater food loss than in other countries. In the context of a distribution system that is not well-ordered, Cambodian farmers have a lower net income than farmers in other countries (Challenge 5).

For discussion

Heat map: Positive / Neutral / Room for improvement

	Item	Indicator	Target			Reference						
												Median[1]
Storage	Crop storage facilities	Qualitative rating 0-1	1	0	n/a	1	0	1	0	1	1
	Ability to store food safely	% of population with access to electricity in all areas	91.6	97.9	n/a	100	94.9	100	100	100	100
Transport	Food loss	Total waste as % of total domestic supply	11.1	6.48	n/a	3.82	3.42	1.7	2.83	3.14	4.84
	Food safety mechanisms	Score 0-100, 100= best	60	80	n/a	80	40	80	80	100	80
	Road infrastructure	Qualitative rating 0-4	1	0	n/a	2	1	2	4	3	2
	Air, port, and rail infrastructure	Qualitative rating 0-4	1	1	n/a	1.7	1	3	4	3.3	2

1. Median of all the assessed countries (113)
Source: Global Food Security Index

Figure 27. Maturity of the food distribution infrastructure

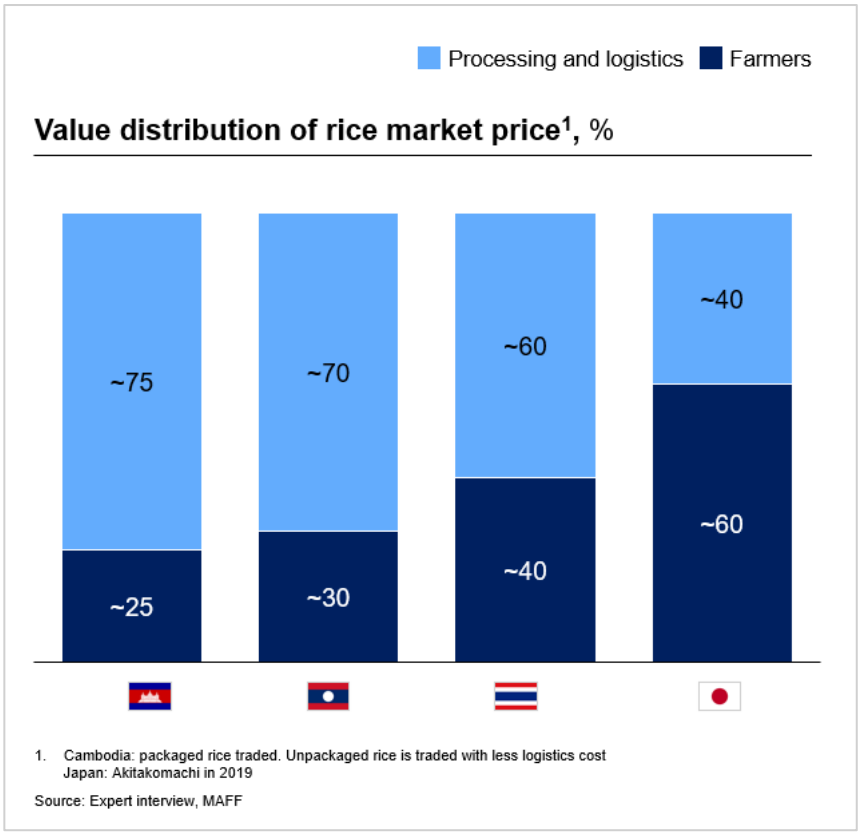


Figure 28. Inefficient logistics systems and room for improvement in distribution infrastructure

Figure 29. Expert comments on the logistics system

Experts	Comments
Cambodian agrobusiness expert	"Costs are going up because of inefficiencies at every stage of logistics. Energy costs are high, so it's expensive to run rice milling machines. Shipping costs involve not only gasoline and labor costs, they also have to do with the time spent collecting cargo. The roads are not very well-serviced, so trucks end up getting damaged or stuck in traffic, and sometimes the crops are in such a poor state that they won't sell, even before they make it to the desiccator. This is why brokers collect set fees." 」
Cambodian rice farmer	"Farmers don't know how much the rice they shipped sells for after its been milled. The mills have a lot of bargaining power." 」

Digitally-enabled solutions to the above challenges could take two orientations: improving the environment for farmers to access information, and introducing equipment and software based on the latest technology. Using these orientations to conduct expert interviews and surveys, we found the following candidates for specific expected solutions for each challenge.

[Improve the environment for accessing information]

- Challenges 1~4: Set up and popularize a platform that allows farmers to get essential information (e.g. information on seeds, agrochemicals, fertilizers, sustainable cultivation techniques, crop prices, and markets)

[Introduce equipment and software]

- Challenge 2: Introduce smart agriculture with precision agriculture, soil sensors, drones, etc.
- Challenge 5: Visualize supply chain information using RFID to reduce food loss and improve added value, improving aspects of crop distribution

Bearing in mind that Cambodia's agricultural productivity is still low, introducing high-quality seedlings, fertilizers, and machinery may be essential for improving productivity. Regarding options like RFID, this will need to be worked on in tandem with preparing the still poorly-serviced distribution infrastructure network.

As for the agriculture platform, this would provide a broad array of information and services needed for farmers' production and sales activities. If this platform were set up and farmers were able to easily access these types of information and services, there would be various benefits: more productive agriculture, a transition to more lucrative crops, sustainability-focused agriculture, and the creation of production and sales plans based on market needs. This solution is not about introducing a specific technology, but instead aims to resolve the challenges Cambodian agriculture faces by improving information access. This means that even taking into account the country's level of development in agriculture, this solutions would have the potential to show results right away.

Based on the above, we have positioned the preparation and popularization of the above agricultural platform as the priority orientation for the digitalization of Cambodian agriculture in this survey.

The specific content of this agricultural platform would be as follows.

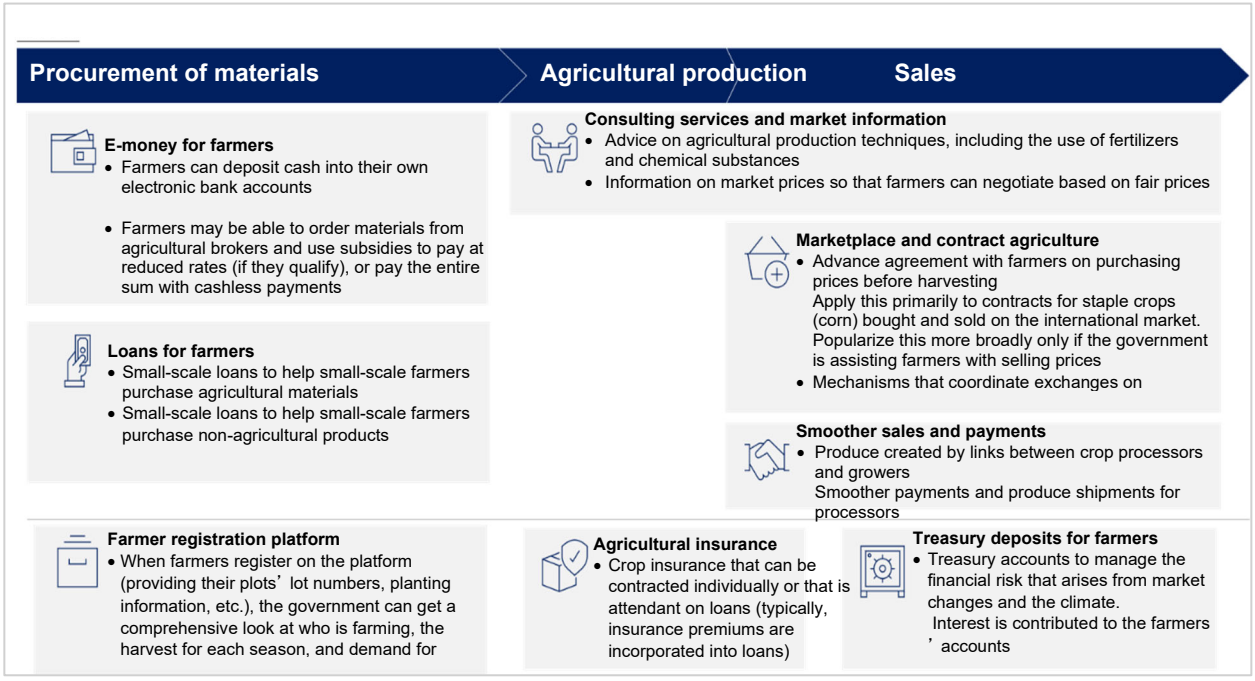


Figure 30. Expected features of the digital platform

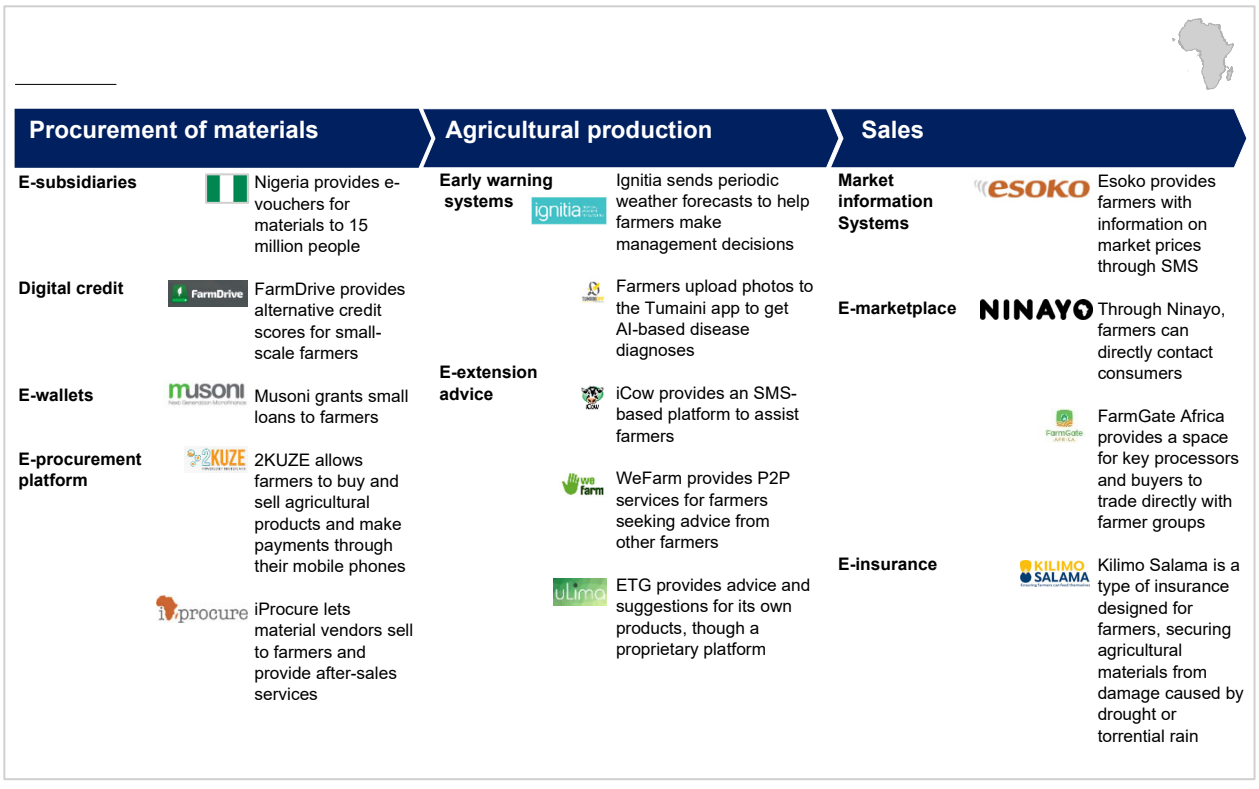


Figure 31. Examples of digital initiatives for small-scale farmers in Africa

(3)-2 Healthcare

Cambodia's Ministry of Health states in its Health Strategic Plan 2016-2020 that its vision is to provide high-quality healthcare to all citizens as a part of sustainable socioeconomic development.

However, the following challenges will be involved along the way to achieving the above vision.

The first is that there are not enough healthcare resources. With 0.2 doctors per 1,000 people (2014), Cambodia has fewer doctors than other countries (Malaysia: 1.5 [2015]; Laos: 0.4 [2017]). There are also not enough pharmaceutical supplies and medical equipment, with the number of hospital bed per 1,000 people at 0.9 (2016) (Malaysia: 1.9 [2017]; Laos: 1.5 [2012]).

The second challenge is the urban-rural healthcare disparity. In Cambodia, public healthcare institutions are primarily established as referral hospitals and health centers. Referral hospitals are established in each urban area with a population of 100,000 to 200,000 people, and doctors offer comprehensive service packages (CPA). Meanwhile, health centers that do not generally have any doctors are established in rural areas with populations from 1,000 to 2,000 people. Registered nurses and other professionals provide preventive measures and first assistance, following a basic service package (MPA). This makes it difficult for people in rural areas to get doctors' diagnoses and comprehensive healthcare at public institutions.

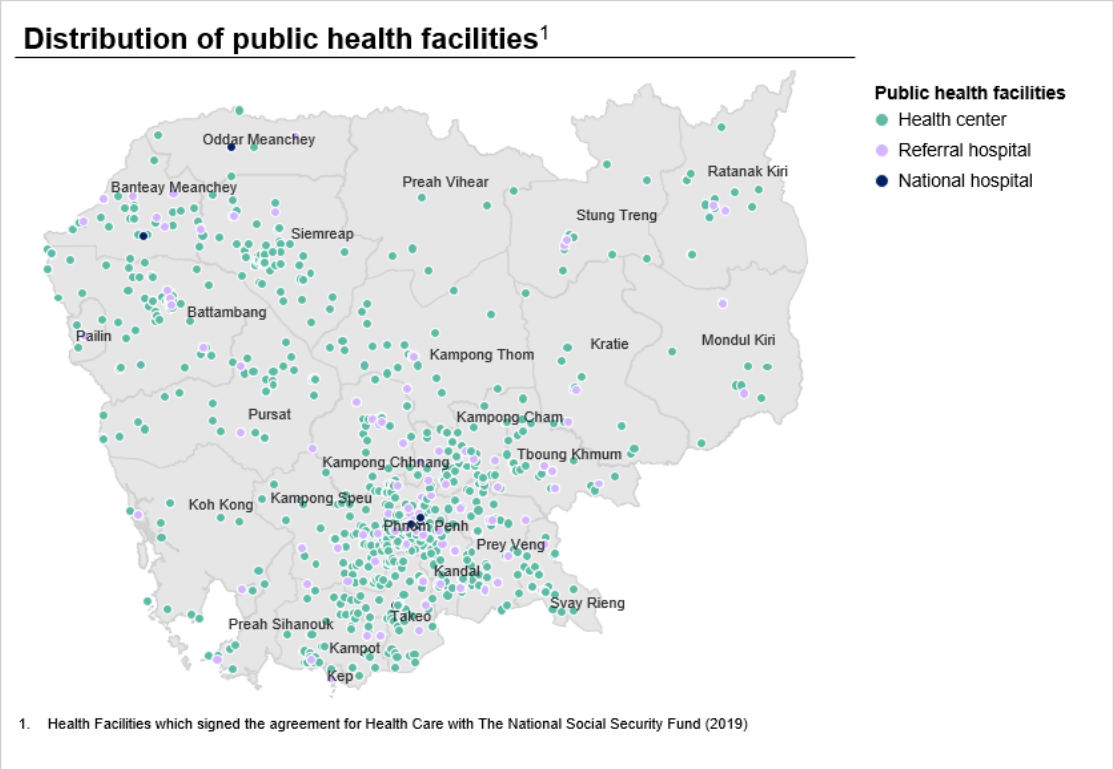


Figure 32. Distribution of public health institutions in Cambodia

The third challenge is the delayed digitalization of healthcare data. Even the above-mentioned plan mentions the use of healthcare data as a challenge. According to one Cambodian healthcare professional, medical records are often kept on paper, by the patients themselves. Efforts have begun in private hospitals to use electronic medical records, but they each use their own format, causing issues with compatibility.

The fourth challenge is that of the burden of paying medical expenses. There is no comprehensive national health insurance system in Cambodia, so medical expenses are often paid by the patients themselves. Per-person medical expenses in 2017 were USD 83; of that, USD 53 was paid for by the patient. In recent years, there have been changes to disease patterns and cause of death. Specifically, there are fewer deaths caused by infectious diseases such as lower respiratory tract infections, and more deaths caused by non-infectious diseases such as stroke, cirrhosis, and diabetes.

With the spread of COVID-19, there is an even greater need to resolve the above issues. The following solutions may be particularly effective as digitally-enabled solutions to the challenges faced by the Cambodian healthcare sector.

- **Close the regional healthcare gap by utilizing urban doctors efficiently, by introducing remote diagnostics:** Use video calls and other options to connect health centers that do not have doctors with referral hospitals that do, allowing for remote medical examinations and care, which would lead to a reduction in the above-mentioned healthcare gap.
- **Set up a centralized healthcare database for sharing medical records, which form the basis of remote diagnostics:** Doing this would make it possible to share and use medical records, and as remote diagnostics move forward, the use of healthcare data may help improve the quality of healthcare.
- **Curb healthcare costs by advancing preventative medicine using digital solutions:** Promoting preventative healthcare may help reduce the morbidity rate of non-infectious lifestyles diseases, curbing healthcare costs.

From the perspective of achieving a digitally-enabled inclusive economy, the most important step would be to improve rural citizens' access to healthcare, as they currently do not receiving comprehensive healthcare services from doctors. To that end, we have positioned the introduction of remote diagnostics, and the establishment of a centralized healthcare database that would form the foundation of remote diagnostics, as the priority for the digitalization of healthcare in Cambodia.

2.2.3 Identifying potential issues to assist

Bearing in mind the orientation of digitalization in the target sectors studied in the previous section, we studied the level of maturity of the enablers required to drive this digitalization.

The results of our survey of the maturity level of enablers as a whole are as follows. We found that in Cambodia, there were challenges involved in all four enablers.

Figure 33. Summary of potential issues to assist in Cambodia

Priority sector	Enablers	Assessment results	Potential issues to assist
Agriculture **Healthcare**	Capacity to formulate and implement policies	Improvements are needed in systems and in the capacity to implement policies	G1: The necessity of having the public healthcare system adapt to digitalization G2: Not enough capacity to implement policies
	Telecom infrastructure	The 4G network is being developed, and smartphone penetration has reached 74%, but rural areas still need assistance	I1: Slow mobile network speeds in rural areas I2: Low smartphone penetration in rural areas
	Human resources	Cambodia is starting to see an increase in ICT personnel Need to start by adding more IT engineers	T1: Education of digital translators is lagging behind due to a shortage of educational institutions and mature companies T2: Not enough education for training digital engineers T3: Insufficient quality in math and science education T4: Insufficient quality/quantity of education for IT engineers T5: Difficulty of using English-language online content due to low level of English
	Innovation ecosystems	The following segments will need to play a greater role in the innovation ecosystem • Startup, corporate • Investors, supporters • Knowledge contributors • Markets	E1: Educational institutions do not have the right mechanisms to secure outstanding personnel E2: Startups do not have enough funding to scale up E3: Lack of mentorship by local digital entrepreneurs E4: The digital market is not vigorous enough to promote independent innovation

Detailed results of the maturity survey are as follows.

(1) Survey of maturity of capacity to formulate and implement policies

According to a survey by the World Economic Forum, the Cambodian government's vision did not place much importance on ICT as of 2014-2015. However, with the Cambodia Digital Economy and Social Policy Framework 2021-2035 announced in 2021, the Cambodian government has started to indicate a posture of focusing on ICT in recent years. It is likely that circumstances have evolved since the time of the survey. In fact, the government's framework will start by reconfirming Cambodia's level of digitalization, then it will clarify policies to introduce and promote digital solutions and digital transformations in all fields in order to achieve economic growth and social welfare. The framework has infrastructure, regulation,

cybersecurity, human resources, government, and business as strategic priority areas, and has outlines essential initiatives.

Regarding ICT regulations, Cambodia scored 67 points out of 100 on the 2020 ITU ICT Regulatory Tracker, showing that there is not so much room for improvement when compared with other countries.

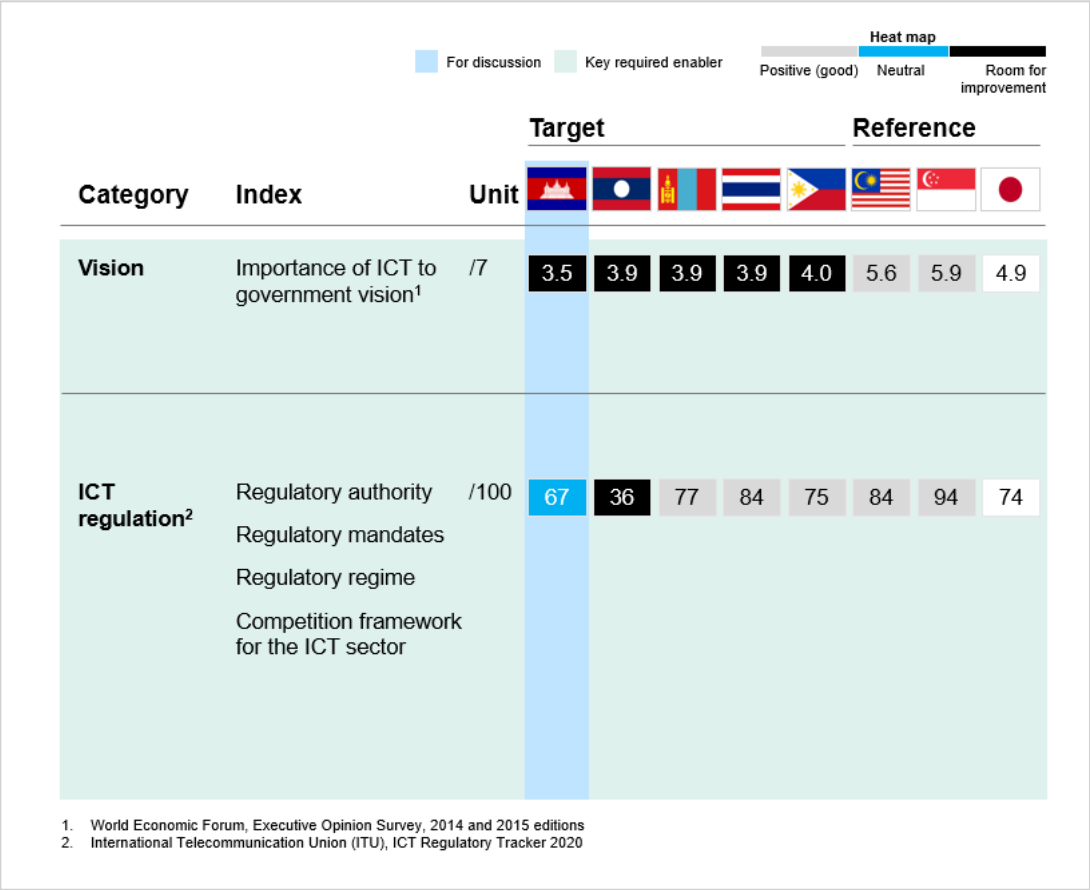


Figure 34. Maturity of capacity to formulate and implement policies

We also received the following types of comments in interviews with experts and with staff at counterpart government agencies

Figure 35. Capacity to formulate and implement policies: Potential issues

Category (Required enablers)	Respondents	Comments, assessment results	Potential issues to assist
Vision	MTPC staff	"The Cambodia Digital Economy and Social Policy Framework 2021-2035 received the minister's approval. I think it might be announced next month."	No major issues found • An ICT vision has been formulated in Cambodia
	JICA local staff	The Department of Planning and Healthcare Information of Cambodia is currently revising the Health Strategic Plan, and I think more emphasis will be placed on digital health in the future."	

Category (Required enablers)	Respondents	Comments, assessment results	Potential issues to assist
Policy & Regulation	MTPC staff	"I'm sure there will be some areas that will need special regulations, but the progress of digitalization has changed at the ministries. The level of importance of agriculture, healthcare, and education has gone up due to COVID-19."	The necessity of having the public healthcare system adapt to digitalization • Healthcare insurance policies • Data standards for shared use of medical records • Regulatory setup for data protection • Central repository of medical records
	Private hospital director	"Since there aren't any regulations for remote diagnostics in Cambodia, private hospitals have an easy time introducing it. On the other hand, there may be institutional issues with introducing it into public healthcare. Personal information also needs to be handled carefully, to ensure security." "In Cambodia, many patients hold on to their own paper-based medical records themselves. Some advanced hospitals have already introduced electronic health records, but they each use their own format, so it's difficult to share information."	
	Medical expert	"The value of digital health is the physical technology of the data itself and its use. It's important to formulate data dorms and establish a corresponding system for medical records."	
Execution	MTPC staff	"In Cambodia, mobile plans are cheap, at about USD 1.50 per gigabyte." "One of the challenges in improving digital capabilities is how to motivate government officials."	Not enough capacity to implement policies

Based on the above, we found the following potential issues to assist in the area of the capacity to formulate and implement policies.

- Policies and ICT regulations: The necessity of having the public healthcare system adapt to digital healthcare
- Implementation: Not enough capacity to implement policies

(2) Telecom infrastructure maturity survey

Below are the results that were found based on various indicators.

- Mobile broadband internet access is more common than fixed broadband: While 4G coverage is at 93%, only 6% of households have fixed broadband.
- 4G networks are being installed, and smartphone penetration is progressing to a certain degree: As mentioned above, 4G coverage is at 93% in Cambodia, on par with Malaysia (93%) and Singapore (100%). Smartphone penetration has also gone from under 20% in 2017 to an estimated 74% in 2021, expanding gradually across the entire country.

For discussion | Key required enabler | Heat map: Positive (good) / Neutral / Room for improvement

	Indicator		Unit	Target					Reference		
Mobile broadband	Network	4G coverage[1] (/population)	%	93%	43%	82%	98%	80%	93%	100 %	99%
		Download speed[2]	Mbps	20.03	27.09	19.51	48	26.24	23.72	66.67	38.81
		Latency[2]	ms	32	31	36	28	31	34	22	44
		Mobile tariff [3](fee of 1GB/monthly GDP capita[4])	%	1.15%	1.94%	0.22%	0.20%	0.51%	0.13%	0.05%	0.12%
	Device	Smartphone penetration[5] (/population)	%	74%	35%	79%	111%	140%	115%	121%	120%
		Smartphone price[6] (/monthly GDP capita)	%	n/a	n/a	n/a	44%	70%	33%	9%	19%
Fixed broadband	Network	Household coverage [7]	%	6%	6%	61%	58%	35%	44%	112%	105%
		Download speed[2]	Mbps	27	39	43	218	38	93	239	141
		Latency[2]	ms	12	16	14	8	23	18	13	23
		Monthly subscription price [3] (/monthly GDP capita)	%	25%	25%	3%	4%	19%	3.7%	0.7%	1.5%

1. GSMA (2019), 2. Speedtest (Feb 2021), 3. Cable.co.uk (2020), 4. IMF (2020), 5. Omdia WCIS (2021), 6. StrategyAnalytics (2020), 7. Informa (2021)

Figure 36. Maturity of telecom infrastructure

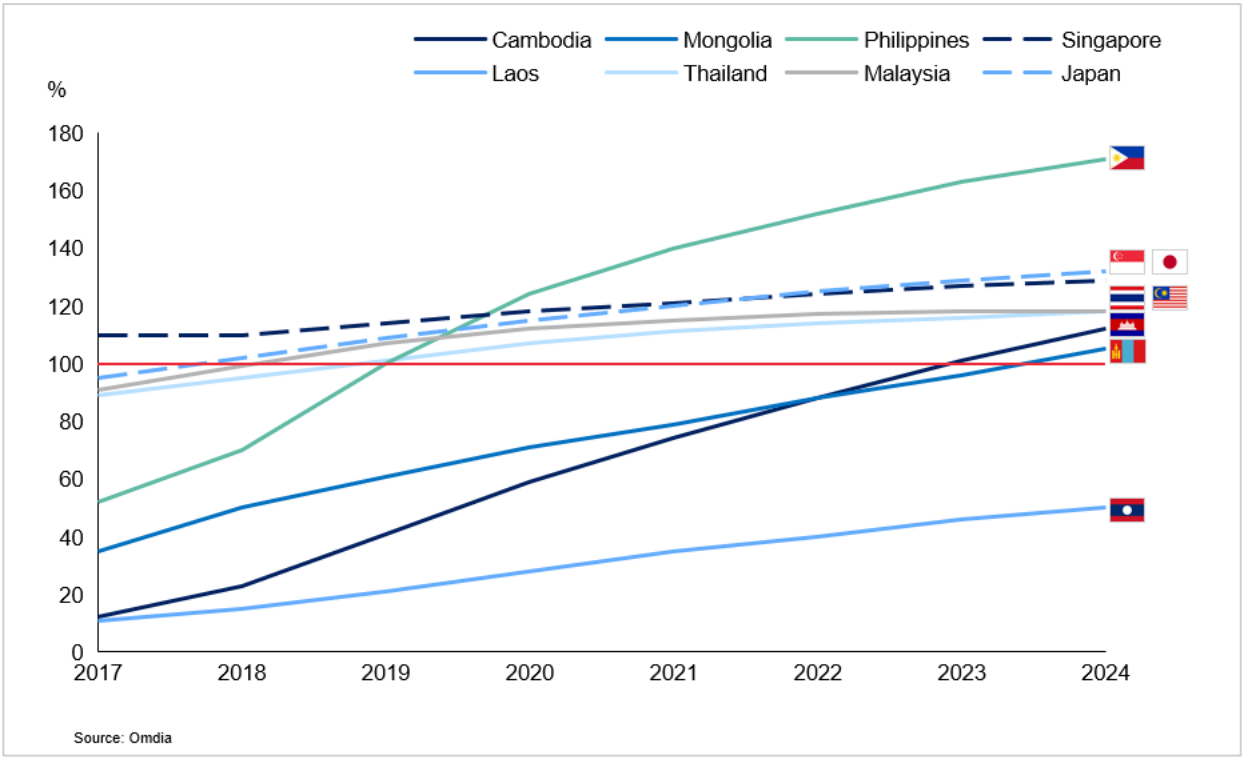


Figure 37. Shifts in smartphone penetration

We also received the following types of comments in interviews with experts and with staff at counterpart government agencies

Figure 38. Telecom infrastructure: Potential issues

Category (Required enablers)	Respondents	Comments, assessment results	Potential issues to assist
Mobile network	IT network expert	"Network coverage is the most important factor for advancing remote diagnostics. 20Mb or more is fine as a download speed, but upload speeds tend to fall below that, which means that this may be the issue when trying to talk to a doctor on a video call."	Slow mobile network speeds in rural areas • Connectivity has been established for based text-based remote diagnostics • Improve upload speeds: Mobile networks will need to be strengthened further, especially in order to promote video-based remote diagnostics
	Medical expert	"The network speeds here are even better than those in Indonesia, where they already do remote diagnostics, so it should work well enough in Cambodia too."	
	Private hospital director	"Connectivity is not as good in rural areas as it is in urban ones. Remote diagnostics function without any problem when using a messaging app, but issues tend to come up when doing video calls."	
	MTPC staff	"Network installation is going smoothly, because we've been working on the goal of getting 95% of the entire population covered."	
Mobile devices	International tourism expert	"There aren't many people in rural Cambodia who have smartphones equipped with the latest features, but many people do have mobile phones with basic features. Perhaps older people don't know how to use a smartphone."	Low smartphone penetration in rural areas • Smartphone penetration needs to be sped up in rural areas
	MTPC staff	"In Cambodia, mobile plans are cheap, at about USD 1.50 per gigabyte."	

Based on the above, we found the following potential issues to assist in the area of telecom infrastructure maturity.

- **Mobile networks:** Slow mobile network speeds in rural areas
- **Mobile devices:** Low smartphone penetration in rural areas

(3) Survey of HR maturity

Only 0.2% of the entire working population of Cambodia is employed in the ICT sector, lower than other countries (Thailand: 1.1%; Malaysia: 3.0%). Following the two scenarios listed in the consideration procedures in 2.1.2, we estimated the ICT personnel demand for Cambodia in 2030. In Scenario 1 (the current rate of increase of ICT personnel and proportion of HR stay the same) that number was 33,000; in Scenario 2 (ICT personnel increases relative to the working population as a whole, to reach the level of countries with greater digitalization than Cambodia [e.g. Thailand]) the number was 134,000 people. Actual future demand will probably fall between these two figures. In Scenario 2 more digital engineers will be needed, but as industry digitalization progresses, IT engineers will be needed first, as the foundations of the

ICT talent pool. In Cambodia, which has a small number of ICT personnel, it will be important to prioritize training IT engineers first.

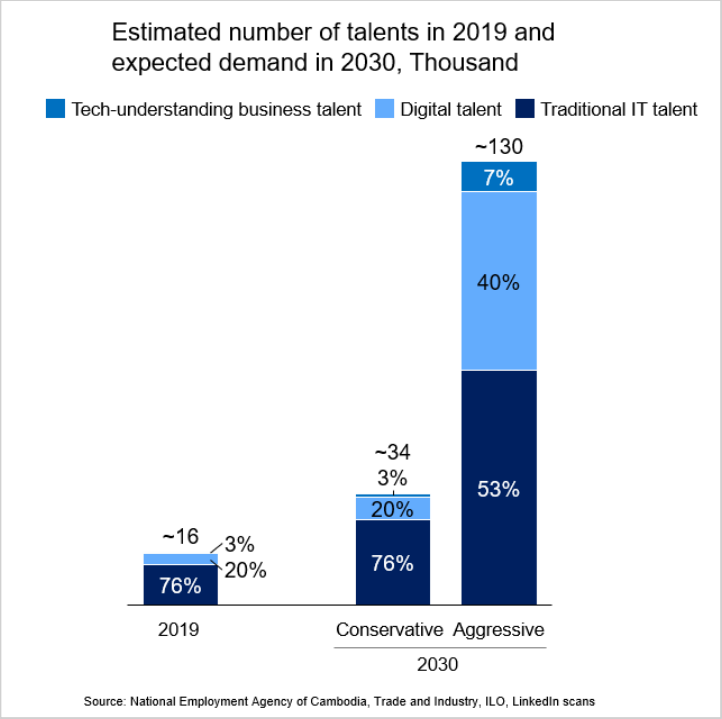


Figure 39. Demand for ICT personnel in Cambodia

We also received the following types of comments in interviews with experts and with staff at counterpart government agencies.

Figure 40. Human resources: Potential issues

Category (Required enablers)	Respondents	Comments, assessment results	Potential issues to assist
Digital translators	Dean of faculty of sciences at a university	"There is no one who knows how to improve business by making full use of technology. The universities don't offer that kind of education, and there also aren't very many mature companies that are seeking digital translators and are ready to train them at the moment."	Education of digital translators is lagging behind due to a shortage of educational institutions and mature companies
Digital engineers	President of an engineering university	"Most demand for ICT talent in Cambodia is still oriented toward traditional IT talent. Training advanced digital engineers would require universities to educate students on trends in international topics and technologies, but most of the universities do not offer this kind of education." "Science and mathematics education will need to be strengthened if Cambodian citizens are to develop algorithms and write papers."	Not enough education for training digital engineers Insufficient quality in math and science education

Category (Required enablers)	Respondents	Comments, assessment results	Potential issues to assist
	Ecosystem expert	"Most cases of digitalization in developing countries were propelled by having people who were educated overseas bring back and copy business models that were successful overseas."	
IT engineers	President of an engineering university	"Systems can't be built without the leadership of brilliant senior engineers, and in Cambodia there are not enough brilliant and experienced engineers."	Insufficient quality/quantity of education for IT engineers • Not enough high-level technology at domestic universities and IT vocational schools • Not enough seasoned educators Insufficient quality in math and science education Difficulty of using English-language online content due to low level of English
	IT academy instructor	"Cambodia's local human resources is challenged in areas like management skills, IT skills, and foreign language abilities. There is not enough talent working as managers in overseas affiliate companies." "There is not enough high-level technology at Cambodian IT educational institutions. Students at the top of their class don't usually rely on their own educational institutions; they study on their own, with YouTube, etc. Although quality local online content in Cambodia is lacking, there is also a language barrier when it comes to accessing foreign content." "Mathematical thinking is the foundation of programming, but there are also issues with STEM education (science, technology, engineering and mathematics)."	
	IT expert	"Educational institutions and the business world are not aligned with one another, so IT talent is lacking at all levels. University education is extremely academic, and in some areas it's falling behind the times. Education needs to connect more strongly with the needs of the real world."	

Based on the above, we identified the following potential issues to assist in the area of HR maturity. There are issues in HR development in any case, but as mentioned above, training IT engineers should be prioritized.

- **Digital translators:** Training is lagging behind due to a shortage of educational institutions and mature companies
- **Digital engineers:** Not enough education for training digital engineers, and insufficient quality in math and science education
- **IT engineers:** Low quality of education for IT engineers, low quality of math and science education, difficulty using English-language online content due to low level of English

(4) Innovation ecosystem maturity survey

Below are the results that were found based on various indicators.

- **Startups:** Cambodia has a tax rate of 23%, low in comparison with other countries (Thailand: 30%; Philippines: 43%; Malaysia: 43%). Relative to other countries, Cambodia has favorable conditions, with a small number of procedures needed to start a company, and a lower corporate tax rate. On the other hand, it takes 99 days to start a business, the longest of the survey target countries. These challenges are not currently as grave as they were, because in 2020 the Cambodian government relaxed registration procedures and vastly reduced the number of days it takes to register.
- **Corporate, knowledge contributors:** R&D expenses are low, and there are issues from the point of view of contributions to innovation.
- **Investors, supporters:** VC investment is a low percentage of GDP, and the government does not do enough to promote investment in new technology.
- **Market access:** Compared with other countries, there is not enough market competition to encourage innovation.

For discussion | Key required enabler | Heat map: Positive (good) / Neutral / Room for improvement

Category	Index	Unit	Target					Reference		
Startup	Average # of startups[1] founded annually	/MM people[2]	0.3	0.0	0.2	0.8	0.2	2.4	68.6	3.7
	Days to start business[3]	#	99	173	12	6	33	17	2	12
	Procedures to start business[3]	#	9	9	8	5	13	8	2	8
	Tax rate % profit[4]	%	23	24	26	30	43	39	21	47
Corporate	Investment in emerging technologies[5]	/100	44	46	33	54	61	79	79	80
	R&D expenditure by businesses[6]	/100	0.4	n/a	0.2	21	1.5	21	33	65
	Creation/merger/acquisition of joint venture[7]	/MM people[2]	0.1	0.1	0.4	0.3	0.1	1.0	12.2	0.7
Knowledge contributor	# of scientific and technical journal articles[8]	/MM people[2]	9	12	42	179	21	717	1,986	786
	R&D expenditure by government and higher education institution[6]	/100	3	n/a	7	16	7	57	80	58
Investor/ supporter	VC investment[9]/GDP[10]	USD/MM USD	79	0	230	361	95	244	11,125	385
	Government promotion of investment in emerging technologies[5]	/100	31	48	20	65	39	77	100	72
	FDI restrictiveness[11]	/1	0.05	0.19	0.07	0.27	0.37	0.25	0.06	0.05
Market access	Intensity of local competition[12]	/7	4.7	4.3	5	5.4	5.2	5.4	5.6	6.3

1. Average number of startups founded during 2016-20 annually listed in PitchBook, approach of summing startups might not be exhaustive, 2. IMF, 3. Doing business 2020 report 4. Paying Taxes 2020 report, 5. World Economic Forum, Executive Opinion Survey 2017–2018, 6. UNESCO Institute for Statistics, 7. Average number of creation /merger /acquisition of joint venture listed in Capital IQ during 2010-2020, 8. World Development Indicators (2018), 9. Average capital invested during 2016-20 annually listed in PitchBook, approach of summing capital might not be exhaustive, 10. IMF (2020), 11. OECD (2019), 12. World Economic Forum, Executive Opinion Survey, 2014 and 2015 editions

Figure 41. Innovation ecosystem maturity

We also received the following types of comments in interviews with experts and with staff at counterpart government agencies.

Figure 42. Innovation ecosystem: Potential issues

Category (Required enablers)	Respondents	Comments, assessment results	Potential issues to assist
Startup, corporate	Document research	In 2020, business registration procedures were simplified and the time needed to register was shortened • Registration time was reduced from three months to 15 days • Procedures that had been conducted at three different ministries were consolidated with the development of a platform to do them together. However, there are still procedures needed for three other ministries • Some procedures (registering photos and fingerprints, etc.) no longer need to be transferred to government offices	No major issues found: Ongoing observation is needed, but no issues were found
	MPTC staff	"A simple registration system was developed, so there aren't any difficulties with starting a business in Cambodia."	
Knowledge contributors	President of an engineering university	"The universities don't produce many papers. When my university tried collaborating with a foreign university, the first thing we were told was that we need to create doctoral programs. This (the lack of doctoral programs) is one reason Cambodian academic institutions have weak R&D."	Educational institutions do not have enough of the right mechanisms to secure outstanding personnel
	University head of technology department	"Most engineering students work to feed their families after they complete the curriculum, so they do not go on to complete a master's degree."	
	Technician	"Universities are reorienting themselves on promoting innovation (for example, the National Polytechnic Institute of Cambodia [NPIC], the leading engineering university in the country, has a large-scale startup hub, and the Institute of Technology of Cambodia [ITC] runs startup events)."	
Investors, supporters	President of an engineering university	"There are some people who intend to invest in Cambodian entrepreneurs, but they are few in number because there haven't been any examples of successful exits. If we could just establish an exit success model, Cambodia might get more investment."	Many people are involved in assisting aspects of funding, but there is not enough funding for startups to scale up • Cambodia's market size is limited, and some market trends are unpredictable, so it is not exactly an
	Tech expert	"Many international assistance organizations assist Cambodia, including USAID and the World Bank, and the government gives USD 7 million to startups."	
	Tech expert	"The market is small, so it hasn't gained the interest of large-scale investors. Many startup	

Category (Required enablers)	Respondents	Comments, assessment results	Potential issues to assist
		ecosystems are assisted by agencies, but there isn't enough financial assistance for startups to expand their business."	attractive investment destination for foreign institutional investors Startups do not have enough funding to scale up • Few mentors in the digital sphere who understand regional circumstances • Many international assistance organizations offer mentorships
	Tech expert	"In Cambodia, there aren't enough local digital entrepreneurs who are familiar with local circumstances." "Real startup conditions are invisible to overseas investors, making it difficult to receiving funding."	
	Document research	Since there aren't any entrepreneurs with experience succeeding in establishing and scaling a startup, entrepreneurs don't have any mentors they can turn to for advice when they need it. Over 50% of entrepreneurs either do not have a mentor, or only receive very limited guidance	
Market access	Innovation ecosystem expert	"The market is too small because the language is unique." "It's easy to become a market leader domestically, but difficult to expand overseas."	The digital market is not vigorous enough to promote independent innovation • In addition to digital enablers, the following prerequisites will be needed for e-commerce development – Logistics – Bank accounts and mobile payment options
	MTPC staff	"Ecosystems are important. Cambodia needs to expand its digital market. On this point, e-commerce is an area that might be able to drive the digitalization of other neighboring sectors, like mobile payments and logistics."	
	Tech expert	"Many businesses are switching over to digital because of the effects of COVID-19. In Cambodia, many citizens, including students, use Facebook as an e-commerce site."	

Based on the above, we found the following potential issues to assist in the area of the capacity to formulate and implement policies.

- **Knowledge contributors**: Educational institutions do not have the right mechanisms to secure outstanding personnel
- **Investors/supporters**: Startups do not have enough funding to scale up, and there is not enough mentorship by local digital entrepreneurs
- **Market access**: The digital market is not vigorous enough to promote independent innovation

2.2.4 Formulating assistance programs

(1) Assessing potential issues

Following the approach mentioned above, we assessed the potential issues based on: (1) impact anticipated from solving the issue; (2) our counterparts' level of interest; and (3) JICA'S interest. The results are as follows. To the right side of the diagram are the issues that are expected to have a large impact if they are resolved, while the issues of greater interest to our counterparts are positioned on the top row of the diagram. Based on (1) and (2), the issues JICA prioritizes for assistance programs are highlighted in grey (the letters at the head of each issue indicate the following: E: innovation ecosystems; G: government policymaking; I: infrastructure building; and T: training talent).

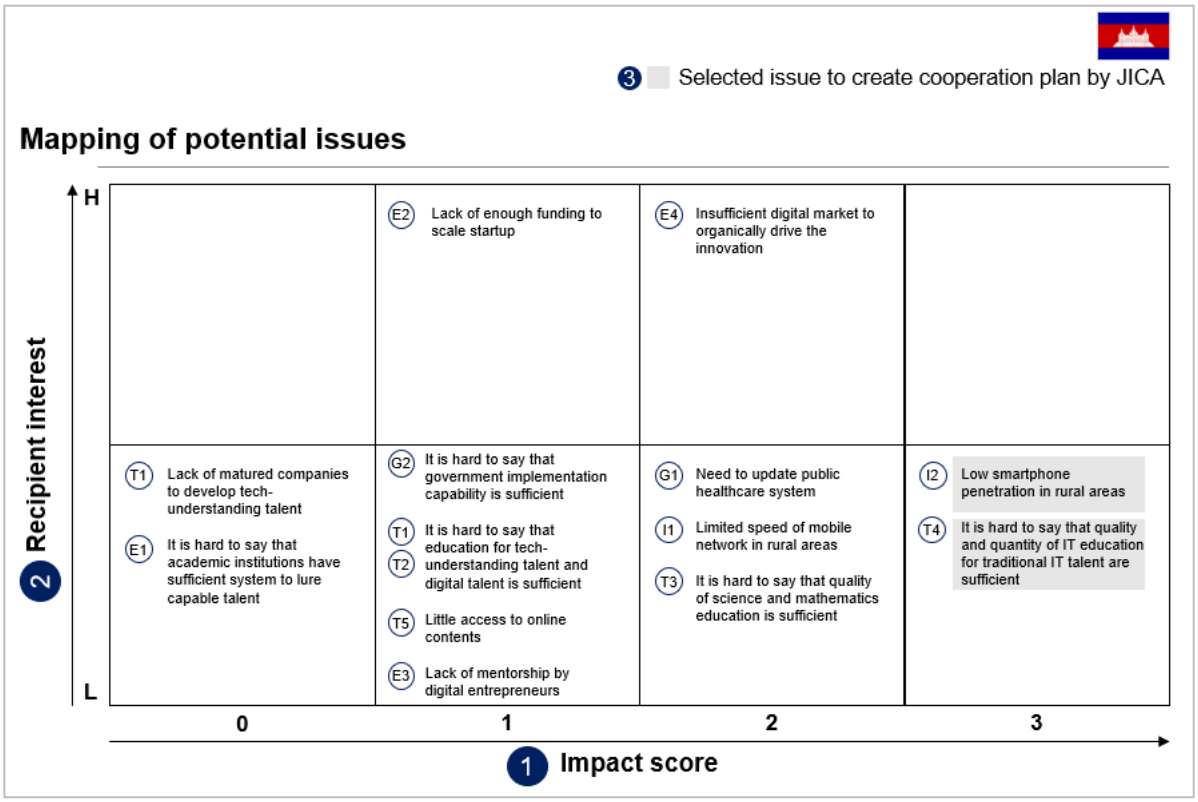


Figure 43. Assessment of potential issues

Below is a detailed explanation on the assessment based on the above three perspectives.

(1)-1 (1) Impact expected from solving the issue

Using the scoring method outlined in the consideration procedures in 2.1.2, we scored the expected impact of solving each potential issue. We found that the following issues would have a relatively high expected impact if they were resolved (scoring 3 or 2).

- Low smartphone penetration in rural areas (score 3)
- Insufficient quality/quantity of education for IT engineers (score 3)
- The necessity of having the public healthcare system adapt to digitalization (score 2)

- Slow mobile network speeds in rural areas (score 2)
- Insufficient quality in math and science education (score 2)
- Digital market not vigorous enough to promote independent innovation (score 2)

(1)-2 (2) Counterpart's interests

Meanwhile, the counterpart Ministry of Post, Telecom and Communications (MPTC) showed interest in "digital market not vigorous enough to promote independent innovation" from among the above six issues.

We received the following comments from the counterpart on each issue.

Figure 44. Counterpart's interests

Interest	Potential issues to assist	C/P comments
High	E4: The digital market is not vigorous enough to promote independent innovation E2: Startups do not have enough funding to scale up	"Ecosystems are important. Cambodia needs to build the foundations for a digital market. On this point, e-commerce is an priority area, and we also promote the digitalization of adjacent sectors like mobile payments and logistics." "Startup funding is the most pressing issue. Young startup founders don't usually have collateral they can use to get a bank loan. The government believes it can assist entrepreneurs with government venture capital and grants."
Low	G1: The necessity of having the public healthcare system adapt to digitalization G2: Not enough capacity to implement policies I1: Slow mobile network speeds in rural areas I2: Low smartphone penetration in rural areas T1: Education of digital translators is lagging behind due to a shortage of educational institutions and mature companies T2: Not enough education for training digital engineers T3: Insufficient quality in math and science education T4: Insufficient quality/quantity of education for IT engineers T5: Difficulty of using English-language online content due to low level of English E1: Educational institutions do not have enough of the right mechanisms to secure outstanding personnel E3: Lack of mentorship by local digital entrepreneurs	"The vision and regulations are already in place. A certain degree of assistance may be needed to implement the vision and regulations, but this is low-priority." "The telecom infrastructure is developed enough to get the digital economy on track." "I think that developing the digital market is essential for increasing employment opportunities for ICT talent, so ecosystem development is more important than developing talent." "Mentorships are often run by investors, so the priority is increasing investment amounts."

(1)-3 (3) JICA 's interests

We mapped the potential issues based on the expected impact of resolving them, and on the counterpart's level of interest. We then selected the priority issues to consider as JICA assistance programs. The results were the selection of the following two potential issues to assist.

- Low smartphone penetration in rural areas
- Insufficient quality/quantity of education for IT engineers

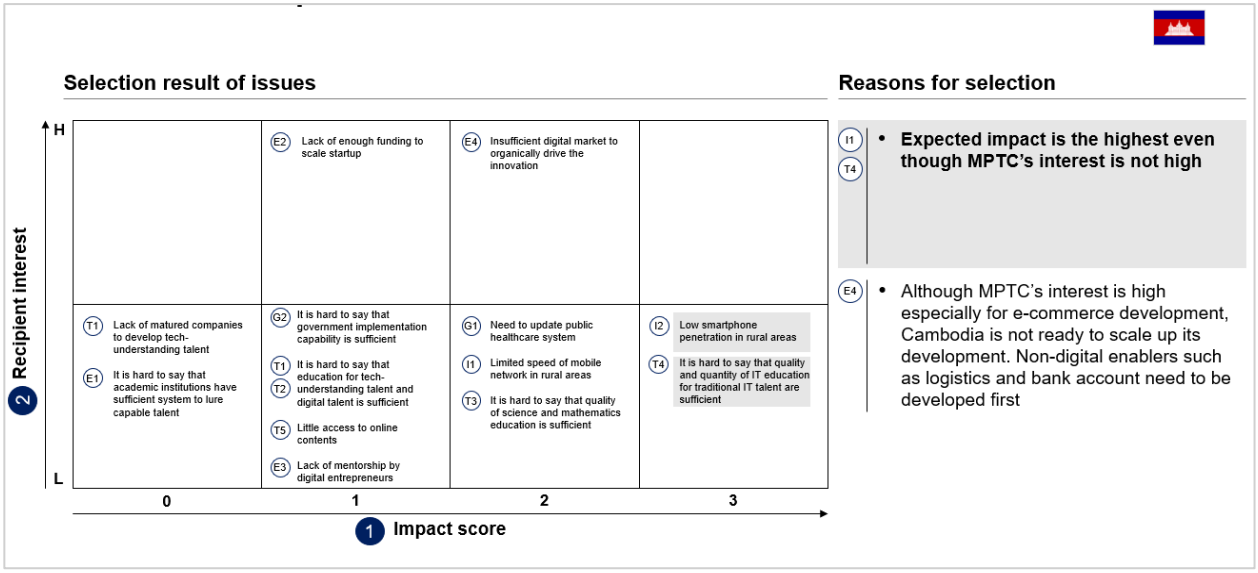


Figure 45. Identifying priority issues

(2) Drafting assistance programs and possible solutions for potential issues

(2)-1 Formulating JICA assistance programs for priority issues

This section outlines JICA assistance programs for each of the priority issues.

Low smartphone penetration in rural areas

Below is a list of global best practices on this issue, as identified through surveys of reference projects done by other donors, and interviews with experts.

- Popularize smartphones and tablets in rural areas
  - ― Government or network operator subsidies to facilitate purchase, or low-interest loans guaranteed by the government
  - ― Install devices in public institutions
  - ― Provide free or inexpensive broadband access plans
- Popularize/raise awareness about how to use devices for economic and social activities

Regarding the spread of devices, other countries' efforts showed that the best practices include not only giving subsidies to simply purchase devices, but also providing cheap data plans for a fixed period. The Singapore government's NEU PC Plus (NPP) Program provides a three-year broadband plan free of charge,

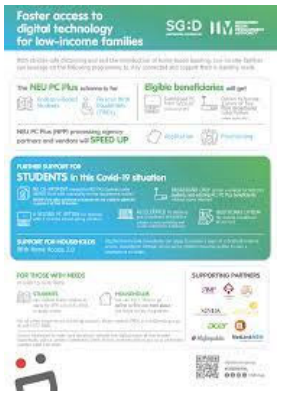
along with assistance purchasing a computer, to low-income houses with students or people with disabilities. In Singapore's Home Access Program (HAP), there is an option to provide two years of inexpensive broadband that comes with a tablet or smartphone. Such programs lower the hurdles for starting to use a device as well as purchase one, and may help drive the spread of devices.

When promoting the spread of devices, it is crucial to have people understand how to also use these devices for economic and social activities. In Uruguay, efforts are made to supply students with computers and improve their learning results. In Japan, NTT DoCoMo runs smartphone classes for older people, to help encourage the spread of smartphones.

The idea is that users learn about the conveniences of these devices by using them, or gain economic and social benefits, thus leading to continued use.

Taking the above best practices as references, when running similar initiatives in Cambodia, it will be important to familiarize and educate people about how to use these devices for economic and social activities in a way that fits the context of Cambodia. At the same time, it will be crucial to consider measures to prevent resale and other issues, based on Cambodia's income level.

Figure 46. Efforts in Singapore

Efforts		
Objectives	• As part of a digital readiness blueprint, access is expanded as much as possible for basic digital enablers, such as devices and networks • Improve productivity at small and medium enterprises (SMEs) by giving Productivity Solutions Grants (PSG)	
Key activities	• NEU PC Plus (NPP) Program: With this program, low-income households with students or people with physical disabilities are provided with computers at a low price, and given three-year contracts for free broadband. The Infocomm Media Development Authority (IMDA) works with non-profit organizations (e.g. the Chinese Development Assistance Council [CDAC]) to process applications submitted through school agencies. When an application is successfully accepted, IMDA places orders for a computer and broadband connection in collaboration with partner companies (telephone company M1, Netlink PC Acer, etc.). IMDA provides subsidies for package deals • Home Access Program (HAP): In this program, households that do not include students or PWD are given subsidies for fiber broadband plans that include a tablet or smartphone • The Ministry of Education (MOE) approved lowering the cost of purchasing personal learning devices by having secondary schools and junior colleges participate in a large-scale bidding scheme, on the condition of having students learn from home at least two days per week starting in the third quarter of 2021. Students can purchase devices using funds from their educational savings	

Efforts		
	(Edusave), and low-income households can receive additional subsidies • Productivity Solutions Grant (PSG): Subsidizes SMEs, assisting the installation of pre-approved IT devices. Up to 80% of expenses can be covered by these subsidies. Companies can access lists of pre-approved vendors and solutions on the GoBusiness Gov Assist website. When they get an estimate from a pre-approved vendor, they can apply for a PSG from the business subsidy portal	
Outcomes	• The rate of computer ownership in all Singaporean households increased overall, from 74% (2003) to 89% (2019) • There have been over 63,000 recipients of NEU PC plus (as of April 2020) • There have been over 14,000 recipients of HAP (as of April 2020)	
Features	• Both devices and broadband plans are provided at a low price	

Figure 47. Efforts in Uruguay (1/2)

Background	Overview	
• The Uruguayan government started a program to expand the use of ICT in educational settings in 1996, but the program did not produce great results • In 2006, President Tabaré Vázquez positioned this as a priority for promoting a "just society," and set out to ensure fair access to information and telecommunications	In 2006, Uruguay started the Plan Ceibal, setting out to expand ICT usage in educational settings, through initiatives with NGO groups such as One Laptop per Child (OLPC).[1]	
	Objectives	• To provide each child and teacher with a laptop computer, as well as prepare broadband access at public schools, run IT training sessions for teachers and households, and other initiatives to develop new tools for online education
	Key interests	• Program implementation was assisted by a leader with great political power (the president) and by a leader with a high level of technical prowess (Technological Laboratory of Uruguay [LATU]) • Other stakeholders had consultant-like roles (Uruguay teachers' unions, and government offices for culture, education, research, innovation, etc.) • Assistance was provided by OLPC for laptop computers, by ANTEL (government-owned telecommunications company) for internet connections, and LATU for logistics and telecom infrastructure • Digital content (resources teachers can use for classes, tests, physical education, and information exchanges) is developed on educational portals including Ceibal, ANEP, EduMEC, and Uruguay Educa
	Execution and costs	• The plan was rolled out in waves: First a small-scale pilot was run in a small city, then it was expanded to urban areas, and finally to the entire country (period of three years)

Background	Overview	
		• The program ran from 2007 to 2009, with total expenses of USD 140 million, all provided by the government

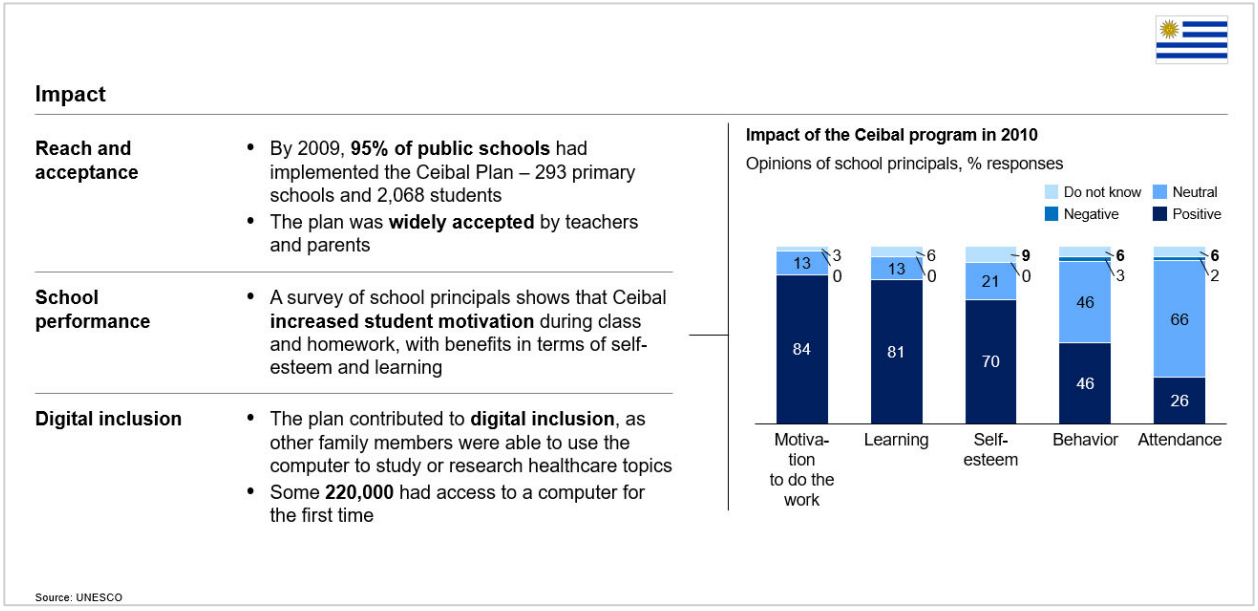


Figure 48. Efforts in Uruguay (2/2)

Insufficient quality/quantity of education for IT engineers

Below is a list of global best practices on this issue, as identified through surveys of reference projects done by other donors, and interviews with experts.

- Improve accessibility of online content
- Improve quality of IT training in educational institutions
  - Strengthen industry-academic coordination
  - Invite accomplished professors from overseas
  - Reevaluate educational institutions' curricula

For IT engineers, it would be helpful to use existing online content, since the learning materials are more easily typified than those of digital engineers. Being able to train many people simultaneously with online content would be a method suited to Cambodia's situation, in which the ICT educational standard is low and the overall number of ICT personnel is low. Some examples of best practices for using online content would be to have the government pre-approve online courses that would help citizens improve their skills, and encourage people to take these courses by assisting with course fees. In Singapore's SkillsFuture program, the government pre-approves educational programs offered by online content providers like Coursera and edX, and assists citizens who take the courses they need to improve their own careers.

Cambodia could also promote the human resources training needed to digitalize the Cambodian economy, by identifying the educational content available online that would be useful for training IT engineers, and encouraging people to take these courses.

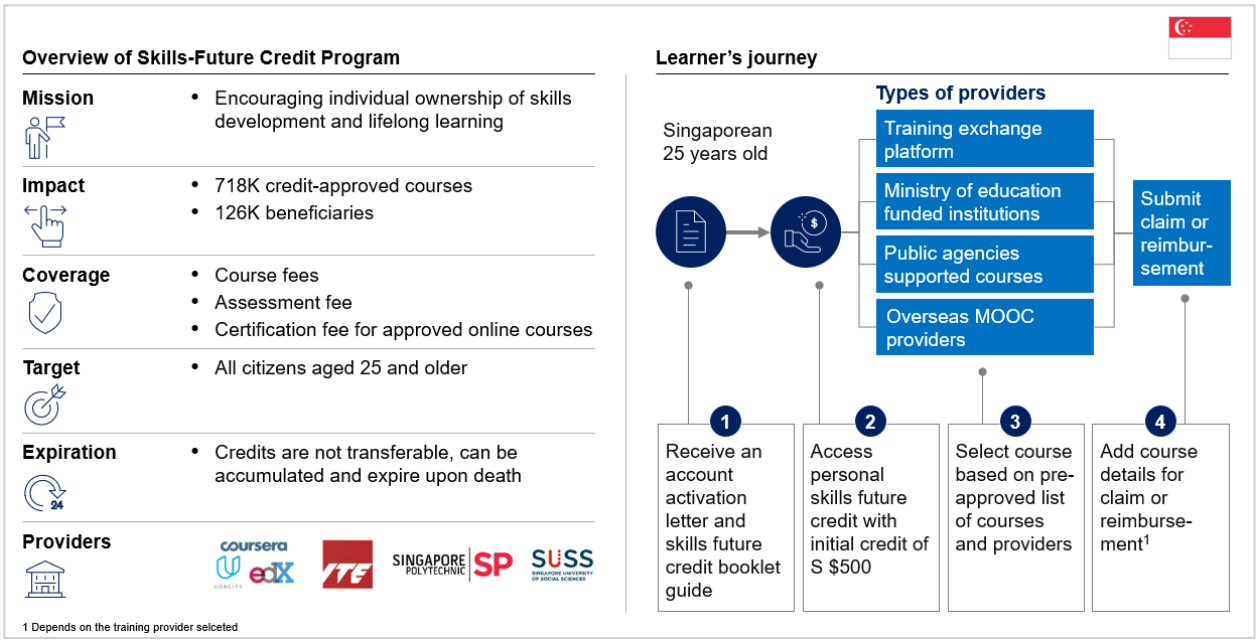


Figure 49. Singapore's SkillsFuture Credit Program

Furthermore, in efforts that aim to improve the quality of education at educational institutions, strengthening coordination between universities and the industrial world has been identified as a best practice. For example, New York built the New York tech pipeline in response to the issue of educational institutions being unable to provide education that fits the needs of the industrial world, and the shortage of people with the skills employers needed. Under this initiative, New York companies created a network and clarified their needs on the industry side, then coordinated with educational institutions to develop and offer education that meets those needs. Some specific action examples include developing and improving the capacities identified as key skills needed by the industrial world by sending industry experts to teach at universities, providing assistance for formulating and implementing internship programs, and assisting in the selection of advisors for career paths in the tech world.

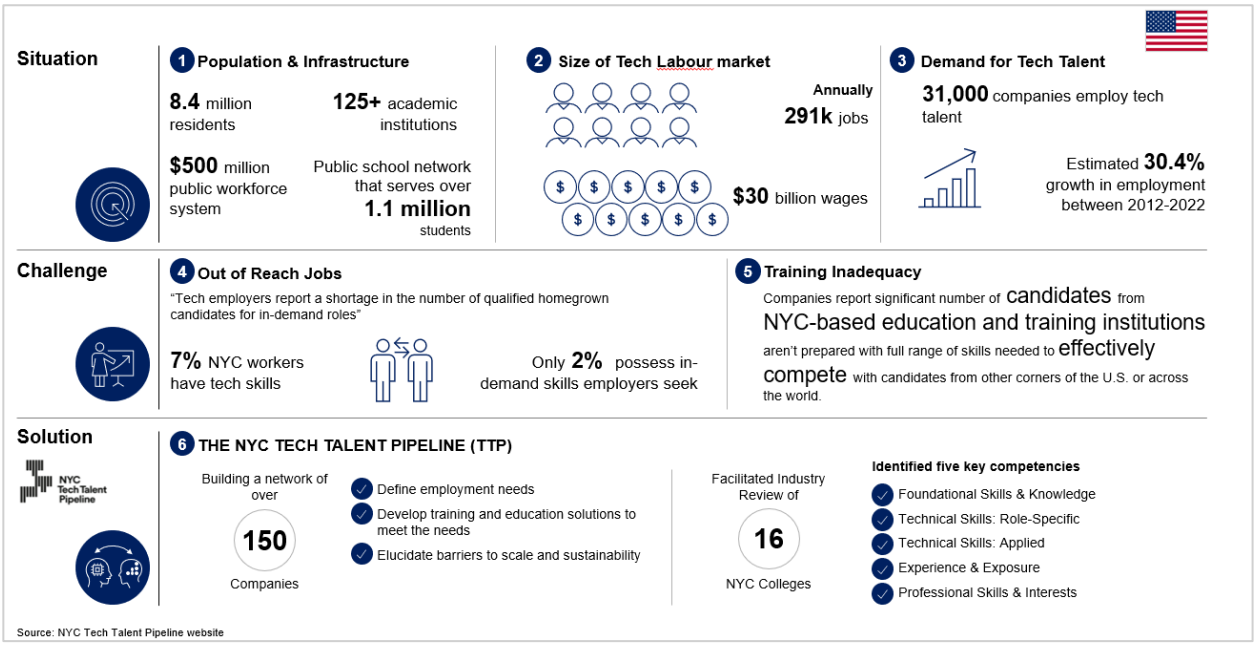


Figure 50. New York's tech talent pipeline

Summary

Based on the above, JICA's assistance programs for the Cambodian government with regards to the priority issues may be as follows.

Program 1

Figure 51. Overview of Cambodia assistance program: Improve proliferation of devices

Program Components	Expected impact of this program	Cost estimate via outside-in study
Institutions receiving assistance: • MPTC (Ministry of Post, Telecom and Communications) • Each ministry (may become future assistance recipients) **Target assistance activities:** • Improve device proliferation • Familiarize/educate how to use devices	**Stimulate economic/social activity, especially in rural areas** • Agriculture: Essential production information will be accessible to farmers, improving productivity • Healthcare: With telemedicine, healthcare access will improve in rural areas Expand digital services through the spread of devices: Digital services will increase in other areas Develop sustainable digital economies after the assistance period: The use of digital services will continue even after the assistance period, due to improved income from stimulated economic activity and more convenient digital services	**Total project cost estimate[1]: Several billion JPY** • Device proliferation improvement: several billion JPY – Number of devices: ~900,000 – 16.5 million (population) × 26% (smartphone ownership: 74%) × 20% (people per household: ~5) = ~900,000 – Device unit price: JPY 20,000~30,000 • Familiarize/educate how to use devices: JPY tens of millions – Labor costs and overhead – Training expenses (teaching materials, venues, etc.)

1. These are estimates of all costs needed to implement the project, and do not necessarily align with JICA assistance amount

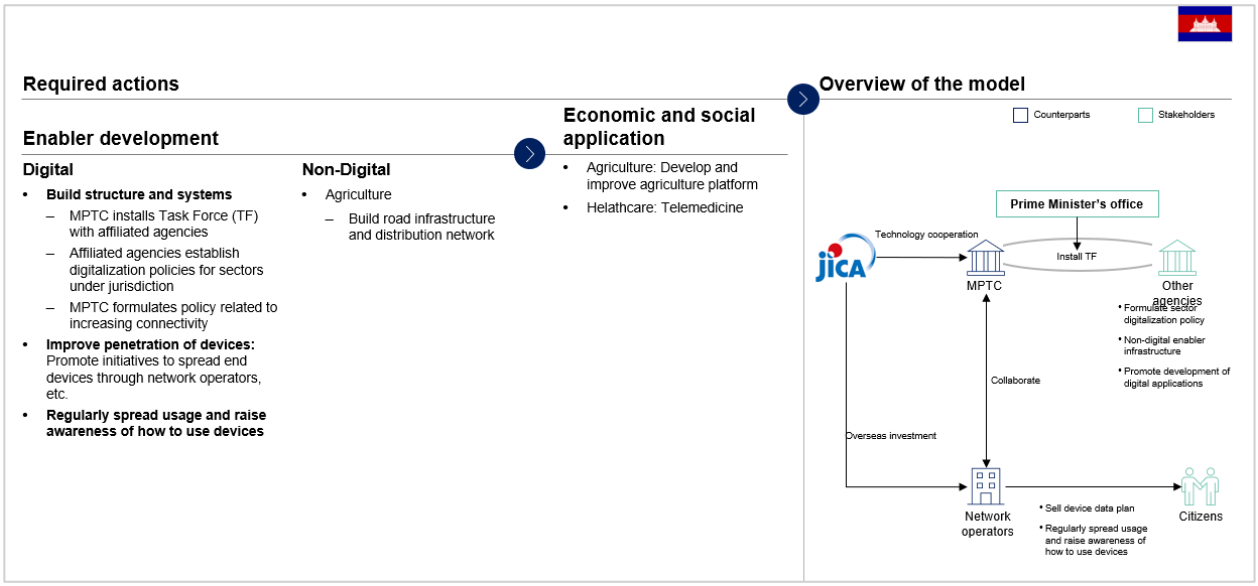


Figure 52. Overview of activities needed to maximize impact

Figure 53. Activity details (building infrastructure)

Category	Steps	Activity details			Applicable JICA scheme	Considera-tions
		CIP	Other stakeholders	JICA		
Enablers: digital	Set up structures/ systems	**MPTC** • Take the lead to establish a Task Force (TF) with related ministries (Ministry of Health [MoH], Ministry of Agriculture, Forestry and Fisheries [MAFF], etc.)	**Related ministries** • Coordinate with MPTC	Assistance TF launch	Technical cooperation	Will other ministries follow MPTC's initiative?
		TF • Agree on policy formulation for digitalization in each sector		Assistance TF operations	Technical cooperation	
		Related ministries • Organize policies for digitalization in each sector	**MPTC** • Assistance related ministries' policy organization	Assistance related ministries' policy organization	Technical cooperation	

Category	Steps	Activity details			Applicable JICA scheme	Considera-tions
		CIP	Other stakeholders	JICA		
		MPTC • Based on the policies of related ministries, formulate a plan to improve digital access in rural areas	**Related ministries** • Coordinate with MPTC	Assistance plan formulation	Technical cooperation	
	Improve device proliferation	**MPTC** • Back the supply of devices by network operators, or install shareable devices along with setting up Wi-Fi access points in public facilities (city halls, etc.)	**Network operators, etc.** • Sell or lease end devices (if providing residents with end devices)	• Assistance operation management for proliferation • Give end devices or provide funding for this purpose	(Overseas investment) Technical cooperation	Will end devices be sufficiently popularized?
	Periodically familiarize/educate how to use devices	**MPTC** • Assistance recovery/awareness activities by network operators	**Network operators, etc.** • Coordinate with MPTC and related ministries to periodically give lectures on usage methods	Assistance public awareness activities	Technical cooperation	
Enablers: non-digital	Convert farmers into commercial farmers	**MAFF** • Use incentives to promote the conversion to commercial farming		Assistance policy planning and implementation for the conversion to commercial farming	Technical cooperation	
	Build road infrastructure and distribution channels	**Related ministries** • Build road infrastructure and distribution channels		Assist with funding to build infrastructure	Loan funding cooperation or free financial assistance	

Category	Steps	Activity details			Applicable JICA scheme	Considera-tions
		CIP	Other stakeholders	JICA		
Apply to economic and social develop-ment	Launch/ improve agricultural platforms	**MAFF** • Assistance the launch/improvement of agricultural platforms in the private sector	**Agricultural startups, etc.** • Develop platforms equipped with essential functions based on the needs of farmers	Financial assistance and technology transfers related to launching the platforms	Overseas investment	
	Set up electronic health records	**MoH** • Promote the setup of electronic health records		Transfer technology related to electronic health records	Technical cooperation	

Program 2

Figure 54. Overview of Cambodia assistance program: IT engineer training

Program Components	Expected impact of this program	Cost estimate via outside-in study
Institutions receiving assistance: • MPTC (Ministry of Post, Telecom and Communications) **Target assistance activities:** • Improve accessibility of online content • Improve quality of IT education in universities	**Provide IT talent needed by the economy/society (agriculture, healthcare, etc.)**: Achieve this by improving the quality of online content and university IT education **Stimulate digital economic activity by supplying IT talent**	**Total project cost estimate[1]: ~several 100 million JPY** • Online content: ~JPY 100 million › Number of trainees: several thousand › Number of ICT personnel in 2019 was approx. 16,000 › Demand for ICT personnel in 2030 is estimated between 33,000 and 134,000 › 1,500~11,000 ICT personnel will need to be trained every year – Participation fee per person: ~JPY 15,000 **JPY 5,000/month × 3 months = JPY 15,000** • Improve university education: ~JPY tens of millions

1. These are estimates of all costs needed to implement the project, and do not necessarily align with JICA assistance amount

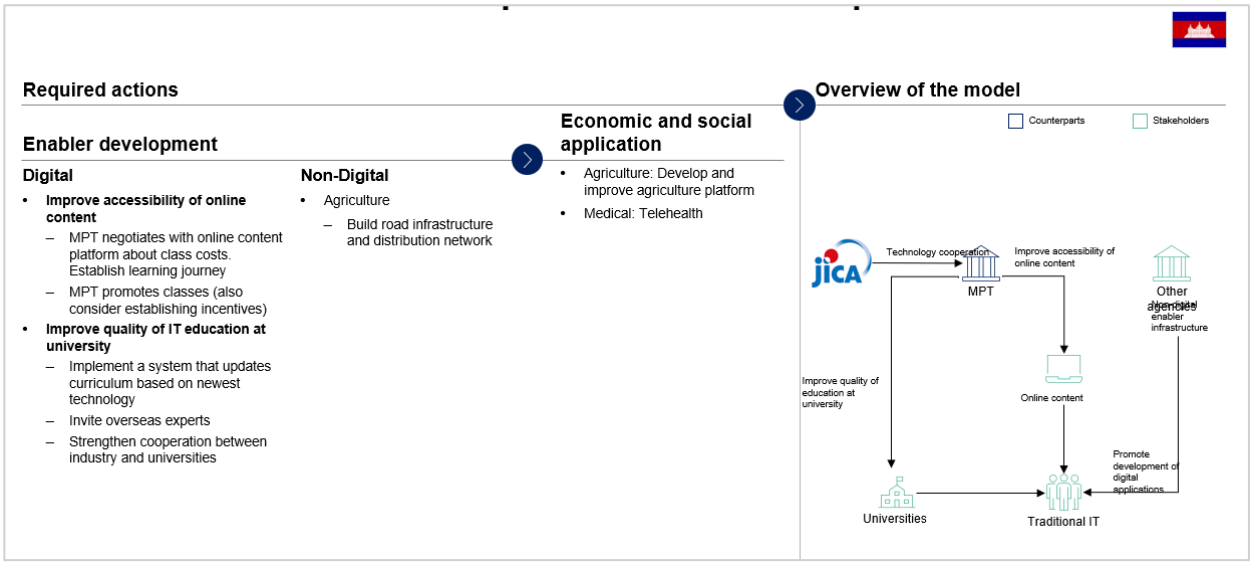


Figure 55. Overview of activities needed to maximize impact

Figure 56. Activity details (talent development)

Category	Steps	Activity details			Applicable JICA scheme	Considerations
		CIP	Other stakeholders	JICA		
Enablers: digital	Improve accessi-bility of online content	**MPTC** • Negotiate with online content platforms, including course fees. Organize the learning journey	**Online content platforms** • Provide content that meets the needs of MPTC	Assistance learning journey organization	Technical cooperation	To what extent are online content platforms cooperative?
		MPTC • Promote courses (consider using incentives as well)		Assist the consideration of incentives	Technical cooperation	
	Improve the quality of university education	**MPTC** • Coordinate with related ministries. Set up mechanisms at universities to update their curricula to match the latest technology trends	**Related ministries/ universities** • Related ministries coordinate with MPTC and assist university reforms	Assist improvements to university curricular systems	Technical cooperation	
		MPTC • With help from related	**Related ministries**	Introduce candidates, etc.	Technical cooperation	

Category	Steps	Activity details			Applicable JICA scheme	Considerations
		CIP	Other stakeholders	JICA		
		ministries, invite well-known university professors from overseas	• Coordinate with MPTC			
		MPTC • With help from related ministries, strengthen coordination between the industrial world and universities (improve internships, etc.)	**Related ministries** • Coordinate with MPTC	Coordinate links between industry and academia	Technical cooperation	
Enablers: non-digital	Convert farmers into commercial farmers	**MAFF** • Use incentives to promote the conversion to commercial farming		Assist policy planning and implementation for the conversion to commercial farming	Technical cooperation	
	Build road infrastructure and distribution systems	**Related ministries** • Build distribution/infrastructure systems		Assist with funding to build infrastructure	Loan funding cooperation or free financial assistance	
Apply to economic and social development	Launch/ improve agricultural platforms	**MAFF** • Assist the launch/improvement of agricultural platforms in the private sector	**Agricultural startups, etc.** • Develop platforms equipped with essential functions based on the needs of farmers	Financial assistance related to launching platforms	Overseas investment	
	Set up electronic health records	**MoH** • Promote the setup of electronic health records		Transfer technology related to electronic health records	Technical cooperation	

(2)-2 List initial solution proposals for potential issues that are outside priority issues

The following are preliminary potential solutions to the potential issues to assist that are not priority issues mentioned above.

Figure 57. Capacity to formulate and implement policies: Candidate solutions for potential issues to assist

Category	Potential issues to assist	Potential solutions	Background
Policy & Regulation	**G1: The necessity of having the public healthcare system adapt to digitalization** – Healthcare insurance policies – Standardize data for shared use of medical records – Regulatory setup for data protection – Central repository of medical records	• Update Cambodian healthcare system – Improve the health insurance system to adapt it to remote diagnostics – Develop personal data protection laws, which also allow practical use of data to promote innovation – Define consistent data standards and implement data governance – Build a central repository of medical records	• Most medical records are still paper-based • Electronic medical records have been introduced in some hospitals, but with no standardized format, it is difficult to share and use data across different hospitals • The Department of Planning and Healthcare Information of Cambodia is currently revising the Health Strategic Plan with an emphasis on digital healthcare
Execution	**G2: Not enough capacity to implement policies**	• Attract and hire talent with digital skills • Incorporate digital capabilities into evaluation criteria and set KPIs to incentivize officials to learn • Strongly promote capacity-building • Develop a secondment system to exchange talent with local IT companies	• Cambodian government has already established the ICT vision, but they have some concerns about implementation

Figure 58. Telecom infrastructure: Candidate solutions for potential issues to assist

Category	Potential issues to assist	Potential solutions	Background
Mobile Networks	**I1: Slow mobile network speeds in rural areas** – Improve upload speeds: Mobile networks will need to be strengthened further, especially in order to promote video-based remote diagnostics	• Improve current networks by investing more in the following areas, to increase speed in rural areas – Devices – Transmissions • Distribute high spectrum to mobile network operators and build more base stations	• Though 4G coverage is good in Cambodia, the network speed is not high enough for video calls

Category	Potential issues to assist	Potential solutions	Background
Mobile devices	**I2: Low smartphone penetration in rural areas** — Smartphone penetration needs to be sped up in rural areas	• Promote the spread of devices in rural areas (See examples below) — Promote the purchase of devices: By migrating users from feature phone to smartphone, network operators can terminate the assistance for older generation of technologies (e.g., 2G), which will lead to lower network management costs — Set up tablets or PCs at public facilities like assembly halls, schools, and health centers to increase opportunities for individuals to learn to use devices without owning one — Offer free or inexpensive broadband access • Educate and spread awareness about how to use smartphones for economic and social activities	• Smartphone penetration is 74% in Cambodia • It continues to increase, but it needs to be accelerated in rural areas

Figure 59. Talent: Candidate solutions for potential issues to assist

Category	Potential issues to assist	Potential solutions	Background
Digital translators	**T1: Education of digital translators is lagging behind due to a shortage of educational institutions and mature companies**	• **Digital learning academies**: Reskill industry talent who can introduce and promote useful digital tools and solutions to others	• While IT engineer training needs to be reinforced first, digital translators also need to be trained
Digital engineers	**T2: Not enough education for training digital engineers** **T3: Insufficient quality in math and science education**	• Digital learning academies: Reskill tech-background talent on the newest technologies and practices to improve performance nationwide • Establish a major or a department focused on emerging technology at various educational institutions	• While IT engineer training needs to be reinforced first, digital engineers also need to be trained • Cambodia co-funds with international assistance agencies to assist people getting PhDs overseas

Category	Potential issues to assist	Potential solutions	Background
		• Build interdisciplinary networks to match university education to business needs and close the gap between industry and academia • Improve STEM education in primary and secondary schools, showcasing successful digital entrepreneurs as role models	
IT engineers	**T4: Insufficient quality/quantity of education for IT engineers** – Domestic universities and IT vocational schools do not meet standards – Not enough seasoned instructors **T3: Insufficient quality in math and science education** **T5: Difficulty of using English-language online content due to low level of English**	• Improve accessibility of existing online educational content • Improve quality of training in educational institutions – Close the gap between academia and industry – Reevaluate educational institutions' curricula – Invite foreign experts • Improve STEM education in primary and secondary schools, showcasing successful digital entrepreneurs as role models • Create national basic IT certificate to increase potential IT talent pool	• The Cambodian ICT talent pool is still small, so IT engineer training needs to be strengthened first

Figure 60. Innovation ecosystem: Possible solutions to address potential issues to assist

Category	Potential issues to assist	Potential solutions	Background
Knowledge contributors	**E1: Educational institutions do not have enough of the right mechanisms to secure outstanding personnel**	• Increase high-quality programs from bachelor's to doctoral degrees, as well as offering scholarships • Increase the R&D expenditure of the government and educational institutions • Provide universities and research institutes with the latest equipment needed for research • Invite professors and students with international achievements. Have them share the latest technology	• Lack of graduate/university programs • Little desire to continue on to graduate programs

Category	Potential issues to assist	Potential solutions	Background
		developed in their countries, and lead research	
Investors/ supporters	**E2: Startups do not have enough funding to scale up** – Not attractive to large-scale foreign investors **E3: Lack of mentorship by local digital entrepreneurs** – Few mentors in the digital sphere who understand regional circumstances – Many international assistance organizations offer mentorships	• Build an attractive environment for investors and supporters including overseas players – Create platform where international funds and supporters can easily access Cambodian startups – Assist high-potential Cambodian startups with global road show – Tailor incentives to each investor's interests (e.g., sustainable development) to attract mission-oriented investors • Further increase government's financial assistance by establishing government venture capital and subsidizing local startups • Drive knowledge-sharing for successful innovation – Promote tech startup events such as hackathons and ideathons – Strengthen the network among local tech startups	• Many international donors exist in Cambodia, but there are no large private foreign investors • Young tech startups get advice from local digital entrepreneurs They express their dissatisfaction with the lack of opportunities
Market access	**E4: The digital market is not vigorous enough to promote independent innovation**	• Improve next key enablers and promote e-commerce – Internet use – Secure internet servers – Bank accounts – Logistics	• E-commerce market has been growing fast since 2017 (CAGR 37%)[1] • In 2021, e-commerce market is more than 1% of Cambodia's GDP • However, e-commerce is not ready for scale-up since its enablers are immature

1. Satistica

2.3 Considering assistance programs for Laos

2.3.1 Basic country information

Laos is a Southeast Asian country located on the peninsula of Indochina. It is the only landlocked country in ASEAN, bordering the People's Republic of China, the Socialist Republic of Vietnam, the Republic of

the Union of Myanmar, the Kingdom of Thailand, and the Kingdom of Cambodia. The majority of the country's territory consists of plateaus and mountainous areas, with a total land area of 230,800km^2 and a population of about 7 million. It has a low population density of 31.94/km^2, the second-lowest in this survey, following Mongolia.

While roughly half or more of the population is Lao, the nation is home to a total of 50 ethnic groups. The literacy rate is low, at 84.6%. In the northern mountainous regions this rate drops to as low as 65%, showing drastic regional disparities.

Laos's 2019 nominal GDP was USD 19 billion, with a real GDP growth rate of 5.2%. The key industries are agriculture, wholesale/retail, and tourism. Agricultural production has a 15% share of GDP, but an extremely high share of employment, at 61%. With power generation projects that utilize the abundant water of the Mekong River, the country exports electric power to Thailand and Vietnam. Per capita GDP in 2019 was USD 2,661, the second-lowest of all the survey target countries, just ahead of Cambodia.

Since we could only obtained limited statistical data on Laos, it bears mentioning that this survey and analysis relied more on supplementary input from expert opinions and knowledge than in other countries.

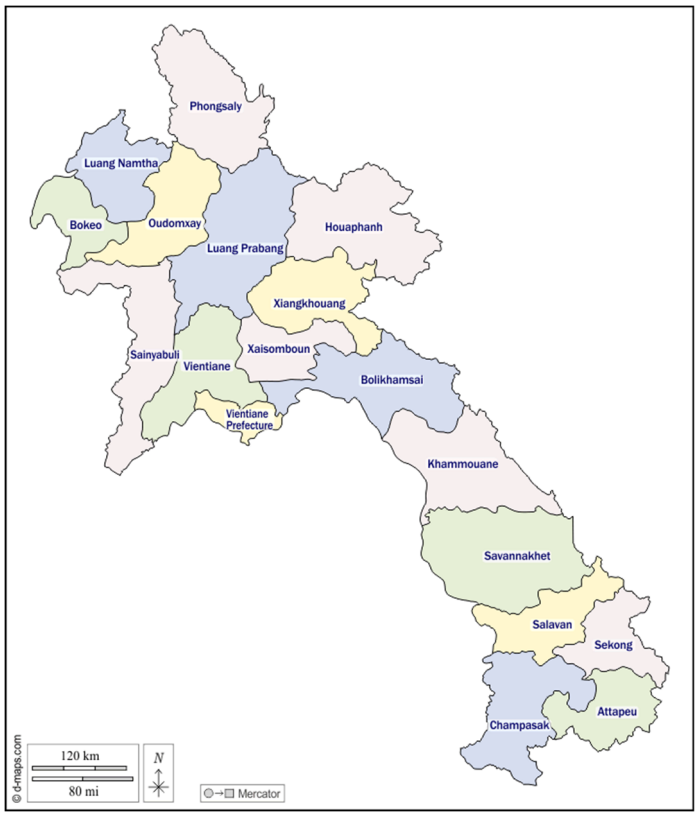


Figure 61. Laos (Source: d-maps.com)

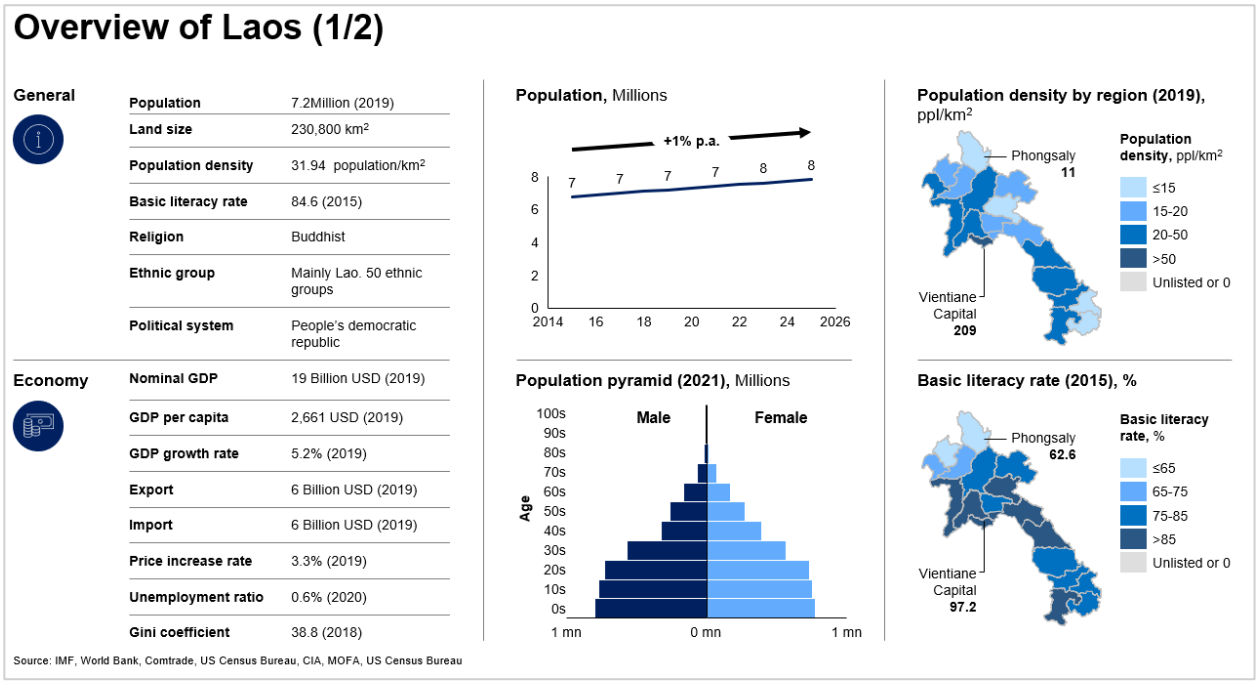


Figure 62. Overview of Laos (1/2)

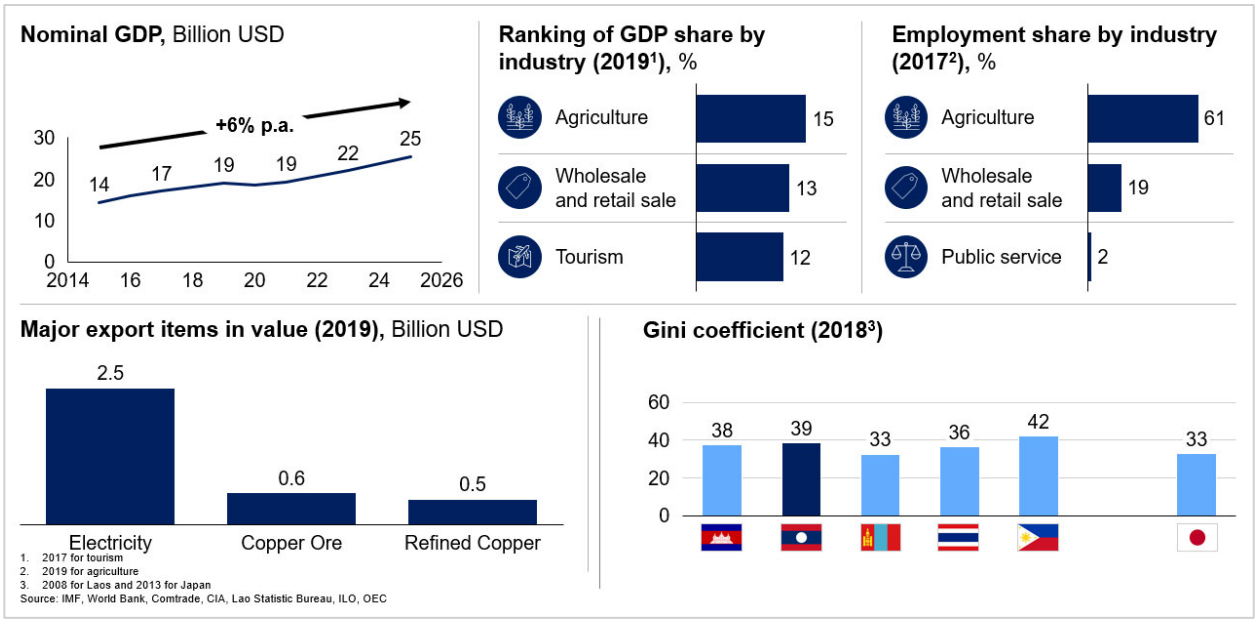


Figure 63. Overview of Laos (2/2)

2.3.2 Organizing the orientation of digitalization

(1) Confirming strategically important sectors of the country

We started by identifying the following ten strategically important sectors in Laos, using the Laotian government's 9th Five-year National Socio-economic Development Plan (2021-2025) draft the 8th Five-year National Socio-economic Development Plan (2016–2020), and the National ICT Development

Strategy for 2016-2025 as references: agriculture, wholesale/retail, tourism, energy, mining, finance, infrastructure/distribution, public services, and manufacturing and processing (including handicrafts). The specific procedure for identifying these sectors was as follows. First, we set the basic targets as the industries mentioned individually in the context of economic growth in the Laotian government's 8th Five-year National Socio-economic Development Plan (2016–2020). We then confirmed in the draft of the 9th Five-year National Socio-economic Development Plan (2021-2025) that there were unlikely to be major changes in the sectors emphasized in the context of economic growth. At the same time, we added education, seeing the educational sphere (including distance learning) listed in this draft for ICT promotion. Then, the "Vision 2030, the development strategy of the sector: 10 years of post and telecommunications (2016-2025)" mentioned the promotion of e-government as a strategy, so we added public services to the list.

(2) Selecting study target sectors

We evaluated these sectors based on the following three perspectives, and selected the target sectors to be taken up in this survey.

- Consistency with JICA's assistance priorities
- Digital divide potential
- Each sector's overarching impact on the economy/society

Following the above selection criteria, we analyzed Laos's key strategic sectors, and confirmed that the high priority sectors for JICA assistance were agriculture, education, and infrastructure/distribution. The reasons are as follows.

- Agriculture: As this is the largest employment sector in Laos (61% of working population), and the country still has a large poor population, this sector can play a large role in stable economic growth and rectifying disparities in Laos
- Education: To outgrow its status as a least-developed country and move forward with independent socio-economic development, it will be crucial for the country to train talent that will assist this; for this reason the educational environment needs to be put in place
- Infrastructure/distribution: Hard and soft infrastructure development is viewed as important for strengthening ties to ASEAN, and surveys have been done on the possibility of using ICT in the realm of distribution

Then, we selected agriculture and education as the current survey's targets for their consistency with JICA's assistance policies as well as for their appropriateness from two other perspectives.

- Agriculture:
  - Digitalization is progressing more slowly than in other sectors, and given the small amount of GDP per capita, it is highly likely that this is an area with a digital divide
  - Furthermore, considering its large share of GDP (15%) and its large share of the working population (61%), digitalizing the agriculture sector may have a large impact on the economy and society

- Education:
  - Digitalization may be progressing more slowly than in other sectors
  - Education is not a large portion of GDP nor is it a major employer (3% of GDP; 5% of working population), but since this sector targets most citizens, making progress in digitalization in applicable sectors would directly help shrink the digital divide, and should be effective for achieving an inclusive digital economy

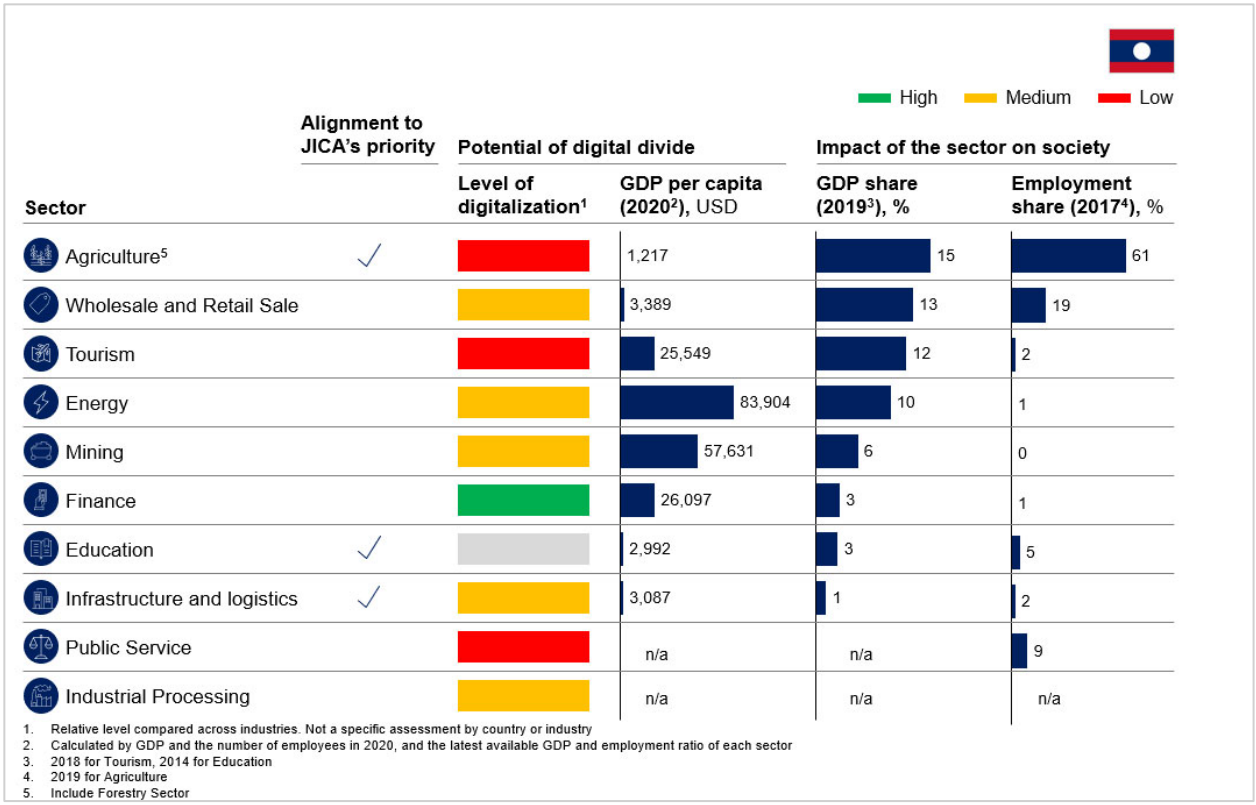


Figure 64. Selecting study target sectors

(3) Understanding the visions and challenges in each target sector considered, and identifying candidates for digitally-enabled solutions

We examined the orientation of digitalization in agriculture and education, the target sectors under consideration for Laos. To sort out the digitalization orientation, we started by confirming each target sector's vision and challenges in achieving that vision, by reviewing government documents and holding interviews with experts. The team then conducted another survey, and listed potential candidates for digitally-enabled solutions to the challenges being faced.

(3)-1 Agriculture

According to the Laos Ministry of Agriculture's "Agriculture Development Strategy to the year 2025 and Vision to 2030," Laos aims to do the following: guarantee food safety; build comparative advantages and competitive edges in agricultural production; develop clean, safe, and sustainable agriculture; and gradually

convert to a resilient, productive, and modern agricultural economy while developing farming villages that contribute to the foundations of the national economy.

Meanwhile, Laos faces the following challenges in achieving this vision.

The first is that Laotian agriculture has issues with productivity. Compared with other countries, Laos still has a large portion of its population working in agriculture, most of whom are engaged in subsistence farming. In order to achieve the competitive agriculture production and modern agriculture economy the Laotian government seeks, they will need to commercialize these subsistence farming operations and raise productivity.

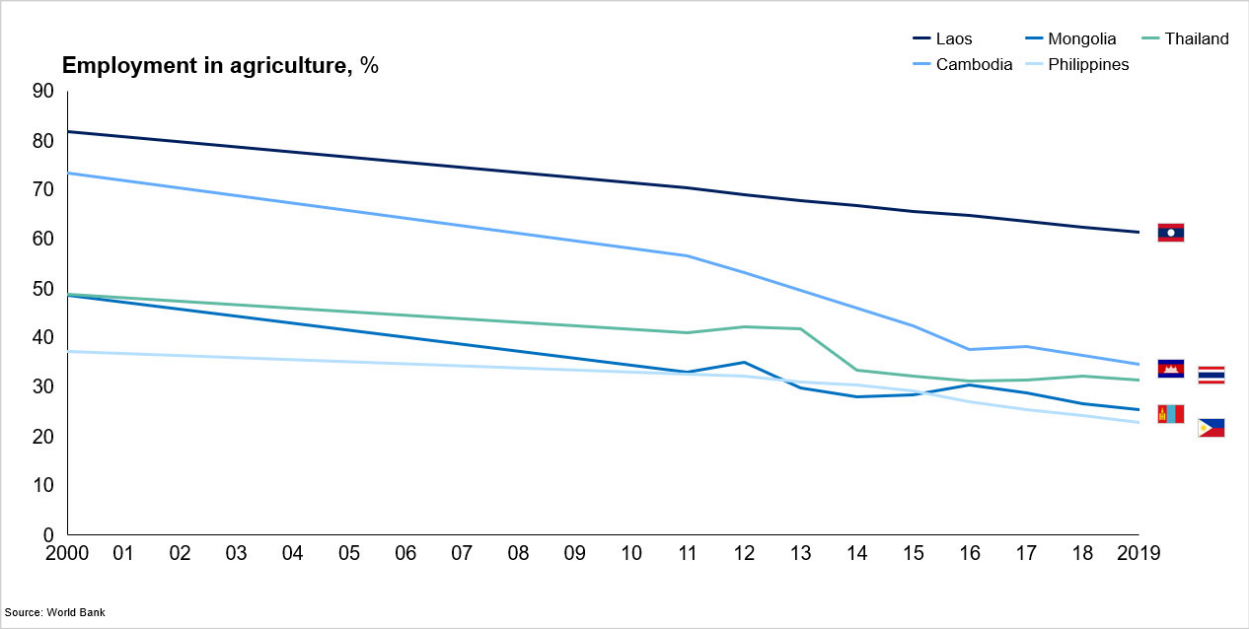


Figure 65. Shifts in the percentage of farmers in Laos

In Laos, 49% of farmland is used to cultivate rice, but the productivity of the country's rice cultivation is only on par with 1980s China. As mentioned previously, from the 1960s to the 2000s, China's rice crop productivity tripled thanks to the development of fertilizers and high-quality seeds and seedlings, and the introduction of farm machinery.

Meanwhile, Laos does not have enough highly productive seeds and seedlings, and agricultural machinery and modern agricultural techniques have not taken off there. This leads to a low state of productivity (Challenge 1).

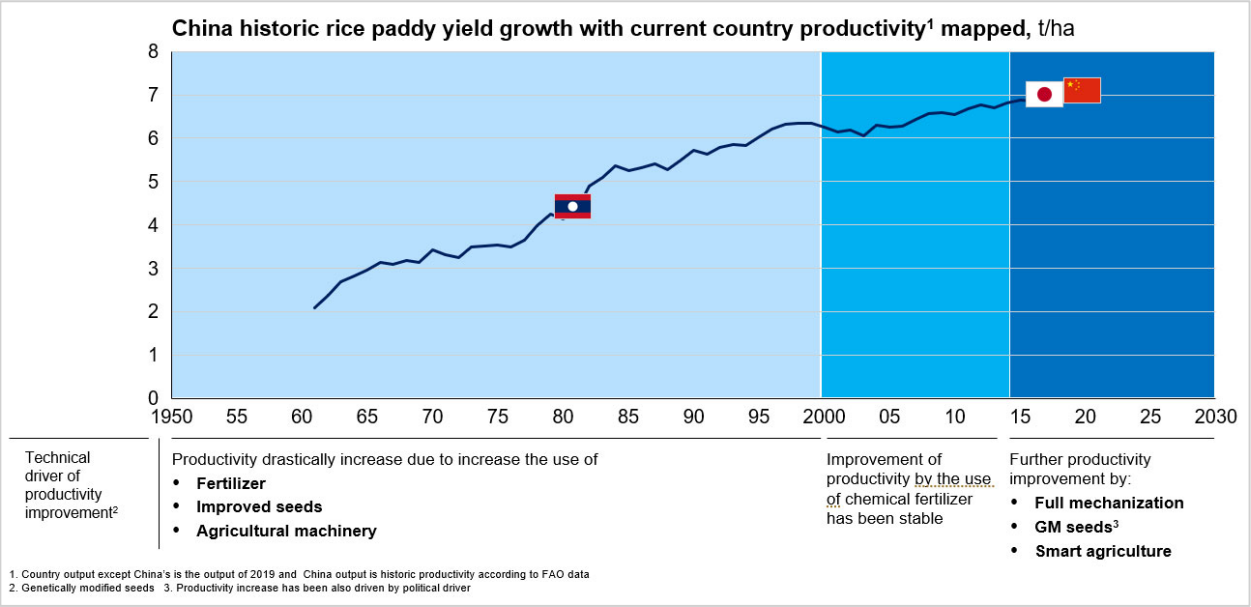


Figure 66. Rice productivity in Laos

The second challenge is the lack of market transparency. Although the Laotian government is aiming for a commercial, market-oriented economy, the Laotian market is not transparent enough. It is difficult for farmers to produce their crops based on demand and price information (Challenge 2).

The third issue is that of sustainability. In Laos, there has always been a lot of organic farming, and the government also promotes clean agriculture in line with Good Agriculture Practice (GAP). On the other hand, the above strategy also mentions the challenge of responding to natural disasters caused by climate change, such as droughts and floods (Challenge 3).

The fourth challenge is the need to strengthen not only productivity but also the processing and distribution parts of the supply chain, to improve the competitive edge of agriculture. In Laos, roads and other distribution infrastructure components are not fully in order, and storage facilities are also lacking. This results in greater food loss than in other countries. In the context of a distribution system that is not well-ordered, Laotian farmers have a lower net income than farmers in other countries, when their products are exchanged on a commercial basis (Challenge 4).

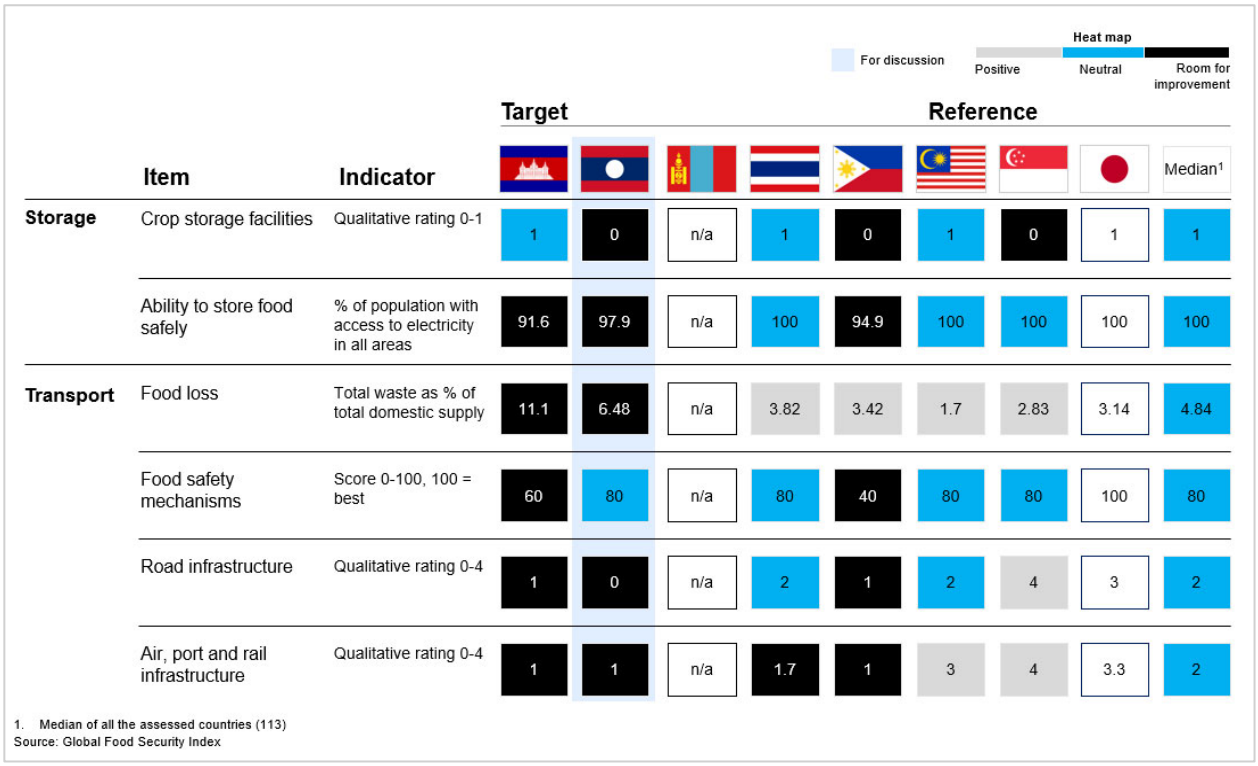


Figure 67. Maturity of the food distribution infrastructure

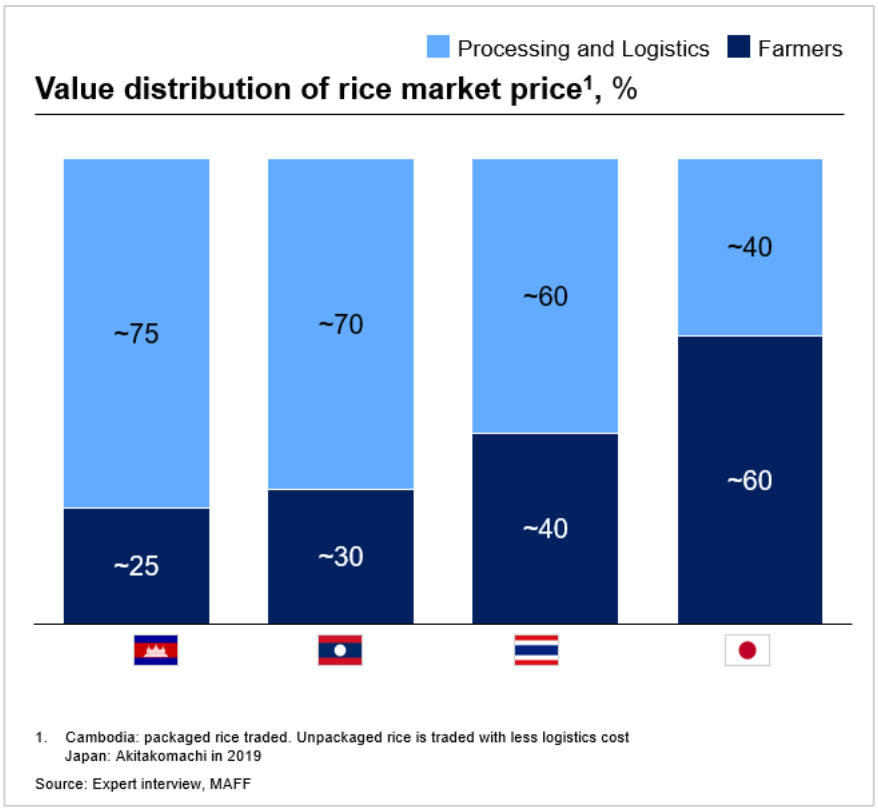


Figure 68. Inefficient logistics systems and room for improvement in distribution infrastructure

Figure 69. Expert comments on the inefficient logistics system

Experts	Comments
Rice distributor in Laos	"The distribution costs for packaged rice sold in supermarkets is higher than for unpackaged rice. However, when you take into account the high price of infrastructure and imported packaging materials, it's not unreasonably expensive." 」
Farm manager in Laos	"Brokers have plenty of capital and extreme amounts of bargaining power. Farmers are uneducated and have no information, so sometimes their earnings are low." 」

Digitally-enabled solutions to the above challenges could take two orientations: improving the environment for farmers to access information, and introducing equipment and software based on the latest technology. Using these orientations to conduct expert interviews and other surveys, we found the following candidates for specific expected solutions for each challenge.

[Improve the environment for accessing information]

- Challenges 1~3: Set up and popularize a platform that allows farmers to get essential information (e.g. information on seeds, agrochemicals, fertilizers, sustainable cultivation techniques, crop prices, and markets)

[Introduce equipment and software]

- Challenge 2: Introduce smart agriculture with precision agriculture, soil sensors, drones, etc.
- Challenge 4: Visualize supply chain information using RFID to reduce food loss and improve added value, improving aspects of crop distribution

Bearing in mind that Laos's agricultural productivity is still low, introducing high-quality seedlings, fertilizers, and machinery may be essential for improving productivity. Regarding options like RFID, this will need to be worked on in tandem with preparing the still poorly-serviced distribution infrastructure network.

As for the agriculture platform, this would provide a broad array of information and services needed for farmers' production and sales activities. If this platform were set up and farmers were able to easily access these types of information and services, there would be various benefits: more productive agriculture, a transition to more lucrative crops, and the creation of production and sales plans based on market needs. This solution is not about introducing a specific technology, but instead aims to resolve the challenges Laotian agriculture faces by improving information access. This means that even taking into account the country's level of development in agriculture, this solutions would have the potential to show results right away.

Based on the above, we have positioned the preparation and popularization of the above agricultural platform as the priority orientation for the digitalization of Laotian agriculture in this survey.

The specific content of this agricultural platform would be as follows.

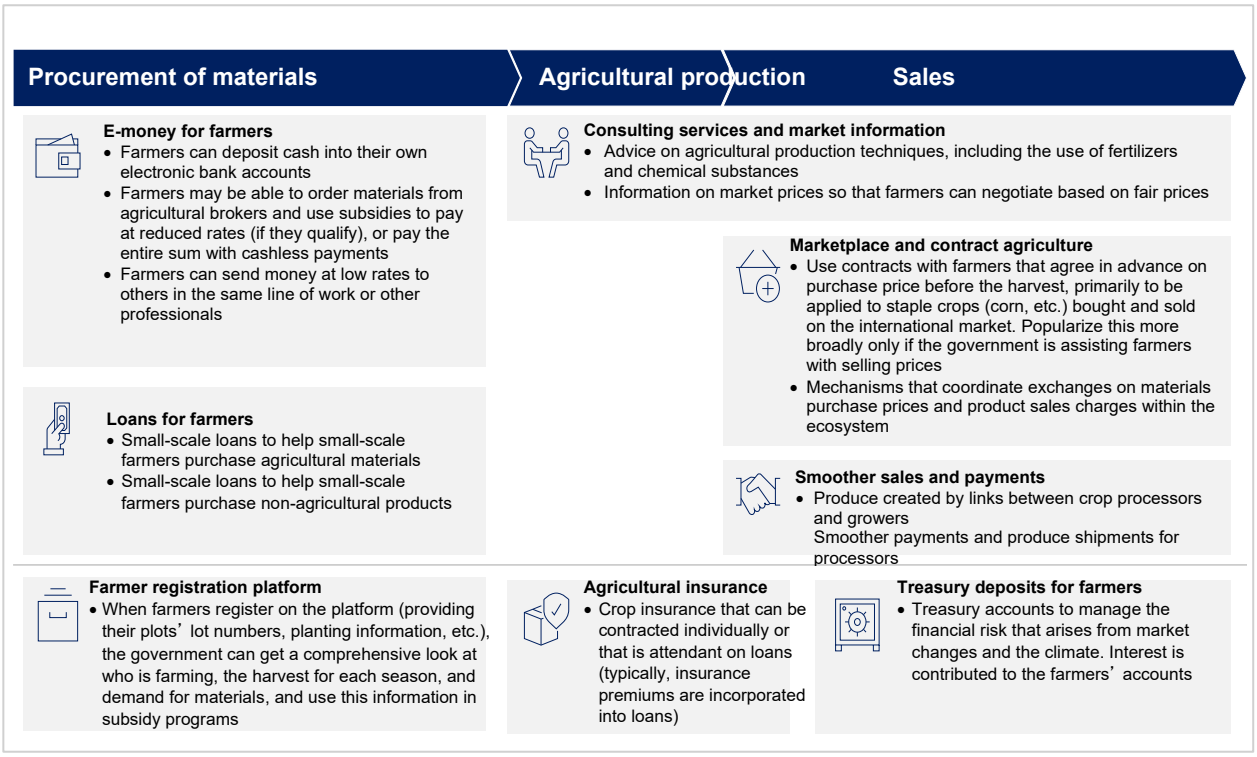


Figure 70. Expected features of the digital platform

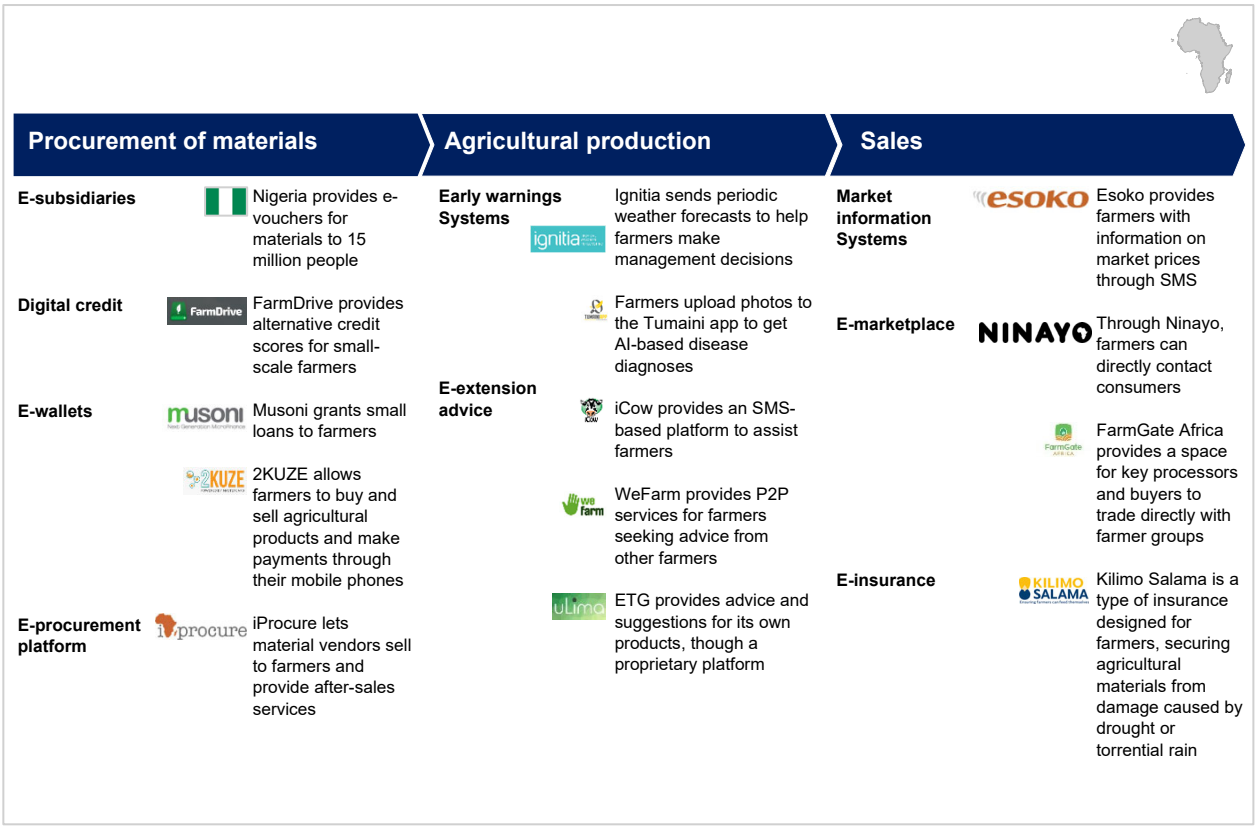


Figure 71. Examples of digital initiatives for small-scale farmers in Africa

(3)-2 Education

In the "Education and Sports Sector Development Plan (2016-2020) Vientiane, December," the Laotian Ministry of Education and Sports states its vision as follows: "By 2030 all Lao population equally and equitably have access to quality education in order to become good citizens, disciplined, healthy, knowledgeable, highly-skilled with professionalism in order to sustainably develop the country, to align, and be compatible with the region and the world."

However, while five years of elementary and four years of junior high school education are compulsory in Laos, as we will show below, Laotian children do not always have enough access to compulsory education. Furthermore, with a low rate of completion of compulsory education, only 55% of students continue on to high school.

- Elementary school: About 7% of students drop out in the first year, and by the end, about 20% of students do not graduate from elementary school. There are also major regional differences, with dropout rates especially high in the south and central parts of the country (Khammouane and Savannakhet provinces).
- Junior high school: 10% of students drop out every year, with about 40% of students failing to graduate from junior high school. As with elementary school, there are also major regional differences, with dropout rates especially high in the south and central parts of the country (Khammouane and Savannakhet provinces).

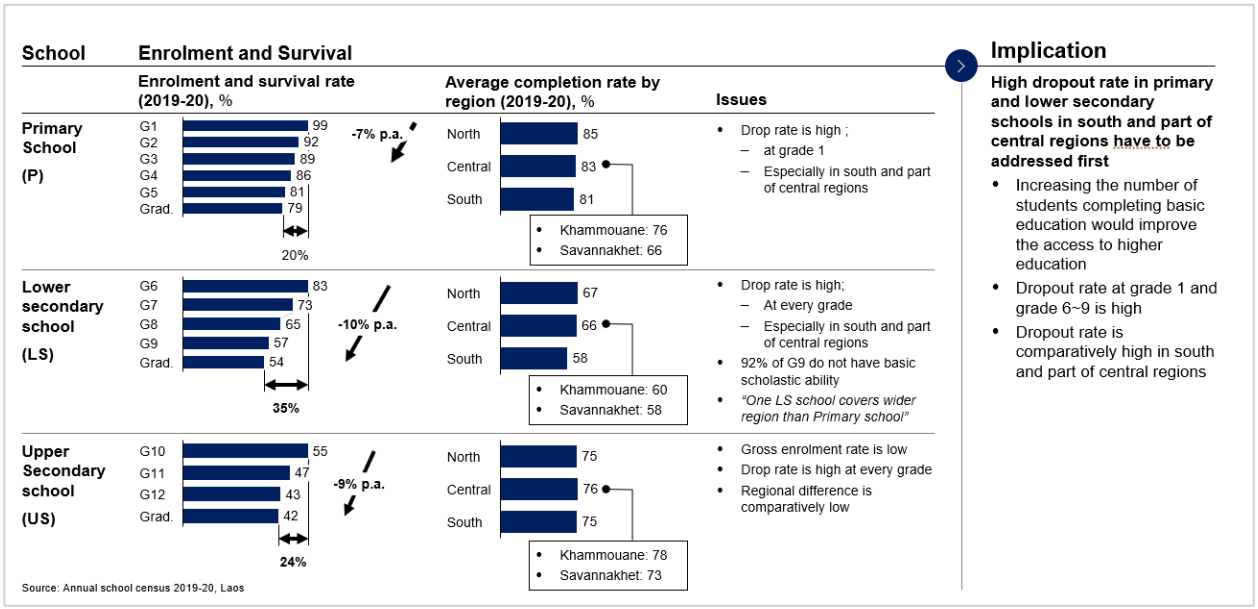


Figure 72. Elementary, junior and senior high school completion rates in Laos

The following challenges are thought to be part of the context for these high dropout rates.

Elementary school

- **Poverty**: Elementary school completion rates are low in southern areas with particularly high rates of poverty, such as Salavan and Sekong provinces. Due to poverty, students need to help their family businesses, and are therefore unable to attend school.
- **Low quality of education**: In many cases, full-time teachers prefer to work in urban areas, and not all elementary schools have licensed teachers. As a result, schools in areas with low numbers of full-time teachers (Khammouane and Savannakhet provinces in the center, and Salavan and Sekong provinces in the south) tend to have low rates of elementary school completion. Non-full-time teachers give instruction in these regions, but the quality of instruction is not always sufficient. Unable to follow the lessons, students may end up not going to school.

Junior high school

In addition to the above reasons for the elementary school dropout rate, the high dropout rate for junior high school involves the following causes.

- Distance to school: Junior high schools cover larger areas than elementary schools, so students need to commute farther than they did to elementary school. In provinces with a large portion of the population living in rural areas (Khammouane, Savannakhet, and Salavan provinces), junior high school completion rates are low, and one of the causes for the high dropout rates may be the difficulty of the commute to school.

Heat map: Positive (good) — Neutral — Room for improvement

		Completion rate		Possible root cause					
				Poverty	% of regular teacher		Distance to school		Mother tongue
				a	b	c	d	e	f
	Province	Primary	Lower secondary	Poverty head-count ratio	Primary school	Secondary	Village with primary school	% of population who lives in rural village	% of population with Lao Mother Tongue
North	Phongsaly	81%	56%	12.3	63%	66%	90%~	81%	8%
	Luang Namtha	86%	73%	16.1	72%	73%	90%~	73%	34%
	Oudomxay	79%	67%	30.1	60%	72%	~80%	76%	26%
	Bokeo	80%	69%	44.4	70%	74%	80%~85%	67%	40%
	Luang Prabang	87%	63%	25.5	55%	68%	85%~90%	68%	41%
	Huaphanh	85%	65%	39.2	66%	82%	90%~	86%	57%
	Sayabouly	93%	73%	15.4	66%	67%	90%~	60%	91%
	Xienkhuang	90%	73%	31.9	74%	86%	90%~	71%	72%
Central	Vientiane capital	93%	84%	5.9	80%	78%	85%~90%	22%	100%
	Vientiane Province	87%	72%	12	71%	86%	80%~85%	67%	80%
	Borikhamxay	88%	62%	16.4	68%	77%	~80%	66%	87%
	Xaysomboun	87%	66%	0	64%	70%	n/a	65%	38%
	Khammuane	76%	60%	26.4	57%	78%	80%~85%	78%	91%
	Savannakhet	66%	55%	27.9	50%	63%	90%~	78%	95%
South	Saravane	66%	49%	49.8	59%	72%	85%~90%	89%	66%
	Sekong	68%	59%	42.7	59%	76%	90%~	65%	25%
	Champasak	75%	59%	19.9	69%	81%	90%~	74%	97%
	Attapeu	73%	66%	8.9	66%	82%	90%~	64%	45%

Source: Annal school census 2019-2020 , Poverty Report for the Lao Consumption and Expenditure Survey 2012–2013, Laos National Literacy Survey, Population and housing census 2015, Survey Results on Expenditure and Consumption of household

Figure 73. Root cause analysis of low graduation rates

Some direct solutions for the above challenges would be to reduce poverty, increase the number of full-time teachers, and build more schools. However, digitally-enabled solutions would include remote learning, which has been promoted globally (including in Laos) as a measure for COVID-19. It may prove useful as a complement to existing education. (Running remote education in developing countries involves major challenges with technology and connectivity, but these issues will be discussed in the section on enablers.)

To start, remote education would make it easier for students to balance their classes and family business. Since remote learning would cut out commute times, students would have more time to use, and would have an easier time continuing their studies at their own pace, while helping their families work.

The second thing would be to improve the quality of education. Rural students could use remote equipment to take classes with full-time teachers in urban areas. It would also be possible to run remote learning effectively, by utilizing teachers specialized in certain subjects, or teachers who can match lessons to students' school years and proficiency levels.

The third would be the reduction of commute times. Students who would have given up on attending school due to distance would have an easier time continuing attending school with remote education.

On the other hand, remote education cannot fully replace existing face-to-face education. UNESCO's "Education in a post-COVID world: Nine ideas for public action" states: "Protect the social spaces provided by schools as we transform education. The school as a physical space is indispensable. Traditional classroom organization must give way to a variety of ways of 'doing school' but the school as a separate space-time of collective living, specific and different from other spaces of learning must be preserved." Furthermore, an education specialist at an international development agency states, "Remote education is useful for children who have difficulties attending school, but interacting with teachers and other students is essential for children's social and emotional development. Remote education should stay in a supplementary role," saying that the usefulness of remote learning is limited to the following situations.

- Students go to school several days per week. The remaining days, they study remotely, using a tablet
- Full-time teachers proceed with giving lessons to the same class two to three days per week. The rest of the days, students take classes with the full-time teacher remotely, under the supervision of a non-full-time teacher

In Laos, promoting remote education may be useful if it takes on a hybrid format with face-to-face education, keeping the above points in mind.

The state of remote education may involve the following types of content.

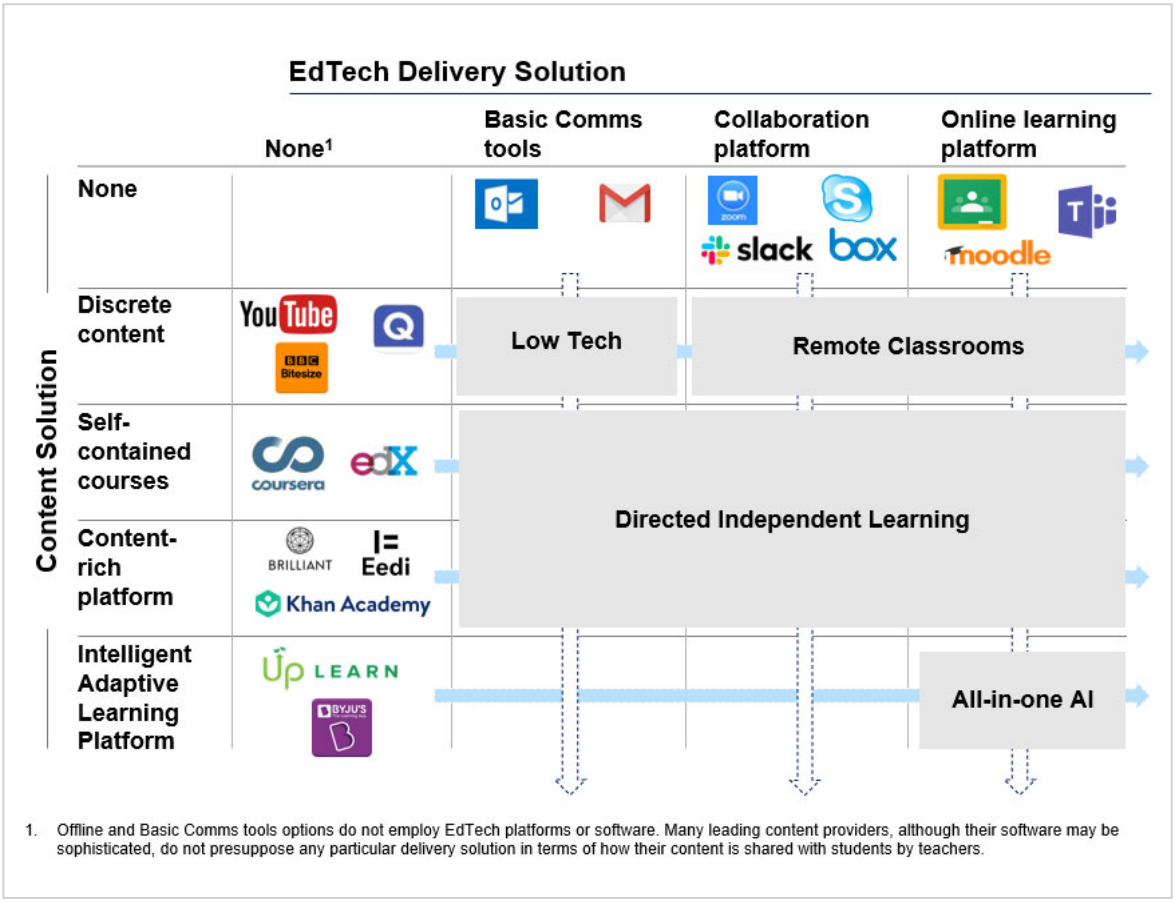


Figure 74. Four basic types of remote education

The definitions of each basic type in the chart are as follows:

- **Low-tech**: Offers simple teaching materials for students, using some kind of means (e.g. television, radio, postal service) If telephone and email are available, teachers can use these to check on students' learning progress.
- **Remote classrooms**: Teachers can upload their own or other selected teaching materials to a general-purpose platform for managing teaching materials. Using video conferencing software, they can check on students' learning progress.
- **Instruction-based, self-guided learning**: Use an online platform and courses to manage student learning. Teachers give instructions to students through email, and set up spaces for periodic face-to-face meetings to check progress or set goals.
- **All-in-one AI**: Use sophisticated, AI-driven platforms to promote learning, which have methods for monitoring students and giving instructions, in addition to general content.

There are two possible digitalization orientations for building remote education: methods for providing education, and content itself.

Due to COVID-19, elementary schools in Laos were closed March 2020, and remote education was run using television and radio. Going forward, it will be important to improve the quality of remote education by using more interactive communication tools like Zoom and Skype.

Figure 75. Delivery solutions

Category	Description	Examples
Offline	Tools that do not require the phone or internet	Television, radio, postal services
Basic communication tools	Simple messaging and phone functions	Email, SMS, phone
Collaboration platforms	Platforms that let teachers post content and interact with students in the class, to allow them to communicate while seeing each other's faces	zoom, box, slack
Online learning platforms	Comprehensive educational platforms that let teachers submit and receive learning assignments, manage learning progress, and give targeted assistance	moodle, schoology, Realizeit
Many enriched content platforms allow content to be sent through email or uploaded to a collaboration platform, and let users hold discussions using video conferencing tools. As such, they do not assume any particular delivery solution		

Furthermore, in developing countries it may be easy to take on content digitalization by using YouTube or existing free online courses on Khan Academy.

The Laotian Ministry of Education and Sports is currently developing a platform called “Khang Panya Lao,” for providing educational tools that can be used in classroom courses and resources that can be used for home learning. This initiative has received assistance from UNESCO, Khan Academy, JICA, and others, as a measure for COVID-19. The development of this platform will be a major course of action for content digitalization in Laos.

Figure 76. Content solutions

	Category	Description	Examples
Significance of personalization ↓	**Individualized content**	Textbooks, flashcards taken from online sources, exercises, websites, videos, etc.	YouTube, Quizlet, BBC Bitesize
	Systematized content series	Multiple systematic reading materials and videos made to achieve clear learning objectives set by the teacher	coursera, edX
		Collections of resources offering practice opportunities and feedback	Khan Academy, BRILLIANT
	Intelligent, adaptive learning platforms	AI-driven learning platforms that enable people to set individual learning objectives, give feedback, and assess learning progress in an entire subject or module series	UP LEARN, ALEKS, IXL, Freckle by Renaissance, BYJU'S, ST Math
While more sophisticated content platforms include functions for students to practice what they’ve learned and receive assessments on it, when using individual contents in class, users need to search for practice and evaluation content separately			

2.3.3 Identifying potential issues to assist

Bearing in mind the orientation of digitalization in the target sectors studied in the previous section, we studied the level of maturity of the enablers required to drive this digitalization.

The results of our survey of the maturity level of enablers as a whole are as follows. We found that in Laos, there were challenges involved in all four enablers

Figure 77. Summary of potential issues to assist in Laos

Priority sector	Enablers	Assessment results	Potential issues to assist
Agriculture **Education**	Capacity to formulate and implement policies	Improvements are needed in regulations and in the capacity to implement policies	G1 Establishment of ICT regulations is lagging G2 MPT does not have enough budget or authority to drive a digital economy
	Telecom infrastructure	4G networks are not in place There is vast room for improvement in smartphone popularization	I1 Low 4G coverage and slow network speeds in rural areas I2 Low smartphone penetration in rural areas
	Human resources	Laos is starting to see an increase in ICT personnel Need to start by adding more IT engineers	T1 Citizens have little interest in digital technology T2 Not enough education for training digital engineers T3 Insufficient quality in math and science education T4 Insufficient quality/quantity of education for IT engineers T5 Difficulty of using English-language online content due to low level of English
	Innovation ecosystems	The following segments will need to play a greater role in the innovation ecosystem • Startup, corporate • Investors, supporters • Knowledge contributors • Markets	E1 Business regulations are not adapted to the latest technology or business models, and registration procedures are not efficient enough E2 Entrepreneurs do not have enough skills E3 There are not enough universities, and the universities do not have big enough budgets, to assist innovation E4 Not enough funding E5 Not enough mentorships E6 The digital market is not vigorous enough to promote independent innovation

Detailed results of the maturity survey are as follows.

(1) Survey of maturity of capacity to formulate and implement policies

According to a survey by the World Economic Forum, the Laotian government's vision did not place much importance on ICT as of 2014-2015. However, afterward, in October 2015, the Laotian government organized the "Vision 2030, the development strategy of post and telecommunications (2016-2025)," and formulated the "20-Year National Digital Economy Development Vision (2021-2040)" the "10-year National Digital Economy Development Strategy (2021-2030)," and the "National Digital Economy Development Plan 5 Years I (2021-2025)" in 2021, showing increased emphasis on ICT.

Regarding ICT regulations, Laos scored 36 points out of 100 on the 2020 ITU ICT Regulatory Tracker, showing that there is vast room for improvement when compared with other countries.

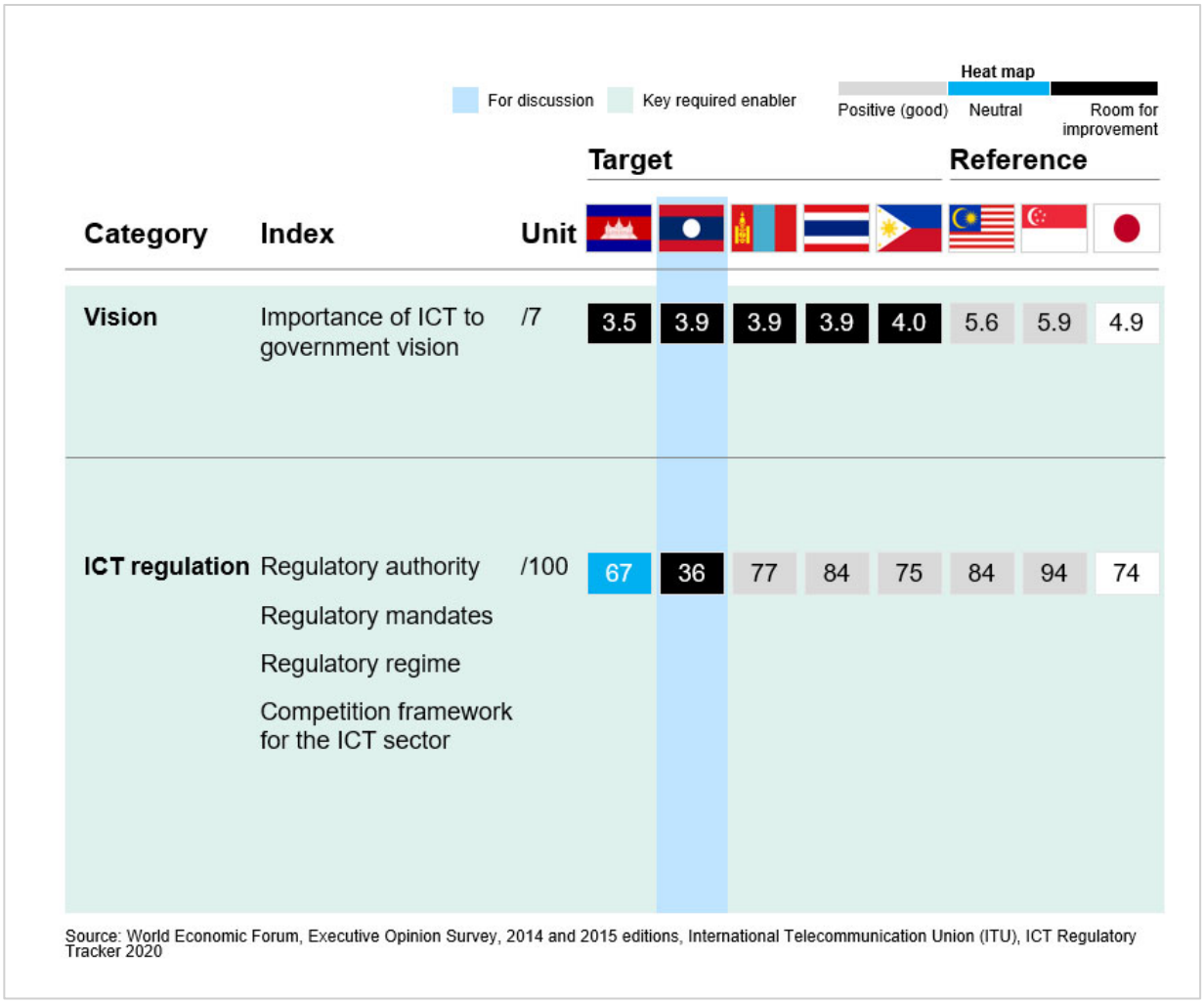


Figure 78. Maturity of capacity to formulate and implement policies

We also received the following types of comments in interviews with experts and with staff at counterpart government agencies

Figure 79. Capacity to formulate and implement policies: Potential issues

Category (Required enablers)	Respondents	Comments, assessment results	Potential issues to assist
Vision	LANIC official	"The Laotian government has set a vision, strategies, and a master plan for developing the digital economy: the 20-Year National Digital Economy Development Vision (2021-40), the 10-Year National Digital Economy Development Strategy (2021-30), and the 5-year I National Digital Economy Development Plan (2021-25). To follow the lead of ASEAN countries, Laos's new vision incorporates key items from the ASEAN Digital Masterplan 2021-2025."	No major issues found

Category (Required enablers)	Respondents	Comments, assessment results	Potential issues to assist
Policy & Regulation **Execution**	LANIC official	"Due to funding issues, MPT has been unable to establish data centers. Each ministry has to receive funding from different international assistance organizations and build their own data centers. This makes it challenging to consolidate data." "For the digital realm to be taken up as a national challenge, we would need to build an organization directly under the prime minister to gather more interest, funding, and leadership."	Establishment of ICT regulations is lagging MPT does not have enough budget or authority to drive a digital economy
	MPT official	"The Ministry of Science and Technology was dismantled, and departments related to digital solutions were incorporated into MPTC. ICT regulations are being updated in the new system."	
	LANIC official	"We need international benchmarks to identify the regulations that need to be revised. Laos needs more laws enacted to manage the ICT industry. The laws aren't keeping up with technological development. Laws have still not been created for the data privacy required by ASEAN countries, and under the current laws, we can't hold auctions for public-frequency bands. This hinders leading companies from bringing mobile networks into the next generation. The National Assembly of Laos has two sessions per year that last only one month each; they are only able to work on about 15 laws in each session."	

Based on the above, we found the following potential issues to assist in the area of the capacity to formulate and implement policies.

- Policies and ICT regulation: Establishment of ICT regulations is lagging
- Implementation: MPT does not have enough budget or authority to drive a digital economy

(2) Telecom infrastructure maturity survey

Below are the results that were found based on various indicators.

- Mobile broadband internet access is more common than fixed broadband: While 4G coverage is at 43%, only 6% of households have fixed broadband.
- Insufficient 4G networks and smartphone penetration: As mentioned above, 4G coverage in Laos is at 43%. With many mountainous areas, coverage is not advanced enough (stalled at a low level relative to Malaysia [93%] and Cambodia [93%]). Smartphone penetration has only reached an estimated 35% as of 2021, lagging behind other countries.

For discussion | Key required enabler | Heat map: Positive (good) / Neutral / Room for improvement

	Indicator		Unit	Target					Reference		
Mobile broadband	**Network**	4G coverage[1] (/population)	%	93%	43%	82%	98%	80%	93%	100 %	99%
		Download speed[2]	Mbps	20.03	27.09	19.51	48	26.24	23.72	66.67	38.81
		Latency[2]	ms	32	31	36	28	31	34	22	44
		Mobile tariff [3](fee of 1GB/monthly GDP capita[4])	%	1.15%	1.94%	0.22%	0.20%	0.51%	0.13%	0.05%	0.12%
	Device	Smartphone penetration[5] (/population)	%	74%	35%	79%	111%	140%	115%	121%	120%
		Smartphone price[6] (/monthly GDP capita)	%	n/a	n/a	n/a	44%	70%	33%	9%	19%
Fixed broadband	**Network**	Household coverage [7]	%	6%	6%	61%	58%	35%	44%	112%	105%
		Download speed[2]	Mbps	27	39	43	218	38	93	239	141
		Latency[2]	ms	12	16	14	8	23	18	13	23
		Monthly subscription price [3] (/monthly GDP capita)	%	25%	25%	3%	4%	19%	3.7%	0.7%	1.5%

1. GSMA (2019), 2. Speedtest (Feb 2021), 3. Cable.co.uk (2020), 4. IMF (2020), 5. Omdia WCIS (2021), 6. Analysys Mason (2020), 7. Informa (2021)

Figure 80. Maturity of telecom infrastructure

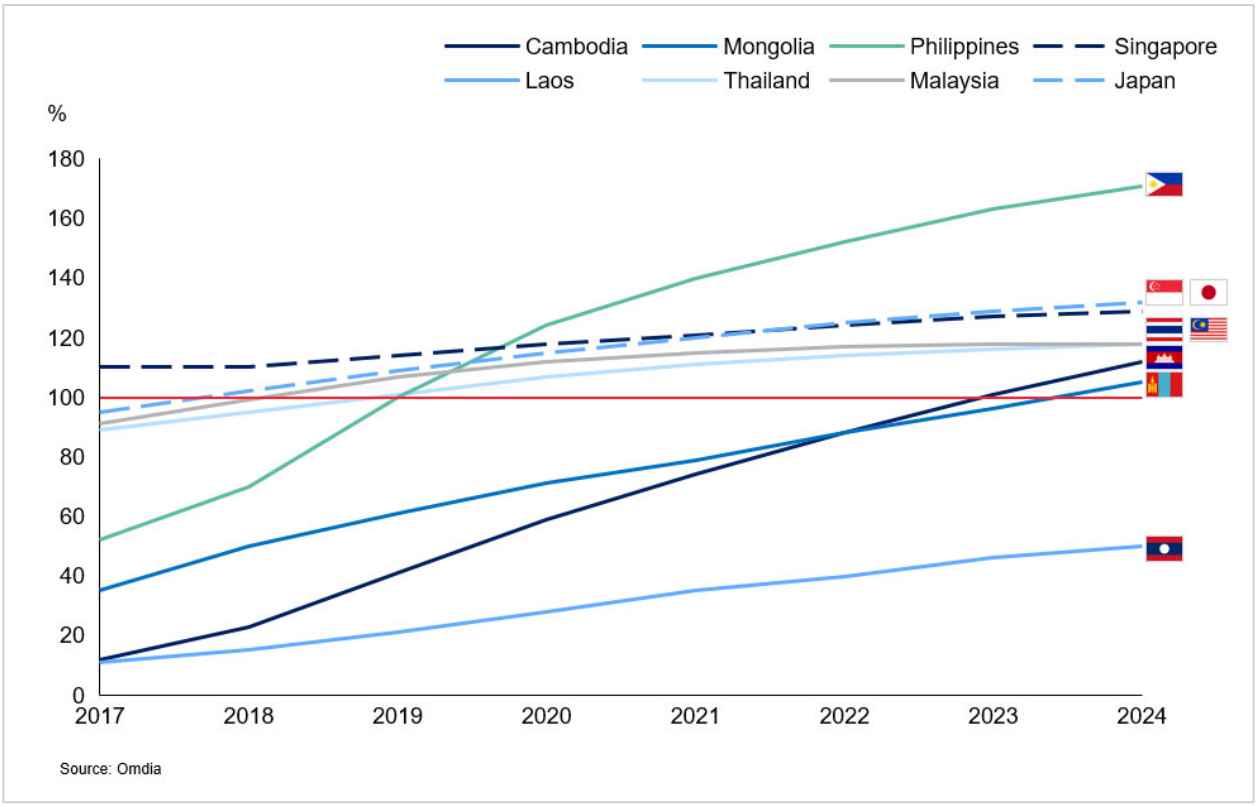


Figure 81. Shifts in smartphone penetration

We also received the following types of comments in interviews with experts and with staff at counterpart government agencies

Figure 82. Telecom infrastructure: Potential issues

Category (Required enablers)	Respondents	Comments, assessment results	Potential issues to assist
Mobile networks	IT network expert	"Coverage is the most important factor for promoting remote education. Upload and download speeds are also of utmost importance for promoting video-based remote education."	Low 4G coverage and slow network speeds in rural areas • 4G networks need to be expanded in rural areas • For promoting video-based remote education above all, high download and upload speeds need to be guaranteed
	JICA local staff	"Mobile networks not still not in place in rural areas, which are in most need of remote education. Remote education is also becoming more important in urban areas, due to COVID-19. Some universities hold classes over Zoom, but the networks are unstable."	
	Education expert	"Being able to access reliable high-speed networks at a reasonable price is a major challenge for improving remote education."	
	Document research[1]	2G coverage is 94%, 3G coverage is 78%	
Mobile devices	Education expert	"In rural areas, some people have smartphones, but you don't see people with laptops or iPads." "For remote education, tablets and the like are usually needed, not smartphones."	Low smartphone penetration in rural areas • The spread of smartphones, laptops, and tablets needs to be accelerated in rural areas
	LANIC official	"Smartphones are especially expensive for people in rural areas. You need USD 800 to purchase an iPhone, which is the equivalent of six months of wages for a Laotian. Low-price models are cheaper, but these also require USD 100-200."	

1. GSMA (2019)

Based on the above, we found the following potential issues to assist in the area of telecom infrastructure maturity.

- Mobile networks: Low 4G coverage and slow network speeds in rural areas
- **Mobile devices:** Low smartphone penetration in rural areas

(3) Survey of HR maturity

Only 0.3% of the entire working population of Laos is employed in the ICT sector, lower than other countries (Thailand: 1.1%; Malaysia: 3.0%). Following the two scenarios listed in the consideration procedures in 2.1.2, we estimated the ICT personnel demand for Laos in 2030. In Scenario 1 (the current rate of increase of ICT personnel and proportion of HR stay the same) that number was 43,000; in Scenario 2 (ICT personnel increases relative to the working population as a whole, to reach the level of countries

with greater digitalization than Laos [e.g. Thailand]) the number was 54,000 people. Actual future demand will probably fall between these two figures. In Scenario 2 more digital engineers will be needed, but as industry digitalization progresses, IT engineers will be needed first, as the foundations of the ICT talent pool. In Laos, which has a small number of ICT personnel, it will be important to prioritize training IT engineers first.

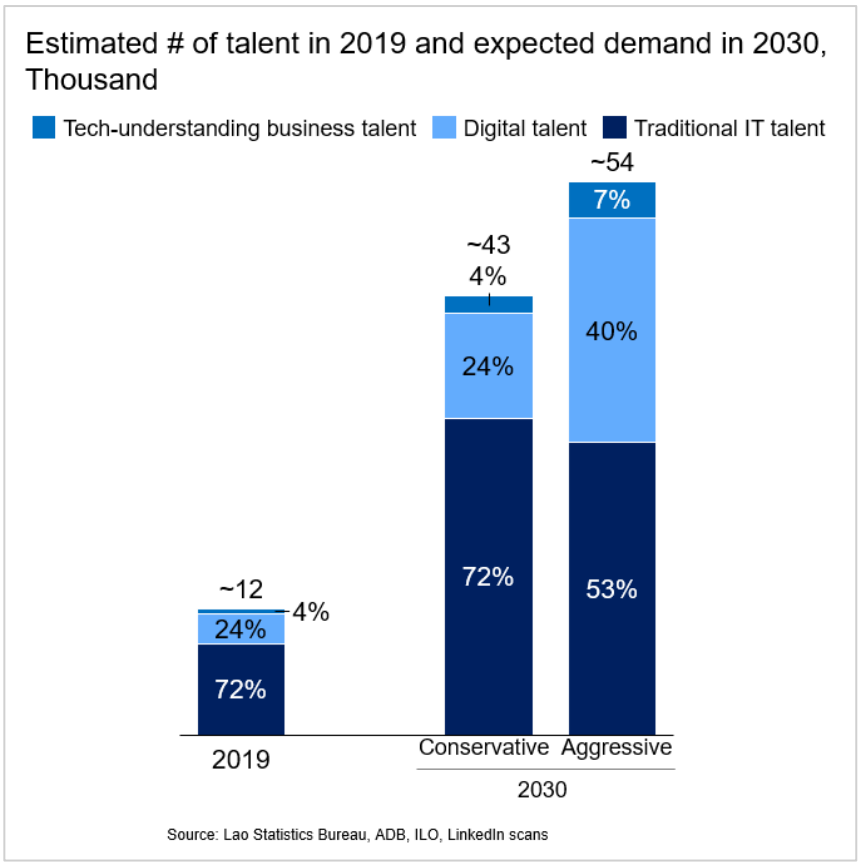


Figure 83. Demand for ICT personnel in Laos

We also received the following types of comments in interviews with experts and with staff at counterpart government agencies

Figure 84. Human resources: Potential issues

Category (Required enablers)	Respondents	Comments, assessment results	Potential issues to assist
Digital translators	Tech company founder	"The younger generations are starting to learn about new technology, but other generations are not. Those generations **work in very old-fashioned ways**. In Laos, not many companies have a website."	Citizens have little interest in digital technology
Digital engineers	IT consultant	"At present, there is only limited demand for digital engineers, and especially AI and machine-learning specialists. Such talent is not currently needed, but even so, there may be a need for cloud infrastructure and IoT talent."	Not enough education for training digital engineers

Category (Required enablers)	Respondents	Comments, assessment results	Potential issues to assist
	IT tech company founder	"Some startups and companies need digital engineers, but **there are no specialized courses offering training sessions or lectures to help people learn the right skills**, so the only method is to learn on your own." "Elementary education needs to convey why it's important to learn science and math, and offer role models as well."	Insufficient quality in math and science education
IT engineers	IT consultant	"The level of education at local universities is not good enough, and there are also very few universities. Plus, since professional opportunities at local companies are limited, the skills of IT personnel are insufficient. There are also few people who study abroad."	Insufficient quality/quantity of education for IT engineers • Updates are needed, to keep up with the latest technology and meet the needs of businesses Insufficient quality in math and science education Difficulty of using English-language online content due to low level of English
	Entrepreneur	"Since the education provided by local organizations is inadequate, the skill level of IT talent is also inadequate. Local online content is limited, and it's difficult for Laotian people to use courses for learning English."	
	Tech company founder	"There are a few technical educational institutions, but there is **still not much of a trend for majoring in IT**. On the other hand, most computer science and engineering students still struggle to meet the criteria of the industrial world. This is because there are no **classes on IT-related skills** in elementary and secondary education. A few IT subjects are taught at universities, but they do not meet the needs of the industrial world."	

Based on the above, we identified the following potential issues to assist in the area of HR maturity. There are issues in training all kinds of talent, but as mentioned above, training IT engineers should be prioritized.

- **Digital translators (talent capable of acting as a bridge between business and technical aspects)**: Citizens have little interest in digital technology
- **Digital engineers:** Not enough education for training digital engineers, and insufficient quality in math and science education
- **IT engineers:** Low quality of education for IT engineers, low quality of math and science education, difficulty using English-language online content due to low level of English

(4) Innovation ecosystem maturity survey

Below are the results that were found based on various indicators.

- **Startups:** Laos has a tax rate of 24%, low in comparison with other countries (Thailand: 30%; Philippines: 43%; Malaysia: 43%). On the other hand, it takes 173 days to start a business, by far a long time among the survey target countries.
- **Corporate**: According to a survey by the World Economic Forum, there is little investment in the latest technology, and there are issues with contributions to innovation.
- **Knowledge contributors**: According to data from the World Development Indicator, the number of contributions per million people to science and technology journals is even lower than Cambodia (12/million people)
- **Investors, supporters:** According to PitchBook, VC investment is a low percentage of GDP, and the government does not do enough to promote investment in new technology.
- **Market access:** Compared with other countries, there is not enough market competition to encourage innovation.

For discussion | Key required enabler | Heat map: Positive (good) / Neutral / Room for improvement

Category	Index	Unit	Target					Reference		
Startup	Average # of startups[1] founded annually	/MM people[2]	0.3	0.0	0.2	0.8	0.2	2.4	68.6	3.7
	Days to start business[3]	#	99	173	12	6	33	17	2	12
	Procedures to start business[3]	#	9	9	8	5	13	8	2	8
	Tax rate % profit[4]	%	23	24	26	30	43	39	21	47
Corporate	Investment in emerging technologies[5]	/100	44	46	33	54	61	79	79	80
	R&D expenditure.by businesses[6]	/100	0.4	n/a	0.2	21	1.5	21	33	65
	Creation/merger/acquisition of joint venture[7]	/MM people[2]	0.1	0.1	0.4	0.3	0.1	1.0	12.2	0.7
Knowledge contributor	# of scientific and technical journal articles[8]	/MM people[2]	9	12	42	179	21	717	1,986	786
	R&D expenditure by government and higher education institution[6]	/100	3	n/a	7	16	7	57	80	58
Investor/ supporter	VC investment[9]/GDP[10]	USD/MM USD	79	0	230	361	95	244	11,125	385
	Government promotion of investment in emerging technologies[5]	/100	31	48	20	65	39	77	100	72
	FDI restrictiveness[11]	/1	0.05	0.19	0.07	0.27	0.37	0.25	0.06	0.05
Market access	Intensity of local competition[12]	/7	4.7	4.3	5	5.4	5.2	5.4	5.6	6.3

1. Average number of startups founded during 2016-20 annually listed in PitchBook, approach of summing startups might not be exhaustive, 2. IMF, 3. Doing business 2020 report 4. Paying Taxes 2020 report , 5. World Economic Forum, Executive Opinion Survey 2017–2018, 6. UNESCO Institute for Statistics, 7. Average number of creation /merger /acquisition of joint venture listed in Capital IQ during 2010-2020, 8. World Development Indicators (2018), 9. Average capital invested during 2016-20 annually listed in PitchBook, approach of summing capital might not be exhaustive, 10. IMF (2020), 11. OECD (2019), 12. World Economic Forum, Executive Opinion Survey, 2014 and 2015 editions

Figure 85. Innovation ecosystem maturity

We also received the following types of comments in interviews with experts and with staff at counterpart government agencies

Figure 86. Innovation ecosystem: Potential issues

Category (Required enablers)	Respondents	Comments, assessment results	Potential issues to assist
Startup, corporate	Document research	Three types of certificates issued from separate ministries are the main items needed to register a business. The government started a one-stop service, but to get the following certificates, companies still need to visit each ministry: company registration certificate, tax registration certificate, and business permit	Business regulations are not adapted to the latest technology or business models, and registration procedures are not efficient enough • Long timeframe needed to start a business • The law demands that new business models meet superfluous conditions • There is not enough understanding of technology in the ministry that issues business permits Entrepreneurs do not have enough skills
	Document research	It seems that many businesses generally lack transparency and consistency in their key tax calculations and management	
	Entrepreneur	"The regulations are unclear and don't keep up with recent trends, so it takes a lot of time and money to start a business, making it almost impossible to do so." "There's a lot of paperwork that needs to be done, so startups usually need ask a company to do it for them in order to complete their registrations." "To start a business, some startups have had to arrange for ten cars and drivers, or a certain amount of capital, even though it wasn't necessary for their business." "One agricultural startup tried to get a business permit from the Ministry of Agriculture, but they couldn't get one because there wasn't anyone in the ministry who understood the startup's technology."	
	IT expert	"**There aren't enough entrepreneurial skills** (e.g. pitching to draft business cases, etc.)"	
Knowledge contributors	Document research	Laos has an extremely small number of universities. On a list of the **top 30,000 universities** in the world, **only four** from Laos made the list[1], while the other four target countries had 30 or more universities make the list. Of these, the National University of Laos, the top university of Laos, is ranked at 5,063	There are not enough universities, and the universities do not have big enough budgets, to assist innovation
	Tech company founder	"University budgets are **extremely limited**. Some universities link up with Thai universities and receive assistance."	
Investors, supporters	Serial entrepreneur	"There aren't any serious investors in Laos, and there isn't enough financial assistance from the government, either. Startups are unprepared, and don't have contact with foreign VCs, so **almost no one is getting VC investment**. Even if they manage to get funding from foreign investors, small startups	Not enough funding • There aren't any serious investors locally, and there isn't enough financial assistance

Category (Required enablers)	Respondents	Comments, assessment results	Potential issues to assist
		need to spend a lot of time completing documents to obtain a business permit from the Laotian government. It's also difficult to get mentorships."	from the government • Difficult to get investment from overseas — Startups are not working at a high level — Difficult to access foreign VCs — Government-related procedures are not efficient enough
	IT consultant	"**Weak financial foundations and the difficulty of accessing capital** are the **bottlenecks** of Laos's startup ecosystem. Since the market is really small right now, **Laos is not an investment target for angel investors or VCs**. **Payment systems and other infrastructure elements are still inadequate. Strict regulations that favor large banks and financial institutions make it impossible for fintech startups to expand their business."」	
	Tech company founder	"Currently, the main assistance from the government is just two startup events run jointly with international assistance organizations."	Not enough mentorships • Hard to find mentors • Very few events for finding mentors
Market access	IT consultant	"The language is unique, and at present the market is not big enough."	The digital market is not vigorous enough to promote independent innovation

1. webometrics.info

Based on the above, we found the following potential issues to assist in the area of innovation ecosystem maturity.

- **Startups**: Business regulations are not adapted to the latest technology or business models, and registration procedures are not efficient enough
- **Knowledge contributors:** Not enough universities, and not enough budget therein, to assist technological innovation
- **Investors, supporters**: Not enough funding or mentorships
- **Market access**: The digital market is not vigorous enough to promote independent innovation

2.3.4 Formulating assistance programs

(1) Assessing potential issues

Following the approach mentioned above, we assessed the potential issues based on: (1) impact anticipated from solving the issue; (2) our counterparts' level of interest; and (3) JICA'S interests. The

results are as follows. To the right side of the diagram are the issues that are expected to have a large impact if they are resolved, while the issues of greater interest to our counterparts are positioned on the top row of the diagram. Based on (1) and (2), the issues JICA prioritizes for assistance programs are highlighted in grey (the letters at the head of each issue indicate the following: E: innovation ecosystems; G: government policymaking; I: infrastructure building; and T: training talent).

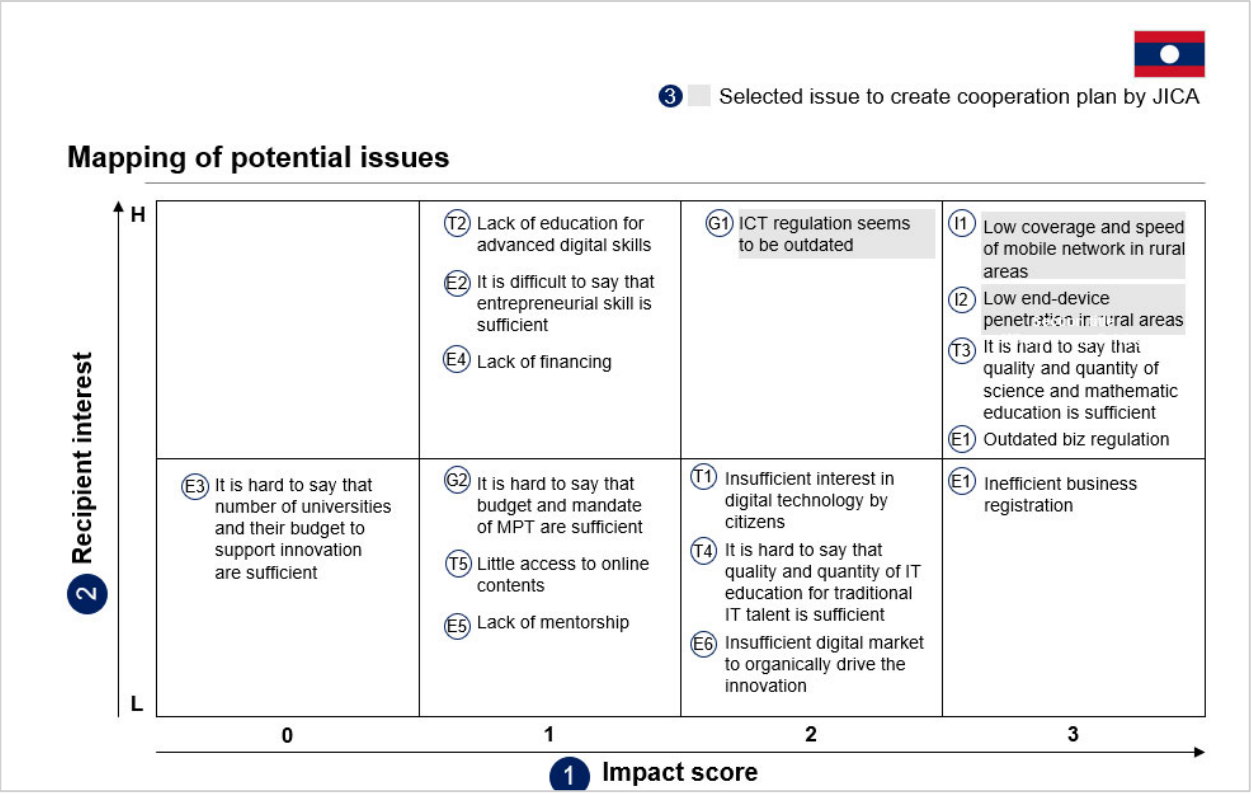


Figure 87. Assessment of potential issues

Below is a detailed explanation on the assessment based on the above three perspectives.

(1)-1 (1) Impact expected from solving the issue

Using the scoring method outlined in the consideration procedures in 2.1.2, we scored the expected impact of solving each potential issue. We found that the following issues would have a relatively high expected impact if they were resolved (scoring 3 or 2).

- Low 4G coverage and slow network speeds in rural areas (Score 3)
- Low smartphone and other device penetration in rural areas (Score 3)
- Insufficient quality/quantity of education for IT engineers (Score 3)
- Business regulations are not adapted to the latest technology or business models (Score 3)
- Registration procedures are not efficient enough (Score 3)
- Establishment of ICT regulations is lagging (Score 2)
- Companies and citizens have little interest in digital technology (Score 2)
- Insufficient quality in math and science education (score 2)

- Digital market not vigorous enough to promote independent innovation (score 2)

(1)-2 (2) Counterpart's interests

Meanwhile, the counterpart Ministry of Post and Telecommunications (MPT) showed interest in assistance for the following from among the above nine issues.

- Low 4G coverage and slow network speeds in rural areas
- Low smartphone and other device penetration in rural areas
- Insufficient quality/quantity of education for IT engineers
- Business regulations are not adapted to the latest technology or business models
- Establishment of ICT regulations is lagging

We received the following comments from the counterpart on each issue.

Figure 88. Counterpart's interests

Interest	Potential issues to assist	C/P comments
High	I1: Low 4G coverage and slow network speeds in rural areas I2: Low smartphone penetration in rural areas T3: Insufficient quality in math and science education E1: Business regulations are not adapted to the latest technology or business models G1: Establishment of ICT regulations is lagging T2: Not enough education for training digital engineers E2: Entrepreneurs do not have enough skills E4: Not enough funding	"The Laotian government developed the online education platform KhangPanya, but without a stable connection and devices to use it, rural residents can't access the platform." "Laotian education needs online content to be developed, which means talent development is crucial." "Some regulations aren't keeping up with the latest technology." "There needs to be development in telecom infrastructure and the innovation ecosystem." "People don't know how to launch a startup."
Low	E1: Registration procedures are not efficient enough T1: Citizens have little interest in digital technology T4: Insufficient quality/quantity of education for IT engineers E6: The digital market is not vigorous enough to promote independent innovation G2: MPT does not have enough budget or authority to drive a digital economy T5: Difficulty of using English-language online content due to low level of English E5: Not enough mentorships E3: There are not enough universities, and the universities do not have big enough budgets, to assist innovation	"Business registration is important, but improvements are being made. We're working on building an electronic licensing system to move the system online. This will reduce the number of days it takes to register a business." "The Ministry of Science and Technology was dismantled, and departments related to digital solutions were incorporated into MPTC. ICT regulations are being updated in the new system."

(1)-3 (3) JICA's interests

We mapped the potential issues based on the expected impact of resolving them, and on the counterpart's level of interest. We then selected the priority issues to consider as JICA assistance programs. The results were the selection of the following three potential issues to assist.

- Low 4G coverage and slow mobile broadband speeds in rural areas
- Low smartphone and other device penetration in rural areas
- Establishment of ICT regulations is lagging

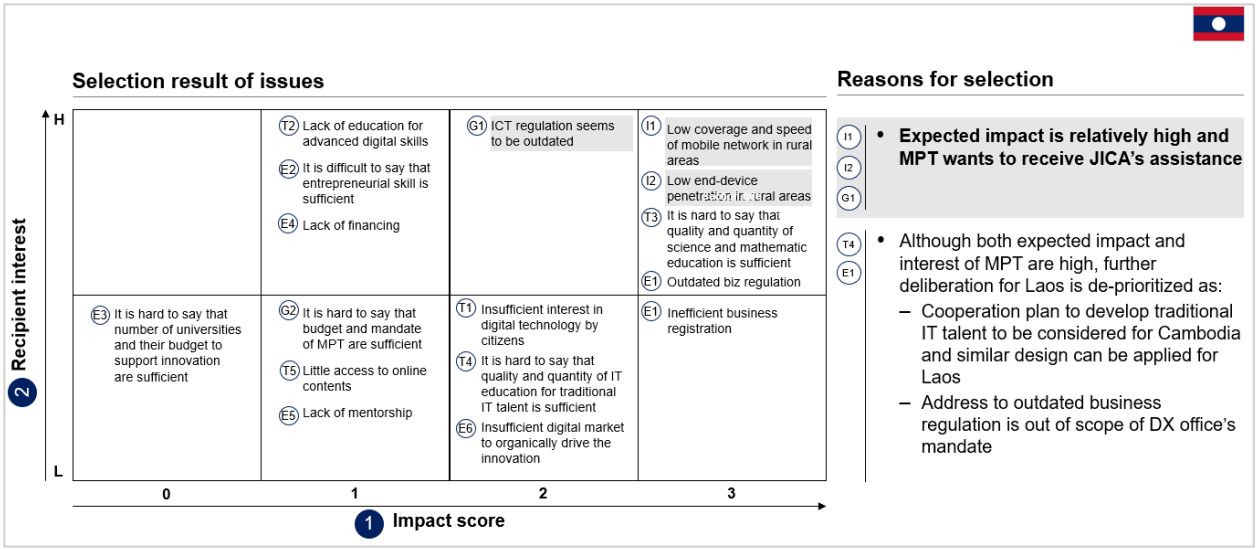


Figure 89. Selecting priority issues

(2) Drafting assistance programs and possible solutions for potential issues

(2)-1 Formulating JICA assistance programs for priority issues

This section outlines JICA assistance programs for each of the priority issues.

Low 4G coverage and slow network speeds, and low smartphone and other device penetration in rural areas

Below is a list of global best practices on this issue, as identified through surveys of reference projects done by other donors, and interviews with experts.

- Improve infrastructure to expand 4G coverage
- Popularize smartphones and tablets in rural areas
  - Government or network operator subsidies to facilitate purchase of devices, or low-interest loans guaranteed by the government
  - Install devices in public institutions
  - Provide free or inexpensive broadband access plans
- Popularize/raise awareness about how to use devices for economic and social activities

Using a survey of best practices for improving mobile network coverage, we identified five models for fundraising and assistance frameworks needed to improve infrastructure. (Figure 78) For example, in Malaysia, the Universal Service Provision (USP) system is used to collect a portion of sales from businesses. This is then used as capital that drives network improvements in rural areas. In Mexico, a consortium is formed by domestic operators, foreign and domestic pension funds, and the IFC, to establish 4G networks.

In Laos too, telecom laws grant MPT the authority to establish the Telecommunication Development Fund with the goal of installing networks in remote locations, but in its current state it is not really functioning. It will be important to successfully activate such systems to promote drive network improvements in rural Laos.

Figure 90. Rural mobile network expansion models

A	B	C	D	E
Fully expand networks, including in low-profit areas, based on public funding such as **public money, universal service funds (USO Fund), and priority loans**	Partner with PE and telecom investors - Companies interested in long-term investment to install networks, in partnership with government	Industry partnerships - Expand affordable mobile coverage by having businesses share networks	Partnerships with international agencies - Build regional networks by having the government get access to long-term low-interest loans and financial assistance	Institutional assistance on the condition of full rollout - Businesses get incentives for covering rural areas through frequency auctions
Malaysia Use USO funds to set up cellular, Wi-Fi and mobile broadband in rural areas **Australia National Broadband Network (NBN)** Set up fixed wireless access and satellite connections for the roughly 8% of households for which it would be economically unreasonable to set up fiber networks	**Rwanda-based KT Rwanda Network (KTRN)** Established through a public-private partnership)(PPP) between the government and SK Telecom (49% contributions from the former, 51% from the latter), the build nationwide 4G networks Mexico's ALTÁN Redes A consortium of local businesses, foreign and domestic pension funds, and the IFC built 4G networks (for wholesale)	**UK** O2, Three, and Vodafone signed a joint contract for 4G networks. Mobile coverage is being expanded in rural UK, with the goal of covering 95% of the population by 2026 **Malaysia** Maxis and U Mobile signed a joint contract for 2G/3G active networks. Celcom and TM Webe signed a joint contract for 4G networks, to expand Webe's coverage	**Uganda** The Ugandan government received USD 200 million in assistance from the World Bank, and is building a digital inclusion scheme to help underserved rural areas get access to online services. In addition to setting up 900 mobile broadband connections at facilities in underserved areas, they have installed 828 Wi-Fi hotspots	**Czech Republic** Regarding frequency distribution, they are giving licenses for the same frequency band with lower minimum buyout prices, on the condition of expanding coverage **Sweden** The spectra conditioned for rural coverage were given an SEK 300 million deduction off the bidding price, to be used toward expanding coverage

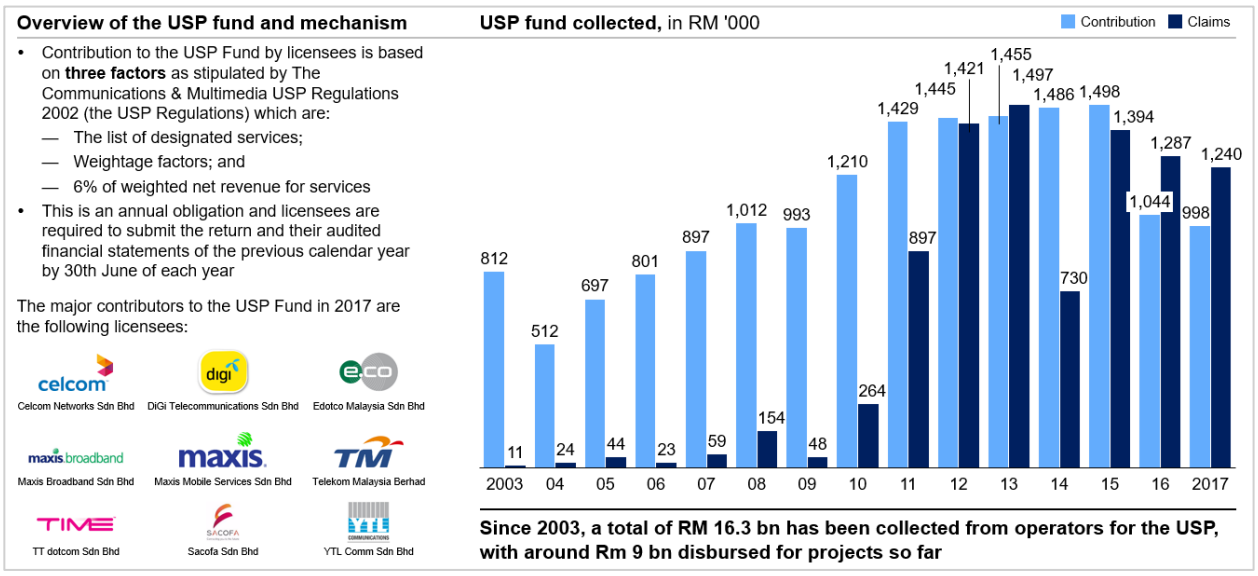


Figure 91. Telecom/internet servicing in Malaysia

For outfitting essential base stations, aside from having private businesses do this independently, business owners and investors could form special purpose companies (SPV), and these installations could be done by the SPV in some cases and by government agencies in others. However, this situation involves the following advantages and disadvantages.

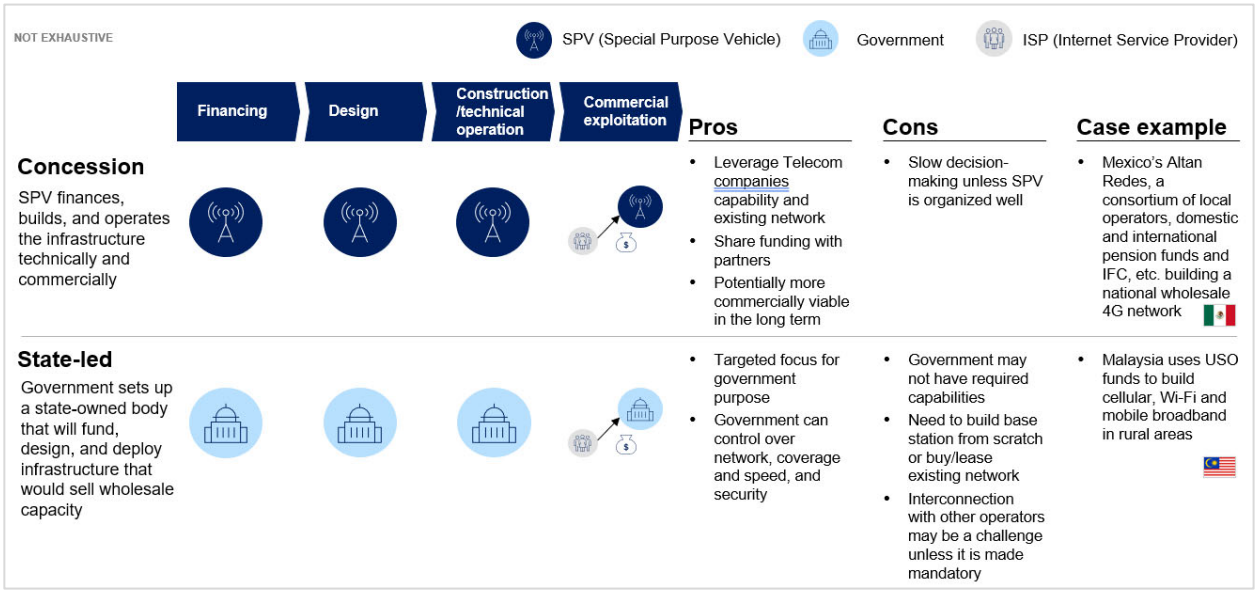


Figure 92. Models for installing and using mobile networks

Unitel and Lao Telecom account for the majority of the domestic mobile network share in Laos, and these two firms have independently installed the backbone of the networks. However, the 100% state-run enterprise Sky Telecom has a monopoly on installing underground optical fiber. If a government agency were to build base stations for 4G networks, they would likely use existing agencies rather than start a new one. Then, to alleviate the above disadvantages, it would be useful to install things systemically, in a way

that would secure the necessary talent and promote private-sector cooperation (leasing privately-owned base stations, or using base stations installed by the agency).

Regarding the spread of devices, other countries' efforts showed that the best practices include not only giving subsidies to simply purchase devices, but also providing cheap data plans for a fixed period. The Singapore government's NEU PC Plus (NPP) Program provides a three-year broadband plan free of charge, along with assistance purchasing a computer, to low-income houses with students or people with disabilities. In Singapore's Home Access Program (HAP), there is an option to provide two years of inexpensive broadband that comes with a tablet or smartphone. Such programs lower the hurdles for starting to use a device as well as purchase one, and may help drive the spread of devices.

When promoting the spread of devices, it is crucial to have people understand how to also use these devices for economic and social activities. In Uruguay, efforts are made to supply students with computers and improve their learning results. In Japan, NTT DoCoMo runs smartphone classes for older people, to help encourage the spread of smartphones.

The idea is that users learn about the conveniences of these devices by using them, or gain economic and social benefits, thus leading to continued use. Taking the above best practices as references, when running similar initiatives in Laos, it will be important to familiarize and educate people about how to use these devices for economic and social activities in a way that fits the context of Cambodia. At the same time, it will be crucial to consider measures to prevent resale and other issues, based on Laos's income level.

Figure 93. Efforts in Singapore

Efforts		
Objectives	• As part of a digital readiness blueprint, access is expanded as much as possible for basic digital enablers, such as devices and networks • Improve productivity at small and medium enterprises (SMEs) by giving Productivity Solutions Grants (PSG)	
Key activities	• NEU PC Plus (NPP) Program: With this program, low-income households with students or people with physical disabilities are provided with computers at a low price, and given three-year contracts for free broadband. The Infocomm Media Development Authority (IMDA) works with non-profit organizations (e.g. the Chinese Development Assistance Council [CDAC]) to process applications submitted through school agencies. When an application is successfully accepted, IMDA places orders for a computer and broadband connection in collaboration with partner companies (telephone company M1, Netlink PC Acer, etc.). IMDA provides subsidies for package deals • Home Access Program (HAP): In this program, households that do not include students or PWD are given subsidies for fiber broadband plans that include a tablet or smartphone • The Ministry of Education (MOE) approved lowering the cost of purchasing personal learning devices by having secondary schools and junior colleges participate in a large-scale bidding	

Efforts		
	scheme, on the condition of having students learn from home at least two days per week starting in the third quarter of 2021. Students can purchase devices using funds from their educational savings (Edusave), and low-income households can receive additional subsidies • Productivity Solutions Grant (PSG): Subsidizes SMEs, assisting the installation of pre-approved IT devices. Up to 80% of expenses can be covered by these subsidies. Companies can access lists of pre-approved vendors and solutions on the GoBusiness Gov Assist website. When they get an estimate from a pre-approved vendor, they can apply for a PSG from the business subsidy portal	
Outcomes	• The rate of computer ownership in all Singaporean households increased overall, from 74% (2003) to 89% (2019) • There have been over 63,000 recipients of NEU PC plus (as of April 2020) • There have been over 14,000 recipients of HAP (as of April 2020)	
Features	• Both devices and broadband plans are provided at a low price	

Figure 94. Efforts in Uruguay (1/2)

Background	Overview	
• The Uruguayan government started a program to expand the use of ICT in educational settings in 1996, but the program did not produce great results • In 2006, President Tabaré Vázquez positioned this as a priority for promoting a "just society," and set out to ensure fair access to information and telecommunications	In 2006, Uruguay started the Plan Ceibal, setting out to expand ICT usage in educational settings, through initiatives with NGO groups such as One Laptop per Child (OLPC).[1]	
	Objectives	• To provide each child and teacher with a laptop computer, as well as prepare broadband access at public schools, run IT training sessions for teachers and households, and other initiatives to develop new tools for online education
	Key interests	• Program implementation was assisted by a leader with great political power (the president) and by a leader with a high level of technical prowess (Technological Laboratory of Uruguay [LATU]) • Other stakeholders had consultant-like roles (Uruguay teachers' unions, and government offices for culture, education, research, innovation, etc.) • Assistance was provided by OLPC for laptop computers, by ANTEL (government-owned telecommunications company) for internet connections, and LATU for logistics and telecom infrastructure • Digital content (resources teachers can use for classes, tests, physical education, and information exchanges) is developed on educational portals including Ceibal, ANEP, EduMEC, and Uruguay Educa
	Execution and costs	• The plan was rolled out in waves: First a small-scale pilot was run in a small city, then it was expanded to urban areas, and finally to the entire country (period of three years)

Background	Overview	
		• The program ran from 2007 to 2009, with total expenses of USD 140 million, all provided by the government

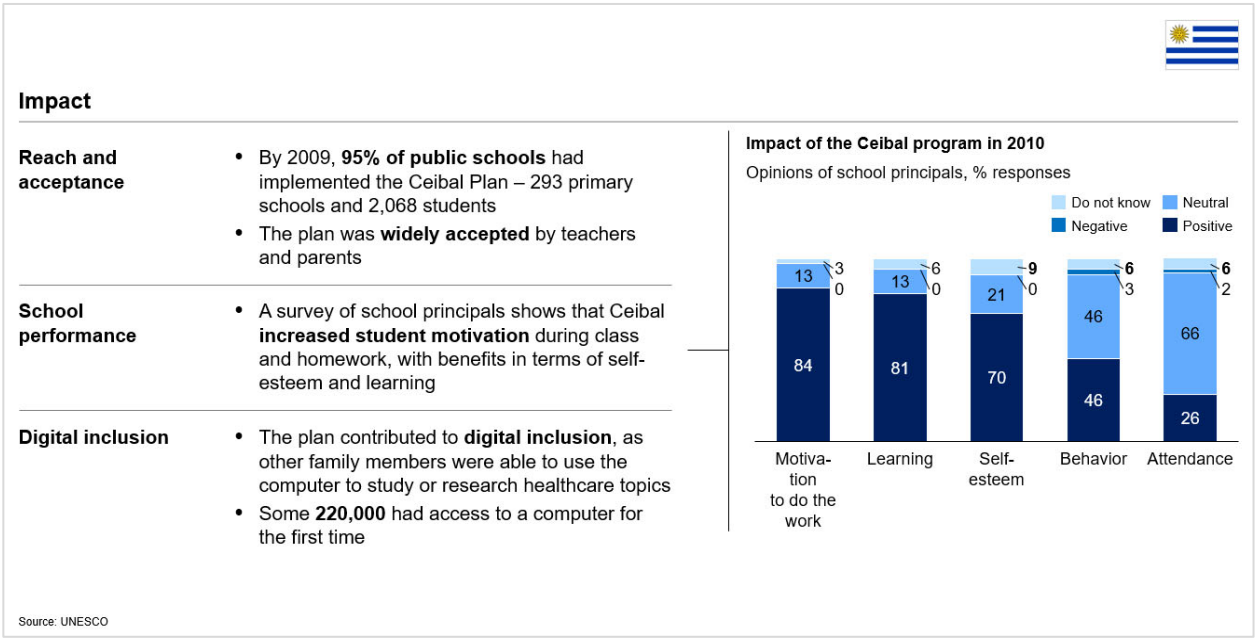


Figure 95. Efforts in Uruguay (2/2)

Establishment of ICT regulations is lagging

The global best practices on this issue, as identified through interviews with experts, form the section "Identifying and installing essential regulations for implementing a vision and strategy."

The scope of regulations in the ICT area is expansive, running from conventional regulations on building infrastructure, to securing a competitive environment for digital services, moderating content, protecting data, and digital taxation.

For this reason, it is important to brainstorm with a wide range of players such as network operators, and grasp the needs in the country, when examining the regulatory system. Following this, it is essential to survey ICT regulations globally and in the ASEAN region, and prioritize tackling issues that have the widest gaps between the state of domestic needs and regulations, and the situation in other benchmark countries.

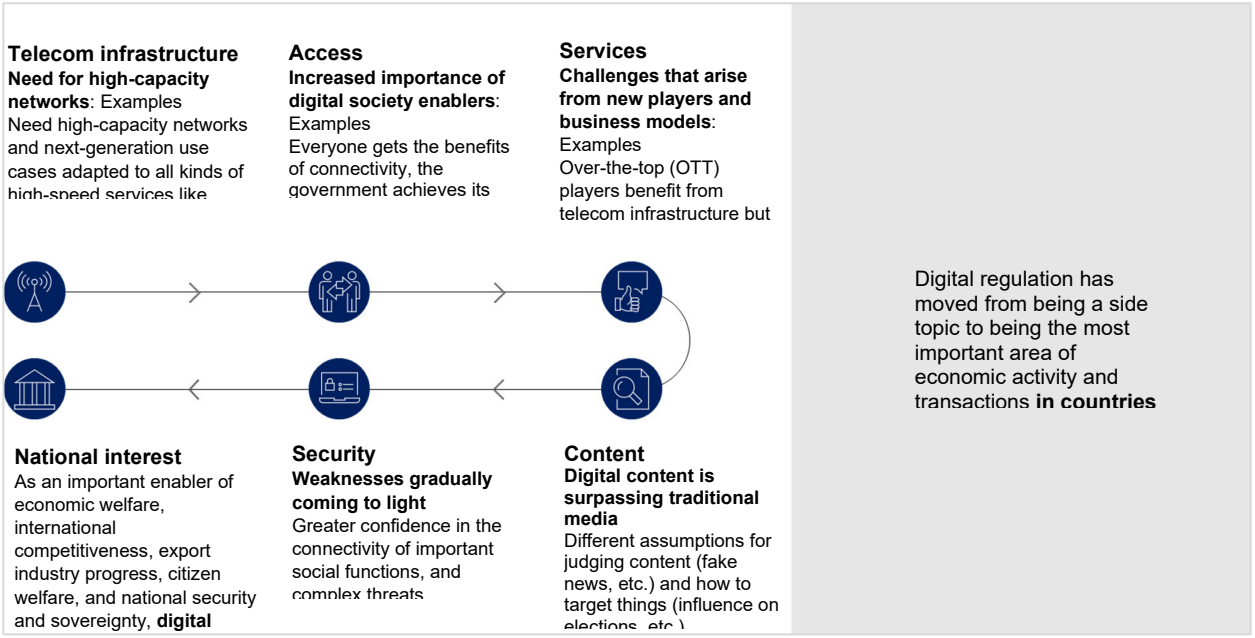


Figure 96. Impact of digitalization in the value chain

	Value chain	Key regulatory challenges
Traditional telecom regulation	Infrastructure	**5G spectrum:** Allocation and licensing and introduction of more flexible spectrum usage e.g. trading, sharing and license exempt usage for e.g., WiFi, IOT etc.
		Network sharing and co-investment: Regulatory boundaries to be defined to help operator CAPEX
	Transmission and access	**Wholesale access:** Definition of potential obligations for giving access to new infrastructure
		Net neutrality: Ensuring capacity requirements and prioritization of critical transmission while maintaining confidentiality of communications and fair competition in transmission and access
Digital regu-lation	Services	**Competition**: Preventing abuse of monopolistic or oligopolistic structures and gatekeeping roles online through application of existing or revised competition laws and new definitions of relevant markets
		Consumer protection: Ensuring fair and transparent contract terms and market conduct, safe usage and transactions, portability and complaint mechanisms etc.
	Content	**Content moderation**: Control and prevention of harmful or illegal content, fake news and ensuring copyright protection as well as neutral political campaigns and elections online
		Data protection: Ensuring personal data protection in digital applications and services
	Security	**Security**: Ensuring robust and secure communication networks, applications and services to guarantee a safe digital society and digital sovereignty
	State interests	**Taxation**: Increasing push for taxation of digital companies to achieve fair financial distribution of online service revenues to countries contributing to its emergence, potentially supporting the infrastructure online players are dependent on

Figure 97. Challenges with value chain regulations

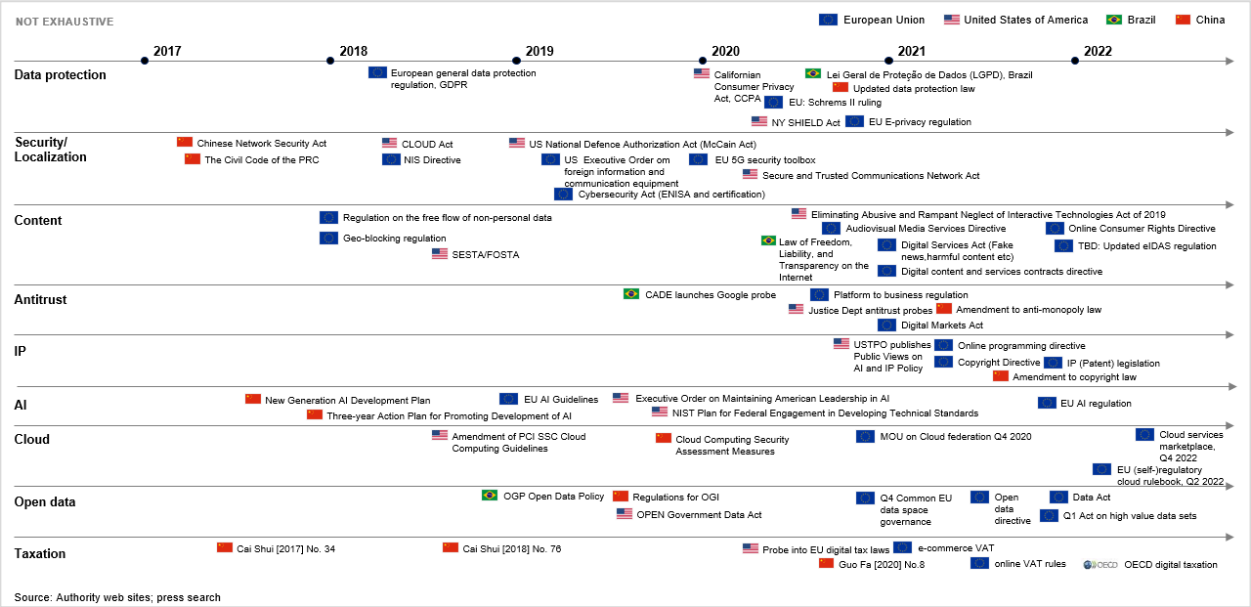


Figure 98. Examples of laws and ordinances

Summary

Based on the above, JICA's assistance programs for the Laotian government with regards to the priority issues may be as follows.

Program 1

Figure 99. Overview of Laos assistance program: Install 4G mobile networks and improve use of devices

Program Components	Expected impact of this program	Cost estimate via outside-in study
Institutions receiving assistance: • MPT (Ministry of Post, Telecom and Communications) • Each ministry (may become future assistance recipients) **Target assistance activities:** • Set up structures/systems • Set up infrastructure to improve 4G coverage • Improve device proliferation • Familiarize/educate how to use devices	**Stimulate economic/social activity, especially in rural areas** Agriculture: Essential production information will be accessible to farmers, improving productivity • Education: Improve educational quality and access with remote learning, and reduce the dropout rate for elementary and junior high school education Expand digital services through the spread of devices: Digital services will increase in other areas Develop sustainable digital economies after the assistance period: The use of digital services will continue even after the assistance period, due to improved income from stimulated economic activity and more convenient digital services	**Total project cost estimate[1]: JPY 50 billion ~ 150 billion** • 4G networks: installation, JPY 50 billion ~ 130 billion — Number of towers, equipment, and transmissions: ~4,000 — Unit price of towers and equipment: JPY 12 million ~ 30 million — Unit price of transmissions: JPY 1.5 million ~ 2 million • Device proliferation improvement: JPY 15-25 billion — Number of devices: ~800,000 — Device unit price: JPY 20,000~30,000 • Familiarize/educate how to use devices: JPY tens of millions — Labor costs and overhead — Training expenses (teaching materials, venues, etc.)

1. These are estimates of all costs needed to implement the project, and do not necessarily align with JICA assistance amount

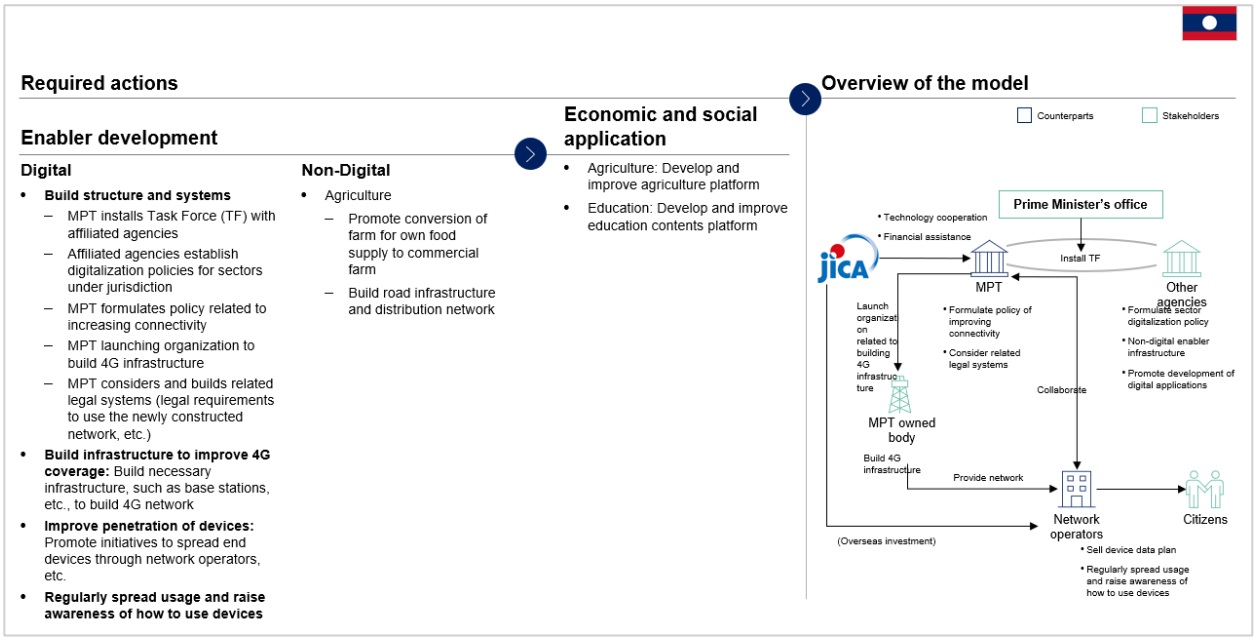


Figure 100. Overview of activities needed to maximize impact

Figure 101. Activity details (building infrastructure)

Category	Steps	Activity details			Applicable JICA scheme	Considera-tions
		CIP	Other stakeholders	JICA		
Enablers: digital	Set up structures/ systems	**MPT** • Take the lead to establish a Task Force (TF) with related ministries (Ministry of Education and Sports [MOES], Ministry of Agriculture and Forestry [MAF], etc.)	**Related ministries** • Coordinate with MPTC	Assistance TF launch	Technical cooperation	Will other ministries follow MPT's initiative?
		TF • Agree on policy formulation for digitalization in each sector		Assistance TF operations	Technical cooperation	
		Related ministries • Organize policies for digitalization in each sector	**MPT** • Assistance related ministries' policy organization	Assistance policy organization	Technical cooperation	

Category	Steps	Activity details			Applicable JICA scheme	Considera-tions
		CIP	Other stakeholders	JICA		
		MPT • Based on the policies of related ministries, formulate a plan to improve digital access in rural areas	**Related ministries** • Coordinate with MPTC	Assist plan formulation	Technical cooperation	
		MPT • Launch an organization to build infrastructure for expanding 4G networks (also consider using existing organizations)		Assist launch of organization	Technical cooperation	Can the budget needed to launch an organization be secured?
		MPT • Review and organize related legal systems (obligations for using newly-built networks, etc.)		Assist organization of legal systems	Technical cooperation	Can the necessary legal systems be organized quickly?
	Set up infrastructure to improve 4G coverage	**MPT** • Contracts for using network operators and existing base stations	**Network operators** • Network operators lend 2G/3G base stations to the government			Can these be loaned at a reasonable rate?
		MPT • Network setup		Network setup assistance	Loan funding cooperation or free financial assistance	Can the necessary setup costs be covered?
	Improve device proliferation	**MPT** • Push for network operators to provide devices • Or, install shareable devices along	**Network operators** • Sell or lease end devices (if providing residents with end devices)	Assistance operation management for proliferation Give end devices or provide	(Overseas investment) Technical cooperation	Will end devices be popularized enough?

Category	Steps	Activity details			Applicable JICA scheme	Considera-tions
		CIP	Other stakeholders	JICA		
		with setting up Wi-Fi access points in public facilities (city halls, etc.)		funding for this purpose		
	Periodically familiarize/educate how to use devices	**MPT** • Assist popularization/ awareness activities by network operators	**Network operators/related ministries** • Coordinate with MPT and related ministries to periodically give lectures on usage methods	Assist public awareness activities	Technical cooperation	
Enablers: non-digital	Convert farmers into commercial farmers	**MAF** • Use incentives to promote the conversion to commercial farming		Assist policy planning and implementation for the conversion to commercial farming	Technical cooperation	
	Build road infrastructure and distribution channels	• Build road infrastructure and distribution channels		Assist with funding to build infrastructure	Loan funding cooperation or free financial assistance	
Apply to economic and social develop-ment	Launch/improve agricultural platforms	**MAF** • Assist the launch/improvement of agricultural platforms in the private sector	**Agricultural startups, etc.** • Develop platforms equipped with essential functions based on the needs of farmers	Financial assistance for launching/improving platforms	Overseas investment	
	Launch/improve education platforms	**MOES** • Pick up on needs as the number of users increases, and improve existing platforms		Assist surveys and research related to improving platforms	Technical cooperation	

Program 2

Figure 102. Overview of Laos assistance program: Review and reform ICT regulations

Program Components	Expected impact of this program	Cost estimate via outside-in study
Institutions receiving assistance: • MPT (Ministry of Post, Telecom and Communications) **Target assistance activities:** • Survey domestic needs • Benchmark analysis • Draft tentative regulatory system	**Preparing an environment for economic development of domestic industries**: Prepare ICT/digital regulations, and create an environment in which domestic companies can develop and provide ICT/digital services in a fair competitive environment **Participate in international digital economies**: Take part in making frameworks for international data use by meeting international ICT/digital regulations	**Total project cost estimate[1]: JPY tens of millions** – Labor costs and overhead for sending in specialists

1. These are estimates of all costs needed to implement the project, and do not necessarily align with JICA assistance amount

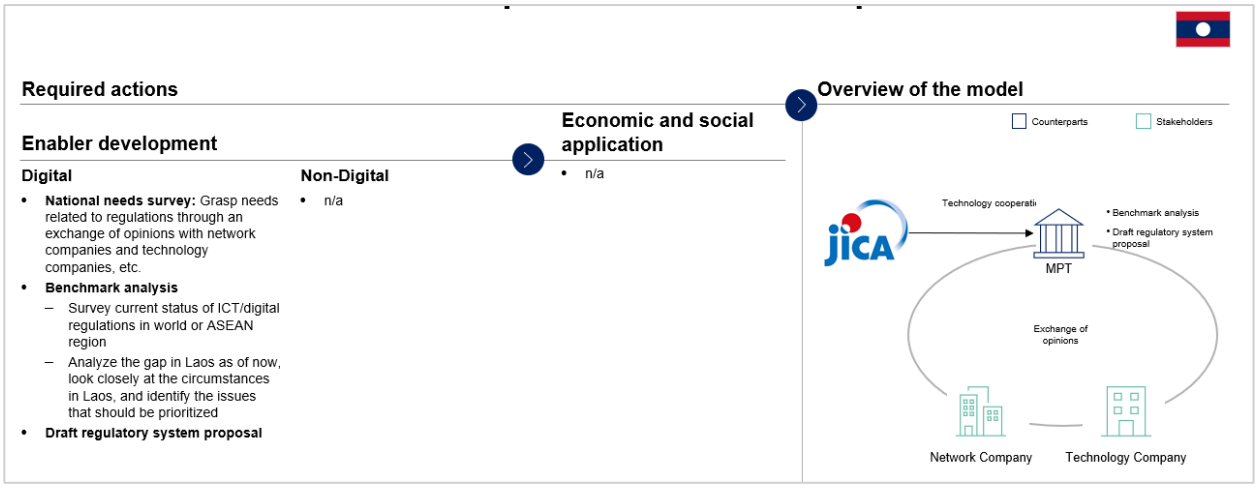


Figure 103. Overview of activities needed to maximize impact

Figure 104. Activity details (preparing ICT laws)

Category	Steps	Activity details			Applicable JICA scheme	Considera-tions
		CIP	Other stakeholders	JICA		
Enablers: digital	Survey domestic needs	**MPT** • Grasp regulatory needs by exchanging opinions with network companies and tech companies	**Related ministries** • Coordinate with MPTC	Survey needs	Technical cooperation	
	Benchmark analysis	**MPT** • Survey current status of ICT/digital regulations globally and in the ASEAN region		Survey ICT/digital regulations in each country	Technical cooperation	
		MPT • Analyze the gap with the current conditions in Laos, reflect on the needs there, and identify items that should be prioritized		Assist analyses	Technical cooperation	
	Draft tentative regulatory system plan	**MPT** • Draft tentative regulatory system		Assist legal preparations	Technical cooperation	

(2)-2 List initial solution proposals for potential issues that are outside priority issues

The following are preliminary potential solutions to the potential issues to assist that are not priority issues mentioned above.

Figure 105. Capacity to formulate and implement policies: Candidate solutions for potential issues to assist

Category	Potential issues to assist	Potential solutions	Background
Policy & Regulation	**G1: Establishment of ICT regulations is lagging**	• **Clarify the regulatory regime needed** to implement the vision and strategy, and take the steps needed, such as **making essential amendments** ― Grasp regulatory needs by exchanging opinions with network companies and tech companies ― Run benchmark analysis Write up drafts of bills	• Laos's ICT regulations lag behind technological progress

Category	Potential issues to assist	Potential solutions	Background
Execution	G2: **MPT** does not have enough budget or authority to drive a digital economy	• To bring more attention, funds, and leadership to the digital realm as a national topic, **position the organization directly under the prime minister**	• This year, the Ministry of Science and Technology has been dissolved, and its digitalization departments have been transferred to MPT

Figure 106. Telecom infrastructure: Candidate solutions for potential issues to assist

Category	Potential issues to assist	Potential solutions	Background
Mobile Networks	**I1: Low 4G network coverage and slow network speeds in rural areas** – If the goal is to promote remote education, it will be important to expand 4G networks into rural areas to ensure adequate upload and download speeds	• Increase 4G network coverage, ensuring enough upload and download speeds – Base stations – Devices – Transmission • Distribute high spectrum to mobile network operators	• 4G coverage is 43%
Mobile devices	**I2: Low smartphone and other end device penetration in rural areas** – The spread of smartphones, laptops, and tablets needs to be accelerated in rural areas	• Promote the spread of devices in rural areas (refer to the following examples) – Promote the purchase of devices: By migrating users from feature phone to smartphone, network operators can terminate the assistance for older generation of technologies (e.g., 2G), which will lead to lower network management costs – Set up tablets or PCs at public facilities like assembly halls and schools, to increase opportunities for individuals to learn to use devices without owning one – **Offer free or inexpensive broadband access** • Educate and spread awareness about how to use smartphones	• Smartphone penetration is 35%

Category	Potential issues to assist	Potential solutions	Background
		for economic and social activities	

Figure 107. Talent: Candidate solutions for potential issues to assist

Category	Potential issues	Potential solutions	Background
Digital translators	**T1: Citizens have little interest in digital technology**	• **Digital learning academies**: Reskill industry talent who can introduce and promote useful digital tools and solutions to others	• While IT engineer training needs to be reinforced first, digital translators also need to be trained
Digital engineers	**T2: Not enough education for training digital engineers** **T3 Insufficient quality in math and science education**	• **Digital learning academies**: Reskill tech-background talent on the newest technologies and practices to improve performance nationwide • **Establish a major or a department** focused on emerging technology at various educational institutions • Build interdisciplinary networks to match university education to business needs and **close the gap between industry and academia** • **Improve STEM education in primary and secondary schools,** showcasing successful digital entrepreneurs as role models	• While IT engineer training needs to be reinforced first, digital engineers also need to be trained
IT engineers	**T4: Insufficient quality/quantity of education for IT engineers** — Updates are needed, to keep up with the latest technology and meet the needs of businesses **T3: Insufficient quality in math and science education** **T5: Difficulty of using English-language online content due to low level of English**	• Improve accessibility of existing online educational content • Improve quality of IT training in educational institutions — Close the gap between academia and industry — Reevaluate educational institutions' curricula — Invite foreign experts • **Improve STEM education in primary and secondary schools,** showcasing successful digital entrepreneurs as role models	• The Laotian ICT talent pool is still small, so IT engineer training needs to be strengthened first

Category	Potential issues	Potential solutions	Background
		• **Create** national basic **IT certificate** to increase potential ICT talent pool	

Figure 108. Innovation ecosystem: Possible solutions to address potential issues to assist

Category	Potential issues	Potential solutions	Background
Start-ups	**E1: Business regulations are not adapted to the latest technology or business models, and registration procedures are not efficient enough** – Long timeframe needed to start a business – The law demands that new business models meet superfluous conditions – There is not enough understanding of technology in the ministry that issues business permits	• **Simplify registration procedures** (notarization, inspection, licensing, etc.) and shorten processing time • **Reduce cost of registration-related procedures** (certificates, taxes, licensing, etc.) • Introduce or improve online procedures • **Abolish or reduce minimum capital requirements** • Create or improve **one-stop processing** • Strongly promote **capacity-building at government agencies**	• Ease of doing business ranking: 154/190. Ease of starting a business ranking: 181/190 • 173 days to start a business
	E2: Entrepreneurs do not have enough skills	• Establish entrepreneurial program for startups and promote startup events • **Incorporate entrepreneurship training** into education for young people – Promote **coordination between public high school education and entrepreneurs** (e.g., boot camps in collaboration with startups, incubators, and accelerators and workshops on entrepreneurship) – **Introduce entrepreneurial program sin STEM faculties**	
Knowledge contributors	**E3: There are not enough universities, and the universities do not have big**	• **Increase the number of universities and the R&D expenditure** of government	• Only 4 Laotian universities[1] were listed among the top 30,000 universities in

Category	Potential issues	Potential solutions	Background
	enough budgets, to assist innovation	• **Provide** universities and research institutes with the **latest equipment** needed for research • Invite accomplished international professors and students. Have them share the latest technology developed in their countries, and lead research	the world, while 4 target countries have more than 30 universities listed. National University of Laos, the top university of Laos, is ranked at 5,063
Investors/ supporters	**E4: Not enough funding** – There aren't enough serious investors locally, and there isn't enough financial assistance from the government – Difficult to get investment from overseas **E5: Not enough mentorships** – Hard to find mentors – Very few events for finding mentors	• Build an attractive environment for investors and supporters including overseas players – Create a platform where international funds and supporters can easily access Laotian startups – Assist high-potential Laotian startups with global road show – Tailor incentives to each investor's interests (e.g., sustainable development) to attract mission-oriented investors • Further increase government's financial assistance by establishing government venture capital and subsidizing local startups • Drive knowledge-sharing for successful innovation – Promote tech startup events such as hackathons and ideathons – Strengthen the network among local tech startups	• There are only 2 major startup events per year that offer collaboration with international assistance agencies
Markets Access	**E6 The digital market is not vigorous enough to promote independent innovation**	• Improve next key enablers and promote e-commerce – Internet use – Secure internet servers – Bank accounts – Logistics	• Laos is not ready to scale up e-commerce since enablers for it are immature

1. Satistica

2.4 Considering assistance programs for Mongolia

2.4.1 Basic country information

Located in northern East Asia, Mongolia is a landlocked country bordering the Inner Mongolia Autonomous Region and the Xinjiang Uyghur Autonomous Region in China, and the Russian Federation. It has a total land area of 1,553,560km^2 and a population of only 3.3 million, roughly half of which (1.5 million people) live in the capital Ulaanbaatar. Mongolia's national population density is 2.2/km^2, the lowest in the world.

Ninety-five percent of the population is Mongolian, and the main religion is Tibetan Buddhism.

Mongolia's 2019 nominal GDP was USD 14 billion, with a real GDP growth rate of 13.8%. The main industries are mining, agriculture, and distribution; mining accounts for 24% of GDP. Mining is also central in exports, and in 2019 (P), they exported USD 2.8 billion in coal and USD 2 billion in copper. The largest part of the workforce is in agriculture (25%), followed by public service, which accounts for 8% of the workforce. GDP per capita in 2019 was USD 4,202.

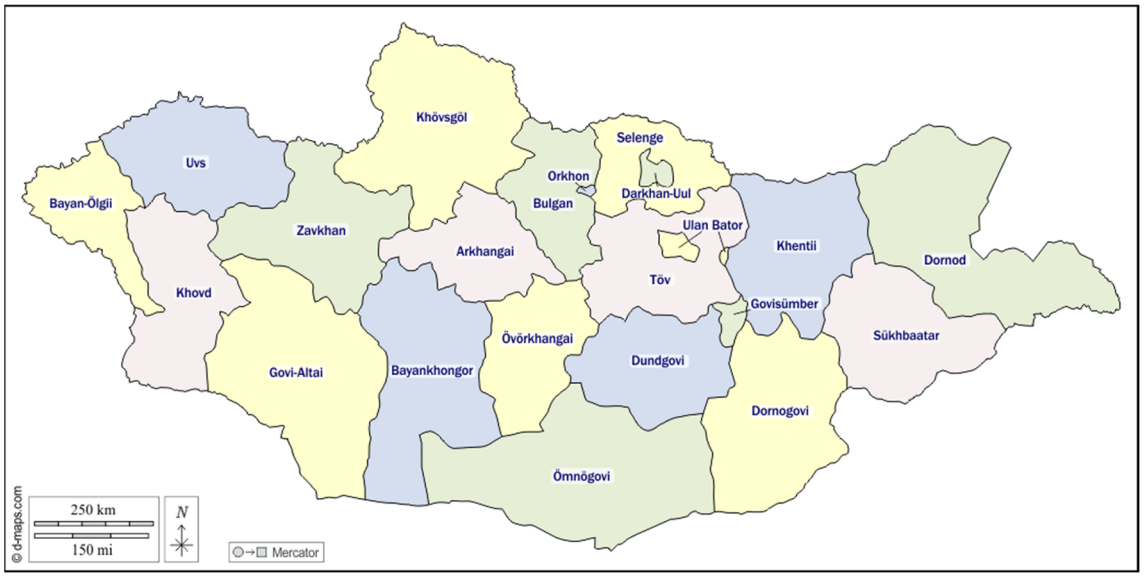


Figure 109. Mongolia (Source: d-maps.com)

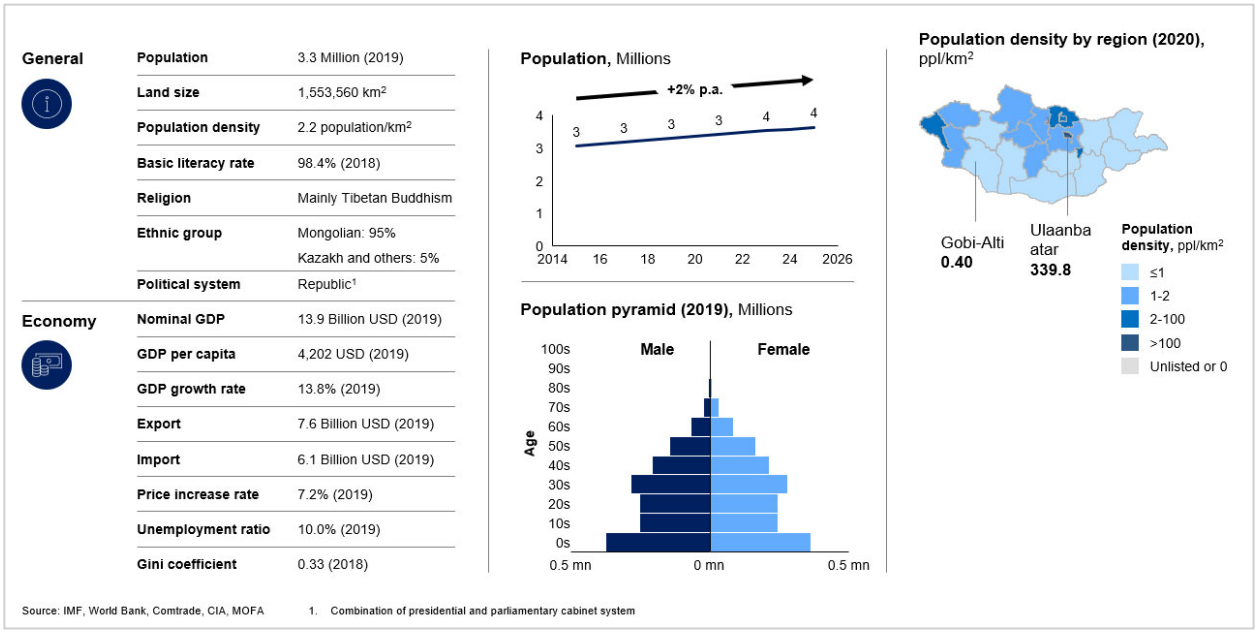


Figure 110. Overview of Mongolia (1/2)

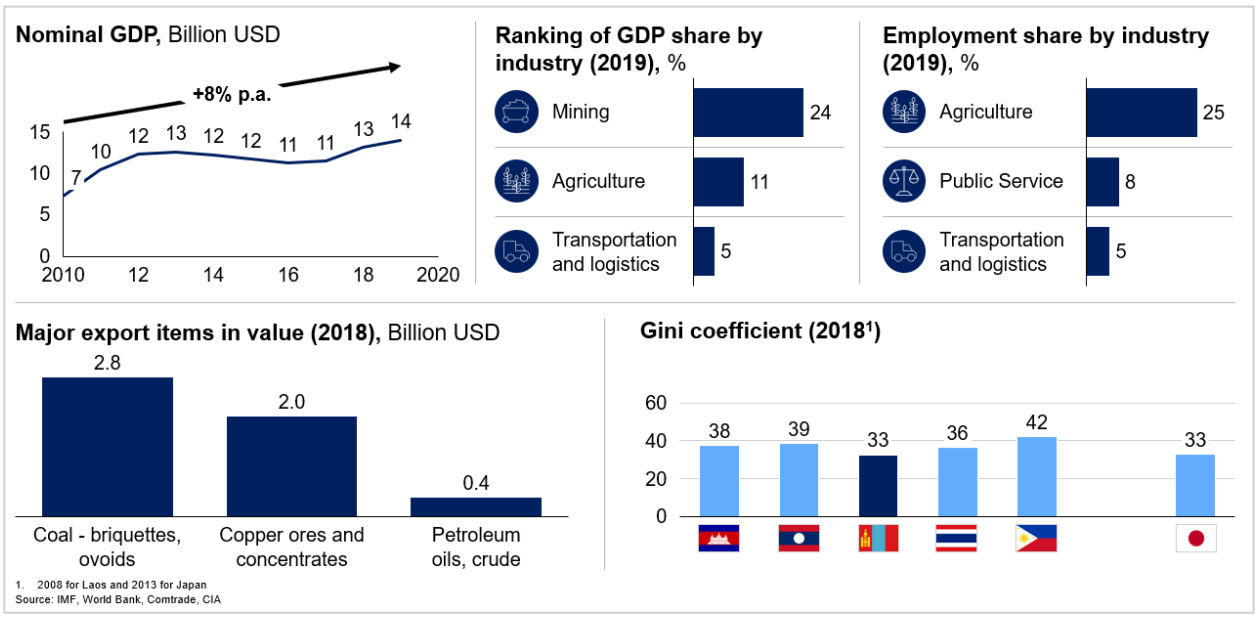


Figure 111. Overview of Mongolia (2/2)

2.4.2 Organizing the orientation of digitalization

(1) Confirming strategically important sectors of the country

We identified the following eight strategically important sectors in Mongolia, after referencing the Mongolian government's long-term development policy "VISION-2050" and its action plan: mining, agriculture, transportation, public services, IT, energy, tourism, and creative industries (Culture, arts, film, music, design, architecture). The specific procedure for identifying these sectors was as follows. We started

by using the sectors mentioned individually in the "VISION-2050" section on "Priority economic sectors" as basic targets. We then added public services, based on the same document's mention of promoting digital government.

(2) Selecting study target sectors

We evaluated these sectors on the basis of the following three perspectives, and selected the target sectors to be taken up in this survey.

- Consistency with JICA's assistance priorities
- Digital divide potential
- Each sector's overarching impact on the economy/society

Following the above selection criteria, we analyzed Mongolia's key strategic sectors, and confirmed that the high priority sectors for JICA assistance were public services and IT. The reasons are as follows.

- Public services: The Mongolian government sends requests for assistance on administrative DX several times per year, and JICA is highly interested in this sector
- IT: We believe that cultivating the IT sector will be effective for economic development in Mongolia, for the following reasons
  - The geographic conditions of being a landlocked country, and limitations such as market size make it quite difficult for Mongolia to establish a role in global value chains. The IT industry can grow without being especially limited by geographic and other conditions
  - IT industry growth can encourage digitalization in other industries, causing a strong ripple effect

Mining and agriculture also initially attracted high levels of interest from JICA, but it was concluded that these would be subordinated to public services and IT in order of priority as assistance targets, for the following reasons.

- **Mining**: Since it accounts for a large share of GDP (24%), digitalization of the mining industry may have a large impact on promoting a digital economy. Considering that Mongolia is currently rather dependent on exporting mineral resources, JICA's ODA basic policy for Mongolia promotes diversification of the economy, putting mining at a low level of priority for assistance
- **Agriculture**: With 11% of GDP and 25% of the workforce, digitalizing the agriculture industry would have a large impact on promoting the digital economy. However, Mongolian agriculture already receives assistance from other donors, so there may not be much room for more assistance

Then, we selected public services and the IT industry as the current survey's targets for their consistency with JICA's assistance policies as well as for their appropriateness from two other perspectives.

- **Public Services:**
  - Digitalization is progressing more slowly than in other sectors, making it highly likely that this is an area with a digital divide

— Public services in Mongolia are not a large portion of GDP (4%) nor are they a major employer (8%), but since this sector provides services to the entire population, making progress in digitalization in applicable sectors would directly help shrink the digital divide, and should be effective for achieving an inclusive digital economy

- **IT**: The sector itself may help with the digital divide, and although it is a small part of GDP (2%) and employment (1%), the IT industry facilitates digitalization of other industries, meaning that it could have a large impact on the economy as a whole

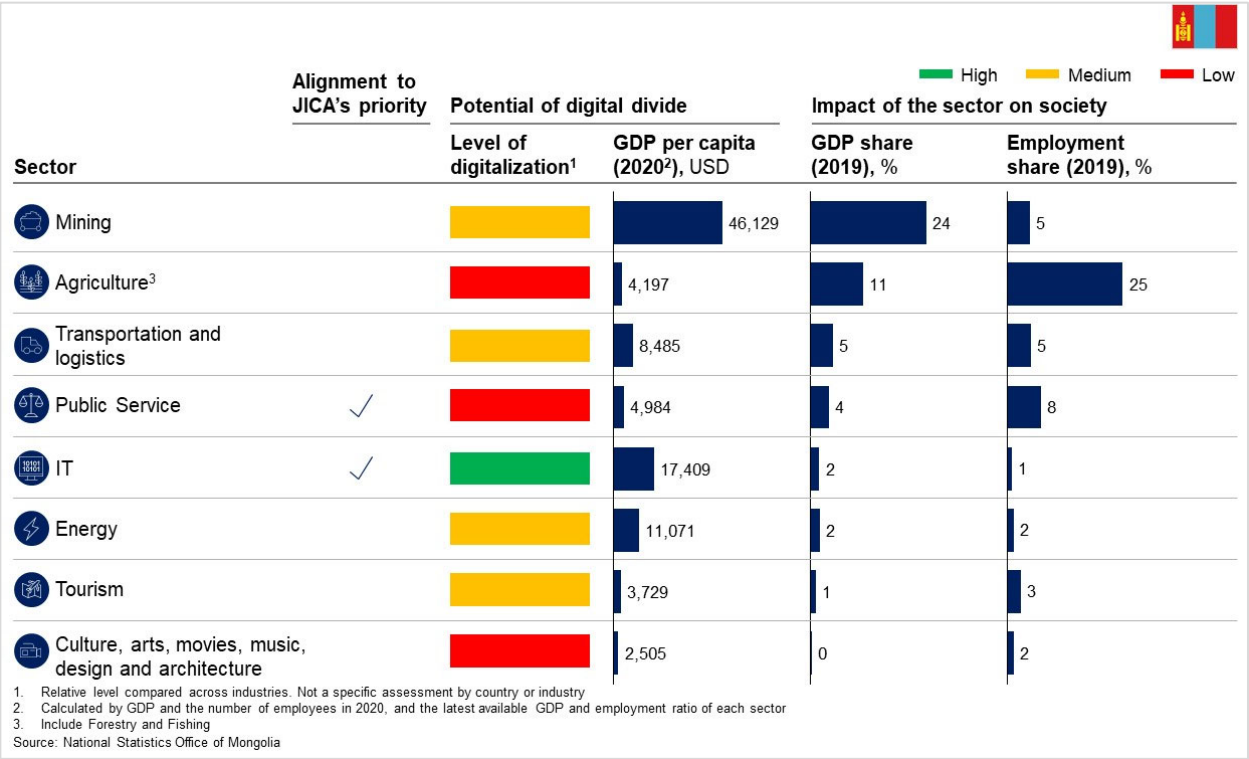


Figure 112. Selecting study target sectors

(3) Understanding the visions and challenges in each target sector considered, and identifying candidates for digitally-enabled solutions

We examined the orientation of digitalization in public services and IT, the target sectors under consideration for Mongolia. To sort out the digitalization orientation, we started by confirming each target sector's vision and challenges in achieving that vision, by reviewing government documents and holding interviews with experts. The team then conducted another survey, and listed potential candidates for digitally-enabled solutions to the challenges being faced.

(3)-1 Public Services

According to the Mongolian government's "VISION-2050," Mongolia has the following vision for the public sector.

- Promote an effective and efficient electronic government

- Optimize the government's administrative functions and authority
- Provide administrative services that are specialized, competent, transparent, effective, and smart

Meanwhile, Mongolia faces the following challenges in achieving this vision.

The first is that citizens have limited access to public services. Mongolia is a spacious country with a small population (as mentioned previously , the population density is 2.2/km^2), and under the current prime minister, digitalizing administration is being advanced as the top priority issue. The "VISION-2050" action plan also announces the concept of the electronic administrative service for citizens, E-Mongolia. In fact, this service was unveiled in October 2020. However, a 2018 survey (Social Indicator Sample Survey) conducted by the Mongolian Bureau of Statistics and a UN agency revealed that only 31% of the population ages 15-49 had basic IT skills, one of the items set as a SDG global indicator. In hearings with our counterpart the Communications and Information Technology Authority (CITA), we found that citizen IT literacy will be an issue for citizen use of E-Mongolia, since major improvements to the IT level are not expected to occur within three years, based on current standards. (Challenge 1)

The second challenge is government transparency. According to a 2020 survey by Transparency International, Mongolia's Corruption Perception Index ranked 111 out of 180 countries, with 69% of respondents stating that they were aware of corruption as a major issue. Reducing government corruption is also listed as one of the objectives of the above-mentioned action plan, with data consolidation and greater transparency of administrative procedures through digitalization positioned as actions to that end. In fact, the introduction of electronic procurement systems in Chile and South Korea have promoted transparency and competition; the International Monetary Fund (IMGF) also reported that these contribute to preventing corruption. (Challenge 2)

The third challenge is that government operations are not efficient enough according to experts. In particular, the large number of paper-based procedures between different ministries or between the government and private companies is a bottleneck for improving efficiency. The context for this large number of paper-based procedures is varied: government systems are not consolidated/integrated; in some cases systems have not been introduced, especially in rural areas; some government officials do not use the system, etc. (Challenge 3)

The fourth challenge is that data usage is limited. Currently, although the National Data Center collects various kinds of data, the laws necessary for promoting data use have not been established, so this data cannot be put to use in government administration and business. On this point, the above-mentioned action plan indicates the need to implement EBPM (Evidence-based Policy Making) for at least 70% of policies going forward, in order to distribute power, govern, create an optimal balance, and promote stable governance. (Challenge 4)

The following key digitally-enabled solutions may be useful for the challenges facing the Mongolian public sector.

- Challenge 1: Improve citizen IT literacy

- Challenge 2: Set up a platform to encourage disclosure of government activities
- Challenge 3: Promote E-Government by standardizing administrative systems and improving government officials' digital capabilities
- Challenge 4: Create an environment to facilitate data usage by strengthening data governance

(3)-2 IT industry

The Mongolian government's "VISION-2050" and its ensuing action plan envision contributing to the Mongolian economy by strengthening the IT industry.

However, the following challenges will be involved along the way to achieving the above vision.

First, as mentioned above, the domestic population is small (3.3 million), and the domestic market is also small (nominal GDP is roughly USD 14 billion in Mongolia, and USD 543 billion in Thailand). These factors impede the development of the IT industry.

The second is its relative lack of appeal in the country, compared with other industries. Mining is the biggest growth industry in Mongolia, accounting for the majority of export value (83% of the 2019 export amount base), and roughly one quarter of GDP. Additionally, average annual GDP growth is extremely high, at 8% (2015-2019). Meanwhile, the IT industry is only 2% of GDP (2019) and has a sluggish average annual growth of -4% (over the same period), causing it to fall behind other industries in terms of appeal. This is why the country is unable to attract foreign investment and outstanding talent (the IT industry accounts for 1% of the workforce). [1])

Based on the above, since the domestic market is small and there are few growth opportunities for the IT industry there, it may be helpful to improve the appeal of the industry by growing the parts of it that are oriented toward overseas markets. This aligns with the "VISION-2050" and its action plan, which list the objective of cultivating an export-oriented economy by strengthening priority economic sectors. To that end, it may be helpful to strengthen the IT industry in line with the following two orientations.

- Cultivate the industry for offshore IT centers for foreign companies
- Cultivate internationally competitive IT companies, and assist their expansion into the international market

2.4.3 Identifying potential issues to assist

Bearing in mind the orientation of digitalization in the target sectors studied in the previous section, we studied the level of maturity of the enablers required to drive this digitalization.

The results of our survey of the maturity level of enablers as a whole are as follows. We found that in Mongolia, there were challenges involved in all enablers except for infrastructure.

[1] https://www.1212.mn//

Figure 113. Summary of potential issues to assist in Mongolia

Priority sector	Enablers	Assessment results	Potential issues
Public Services **ICT**	Capacity to formulate and implement policies	More specific vision and regulations are needed Governance needs to be strengthened related to IT tools and capabilities	G1: The long-term vision for developing the IT industry is not concrete enough G2 There are not enough concrete policies and specific measures in place to facilitate IT industry growth G3 E-Government system governance is not fully prepared G4 There is not enough IT literacy education for citizens G5 Mechanisms to improve digital capabilities of government officials are not demonstrating enough effectiveness
	Telecom infrastructure	There is high-quality network coverage for urban residents, which account for over 70% of the population	No major issues found
	Human resources	Advanced digital education and the IT industry need to have more appeal in Mongolia	T1 Not enough advanced digital education T2 Not attractive to highly talented personnel, relative to other growth industries T3 Highly talented personnel leave the country
	Innovation ecosystems	Need to improve interest in local IT industry (investment, assistance)	E1: Not enough entrepreneurs launching digital startups E2 Not enough government assistance for higher education E3 Not enough investment from the government or foreign and domestic private companies

Detailed results of the maturity survey are as follows.

(1) Survey of maturity of capacity to formulate and implement policies

According to a survey by the World Economic Forum, the Mongolian government's vision did not place much importance on ICT as of 2014-2015. However, the Mongolian government later greatly increased the priority level of ICT, and is engaged in the following kinds of efforts. It is likely that circumstances have changed since the time of the survey.

- THE STATE POLICY ON THE DEVELOPMENT OF INFORMATION AND COMMUNICATIONS TECHNOLOGY (2017-2025) announcement: Quantitative goal-setting to grow the ICT industry as a trigger for economic development in Mongolia

- Mongolia's long-term development policy 2050 announcement: Long-term plan to have Mongolia become an advanced nation in Asia by 2050. This plan refers to the need to promote the development of IT/digital technology and the move toward electronic government
- E-Mongolia development: Began providing administrative services on its website and app in October 2020

Regarding ICT regulations, Mongolia scored 77 points out of 100 on the 2020 ITU ICT Regulatory Tracker, showing that it is in a relatively favorable position when compared with other countries.

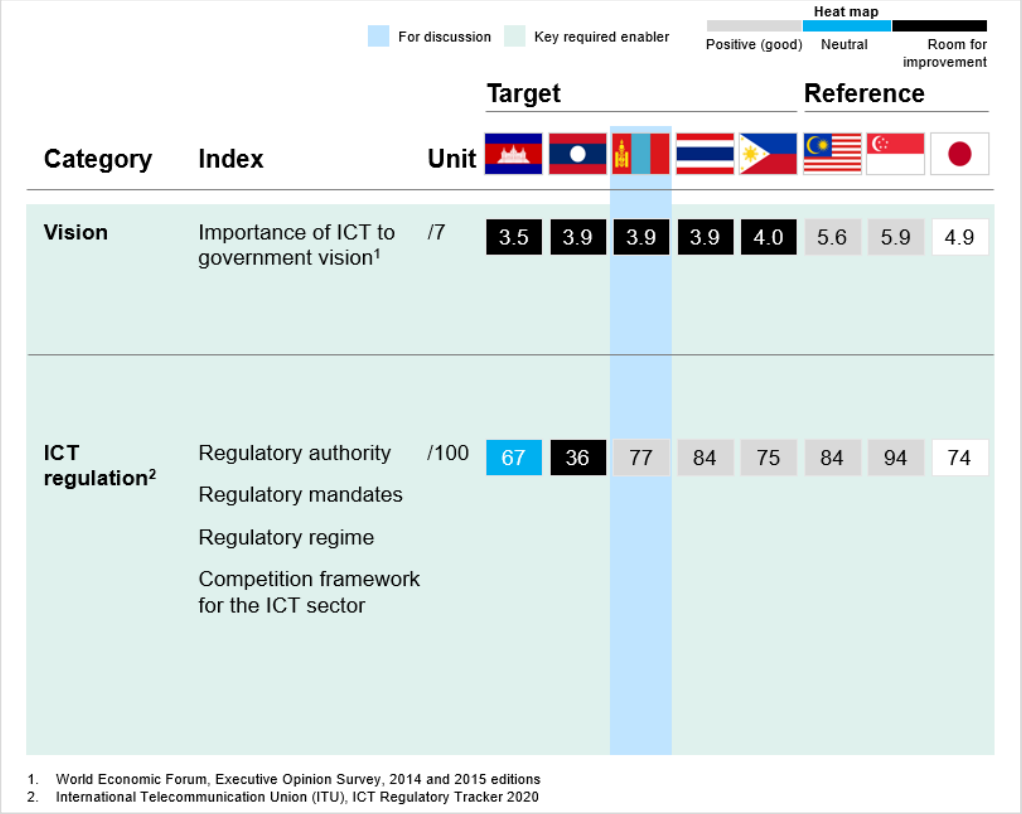


Figure 114. Maturity of capacity to formulate and implement policies

We also received the following types of comments in interviews with experts and with staff at counterpart government agencies.

Figure 115. Capacity to formulate and implement policies: Potential issues

Category (Required enablers)	Respond-ents	Comments, assessment results	Potential issues
Vision	**CEO of a major IT company**	"Since the majority of government employees are changed out every time there's a change of government, they are more eager to make policies that give short-term results, rather than policies with a rational, sustainable, long-term vision for industries with a lot of potential, like IT."	The long-term vision for developing the IT industry is not concrete enough
	CITA official	"We aren't currently thinking about focusing on offshore IT services. Mongolia's low population is the	

Category (Required enablers)	Respond-ents	Comments, assessment results	Potential issues
		fundamental issue, and the country can't really cultivate enough IT talent to compete with other offshore service centers in places like India. There's not even enough talent in the area of advanced software development, which doesn't require a large workforce. IT professionals with the skills to develop advanced software choose to produce their own content, rather than working as subcontractors. **We want to assist companies that create their own projects and content, and are not planning on assisting initiatives to build offshore centers**."	
Policy & Regula-tion	**CITA official**	"After working out the Digital Nation policy, it's become more important to set up laws and regulations. There are currently four laws under consideration in parliament, and it seems likely that they will be approved by the end of this year. If those laws are passed, that will nearly finish the establishment of laws in this area." "There are visions outlined in 'Digital Nation' and 'Mongolia 2050,' and rough budgets have been set, but there are no specific roadmaps for implementing them. There is a short-term plan for 2020-24, but the actual budget needs to be set by parliament each year."	Since no basic surveys of the IT sector have been done and no comprehensive data has been collected, they can't fully set up concrete policies and specific measures to promote IT industry growth
	CEO of an IT startup	"There is no specific financial assistance for IT startups in Mongolia."	
	CEO of a major IT company	"Most of the countries with successful offshore IT centers have a **special economic zone** just for offshore IT service businesses. Companies in that zone can get stable networks, reduced tax rates, and other benefits like reduced rent. However, there is still no such thing in Mongolia."	
	CITA official	"If digital-related laws are approved, relevant ordinances will need to be formulated. **There are currently almost no policies assisting the IT industry**, and we may need assistance from other donors." "The government is **not currently running basic surveys on the IT industry or collecting - comprehensive data**, so it's difficult to make policies based on evidence. The government is also faced with budget issues when it comes to running these surveys."	
Execution	**CEO of a major IT company**	"The government tends to let each ministry or department build its own IT system, and **as a result, it's difficult to communicate internally**. For example, the police, public prosecutors, and courts all	E-Government system governance is not fully prepared

Category (Required enablers)	Respond-ents	Comments, assessment results	Potential issues
		have their own data systems, making it needlessly time-consuming to run a survey."	• IT systems are not integrated between departments • Databases are not integrated **There is not enough IT literacy education for citizens** Mechanisms to improve digital capabilities of government officials are not demonstrating enough effectiveness
	Mongolian IT engineer	"If I can mention one thing I've noticed as an IT professional in Mongolia, it's that the government announces that it's thinking about strengthening the IT industry, but I get the impression that they **don't always follow through with real actions.**"	
	CEO of a major Mongolian IT company	"When running maintenance on a system developed for a local government, we noticed that a certain number of government officials hesitated to use the system, and that they were still relying on paper-based tasks. **They aren't used to using computers or digital solutions.**"	
	CITA official	"According to a survey we ran in 2018, **only 31%** of Mongolia's population can use digital services smoothly. I can't help but think that this will be a major bottleneck when it comes to establishing the E-Mongolia platform." "In terms of applying data, the government has two databases: DAN and HUR. DAN is for managing personal ID data, and HUR is for managing government data. The fact that these two data systems are not connected is one of the causes of administrative inefficiency. Meanwhile, there are other existing systems within the government, and all of these need to be optimized." "Government employees whose work is related to the ICT field have some degree of digital literacy, but other government employees, and especially those who work in rural areas, often lack such literacy." "Government employees with good IT skills tend to leave in search of higher pay, either to the private sector or overseas." "The government's capacity-building system is often feeble and inefficient, it needs to be strengthened. I think there are also budgetary issues, but employees need an environment that lets them accumulate a variety of experiences (study abroad, training programs, etc.)"	

Based on the above, we found the following potential issues to assist in the area of the capacity to formulate and implement policies.

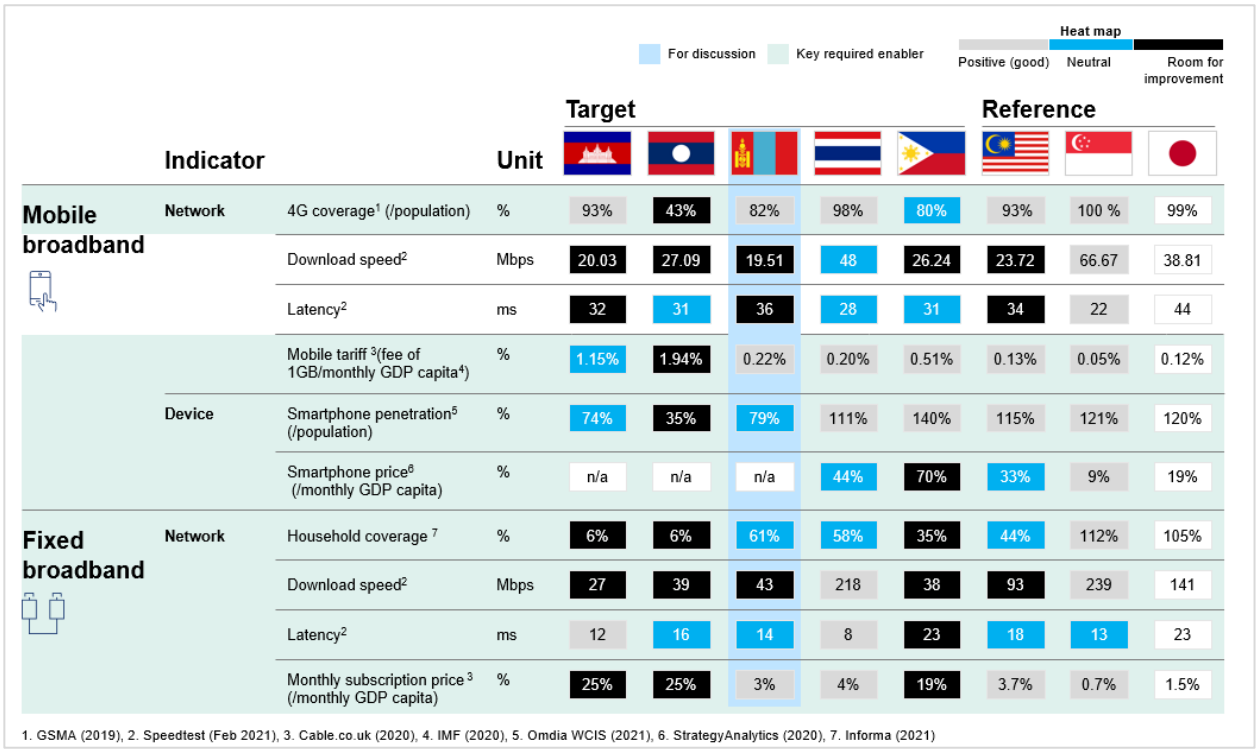
- **Vision**: There are not enough concrete policies and specific measures in place to facilitate IT industry growth

- **Policies and ICT regulation**: Since no basic surveys of the IT sector have been done and no comprehensive data has been collected, they can't fully set up concrete policies and specific measures to promote IT industry growth
- **Implementation**:
  - E-Government system governance is not fully prepared
    - IT systems of different ministries and departments are not integrated
    - Data is not connected enough
  - There is not enough IT literacy education for citizens
  - Mechanisms to improve digital capabilities of government officials are not demonstrating enough effectiveness

(2) Telecom infrastructure maturity survey

Below are the results that were found based on various indicators.

- Regarding mobile broadband, about 80% of Mongolian citizens own a smartphone, and 4G networks can be used at an affordable rate (Usage fees for 1GB are roughly equivalent to 0.22% of average GDP per capita, a similar level to Thailand's 0.20%). The infrastructure is in place for the majority of citizens to access the government's online services.
- As for fixed broadband, while there is some room for improvement compared with developed countries like Singapore, the basic infrastructure is in place. Specifically, about 60% of households have fixed broadband contracts, which have fees of about 3% of GDP, cheaper than Thailand (4%) and Malaysia (3.7%). However, there is still room for more improvement in aspects of quality: download speed (43Mbps) and latency (14ms).



	Indicator		Unit	Target					Reference		
Mobile broadband	**Network**	4G coverage[1] (/population)	%	93%	43%	82%	98%	80%	93%	100 %	99%
		Download speed[2]	Mbps	20.03	27.09	19.51	48	26.24	23.72	66.67	38.81
		Latency[2]	ms	32	31	36	28	31	34	22	44
		Mobile tariff [3](fee of 1GB/monthly GDP capita[4])	%	1.15%	1.94%	0.22%	0.20%	0.51%	0.13%	0.05%	0.12%
	Device	Smartphone penetration[5] (/population)	%	74%	35%	79%	111%	140%	115%	121%	120%
		Smartphone price[6] (/monthly GDP capita)	%	n/a	n/a	n/a	44%	70%	33%	9%	19%
Fixed broadband	**Network**	Household coverage [7]	%	6%	6%	61%	58%	35%	44%	112%	105%
		Download speed[2]	Mbps	27	39	43	218	38	93	239	141
		Latency[2]	ms	12	16	14	8	23	18	13	23
		Monthly subscription price [3] (/monthly GDP capita)	%	25%	25%	3%	4%	19%	3.7%	0.7%	1.5%

1. GSMA (2019), 2. Speedtest (Feb 2021), 3. Cable.co.uk (2020), 4. IMF (2020), 5. Omdia WCIS (2021), 6. StrategyAnalytics (2020), 7. Informa (2021)

Figure 116. Maturity of telecom infrastructure

Furthermore, given the types of comments we received from our counterparts working in government agencies and from interviews with experts (listed below), we decided that there are no major potential issues to assist regarding telecom infrastructure maturity.

Figure 117. Potential issues in telecom infrastructure

Category (Required enablers)	Respond-ents	Comments, assessment results	Potential issues
Mobile/ fixed broadband	**University IT professor**	"The ICT infrastructure is in relatively good shape in Mongolia's urban areas, and about 70%[2] of the population lives in those areas, so network coverage and speed are not a big issue in Mongolia."	**No major issues found**
	Mongolian IT engineer	"I've been working remotely ever since COVID-19, and have **never once been inconvenienced by the network at my house**."	
	IT park employee[1]	"About 90% of the country is currently connected with fiber optics, and there are also plans to develop 5G in Ulaanbaatar. So when it comes to developing the IT industry, I don't think there are any serious issues with infrastructure in Mongolia."	
	CITA official	"There aren't any issues with ICT infrastructure around Ulaanbaatar. There are even talks about completing the 5G network by 2024. However, since Mongolia is of course a vast country, the fixed broadband coverage might not be as good in rural areas as it is in urban ones."	

1. The startup incubator is affiliated with CITA
2. This can be confirmed by data from the Mongolian Bureau of Statistics annual population report

(3) Survey of HR maturity

In terms of digital talent in Mongolia, 1.1% of the workforce works in the ICT sector, a relatively high rate on par with Thailand (1.1%) and Japan (1.5%). However, since the population is small, the total number of ICT professionals is only about 20,000, the lowest number among Asian countries (Thailand: approx. 420,000; Japan: 1.03 million). In recent years, the absolute number of ICT personnel had been on a downward trend (-4% from 2013-2019), but most recently its appeal is growing relative to the mining and construction industries. There may be more students today who will increase the number of personnel supplying the IT industry a few years after they graduate.

We also received the following types of comments in interviews with experts and with staff at counterpart government agencies.

Figure 118. Human resources: potential issues

Category (Required enablers)	Respond-ents	Comments, assessment results	Potential issues
Overall	**CITA official**	"In this country, there aren't enough IT professionals anywhere. The main reasons are that the country has a small population, that there isn't enough capacity for on-site education, and that the talent we have continues to leave the country. We are hoping to receive know-how, technology, and information shared by other countries to improve the capacity of local IT talent."	**Not enough advanced digital education** Not attractive to highly talented personnel, relative to other growth industries: IT industry salaries are relatively low in the country, so highly talented personnel choose to work in high-growth industries like mining and construction **Highly-skilled workers:** Top talent tends to look for job opportunities overseas
Digital translators	**Mongolian IT expert**	"There is **a certain number of digital translators** in Mongolia, and I have some friends who have has successful IT startups in Mongolia."	
Digital engineers	**Mongolian IT expert**	"Local higher education is lacking in Mongolia, so it's extremely difficult to get really outstanding digital engineers, **even among IT personnel**. Some digital engineers who studied abroad and received a high-level education choose to stay overseas because of the pay gap."	
	CEO of a leading local IT company	"Right now, other industries like **mining and construction are more appealing and pay better** than the IT industry. To employ people highly skilled people like data scientists and data engineers, we always have to compete with those industries."	
	University IT professor	"**Our country has a smaller population** than other Asian countries, and this is the **bottleneck** for producing enough traditional IT talent and digital engineers. Only about 1,000 students graduate with IT-related majors per year."	
IT engineers	**IT Park employee**	"Most students who complete university are IT engineers. But since the population is small, there are not even enough of those."	

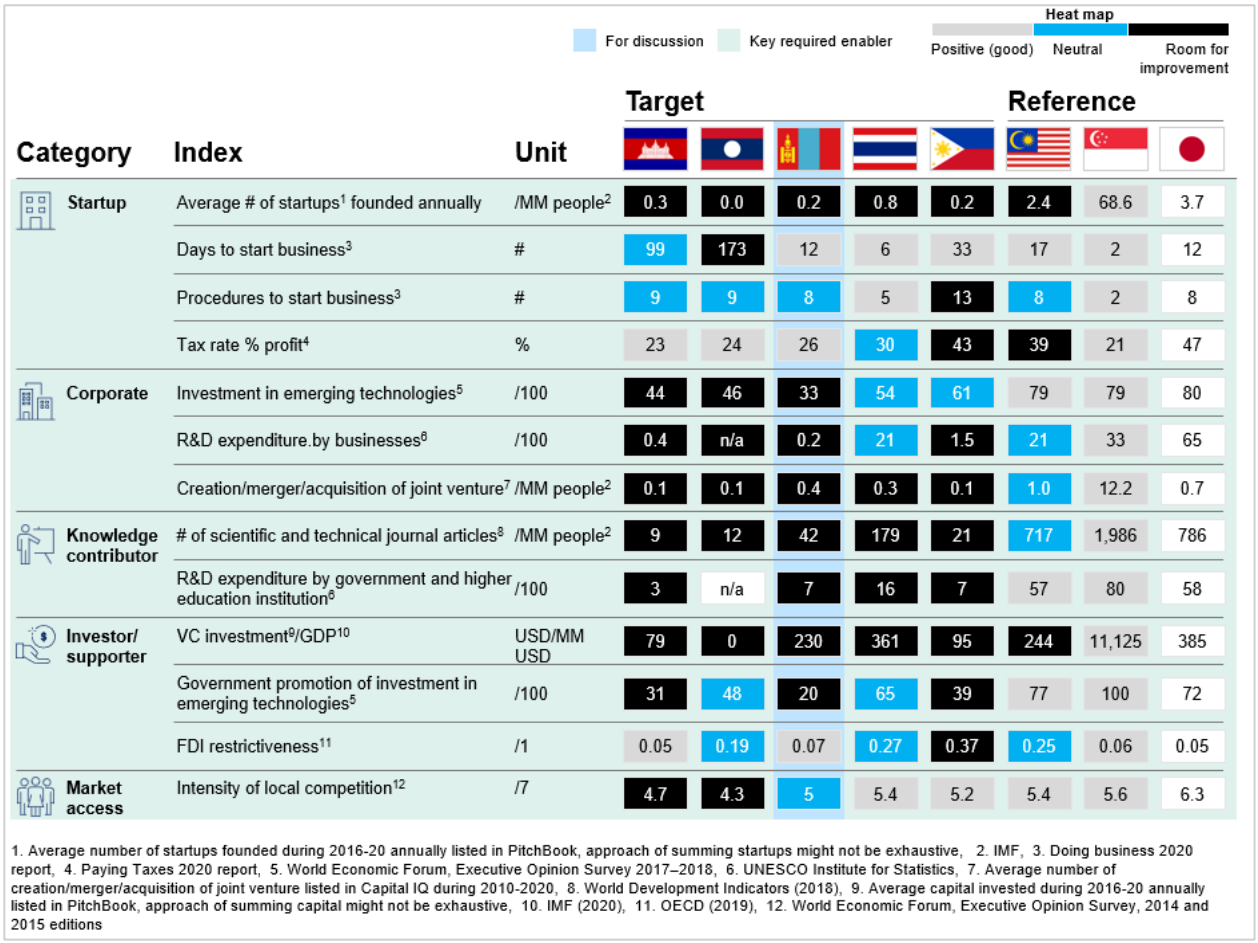
Based on the above, we identified the following potential issues to assist in the area of HR maturity.

- Not enough advanced digital education
- Not attractive to highly talented personnel, relative to other growth industries
- Highly talented personnel leave the country

(4) Innovation ecosystem maturity survey

Below are the results that were found based on various indicators.

- Startups: Mongolia compares favorably with other countries in metrics such as the number of days needed to start a business, the number of procedures that need to be done to start a business, and the corporate tax rate. On the other hand, according to PitchBook, there are few startups established each year in Mongolia given its population.
- Corporate: Companies rarely take the initiative to invest in the latest technology or R&D or collaborate with one another (by establishing joint ventures, for example).
- Knowledge contributors: Governments and higher education institutions only make limited investments in R&D, which is a problem in terms of their contribution to innovation.
- **Investors, supporters:** VC investment is a low percentage of GDP, and the government does not do enough to promote investment in new technology. However, there are few restrictions around direct foreign investment.
- Market access: There is a middling amount of healthy market competition to encourage innovation.



Category	Index	Unit	Target					Reference		
Startup	Average # of startups[1] founded annually	/MM people[2]	0.3	0.0	0.2	0.8	0.2	2.4	68.6	3.7
	Days to start business[3]	#	99	173	12	6	33	17	2	12
	Procedures to start business[3]	#	9	9	8	5	13	8	2	8
	Tax rate % profit[4]	%	23	24	26	30	43	39	21	47
Corporate	Investment in emerging technologies[5]	/100	44	46	33	54	61	79	79	80
	R&D expenditure.by businesses[6]	/100	0.4	n/a	0.2	21	1.5	21	33	65
	Creation/merger/acquisition of joint venture[7]	/MM people[2]	0.1	0.1	0.4	0.3	0.1	1.0	12.2	0.7
Knowledge contributor	# of scientific and technical journal articles[8]	/MM people[2]	9	12	42	179	21	717	1,986	786
	R&D expenditure by government and higher education institution[6]	/100	3	n/a	7	16	7	57	80	58
Investor/ supporter	VC investment[9]/GDP[10]	USD/MM USD	79	0	230	361	95	244	11,125	385
	Government promotion of investment in emerging technologies[5]	/100	31	48	20	65	39	77	100	72
	FDI restrictiveness[11]	/1	0.05	0.19	0.07	0.27	0.37	0.25	0.06	0.05
Market access	Intensity of local competition[12]	/7	4.7	4.3	5	5.4	5.2	5.4	5.6	6.3

1. Average number of startups founded during 2016-20 annually listed in PitchBook, approach of summing startups might not be exhaustive, 2. IMF, 3. Doing business 2020 report, 4. Paying Taxes 2020 report, 5. World Economic Forum, Executive Opinion Survey 2017–2018, 6. UNESCO Institute for Statistics, 7. Average number of creation/merger/acquisition of joint venture listed in Capital IQ during 2010-2020, 8. World Development Indicators (2018), 9. Average capital invested during 2016-20 annually listed in PitchBook, approach of summing capital might not be exhaustive, 10. IMF (2020), 11. OECD (2019), 12. World Economic Forum, Executive Opinion Survey, 2014 and 2015 editions

Figure 119. Innovation ecosystem maturity

We also received the following types of comments in interviews with experts and with staff at counterpart government agencies.

Figure 120. Innovation ecosystem: Potential issues

Category (Required enablers)	Respond-ents	Comments, assessment results	Potential issues
Startups	**CEO of a major local IT company**	"**Mongolia still has a smaller number of IT startups than other Asian countries**, but over the past two or three years, IT startup popularity has exploded, and there are more of them, too."	**Not enough entrepreneurs launching digital startups**
Corporate	**CEO of an IT startup**	"**COVID-19 has been the main reason people have learned about the importance of IT tools, and recently, companies have started to actively think about spending on IT solutions and the latest technology.**"	**No major issues found**
Knowledge contributors	**University IT professor**	"Since the population is growing, the government is currently **focused more than ever on building elementary and junior high schools**, and is not allocating enough of a budget toward higher education."	**Not enough government assistance for higher education** because it is a low budgetary priority

Category (Required enablers)	Respond-ents	Comments, assessment results	Potential issues
Investors and supporters	**CEO of an IT startup**	"Compared with industries like mining, the IT market is small in Mongolia, and it's not very appealing, so there are **basically no local or foreign investors**."	The current market is small, and there is **not enough investment from the government or foreign and domestic private companies**
	CEO of a major local IT company	"There aren't enough investors, but they are increasing. Private companies like the MSC Group have started to build independent funds to assist startups. Several startups, like QPay, receive investment from Japan and other foreign countries. However, **government investment is limited**."	
	IT park employee	"The government announced the Digital Nation strategy, but as of now, **there are only limited signs of the government's commitment to (investment in)** the IT industry. For example, IT Park is the only state-owned incubator, but it can only assist about 20 startups per year, in terms of expenses like rent and network fees."	
	CITA official	"**The number of investors is growing, but it's still a small number.** Most foreign investors especially seem to think of Mongolia as a politically risky country." "**There isn't currently any concrete plan to develop the innovation ecosystem.** Even so, CITA organized a special team to formulate plans to assist innovation. Right now, that team is running a survey and working on setting objectives and plans."	
Market access	**CEO of a major local IT company**	"Up until just a few years ago, there was hardly any interest in digital solutions or the latest technology, but the situation has changed rapidly. Now, **most clients understand the importance of IT tools for business.** For example, a few years ago, most companies had no idea what an ERP system was. But now, almost all the companies I know have started to think about installing an ERP system."	**No major issues found**

Based on the above, we found the following potential issues to assist in the area of innovation ecosystem maturity.

- **Startups**: Not enough entrepreneurs launching digital startups
- **Knowledge contributors**: Not enough government assistance for higher education
- **Investors/supporters**: Not enough investment from the government or foreign and domestic private companies

2.4.4 Formulating assistance programs

(1) Assessing potential issues

Following the approach mentioned above, we assessed the potential issues based on: (1) impact anticipated from solving the issue; (2) our counterparts' level of interest; and (3) JICA'S interests. The results are as follows. To the right side of the diagram are the issues that are expected to have a large impact if they are resolved, while the issues of greater interest to our counterparts are positioned on the top row of the diagram. Based on (1) and (2), the issues JICA prioritizes for assistance programs are highlighted in gray (E: innovation ecosystems; G: government policymaking; I: infrastructure building; T: training talent).

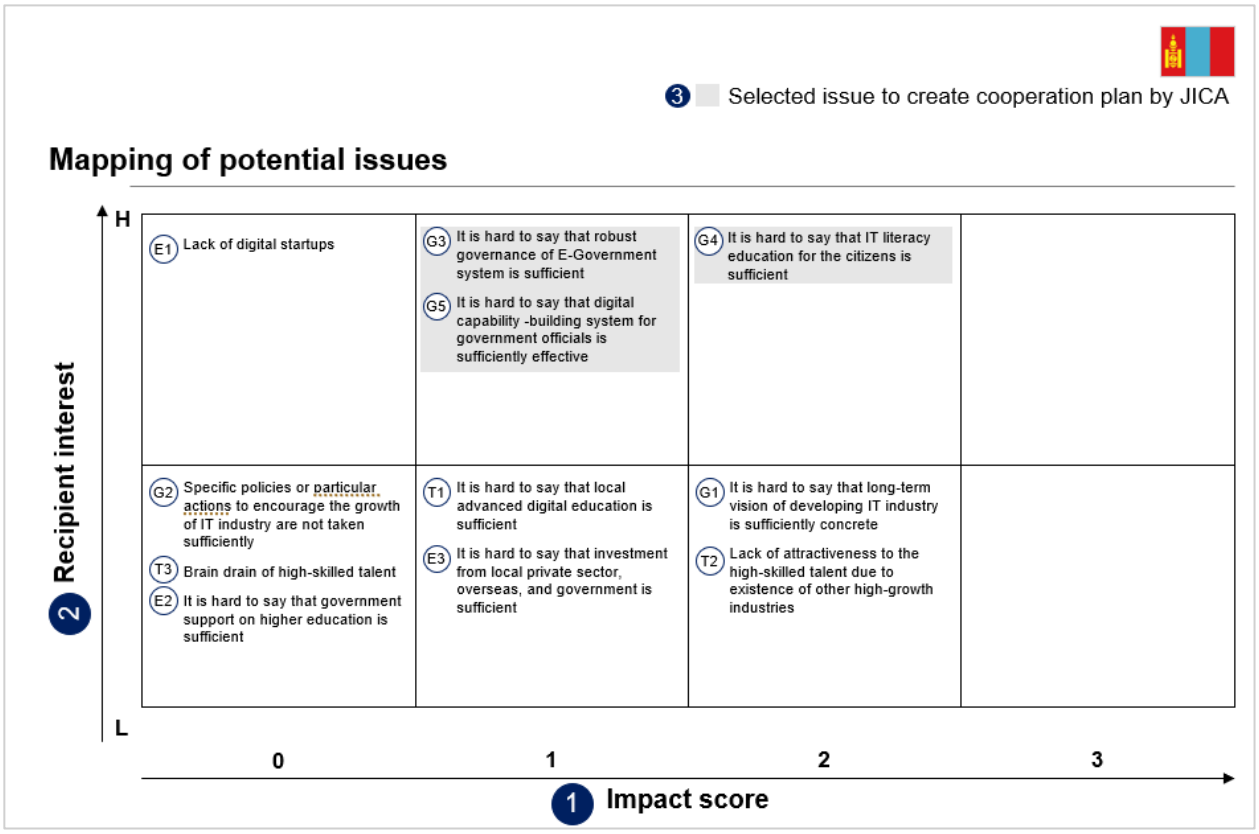


Figure 121. Assessment of potential issues

Below is a detailed explanation of the assessment based on each of the above three perspectives.

(1)-1 (1) Impact expected from solving the issue

Using the scoring method outlined in the consideration procedures in 2.1.2, we scored the expected impact of solving each potential issue. We found that the following issues would have a relatively high expected impact if they were resolved (score of 2).

- The long-term vision for developing the IT industry is not concrete enough
- There is not enough IT literacy education for citizens
- Not attractive to highly talented personnel, relative to other growth industries

(1)-2 (2) Counterpart's interests

Meanwhile, the counterpart Communications and Information Technology Authority (CITA) showed interest in assistance for the following four issues.

- There is not enough IT literacy education for citizens
- E-Government system governance is not fully prepared
- Mechanisms to improve digital capabilities of government officials are not demonstrating enough effectiveness
- Not enough entrepreneurs launching digital startups

We received the following comments from the counterpart on each issue.

Figure 122. Counterpart's interests

C/P[1] interest level	Potential issues	C/P comments
High	G3: E-Government system governance is not fully prepared	"At the current phase of planning, we are hoping for long-term JICA assistance throughout the entire process, including consulting on systems development and system integration PMO, etc. We would even be grateful for assistance on just part of the process."
	G4: There is not enough IT literacy education for citizens	"I think **the most important think is an educational platform for citizen digital literacy.**"
	G5: Mechanisms to improve digital capabilities of government officials are not demonstrating enough effectiveness	"The citizen digital literacy education platform itself is for a general audience, but **we would also like to include programs targeting public servants.**"
	E1: Not enough entrepreneurs launching digital startups	"IT Park is the only government agency assisting startups, but it still hasn't been able to formulate an effective plan for stimulating Mongolia's innovation ecosystem, and due to budgetary circumstances, basic research isn't moving forward either. It would be great to have JICA assistance for these issues."
Low	G1: The long-term vision for developing the IT industry is not concrete enough G2 There are not enough concrete policies and specific measures in place to facilitate IT industry growth	"Since the announcement of "Digital Nation," four IT-related bills have been worked out, and the topic is being carefully deliberated in parliament. It seems like the laws

C/P[1] interest level	Potential issues	C/P comments
		will be mostly be in place by the end of this year. When the bills are approved, there may be some need for financial assistance for clarifying the authority and role of each agency and formulating related policies, but that's not clear yet."
	T1: Not enough advanced digital education T2 Not attractive to highly talented personnel, relative to other growth industries T3 Highly talented personnel leave the country	"To get more talent, there may be some effective initiatives, like getting more students to choose IT and raising university education standards, but these things are **under the jurisdiction of the Ministry of Education, Culture and Science**."
	E2: Not enough government assistance for higher education E3 Not enough investment from the government or foreign and domestic private companies	"**There is more and more domestic investment.** Large companies are also starting to establish or invest in in-house ventures, launch incubators, and assist startups selected for their outstanding performance. However, **the government still does not have budgets big enough to engage in large-scale investment**."

1. Counterpart

Assistance for the digital realm in Mongolia has come from Estonia (with assistance for the E-Mongolia project), as well as from UN agencies, the World Bank, KOICA, and ADB. UN agencies are giving assistance for improving digital literacy and promoting e-governance and innovation, among other things. The World Bank is assisting ICT use in public services. KOICA assists with capacity-building by sending ICT specialists, and assisting education for women entrepreneurs and startups, while ADB assists data use and promotes innovation.

(1)-3 (3) JICA's interests

We mapped the potential issues based on the expected impact of resolving them, and on the counterpart's level of interest. We then selected the priority issues to consider as JICA assistance programs. The following three potential issues were selected.

- E-Government system governance is not fully prepared
- Mechanisms to improve digital capabilities of government officials are not demonstrating enough effectiveness
- There is not enough IT literacy education for citizens

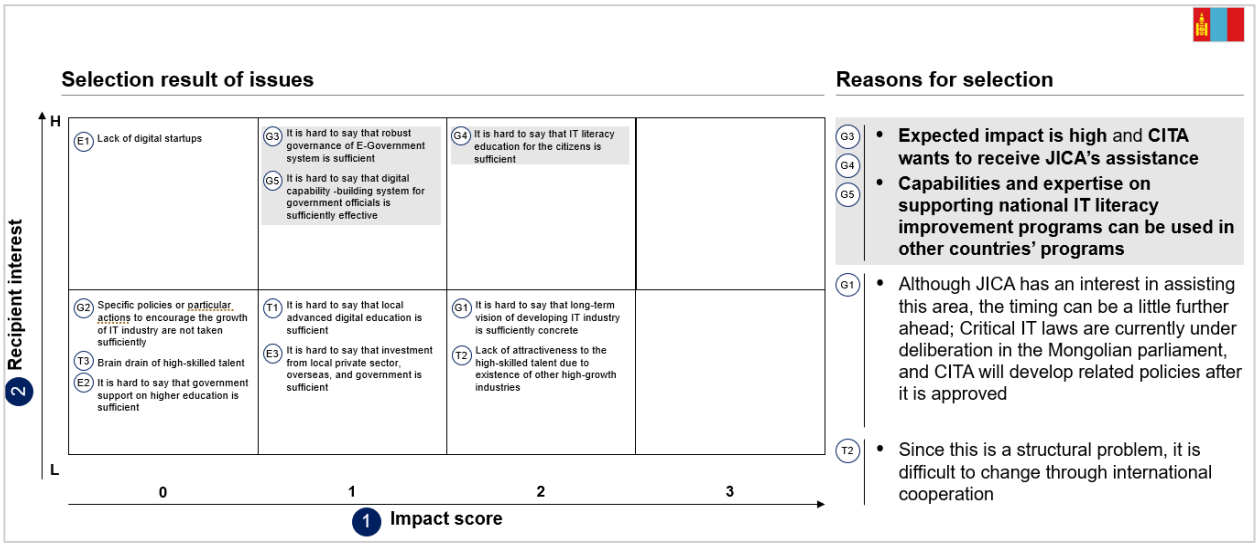


Figure 123. Identifying priority issues

(2) Drafting assistance programs and possible solutions for potential issues

(2)-1 Formulating JICA assistance programs for priority issues

This section outlines JICA assistance programs for each of the priority issues.

E-Government system governance is not fully prepared

Below is a list of global best practices on this issue, as identified through surveys of reference projects done by other donors, and interviews with experts.

- Develop middleware, and use it to connect existing systems
- Rebuild the E-Government system
- Establish guidelines to act as principles for developing and expanding new systems in the future

E-Government best practices involve the presence of surface channels and applications in each setting of life, as well as multiple layers (foundations, data, infrastructure, etc.) provided in close connection with one another. In contrast, Mongolia's E-Government does not currently connect all administrative systems and databases, and it needs connections for foundational and data layers to be built.

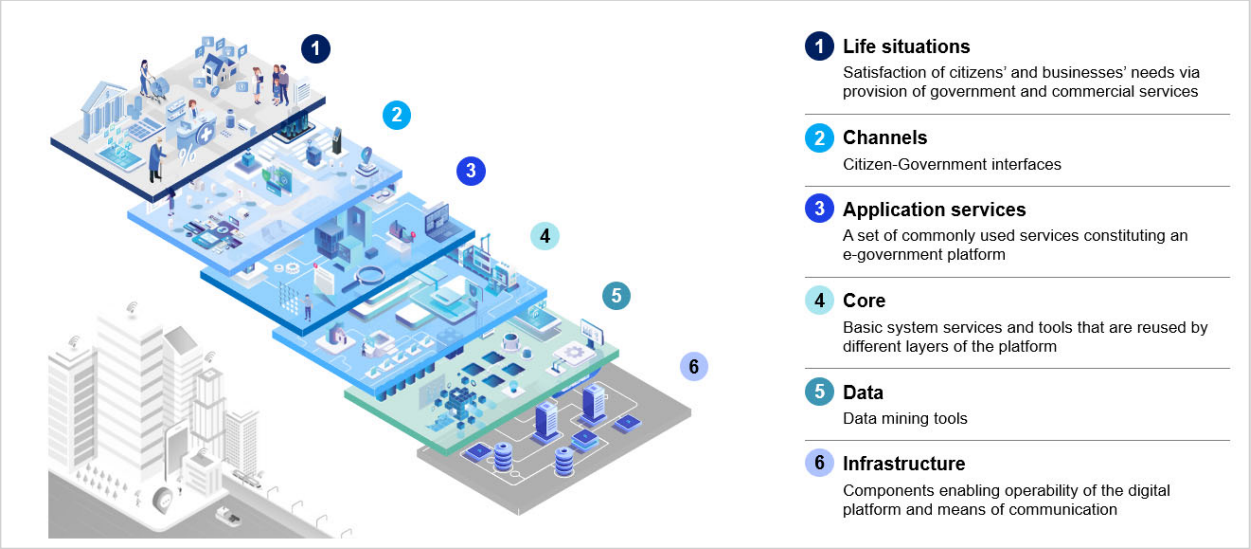


Figure 124. Best practices: Building a comprehensive E-Government

There are four typical models for methods to connect foundations and data

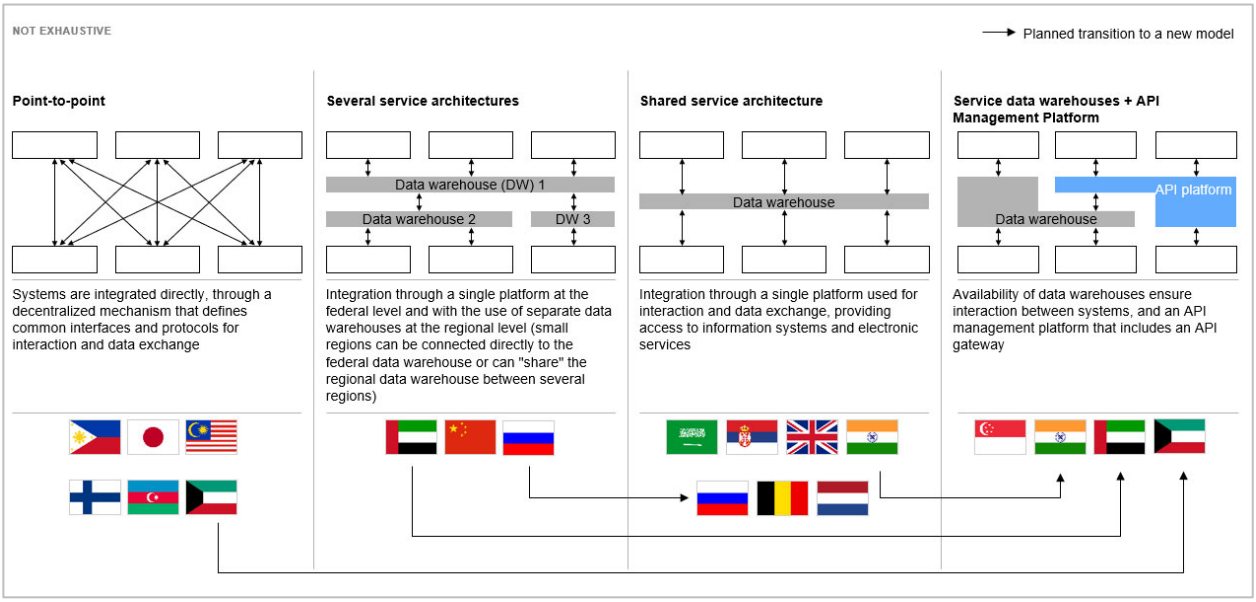


Figure 125. Four trends in integrating administrative systems

There are pros and cons to each of these models, but the cutting-edge model uses data warehouses and an API platform (right-most in the diagram above). Using API vastly improves the platform's flexibility, making it possible to integrate the private sector as well, in real time. In fact, the E-Government systems of Singapore, India, the United Arab Emirates, and Kuwait were all developed on this model. For example, Singapore's Government Technology Agency developed an API Exchange (APEX), which ensures a safe connection for internal government networks and internet, and simplifies the development and integration process for each organization, with predefined templates and formats. As a result, they achieved a 45% OPEX reduction.

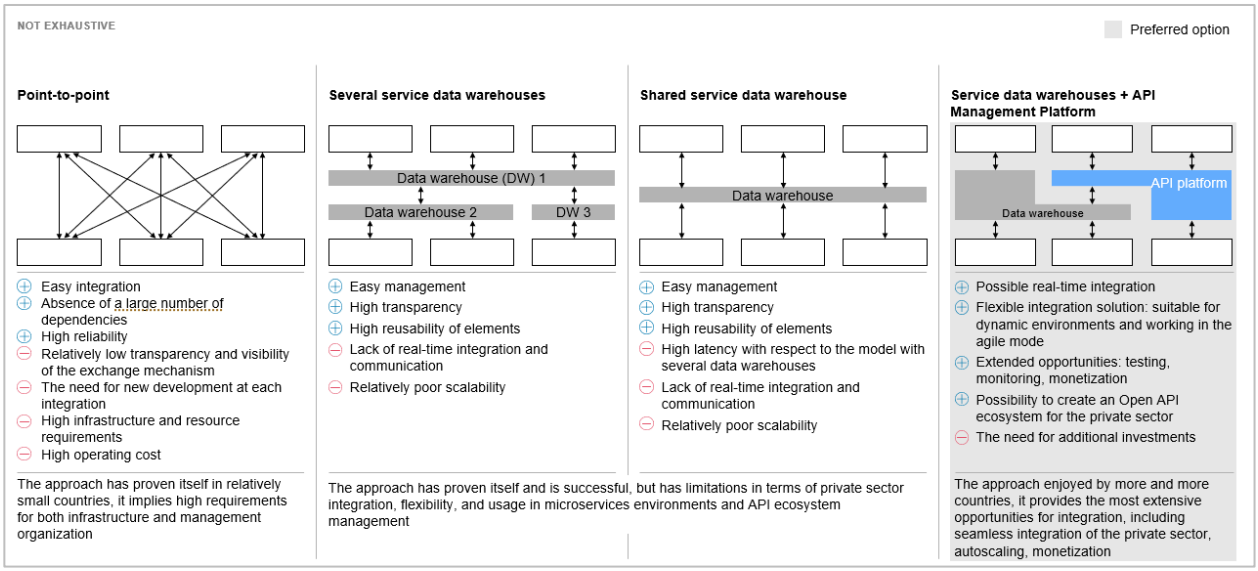


Figure 126. Summary of pros and cons of each option

There are also two approaches to development.

The first is called the big bang approach, and it involves developing and introducing all functions at once. Since this approach involves a vast amount of systems/data to integrate, it can take a long time to define the requirements and develop things, and there is the risk that the project will become too complicated, and fail. On the other hand, it has the advantage of helpful find new, unexpected insights more easily because such large volumes of data are used.

The second is the use-case-driven approach. With this method, the functions being developed are determined gradually, and developed/introduced in order. Since more high-priority functions are implemented first, the advantage is that impact is soundly and quickly realized. Another advantage is that the scope can be determined while provisionally introducing things on a small scale. On the other hand, since this method does not allow the overall perspective of the platform to be defined when the project starts, it's important to ensure flexibility in the early design stages.

With Mongolia's E-Government platform, it may be best to gradually reform the foundations, to reduce risk and level costs, and then also build applications in the use-case-driven approach. This would allow them to cope with everyday technological progress while reflecting in detail the demands of citizens, the users of the service.

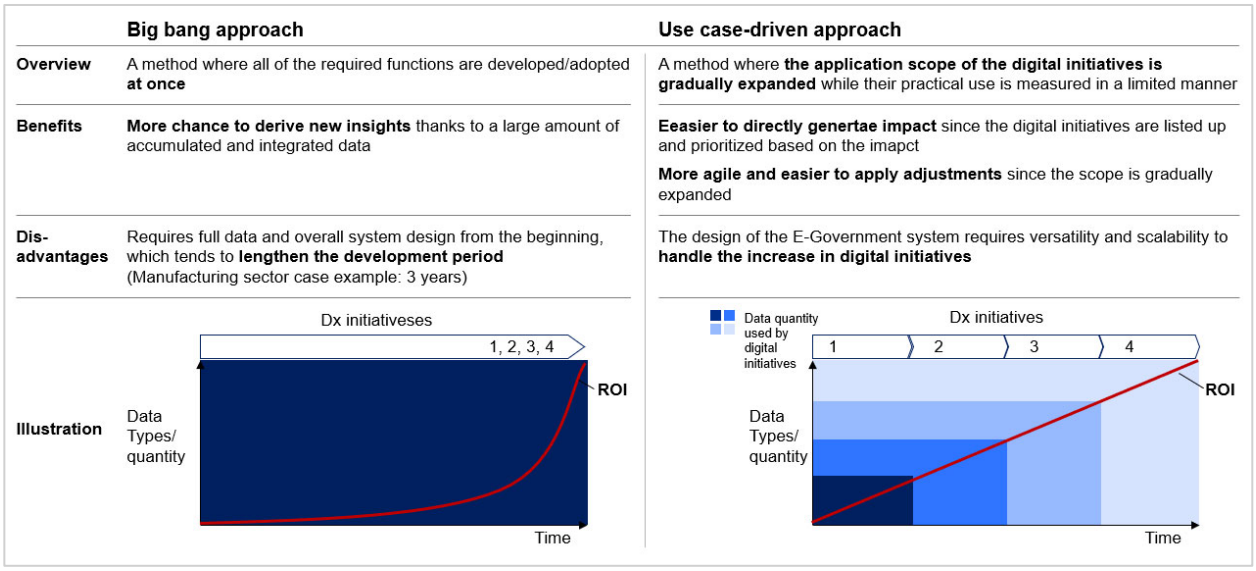


Figure 127. IT system development options

We can expect the following kinds of difficulties in strengthening E-Government. The first is that execution speed may suffer as there would need to be cooperation and coordination between multiple ministries. The second is that some of the on-site employees that actually use these systems may not have incentives to improve government administrative transparency with digitalization, and in some cases it may be difficult to get on-site cooperation. With these difficulties in mind, we believe that it will be essential to build a strong driving structure underneath strong leadership in order to implement, and that an approach using deliver units would be effective.

A delivery unit is typically set up across multiple ministries, working directly under the prime minister. It is a group that directs implementation in major transformations, acting to ensure reliable implementation by giving progress reports to the prime minister and solving problems at a high cadence to resolve issues. These units have been put to practical use in government transformation programs in over 20 countries globally, and this approach has proven results.

In Mongolia's case, since the action plan includes mention of setting up an "e-government committee (council)" directly under the prime minister, we believe that it will be important to plan the appropriate authority, personnel, governance, operations, and budget so that this organization can fulfill the role of a delivery unit.

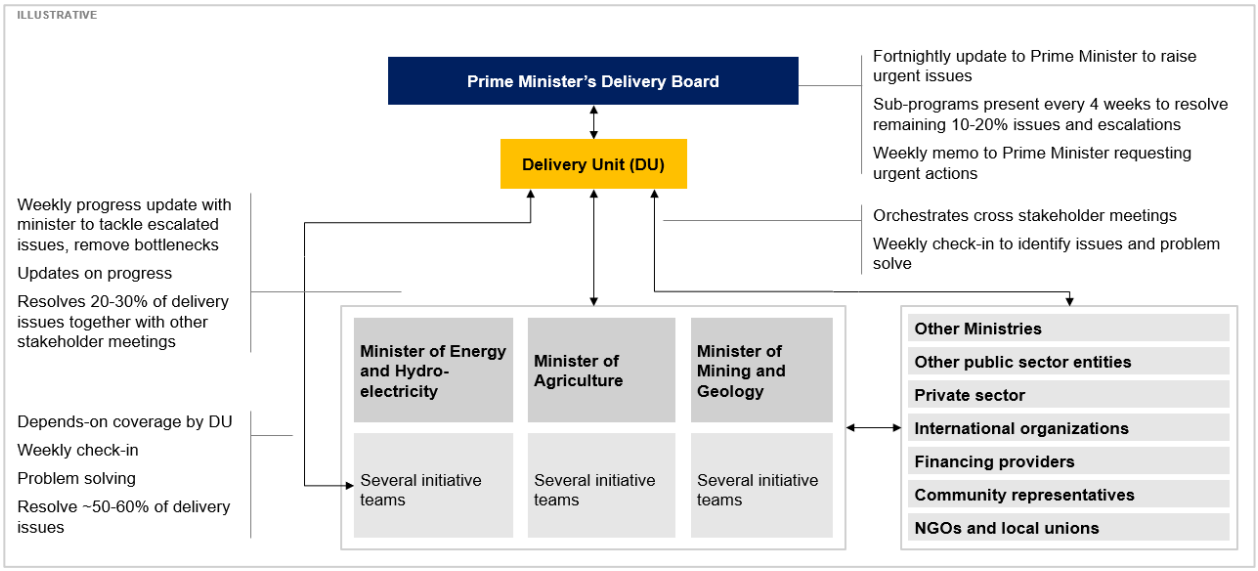


Figure 128. Overview of delivery units (DU)

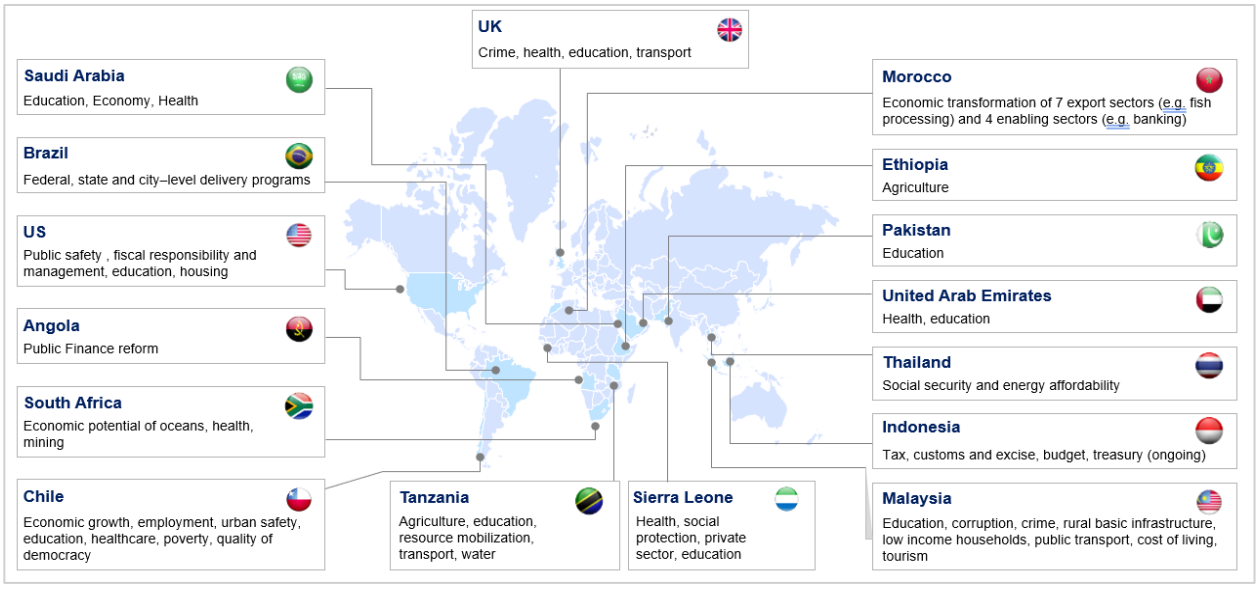


Figure 129. Examples of delivery unit usage

Lack of effective digital capability education for government employees

Below is a list of global best practices on this issue, as identified through surveys of reference projects done by other donors, and interviews with experts.

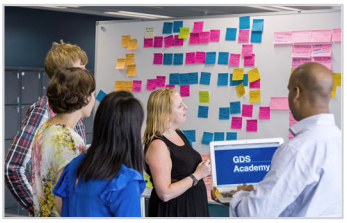
- Convey the appeal of the position and hire digitally capable talent
- Include digital capabilities on HR performance reviews, and set KPIs to motivate government employees to learn
- Build structures for capability-building (using online, offline, and hybrid formats)
- Develop a secondment system to exchange talent with local IT companies

One particularly helpful best practice in training to improve government employees' digital capabilities is exemplified by the UK's GDS Academy. This academy grew out of something that was established with the goal of improving the digital capabilities of government employees at the Department for Work and Pensions. It now offers training for a broad range of public sector employees, including those working for local governments. Typical examples include the following.

- Designed to have government employees (with or without a technology background) gain the capabilities needed to lead a digital transformation of public services, face-to-face and online training sessions are offered to improve efficiency
- Funding is committed to ahead of time, and mass trainings are held, including for local government employees (with the objective set at training 3,000 people per year)

The above GDS Academy was also used as a reference for Canada and Scotland when they established similar digital academies for government employees.

Figure 130. UK GDS activities

Initiatives		
Objectives	• Improve the digital capabilities of public sector employees, including knowledge about emerging technologies, and data analysis skills	  
Key activities	• Build capabilities throughout the government by instructing public sector employees on new technologies • **Trainings are held for people with and without specialized skills** • **Offline trainings** are held at four training centers in the UK. Courses can also be held at pop-up locations, and instructors can be sent to regional offices • **Online trainings** are held through a digital platform that features a user-friendly UI, offering the following kinds of online learning courses – Digital leadership course – Digital and agile foundations course – Data analysis course, etc.	
Outcomes	• Aim to have over 3,000 people attend trainings per year • Up to 2020, about 13,000 government staff had participated in trainings	
Features	• **Trainings are prepared for people with and without specialized skills** • **Both online and offline learning courses are held** • **The training courses explain the professional duties of the DDAT[1] professions, connecting to a DDaT capability framework that defines the details of the skills needed to work at each professional level** • **Increase the number of local public servants who can participate, using public funding from residential, community, and local government departments**	

The Singaporean government provides opportunities for employees to improve their digital capabilities by temporarily transferring them to private-sector digital companies for six months to one year (Digital Technology Attachment Programme). Employees that transferred through this system pick up new information on the latest technology used at private digital companies, and digital-based work styles. When they return to their government jobs, they contribute to improving digital capabilities in the government.

Figure 131. Efforts in Singapore

Initiatives		
Objectives	• Create digital services within the organization, and build capabilities for advising on policymaking related to the digital realm	  
Key activities	• The top two or three senior leaders in the government's digital bureau select candidates based on various standards (communication skills, digital skills, age, interest in participating, etc.) • The selected candidates are sent to work in digital consulting activities at digital companies that have contracts with the Singaporean government • With a transfer period typically lasting six to twelve months, the employees are required to absorb information on product cycles, corporate culture, industry overview, etc., in that period of time • Afterward, these employees may return to their original departments, or sometimes they launch a new digital division	
Outcomes	• Since 2016, six new administrative divisions (AI division, IoT division, etc.) have been created through this transfer program	
Features	• **Can generate talent with strength and imagination** • **By incorporating the startup mindset into administrative tasks, everyday tasks are sped up and processes are optimized**	

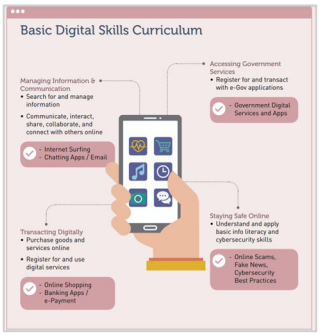
Lack of digital literacy education for citizens

One of the global best practices for this issue, as identified through reviewing reference projects by other donors and conducting hearing with experts, is running a targeted, intensive digital literacy program.

One model example of a solution to this issue is Singapore's "Digital Readiness" program run by the country's Ministry of Communications and Information. This initiative has the objectives of allowing all citizens to use online public services, and helping all citizens attain the capabilities to enjoy the a digitally advanced society and economic activity trends; the program features initiatives that align with the characteristics of each citizen. Those in low-income groups and older people are particularly targeted to receive assistance, as they are more at risk of being left behind in a digital society. For example, they provide subsidies to low-income groups for laptop computers and internet connections (about 83,000 households), and provide older people with subsidies for smartphones or laptops, as well as direct instruction from tutors.

They also provide online learning courses in basic digital information, geared toward the general public. (Cyber security, cyber wellness, etc.) When confronting the same issue in Mongolia, it will be important to segment the targets and give assistance that meets the needs of each segment.

Figure 132. Singapore's "Digital Readiness" program

Initiatives		
Objectives	• Make online public services usable by all citizens • Give all citizens the capability to enjoy the benefits of a digitalized society and economic trends	 
Key activities	• The Ministry of Communications and Information (MCI) worked out initiatives to fit the characteristics of each citizen • Low-income households: Subsidize laptop computers and connection fees (about 8,300 households) • **Seniors** — Deploy digital instructors to regional communities to teach seniors the basics of how to use technology — Use subsidies to popularize smartphones and laptops — Hold very simple IT courses (how to use mobile apps, social media, IT software, take photos, take video, etc.) • **People with physical disabilities** — Subsidize up to 90% of expenses related to assistance technology devices — Receive tech assistance from related ministries, hospitals, and volunteer groups • **Able-bodied adults** — Free internet access at public facilities — Online courses for learning basic digital knowledge (advice about cybersecurity, cyber wellness curriculum, etc.)	
Features	• **Assist content adjusted to meet the needs of each segment** • **Gracious assistance for socially disadvantaged people**, such as low-income households, seniors, and people with physical disabilities	

Summary

Based on the above, JICA could consider the following assistance programs for the Mongolian government.

Figure 133. Overview of Mongolia assistance program: Strengthen E-Government, improve the digital capabilities of government employees, and encourage citizens to use E-Mongolia

Program Components	**Expected impact of this program**	**Cost estimate via outside-in study**
Institutions receiving assistance:	**Improve accessibility, efficiency, and convenience of administrative services**	**Total project cost estimate[1]: Several billion JPY**

Program Components	Expected impact of this program	Cost estimate via outside-in study
• CITA and CITA-led Delivery Unit • Each ministry (may become future assistance recipients) **Target assistance activities:** • Strengthen governance of E-Government, prepare platform, train government employees for promoting use of the platform • Trainings for government employees with the objective of improving digital/IT capabilities • Trainings for citizens with the objective of facilitating their use of E-Mongolia	• Raise the E-Mongolia usage rate from 31% to 95% of citizens • Raise the rate of government employees capable of using E-Government to 100% • Have 95% of administrative operations completed electronically Strengthen and develop inclusive digital economies by strengthening the capability to make and implement government digital and IT policies **Stimulate the Mongolian IT industry** • The scale of the Mongolian IT industry will expand if the government orders large-scale development, operations, and maintenance projects for the E-Government platform and related applications • By transferring know-how with this assistance, the capabilities of the Mongolian IT industry will improve	• **E-Government systems integration: JPY several billion** — E-Government platform development: JPY several billion — E-Government platform maintenance and operations: Approx. 20% of development costs annually • **E-Government systems training: JPY tens of millions** — Labor costs and overhead for sending in specialists — Training expenses (teaching materials, venues, etc.) • **Citizen digital literacy training: JPY hundreds of millions** — Labor costs and overhead for sending in specialists — Training expenses (teaching materials, venues, etc.)

1. These are estimates of all costs needed to implement the project, and do not necessarily align with JICA assistance amount

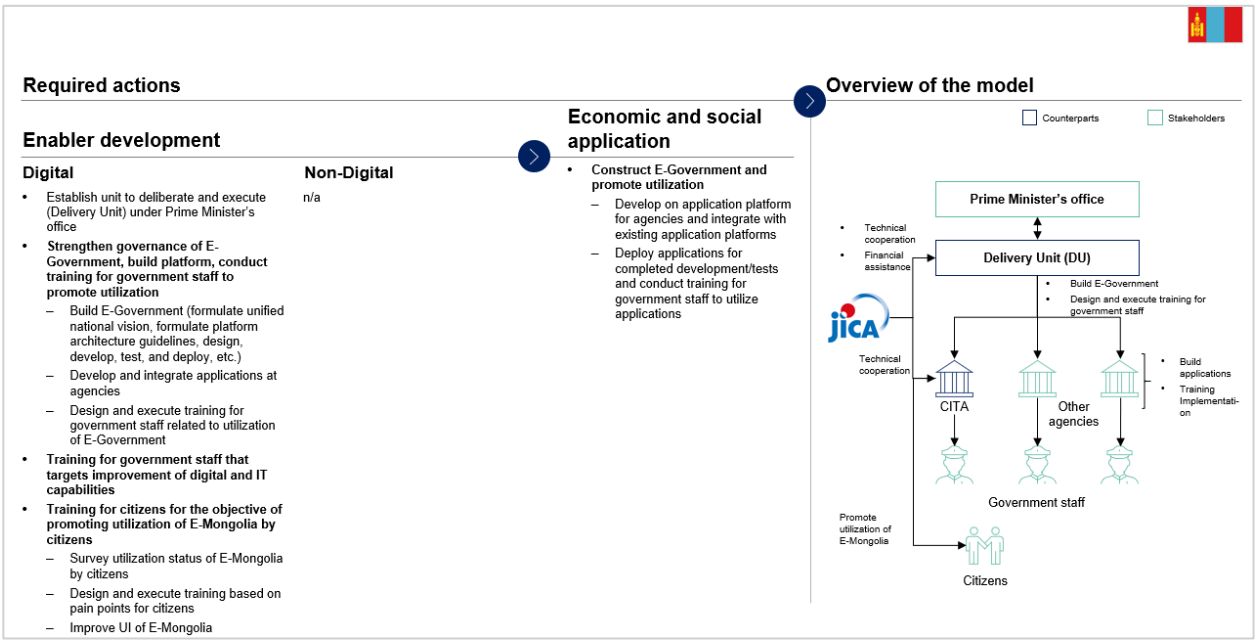


Figure 134. Overview of activities needed to maximize impact

Figure 135. Activity details

Category	Steps	Activity details			Applicable JICA scheme	Considera-tions
		CIP	Other stakeholders	JICA		
Enablers: digital	Launch DU	**CITA** • To get approval to set up the DU, make a report demonstrating the need to set up E-Government and offer digital/IT training to government employees, and the need to improve citizen IT literacy		Assist design and implementation of essential surveys and analyses	Technical cooperation	
		CITA • Build consensus within the government that the above activities are a national priority, and get approval to establish a task force (delivery unit, DU) for promoting these activities across ministries	**Prime minister's office** • The prime minister's office approves DU setup, and secures the necessary budget and staff	Assist DU launch	Technical cooperation	• Can the budget needed to launch DUs be secured? • Will it be possible to launch quickly, keeping up with the JICA assist timeline?
	Formulate a national vision for IT	**DU** • Formulate a nationally unified long-term vision for E-Government		Assist formulation of long-term vision	Technical cooperation	
	Set up E-Government	**DU** • Formulate platform architecture guidelines for E-Government • Prioritize the functions that E-Government should have • Design E-Government platform		Assist E-Government design	Technical cooperation	

Category	Steps	Activity details			Applicable JICA scheme	Considera-tions
		CIP	Other stakeholders	JICA		
	E-Government develop-ment/testing	**DU** • Organize the current state of connection of government-run systems/data		Assist status analysis	Technical cooperation	
		DU • Secure a budget, and develop/test items in order of priority use cases		Provide funding for E-govern-ment development	Loan assistance	• Can the funding needed for develop-ment be secured? • Can funding for mainten-ance be secured continu-ally?
	E-Government training	**DU** • Train government employees to properly develop, maintain, and use things on E-Government		Training for government employees	Technical cooperation	
	Digital/IT training for government employees	**DU** • Define the digital/IT capabilities needed for each government employee role/pass		Training for government employees	Technical cooperation	
		DU • Carefully examine the current digital/IT capabilities of each government employee, and divide them into segments according to their capabilities and pass level		Training for government employees	Technical cooperation	

Category	Steps	Activity details			Applicable JICA scheme	Considera-tions
		CIP	Other stakeholders	JICA		
		DU • Define each segment's training journey		Training for government employees	Technical cooperation	
		DU • Run training sessions that fit each training journey		Training for government employees	Technical cooperation	• Is it possible to prevent trained employees from changing jobs?
	Promote use of E-Mongolia	**CITA** • Survey the current status of citizen use of E-Mongolia. Conduct a detailed survey of citizens who do not use it much, and define the pain points behind the issue (e.g. in-depth surveys, ethnographic research)		Survey about E-Mongolia	Technical cooperation	
		CITA • Segment the citizens who are unable to use E-Mongolia by their pain points, and select assist targets that have larger assist needs		Survey about E-Mongolia	Technical cooperation	
		CITA • Design and implement training sessions that meet the needs of the target segments		Assist design of training sessions	Technical cooperation	
		CITA • Consider improving the E-Mongolia UI, as needed		Assist UI improvements	Technical cooperation	

Category	Steps	Activity details			Applicable JICA scheme	Considera-tions
		CIP	Other stakeholders	JICA		
Apply to economic and social develop-ment	Develop/ integrate E-Government apps	**Ministries** • Develop apps for each ministry on the platform • Integrate with existing app platforms		Assist app development	Technical cooperation	• Can design/ develop-ment be accom-plished following the guidelines set by DU? • Possibility of difficulty integrating due to the ministries' existing applica-tions
	E-Government deployment	**DU** • For each use case that has been developed, run trainings for the government employees that will use it (Start small and gradual, and make improvements based on initial feedback. Cultivate "champions" that take the initiative to use and popularize the use case. Champions will then be trainers in later training sessions)		Run training sessions	Technical cooperation	

(2)-2 List initial solution proposals for potential issues that are outside priority issues

The following are preliminary potential solutions to the potential issues to assist that are not priority issues mentioned above.

Figure 136. Capacity to formulate and implement policies: Possible solutions for potential issues

Category	Potential issues	Potential solutions	Background
Vision	G1: The long-term vision for developing the IT industry is not concrete enough	• Conduct **comprehensive research** on IT industry to understand current baseline and issues clearly • **Benchmark current regulations and policies** with regional/global best practices • Develop concrete action plans to **assist IT industry to realize long-term vision**	• The majority of government employees change out when the government changes. They tend to enthusiastically work to implement initiatives that can produce results in a short time period.
Policy & Regula-tion	G2 There are not enough concrete policies and specific measures in place to facilitate IT industry growth		• Not enough basic research and comprehensive data collection by the government about the IT industry • **Not enough specific financial assist** for IT startups in Mongolia
Execution	G3 E-Government system governance is not fully prepared – Lack of integration of IT systems of different departments – Lack of integration of databases	• Develop middleware to connect existing systems • Rebuild the new e-government system • Establish system standards that will serve as guidelines for future development and expansion	• Each ministry establishes its own IT system, making internal collaboration difficult
	G4 There is not enough IT literacy education for citizens	• **Targeted and focused** digital literacy program	• Mongolia has a large land area with a sparse population, and the government has developed e-Mongolia to digitize the administrative procedures for citizens • Despite the government's promotion, only 31% of the Mongolian population can use digital services smoothly due to the lack of digital literacy
	G5 Mechanisms to improve digital capabilities of government officials are not demonstrating enough effectiveness	• **Convey the appeal of the position and hire digitally capable talent** • **Incorporate digital capabilities into evaluation criteria** and set KPIs to incentivize officials to learn	• Government officials do not possess enough skills to promote ICT policy and digital transformation to solve social issues • Government officials have issues utilizing the existing IT systems to

Category	Potential issues	Potential solutions	Background
		• **Formulate structure to drive capacity-building** • **Develop a secondment system to exchange talent with local IT companies**	increase their work efficiency

Figure 137. Talent: Candidate solutions for potential issues to assist

Category	Potential issues	Potential solutions	Background
Digital translators **Digital engineers** **IT engineers**	**T1: Not enough advanced digital education**	• **Digital learning academies: Reskill industry talent who can introduce and promote useful digital tools and solutions to others** • **Digital learning academies: Nationwide, practical drills to re-educate and improve the capabilities of tech talent regarding the latest technology** • **Build interdisciplinary networks to match university education to business needs and close the gap between industry and academia**	• Advanced digital engineers is the least available category of IT talent in Mongolia, mostly because of the lack of local advanced education
	T2: Not attractive to highly talented personnel, relative to other growth industries	• **Enhance industrial attractiveness by** – Transforming the industry into a high-growth sector with strong government assist and commitment – Promote more favorable working environment in IT sector – Educate people about the exciting opportunities in IT sector	• Domestically, high-skilled talent prefers to work in other high-growth industries like mining and construction, as the salary level of IT industry is less competitive
	T3 Highly-skilled workers leave – Top-notch local talent also tends to seek attractive job opportunities abroad	• **Create an ecosystem to grow and hire talent domestically**: partner educational institutions with companies in Mongolia, e.g., companies provide high-quality internships as part of degree programs and hire excellent students immediately after graduation • **Explore a variety of retention mechanisms,** such as offering scholarships requiring recipients to take jobs in-	• Many talented people go overseas to study abroad and receive a high-level education • Some people also choose not to return to the country, because salaries are higher elsewhere

Category	Potential issues	Potential solutions	Background
		country, or incentives to stay in the Philippines (e.g. job opportunities, training, social services)	

Figure 138. Innovation ecosystem: Possible solutions to address potential issues to assist

Category	Potential issues	Potential solutions	Background
Startups	**E1: Not enough entrepreneurs launching digital startups**	• **Continuously review** policies to create a business environment that attracts more talent – Benchmark with regional/global best-practice countries to learn how to improve further	• **Number of IT startups are still relatively low** compared to other Asian countries; however, IT startups became very popular in the last 2-3 years and the number is growing
Know-ledge contribu-tors	**E2 Not enough government assist for higher education**	• **Review budget allocation for R&D to boost innovation**	• Because of the continued increase in population, the government is currently more focused on building elementary and middle schools
Investors/ supporters	**E3 Not enough investment from the government or foreign and domestic private companies**	• Build an attractive environment for investors and supporters including overseas players – Create a platform where international funds and supporters can easily access Mongolian startups – Assist high-potential Mongolia startups with global road show – Tailor incentives to each investor's interests (e.g., sustainable development) to attract mission-oriented investors – Incorporate local private sector into existing startup network • Further increase government's financial assistance by establishing government venture capital and subsidizing local startups	• There are only two major startup events per year that have collaboration from international donors

2.5 Considering assistance programs for the Philippines

2.5.1 Basic country information

The Philippines is an archipelago country of 7,109 islands in Southeast Asia. The country covers 298,170 km^2 and has a population of about 100 million people, giving it a population density of 359.5 people per square kilometer.

The dominant ethnicity is Malay, with significant populations of Spanish and Chinese descent plus other minority groups. The Philippines is the only Christian country among the ASEAN member states, with a population that is 83% Catholic, 10% non-Catholic Christian, and 5% Muslim (though the population of the Mindanao Islands is over 20% Muslim).

The Philippines' 2019 nominal GDP was USD 377 billion, with a real GDP growth rate of 6.9%. The nation's key industries are manufacturing, tourism, finance, and agriculture. Manufacturing also dominates exports. The Philippines exported USD 23 billion worth of integrated circuits in 2019 along with USD 12 billion worth of office equipment. Per-capita GDP in 2019 was USD 3,512.

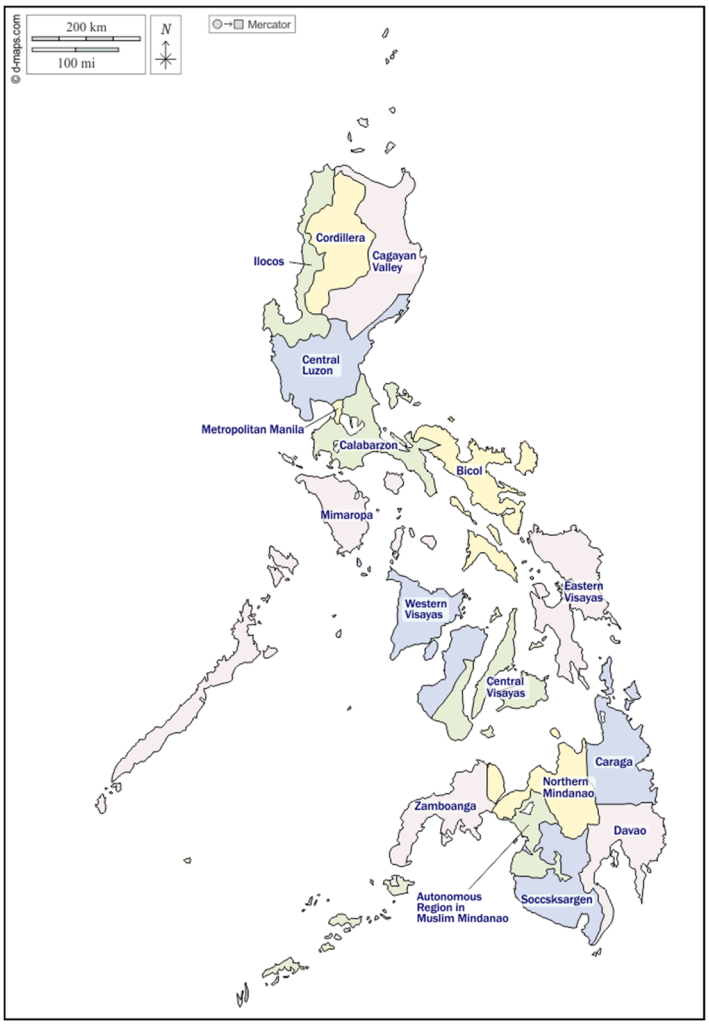


Figure 139. The Philippines (source: d-maps.com)

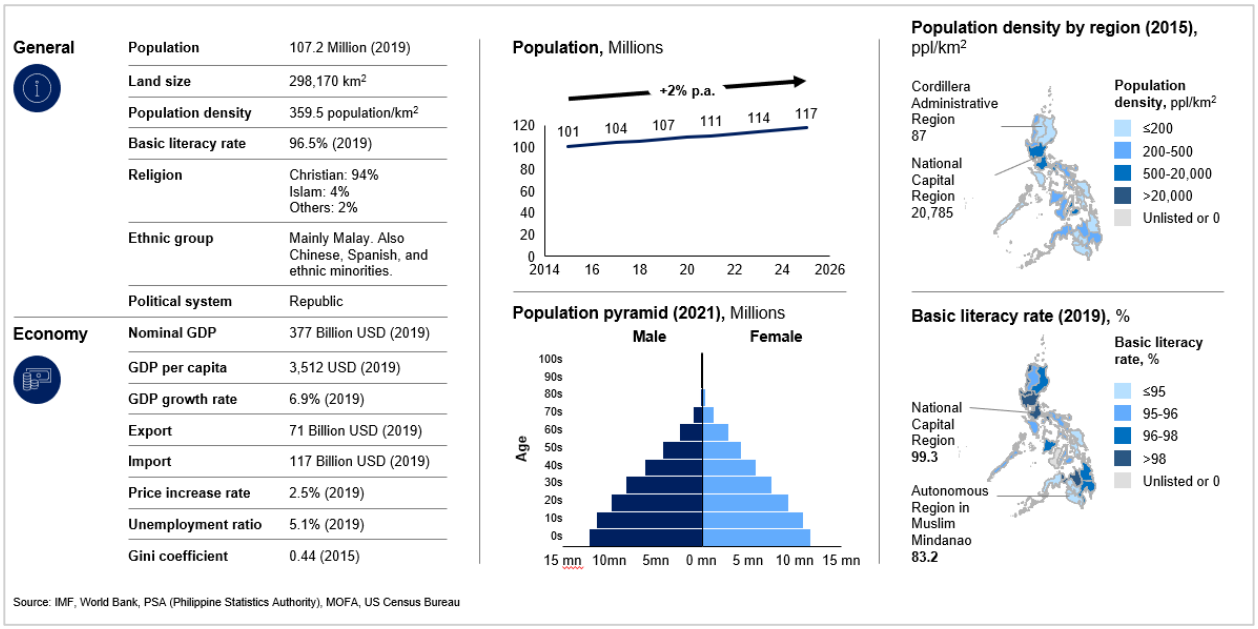


Figure 140. Overview of the Philippines (1/2)

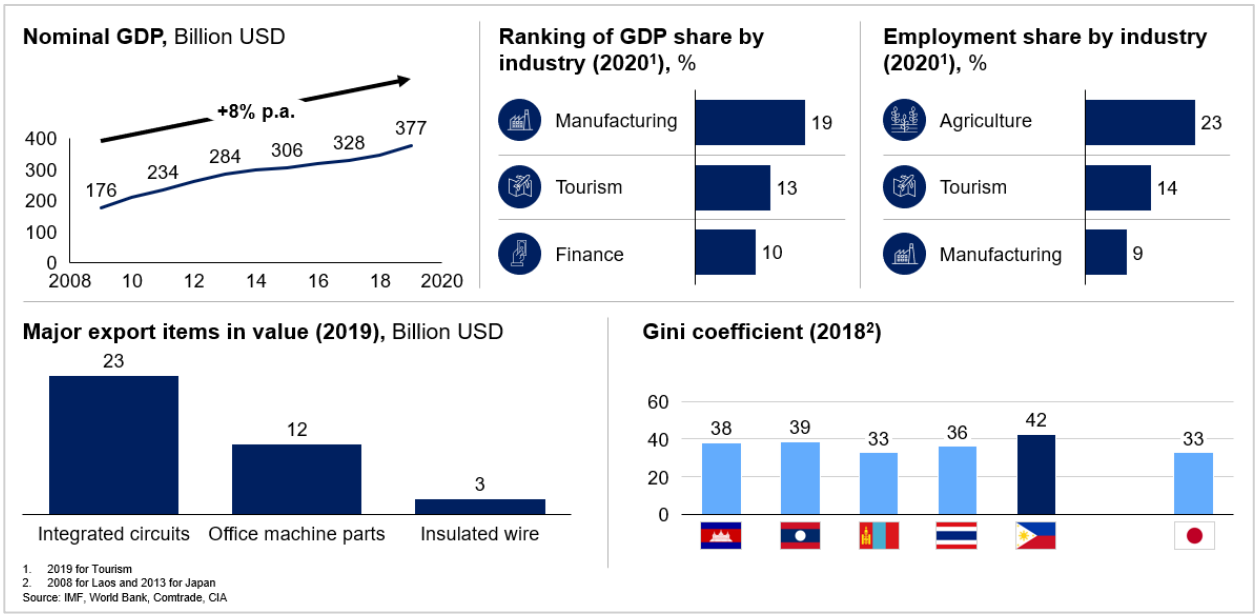


Figure 141. Overview of the Philippines (1/2)

2.5.2 Organizing the orientation of digitalization

(1) Confirm strategically important sectors of the country

The team first identified the strategically important sectors of the Philippines by looking at long-term development policies issued by the national government, specifically the Ambisyon Natin 2040 (A Long-term Vision for the Philippines), the Philippine Development Plan (2017–2022), and the Comprehensive National Industrial Strategy. Seven key industries were identified: manufacturing, tourism, finance, agriculture, the IT BPM/KPO industry, public services, and transport/logistics. The specific procedure for

identifying these sectors was as follows. To start, the Philippine government's Comprehensive National Industry Strategy treats five sectors as priority areas and basic targets. The Philippine Development Plan (2017–2022) and other sources mention the importance of strengthening sectors like finance and public services, so the team added both of those to the list as well.

(2) Selecting potential target sectors

The team evaluated these sectors on the basis of the following three perspectives, and selected the target sectors to be taken up in this survey.

- Consistency with JICA's assistance priorities
- Digital divide potential
- Each sector's overarching impact on the economy/society

Following the above selection criteria, the team analyzed the key strategic sectors in the Philippines, and confirmed that the high priority sectors for JICA assistance were manufacturing, finance, agriculture, the IT BPM/KPO industry, and transport/logistics. The reasons are as follows.

- **Manufacturing** has a high degree of economic importance, making up a large proportion of both GDP (19%) and jobs (9%). The Philippine manufacturing industry also receives quite a bit of FDI from Japan.
- **Finance** has great potential for effective assistance, since counterparts in this sector have a solid understanding of digital and good policy implementation capabilities. Using digital to promote financial assistance for MSMEs would align with the "promoting inclusive, safe digital economies" theme of this survey, and JICA would be interested in looking into the potential for assistance in this area.
- **Agriculture** has a high degree of economic importance, making up a large proportion of both GDP (10%) and jobs (23%)
- **The IT BPM/KPO industry** is a distinctive key industry of the Philippines, and JICA would be interested in looking into the potential assistance in this area
- **Transport/logistics** is a critical industry, since infrastructure development is an essential requirement for attracting foreign direct investment

Based on the above considerations and two additional perspectives, the team selected manufacturing and agriculture as being particularly well-suited as target sectors for the survey.

- **Manufacturing:**
  - There has been moderate digital progress in the manufacturing sector, but relatively little compared to other sectors that are highly aligned with JICA policy
  - Manufacturing accounts for a large proportion of both GDP (19%) and jobs (9%), so it is likely to have a major impact on the economy and society as a whole.
- **Agriculture:**
  - There has been little digital progress in the agricultural sector

— Agriculture accounts for a large proportion of both GDP (10%) and jobs (23%), so advancing digital in this sector is likely to have a relatively large impact on promoting inclusive digital economies.

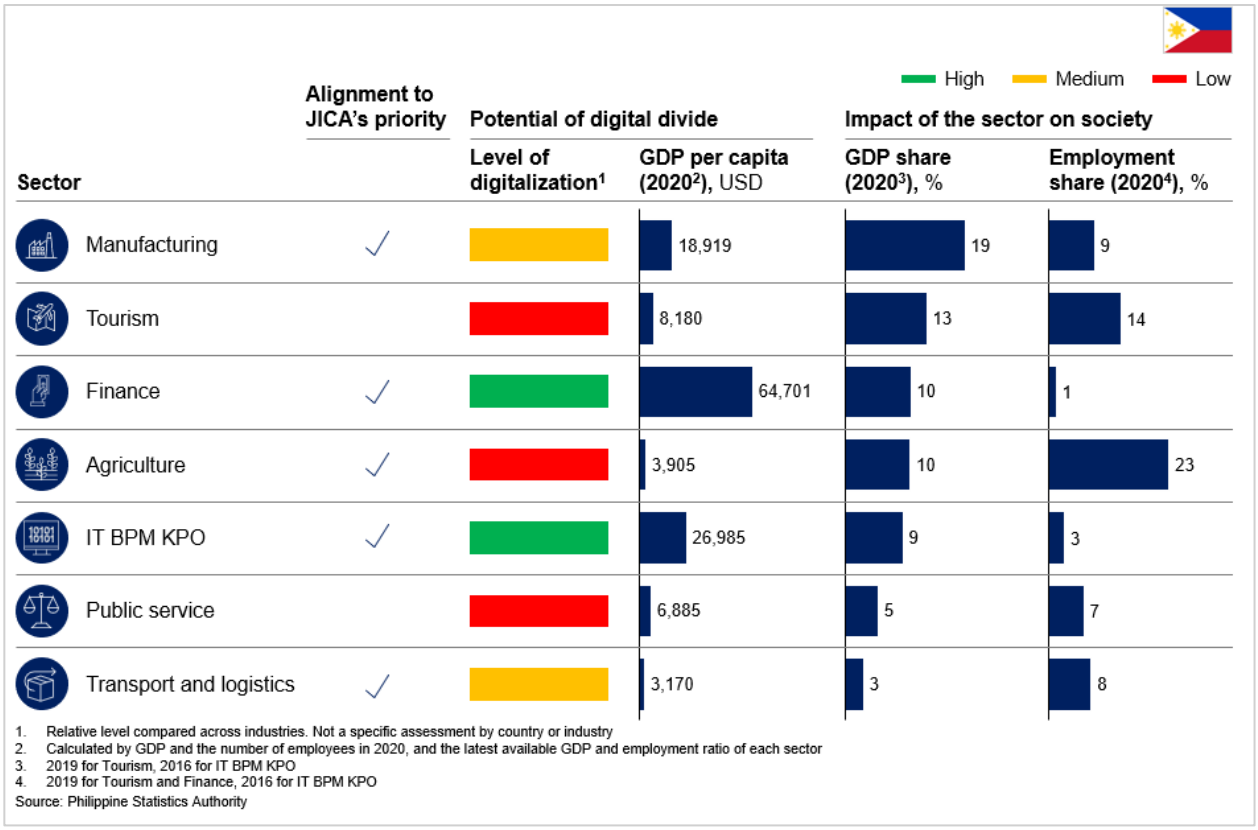


Figure 142. Selecting study target sectors

(3) Understand the vision and challenges in each potential target sector, and identify candidates for digitally-enabled solutions

The team examined the approach to digitalization in agriculture and manufacturing, two target sectors under consideration for the Philippines. To sort out the approach to digitalization, the team started by confirming the vision and challenges to achieving that vision in each sector by reviewing government documents and interviewing experts. The team then conducted another survey, and listed potential candidates for digitally-enabled solutions to the challenges being faced.

(3)-1 Agriculture

The Philippine Development Plan (2017–2022) issued by the national government sets the following targets for the country's agriculture, forestry, and fishing industries.

- Expand economic opportunities for people employed in agriculture, forestry, and fishing
- Give small-scale farmers and fishers greater access to economic opportunity, since subsistence-level industrial activities involve limited market participation

For the purposes of this survey, the above two targets are treated as the Philippines' vision for its agricultural sector.

A breakdown of the value-add from the country's agriculture, forestry, and fishing industries is as follows: agriculture (about 89.5%), fishing and fisheries (8.9%), other (1.7%) (total exceeds 100% due to rounding). The survey team therefore decided to streamline its inquiry by focusing only on agriculture.

Philippine agriculture is facing the following challenges in its efforts to realize the vision outlined above.

First, the country lacks mutual assistance structures for farmers in the form of agricultural cooperatives, making it difficult for farmers to leverage that cooperation to generate synergy and bargaining power. This is exacerbated by the fact that Philippine farmers have less farmland per farmer than their counterparts in other countries (1.3 ha versus about 2 ha in Malaysia and about 3 ha in Japan). One of the historical reasons for this is that agricultural reform initiatives like the Comprehensive Agrarian Reform Program (1988–2018) and the Comprehensive Agrarian Reform Program Extension with Reform (2009–2014) promoted the redistribution of land to farmers without any, creating a situation where farmland has become fragmented. While the large percentage of smallholder farmers in the Philippines makes it even more critical that they work together through agricultural cooperatives, the fact that the country is made up of more than 7,000 islands of varying sizes means that even the land held by agricultural cooperatives is in incredibly small parcels (there are some 5,700 agricultural cooperatives in the Philippines). This makes it difficult for the cooperatives to function as they should--by facilitating joint purchases of quality agricultural supplies and equipment, working with financial institutions to provide financial products and services, and boosting productivity through shared activities, for example (Problem 1).

The second challenge has to do with production. Agrichemicals, crop seeds, and other production essentials come with high agricultural input and electricity costs in the Philippines. It is also difficult for smallholder farmers to get loans (the 2014 Small Farmers and Fisherfolk Indebtedness Survey reported that 39% of indebted small-scale farmers and fishers were unable to get a formal loan), creating a barrier to the investment needed to boost productivity. In addition, though there are regional differences, the mechanization rate for the country as a whole remains low (1.2 hp per hectare versus about 7 hp in Japan). This further contributes to low agricultural productivity. Finally, the country is vulnerable to typhoons and other climate impacts, which makes it difficult to ensure stable production (Problem 2).

The third challenge has to do with the geography of the Philippines, which is composed of a large number of islands. This often results in long distribution times and high shipping costs. The situation makes the efficient distribution of perishable food products particularly difficult. Other factors hindering distribution efficiency somewhat are the presence of intermediaries at multiple stages of the process and stricter border quarantines resulting from the pandemic (Problem 3).

The fourth challenge is the high crop prices in the Philippines, which is attributable to a combination of the above factors. Food expenses as a percentage of per-capita GDP are extremely high in the Philippines compared to other countries--29.3% versus 12.4% in Malaysia and 8.7% in Japan (Problem 4).

The team then looked at digital solutions to the above challenges facing the agricultural sector in the Philippines. To start, digitally-powered solutions would be an effective way to provide Philippine farmers with more opportunities for mutual assistance, something that they currently lack. More specifically, establishing online information-sharing and service platforms to assist the following activities would likely be effective.

- Joint purchases of agricultural supplies and equipment (Problem 1, Problem 4)
- Learning more productive farming methods (Problem 2, Problem 4)
- Shared use of farming equipment (Problem 1, Problem 4)
- Access to financial products and services (Problem 1, Problem 4)
- Streamlining shipping costs through joint shipments involving multiple business owners (Problem 3, Problem 4)
- Transport management and tracking (Problem 3, Problem 4)

In fact, services like these are already being provided in developing countries that are facing similar problems. In Kenya, for example, there is an alternative credit-scoring service called FarmDrive designed to address the fact that less than 10% of smallholder farmers can get loans. The farmers can use apps like Messenger to enter income and expenditure data from their mobile phones. FarmDrive then combines that information with satellite positioning and remote sensor data as well as information on soil, climate, and other factors. Machine learning algorithms are used to analyze the data and generate credit scores. The service was established in 2014 with the goal of helping three million smallholder farmers get loans. It successfully procured funding twice, once in 2017 and 2019, allowing it to expand its operations.

Figure 143. FarmDrive (https://farmdrive.co.ke/credit-scoring)

The Department of Agriculture (DA) has also initiated pilot programs that use a variety of online services to assist farmers. Some of their key initiatives are described below.

- Training provided to various key players (farmers, agricultural reform project instructors, government employees, etc.) via online classrooms, radio, and similar means
- Launch of the Fisheries and Agriculture Response Management (FARM) Citizens Application (2019): Smartphone app that allows farmers to reach the DA 24 hours a day via chat, email, or social media. The service also provides information on typhoons and other weather events, navigation warnings, and more to farmers and fishers. The app also has a features that allows users to make a phone call using a hotline button in an emergency.
- Plan to develop the Agri-Information Support Portal announced (2020): The plan provides the following benefits to farmers via an agricultural information assistance portal:
  - More efficient collection of agricultural information and data
  - Distributes information on programs and projects more quickly
  - Enhanced decision-making assistance mechanisms
- Launch of Deliver-E (2020): This ecommerce platform jointly developed by the DA and the Department of Trade and Industry allows farmers to sell their crops directly to consumers.
- Development of BayAni Kita (2020): Mobile app that assists digitalization for farmers and fishers. The app provides a digital ID that allows users to directly contact the DA, chat with fellow farmers and fishers, record positioning information, and more.

Figure 144. Digital initiatives for farmers from the Philippine government

Method	Government initiatives
Increase farmer access to knowledge, information, and the market through digital platforms and software, including: • Platforms that link farm inputs (seeds, fertilizer, etc.) to the market • Online platforms for agronomic, pricing, and market information • Online marketplaces for farmers • Online financial services (loans/credit/insurance) • Enhancing farm infrastructure	• The Agricultural Training Institute (under the Department of Agriculture) offers various training programs for key players involved in boosting the competitiveness of the agriculture and fisheries sectors • The Department of Agriculture launched the Fisheries and Agriculture Response Management (FARM) Citizens Application in March 2019 — This tool allows farmers to send their concerns and reports directly to the DA through chat, email, and text services available 24/7 — It also sends out warnings of incoming typhoons or inclement weather as well as rain forecasts and navigation advisories for fishers — Users can also call using the hotline button in the FARM Citizens app for a rapid response during emergencies • The DA announced its plans to develop a **web-based information assistance system** called the Agri-Information Support Portal The portal is designed to: — Provide more efficient sourcing of agricultural information and data — Enable faster reporting on programs and projects — Enhance decision-making assistance mechanisms • In December 2020, the DA and the Department of Trade and Industry (DTI) launched Deliver-E, an **integrated end-to-end ecommerce platform** for agricultural and food products to: — Help MSMEs, farmers, and farmers' cooperatives sell their products directly to consumers

Method	Government initiatives
• Integrated transport platforms across groups/sectors • Quality management and traceability • Farming-as-a-service	– Increase farmer incomes by cutting out intermediaries or "middlemen", thereby lowering the price of agricultural products on the market • In 2020, the DA launched a comprehensive mobile app called "BayAni Kita", available to all farmers and fishers. The app has multiple features, including **digital ID, e-wallet, survey forms, bulletin boards, chat, and geotagging**.

Another potential approach to digitalization is introducing smart agriculture driven by sophisticated data analysis or the use of drones and other advanced farming equipment. However, it is likely premature to prioritize these solutions in a country that has yet to make progress in areas like mechanization and the use of high-yield seeds.

(3)-2 Manufacturing

The manufacturing sector in the Philippines represents an extremely broad target, so the team first needed to narrow its focus by analyzing the industrial structure of the sector. This would allow for a more effective consideration of approaches to digitalization. As a result of this analysis, the team concluded that using digitalization at MSMEs to boost labor productivity would help achieve an inclusive digital economy in the Philippines. More specifically, there are roughly 120,000 companies in the Philippine manufacturing sector, 96% of which are MSMEs with 200 or fewer employees. While 58% of manufacturing workers are employed at these small enterprises, they only account for 13% of added value. If digitalization can boost labor productivity at these MSMEs, which account for such a large proportion of jobs, it will likely make the digital economy more inclusive while stimulating the national economy.

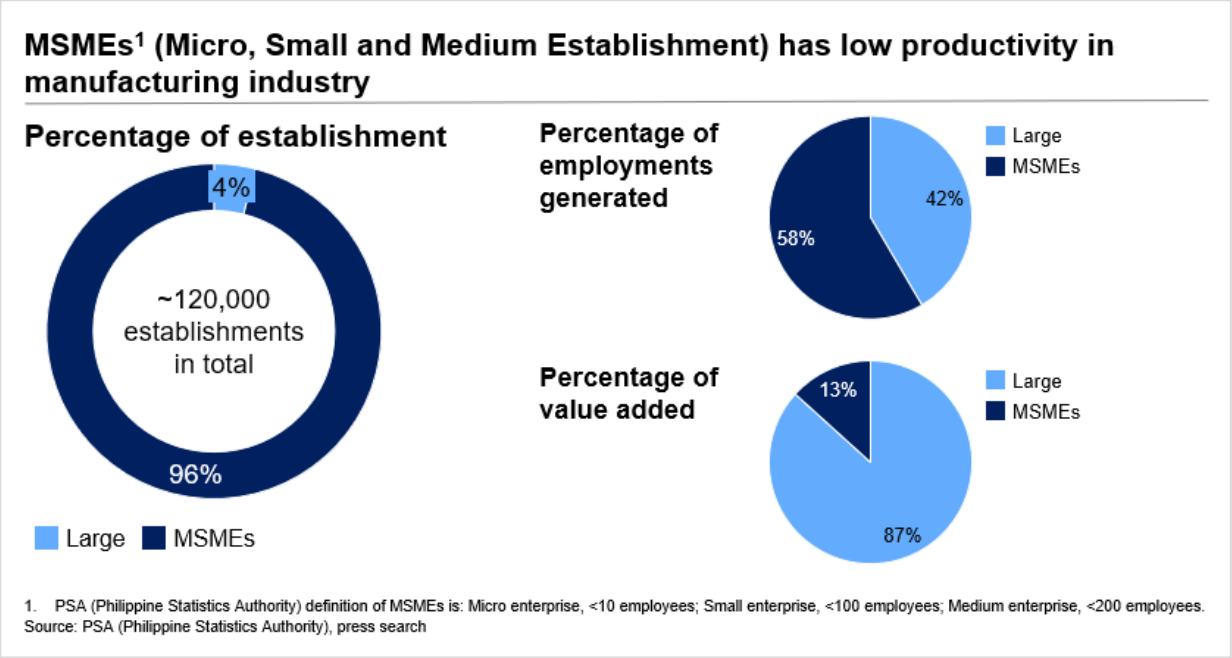


Figure 145. Manufacturing productivity in the Philippines

Next, the team looked at the Philippines' vision for its manufacturing industry and the challenges facing its MSMEs.

The manufacturing vision for the Philippines issued by the national Department of Industry is "to create a globally competitive manufacturing industry with strong forward and backward linkages to serve as hubs in the regional and international production networks of automotive, electronics, garments and food and assisted by well-managed supply chains."

But MSMEs are up against several challenges as they strive to achieve this vision.

The first is high sales costs. The electronics industry has been impacted by the international semiconductor shortage, and is grappling with shortages of all kinds of materials, including high-priced chips. The food industry is structured to rely heavily on imports due to the high cost of domestic crops. Electricity is also expensive in the Philippines (industrial electricity rates are nearly twice what they are in Malaysia), which drives up manufacturing costs as well (Problem 1). [2]

The second challenge, as mentioned earlier, is low labor productivity. Since there are many suppliers with different strengths and a low level of mechanization, there is a tendency for MSMEs take high mix, low-volume orders. This in turn results in low productivity (Problem 2).

The third challenge is a shortage of highly-skilled workers. It is difficult to secure high-level engineers or other highly-skilled workers in the Philippines, since they tend to leave the country in search of better working conditions (Problem 3).

The fourth challenge is that there are few opportunities to make data-driven decisions. Interviews with experts in the Philippine manufacturing industry pointed out that decisions were frequently made based on personal judgment rather that based on objective facts. The problem was particularly pronounced, they said, when it came to performance reviews, formulating purchasing plans, and demand forecasting (Problem 4).

Finally, there is the problem of product competitiveness. Since manufacturing costs are high, domestic products are sometimes more expensive than imports, or less competitive because large companies in the Philippines tend to be weaker in terms of technological capabilities and marketing skills.

Based on discussions with experts in the Philippine manufacturing industry, the team identified the following digitally-powered solutions as being potentially effective for resolving challenges like these.

- Use smart grids to optimize electricity usage (Problem 1)
- Develop and popularize an online information-sharing and service platform to match manufacturers and clients (Problem 2)
- Develop and popularize a job recruiting platform to make it easy to hire highly-skilled workers (Problem 3)
- Popularize digital software to assist objective business management (Problem 4)

[2] Based on a comparison between the cost of electricity from Visayan Electric Company, the Philippines' second-largest electricity provider, and Tenaga Nasional Berhard, a multinational electricity provider in Malaysia.

Interviewees commented that the online information-sharing and service platform to match manufacturers and clients was a particularly high priority, as it targets two key issues faced by MSMEs; namely, low productivity resulting from high-mix, low-volume production and the lack of matching capability.

Online platforms for clients placing orders are a popular solution in Japan as well, where MSME manufacturers face similar problems. CADDi Inc., established in 2017, offers a manufacturing order exchange platform where clients place orders using an automated estimate system and are matched with processing companies that meet their quality, cost, and delivery requirements. The platform had a client base of over 6,000 companies as of December 2020, with around JPY 1.09 million in completed transactions (including the seed round). The company plans to expand overseas by 2023, and tie-ups with private business operators in the Philippines may be up for discussion.

Figure 146. Examples of digital solutions

Weakness among manufacturing MSMEs	Potential digital solution	Examples
Low production efficiency due to high-mix, low-volume production: • Capabilities of individual factories vary and suppliers are fragmented • Small manufacturing capacity heavily reliant on manual labor **Supply and demand gaps:** • MSMEs are unable to effectively sell their own products • Buyers are unable to use different order processing methods **Having to process large numbers of estimates deprives MSMEs of the time they need to boost competitiveness (e.g. improve their technological capabilities or operation efficiency)**	**Online platforms to match demand and supply** • Ordering and estimates can be done quickly and easily online • Supplier information is stored in a database so that buyers can find the right supplier for their order • MSMEs can focus on their competitive edge, while increasing factory utilization rate and improving profitability	CADDi • Established in 2017 • Headquartered in Tokyo • Provides a web-based ordering platform that allows on-demand ordering of parts involving metal plate processing and cutting – Estimates generated automatically from CAD data – Automatically identifies the best supplier in terms of quality, price, and delivery • Client base of over 6,000 (including companies like Panasonic and Kawasaki Heavy Industries, Ltd.)

The roadmap below will likely be effective for popularizing digitalization in business management.

Figure 147. Example digitalization steps for manufacturing: Execution roadmap based on ROI and feasibility

	1. Dramatic productivity improvements	2. Transformation of existing businesses	3. New business model
Full utilization of digital and data	**Digitalization of work** • **Use cloud, AI, and other existing technologies to automate or eliminate the need for repetitive routine work, internal memos, e-mails, Excel, meetings, or minutes, documents, and so on** – Chat – RPA – SaaS apps – Natural language processing AI – Image-recognition AI and other technologies	**Marketing and sales** • Enhanced complaint management • Productivity improvement via a remote sales model **Purchasing** • Analytics-driven opportunity analysis • Supplier negotiation using cumulative cost analysis (clean sheet) **Manufacturing plants** • AI-driven preventative maintenance, inspections, production line design automation **Corporate management** • Management dashboard • Budget formulation/monitoring • Projected forecasts, action plans **Back office** • Utilization of digital platforms for various operations (finance, HR, legal, IT, etc.) **SCM** • Logistics vendor negotiation using cumulative cost analysis • AI-based demand forecasting/indication of delivery routes	**Digital sales (D2B)** • Full automation of marketing/sales/services • Aftermarket automation **Digital factory, SCM** • Full automation of design/manufacturing • Full automation of SCM (automated warehouses, drone dispatches, etc.) **Incorporating IoT into products** • Incorporating IoT into products, smartphone control • Suggesting/ordering consumables and maintenance services • Links to other companies' products, apps, smart speakers, etc.
Core systems	• **Weeding out unnecessary systems** • **Negotiating with vendors** • **Demand optimization (licensing, etc.)**	• **Optimizing IT investment:** Increasing investment efficiency in terms of business impact • **Apps:** Use of SaaS platforms	• **Infrastructure:** Relocate all infrastructure to the cloud

	1. Dramatic productivity improvements	2. Transformation of existing businesses	3. New business model
		• **Vendor sourcing:** Optimum combination of vendors (also utilize cloud services and startups)	• **Integration:** Use API to link internal and external systems • **Data:** Create a central master file, build an analytics engine • **Backbone:** Expand SaaS/PaaS utilization areas, optimize ERP expenditures • **Quality and security:** Strengthen security by forming a quality assurance team (using Zero Trust, for example)
Organizational capability		• **Agile delivery model:** Integrate business and IT teams, and speed up through daily releases of new functions, etc. • **Organizational capability:** Add new organizational capability through training or hiring (project owners, agile coaches)	• **Agile organization:** Introduce OKR management and form new teams including TRIBES, CHAPTERS, and SQUADS • **Organizational capability:** Add new capabilities including analytics translators, data scientists, designers, cloud engineers, and architects • **Automation:** Automate development and operations (DevOps)
	Year one	**Within two years**	**Within two or three years**

2.5.3 Identifying potential issues to assist

Given the digitalization approaches in the target sectors that were considered in the previous section, the team then looked at maturity level for the enablers required to drive this digitalization. It found that in the Philippines, there were challenges facing all four enablers.

Figure 148. Summary of potential issues to assist in the Philippines

Priority sector	Enablers	Assessment results	Potential issues to assist
Agriculture	**Capacity to formulate and implement policies**	Consistency with policy implementation plans needs improvement	G1 Aside from offshore IT services aimed at other countries, the Philippines appear to lack concrete action steps for promoting the growth of the domestic IT industry G2 There is room for improvement in terms of consistency with policy, and people seem to lack faith in the government
Manufacturing MSMEs	Communications infrastructure	Low technological penetration among rural farmers	I Low smartphone penetration and network coverage in rural areas
	Human resources	Lack of IT professionals (aside from traditional IT personnel)	T1 Few professionals who understand both agriculture and digital technology T2 Highly-skilled workers leave the country T3 The Philippines seem to lack sufficient advanced digital education at home
	Innovation ecosystems	The following stakeholders are key enablers that need to play a greater role in the innovation ecosystem • Startups and companies • Investors and supporters • Customers	E1: Lack of startups providing digital solutions for farmers and MSME manufacturers E2 Lack of outstanding companies motivated to build digital solutions for farmers and MSME manufacturers E3 Lack of investors and supporters E4 Lack of awareness among smallholder farmers and MSME manufacturers about the effectiveness of digital solutions and a lack of training in how to use them

Detailed results of the maturity survey are as follows.

(1) Survey of maturity in capacity to formulate and implement policies

According to a survey by the World Economic Forum, the Philippine government's vision did not place much importance on ICT as of 2014–2015. However, the Philippine government later greatly elevated the priority of ICT and is now engaged in the following kinds of initiatives--so it is likely that circumstances have changed.

- Department of Information and Communications Technology (DICT) established (2016): The government established DICT to take charge of policies related to ICT development and exercise

authority over digital transformation in the government. At the same time, the Department of Transportation and Communications (DOTC) was renamed the Department of Transportation, and the communications arm of the department was transferred to DICT

- National Broadband Plan (NBP) announced (2017): DICT announced a plan to improve internet speeds and reduce prices nationwide by rolling out fiber optic networks and wireless technologies

Regarding ICT regulations, the Philippines scored 75 points out of 100 on the 2020 ITU ICT Regulatory Tracker, indicating that the country is making solid progress relative to other countries.

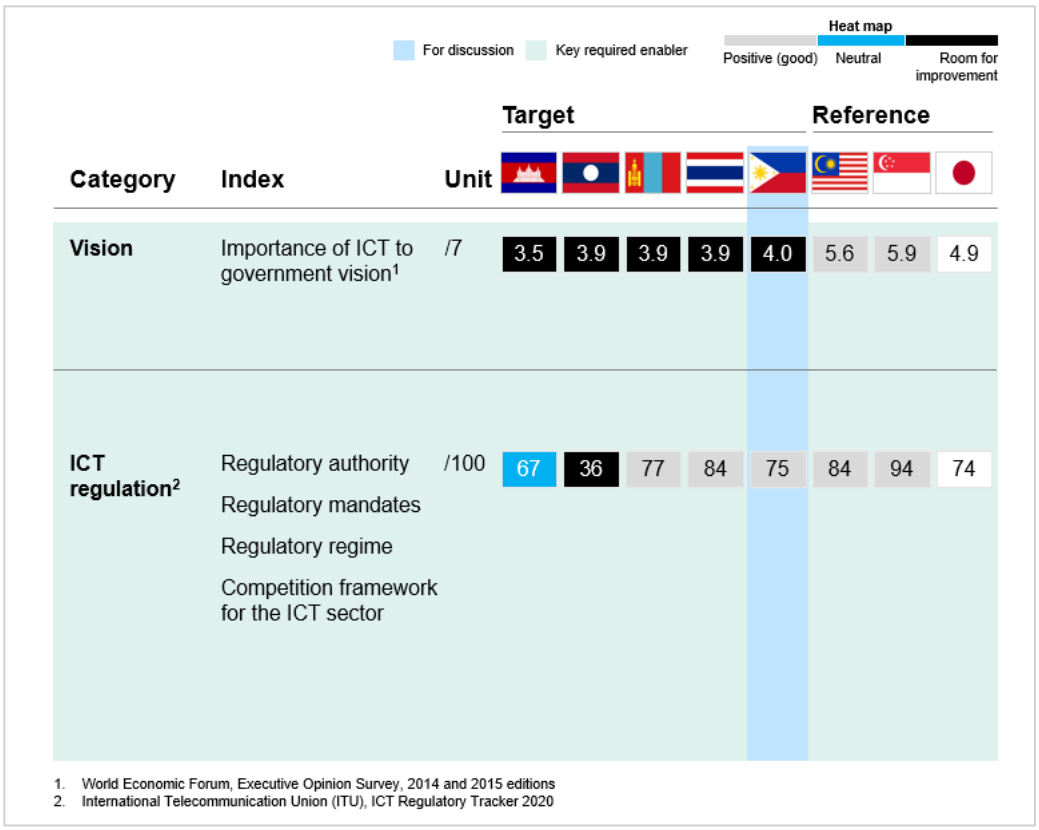


Figure 149. Maturity of capacity to formulate and implement policies

The team also received comments like these in interviews with experts and with staff at counterpart government agencies.

Figure 150. Capacity to formulate and implement policies: Potential issues to assist

Category (Required enablers)	Respondents	Comments, assessment results	Potential issues
Vision	**CEO of an agri-tech startup**	"I feel that the **government does have a certain vision to develop digital solutions** for the agriculture industry. For example, the DA has launched several apps over the last few years in order to connect famers with the market."	**No major issues found**
	DICT employee	"Since DICT was established, we have been working on formulating an ICT industry vision for the Philippines and promoting its	

Category (Required enablers)	Respondents	Comments, assessment results	Potential issues
		development. For example, we developed the Philippines digital economic steering committee with related agencies in order to make our industry more competitive."	
Policies and regulations	**CEO of a major local IT company**	"Policy assistance for the IT industry currently **focuses on offshore IT service providers** like PEZA1, and only provides tax breaks for these providers."	Aside from offshore IT services aimed at other countries, the Philippines appear to lack concrete action steps for promoting the growth of the domestic IT industry
	President of an agricultural cooperative	"There is **very little government intervention** when it comes to digitalization. There is no reward for using IT solutions, no reward for cooperatives that promote them, and no reward for companies to create digital solutions."	
	CEO of an agri-tech startup	"Policy assistance could be better thought-out. A law was recently passed to financially empower IT-related agriculture startups, but it's a **blanket provision** that hasn't yet yielded results"	
Execution	**Manufacturing MSME management**	**"I think there are problems with the consistency and reliability of our policies.** A year ago, for example, the president canceled a contract with our biggest water provider despite the fact that there were still ten years left, just because he thought it was 'disadvantageous and cumbersome'."	**There is room for improvement in terms of policy consistency**

Based on the above, the team identified the following potential issues to assist in terms of the capacity to formulate and implement policies.

- **Policy and ICT regulations:** Aside from offshore IT services aimed at other countries, the Philippines appear to lack concrete action steps for promoting the growth of the domestic IT industry
- **Implementation:** There is room for improvement in terms of policy consistency, which may be sapping private sector motivation

Still, DICT has recently begun initiatives like the ones below, and is working on policies to eliminate the digital divide and strengthen the digital economy.

- Introducing the **Connect, Harness, Innovate, and Protect (CHIP)** framework: DICT announced this framework, whose purpose is to establish a system for the Philippines' complete, inclusive participation in the global digital economy, in June 2021. CHIP aims to promote digital transformation through infrastructure development skill/literacy improvements and legal frameworks, promoting innovation, and strengthening cybersecurity and privacy protections.
- Promoting the **Technology for Education, Employment, Entrepreneurs, and Economic Development (Tech4ED)** project**:** This is a nationwide digital inclusion initiative that establishes

eCenters to provide critical e-government and ICT-enabled services in communities with minimal or no access to information or government services.

- Rolling out a **Central Business Portal:** The first phase of the rollout, which began in January 2020, was a platform that would allow citizens and business owners to access the forms and requirements necessary for registering their businesses. The purpose of the portal is to simplify and shorten the registration process.

Figure 151. DICT policies to enhance the digital economy (reference)

Program	CHIP	Tech4ED	CBP
Overview	• In February 2021, DICT adopted the Connect, Harness, Innovate and Protect (CHIP) framework, which is designed to put systems in place to foster the Philippines' participation in the digital economy. It is a DICT plan and policy overview for accelerating the Philippines' digital transformation in the post-pandemic era as well as a restructuring • **Connect** indicates a focus on building the infrastructure needed to ensure inclusive participation in the digital economy. **Harness** indicates a focus on analog reinforcements, including skills, literacy, and regulations. **Innovate** includes developing and expanding new economy services, business models, and digital entrepreneurship. **Protect** refers to activities to mitigate threats to cybersecurity and privacy	• The Technology for Education, Employment, Entrepreneurs, and Economic Development (Tech4ED) project is a nationwide digital inclusion initiative that establishes eCenters to provide critical **e-government** and **ICT-enabled services** in communities with minimal or no access to information or government services • The project promotes grassroots activities that **expand opportunities for inclusive growth and poverty reduction**. It will give communities access to information, communication, technology, government services, informal education, skills training, telehealth, job markets, and business portals	• The first phase of the Central Business Portal (CBP) kicked off on January 28, 2020. This is a platform to allow citizens and business owners to access the forms and requirements necessary for registering their businesses • The platform aims to not only reduce paperwork and written requirements, but also shorten the processing time for SEC and BIR registration from ten or more days to a maximum of three or four days • The government is aiming to launch the second phase of the CBP by the end of 2021

(2) Survey of communications infrastructure maturity

Below are the results derived from various metrics.

- With 4G network penetration at 80% in 2019, the Philippines has the second-lowest mobile broadband penetration rate of the eight target countries (including Japan, which was used as a benchmark). There is plenty of room for improvement (Laos scored lowest at 43%).
- Network connectivity costs in the Philippines (where 1GB of data is equivalent to 0.51% of per-capita GDP on average) are reasonable compared to countries like Laos and Cambodia, but still higher than other target countries in the study (Thailand: 0.20%, Malaysia 0.13%). Smartphones are also extremely expensive compared to other target countries (with one device equivalent to 70% of per-capita GDP on average), but the penetration rate is still 1.4 per person--meaning that most people in the Philippines have been able to get smartphones.
- Household coverage for fixed broadband is low at 35%, and there is room for improvement compared to other countries in terms of download speeds (38 Mbps), latency (23 ms), and connectivity costs (19% of per-person GDP on average).

For discussion | Key required enabler | Heat map: Positive (good) / Neutral / Room for improvement

	Indicator		Unit	Target					Reference		
Mobile broadband	Network	4G coverage[1] (/population)	%	93%	43%	82%	98%	80%	93%	100 %	99%
		Download speed[2]	Mbps	20.03	27.09	19.51	48	26.24	23.72	66.67	38.81
		Latency[2]	ms	32	31	36	28	31	34	22	44
		Mobile tariff [3](fee of 1GB/monthly GDP capita[4])	%	1.15%	1.94%	0.22%	0.20%	0.51%	0.13%	0.05%	0.12%
	Device	Smartphone penetration[5] (/population)	%	74%	35%	79%	111%	140%	115%	121%	120%
		Smartphone price[6] (/monthly GDP capita)	%	n/a	n/a	n/a	44%	70%	33%	9%	19%
Fixed broadband	Network	Household coverage [7]	%	6%	6%	61%	58%	35%	44%	112%	105%
		Download speed[2]	Mbps	27	39	43	218	38	93	239	141
		Latency[2]	ms	12	16	14	8	23	18	13	23
		Monthly subscription price [3] (/monthly GDP capita)	%	25%	25%	3%	4%	19%	3.7%	0.7%	1.5%

1. GSMA (2019), 2. Speedtest (Feb 2021), 3. Cable.co.uk (2020), 4. IMF (2020), 5. Omdia WCIS (2021), 6. StrategyAnalytics (2020), 7. Informa (2021)

Figure 152. Maturity of telecom infrastructure

The team also received comments like these in interviews with experts and with staff at counterpart government agencies.

Figure 153. Potential issues to assist in communications infrastructure

Category (Required enablers)	Respondents	Comments, assessment results	Potential issues
Mobile networks	**President of an agricultural cooperative**	"My understanding is that mobile coverage is around 80% of the total population. But I'm guessing that coverage for our farming population is less than 50%**,** since most networks only cover cities and coastal areas where there are few farmers"	**Low smartphone penetration and network coverage in rural areas** • Network coverage does not extend to agricultural areas • Smartphone prices are too high compared to average income • Farmers lack the skills and interest to use smartphones
	President of an agricultural cooperative	"Download speeds are not fast enough, even in urban areas like Greater Manila and Cebu. But things are improving since a new operator called DITO entered the telecom market, heating up competition in network development"	
Mobile devices	**CEO of a major local IT company**	"Smartphone penetration has got to be extremely low for rural farmers. Most of them are older and **don't know how to use IT**, and **average incomes are only around four or five thousand pesos**[2]. Smartphones are too expensive and don't mean much to them"	

1. The price of smartphones from local Philippine brands ranges from 5000 pesos to 15,000 pesos

Based on the above, the team identified the following potential issues to assist in the area of communications infrastructure maturity.

- **Mobile networks and mobile devices:** The Philippines faces poor network coverage in rural areas and low smartphone penetration. More specifically, there is no signal in agricultural areas, and smartphones are far too expensive given the average income of farmers. Nor do farmers have the skills or interest to learn how to use them.

Most manufacturing facilities are concentrated in Greater Manila, which has increasing broadband coverage. The manufacturing industry does not therefore appear to suffer from any major communication infrastructure challenges.

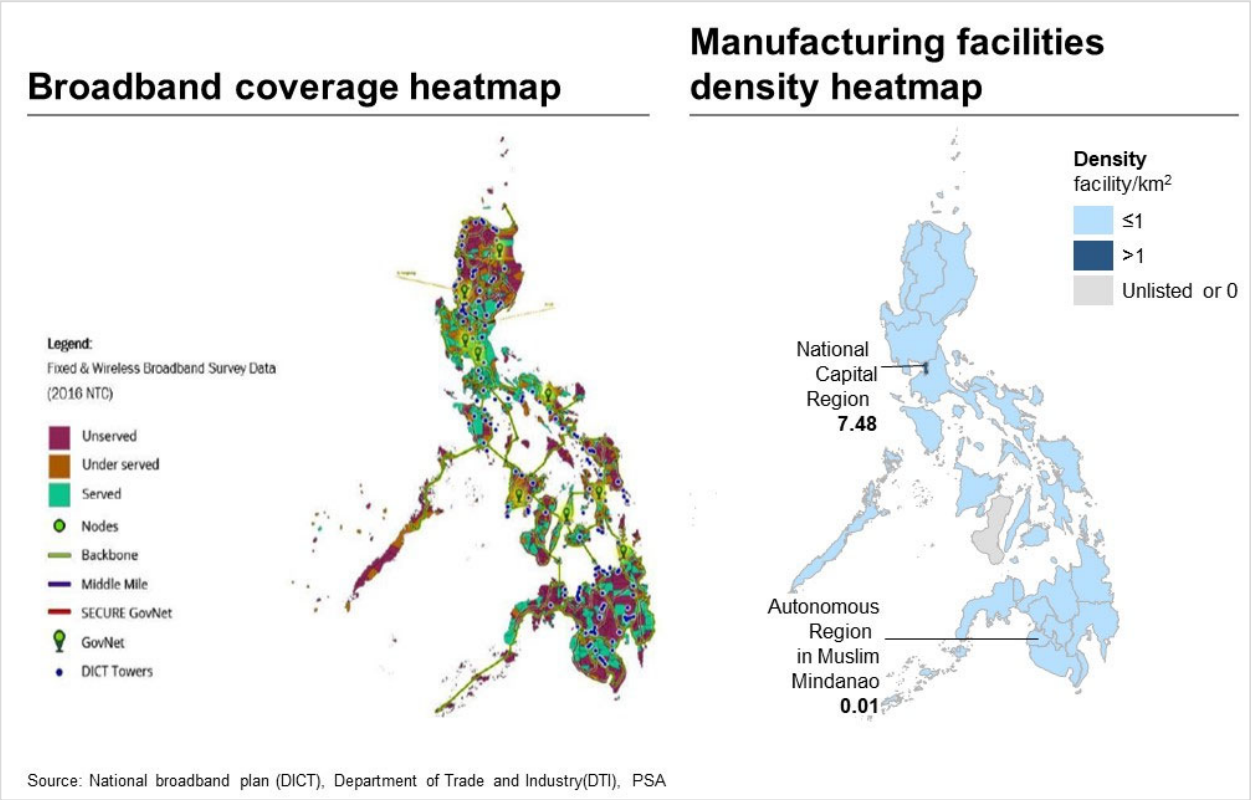


Figure 154. Heatmap of fixed broadband coverage vs. manufacturing plant density

(3) Survey of HR maturity

The ICT sector employs 0.9% of professionals in the entire working population of the Philippines, which is the third-lowest among the eight target countries (including Japan, which was used as a benchmark). The figure for Thailand is 1.1%, Mongolia 1.1%, and Japan 1.5%. Further, when the team analyzed hiring information in LinkedIn, the found that 80% of ICT workers were IT engineers and that few were digital engineers.

When the team used the two scenarios described in the review process in 2.1.2 to estimate demand for ICT professionals in the Philippines in 2030, they calculated 780,000 people under Scenario 1 (where demand for both digital engineers and IT engineers continues to grow at the same rate it has in recent years--with the expectation that the industry's current structural focus on offshore IT services will be maintained). Under Scenario 2, where the industry structure is expected to shift to a focus on digital talent as in Singapore, and Singapore figures were used for the ratio of digital engineers to IT engineers, the team calculated a demand of 830,000 professionals. It is likely that the true number will fall somewhere between those two figures. Given that the market already has a high availability of IT engineers, the Philippines will need to consciously focus on training digital translators and digital engineers (including by reskilling its IT engineers) under either scenario.

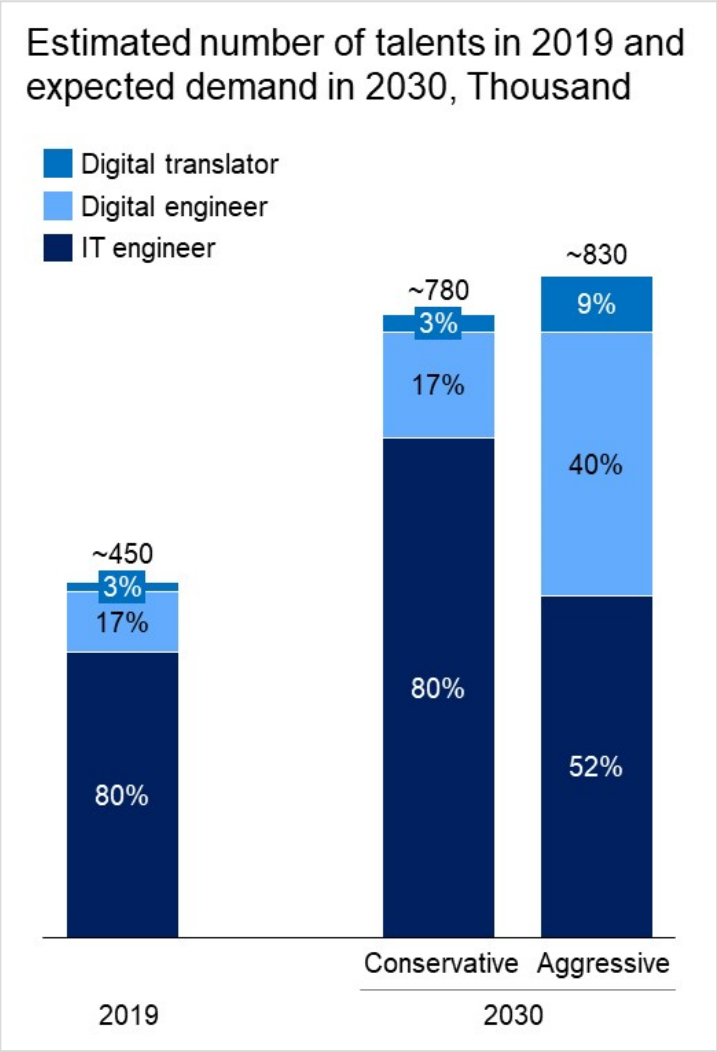


Figure 155. Demand for ICT professionals in the Philippines

The team also received comments like these in interviews with experts and with staff at counterpart government agencies.

Figure 156. Potential issues to assist in human resources

Category (Required enablers)	Respond-ents	Comments, assessment results	Potential issues
Digital translators	**CEO of an agri-tech startup**	"There are very few digital engineers who have a good understanding of agribusiness. For example, building e-commerce sites has recently become very popular with smart agriculture entrepreneurs, since it seems easy to monetize. However, **very few people understand the entire agricultural value chain** or the massive hidden potential on the production side"	**Few professionals who understand both agriculture and digital technology:** There are not enough people able to provide sweeping solutions for agriculture

Category (Required enablers)	Respond-ents	Comments, assessment results	Potential issues
Digital engineers	**CEO of a major local IT company**	**"Brain drain is a serious problem in the Philippines**. Since English is one of our official languages, there are virtually no barriers to our best talent to earn much higher wages abroad in the Middle East, Russia, or the US"	**Outflow of highly-skilled workers:** Top talent tends to look for better job opportunities overseas **The Philippines seem to lack sufficient advanced digital education at home**
	DICT employee	**"We have started several initiatives to develop advanced IT professionals**, such as offering master's degrees to government CIOs, strengthening IT capabilities among management, and offering short IT courses to both the public and private sectors--particularly to MSMEs with PUs"	
	President of an agricultural cooperative	"Advanced digital education in the Philippines is in its infancy. For example, only a few top institutions like AIM or UP[1] offer a data science major"	
IT engineers	**Vice president of a major IT company**	**"Offshore IT services are the third-largest industry in the Philippines, so we have more than enough IT engineers**"	**No major issues found**

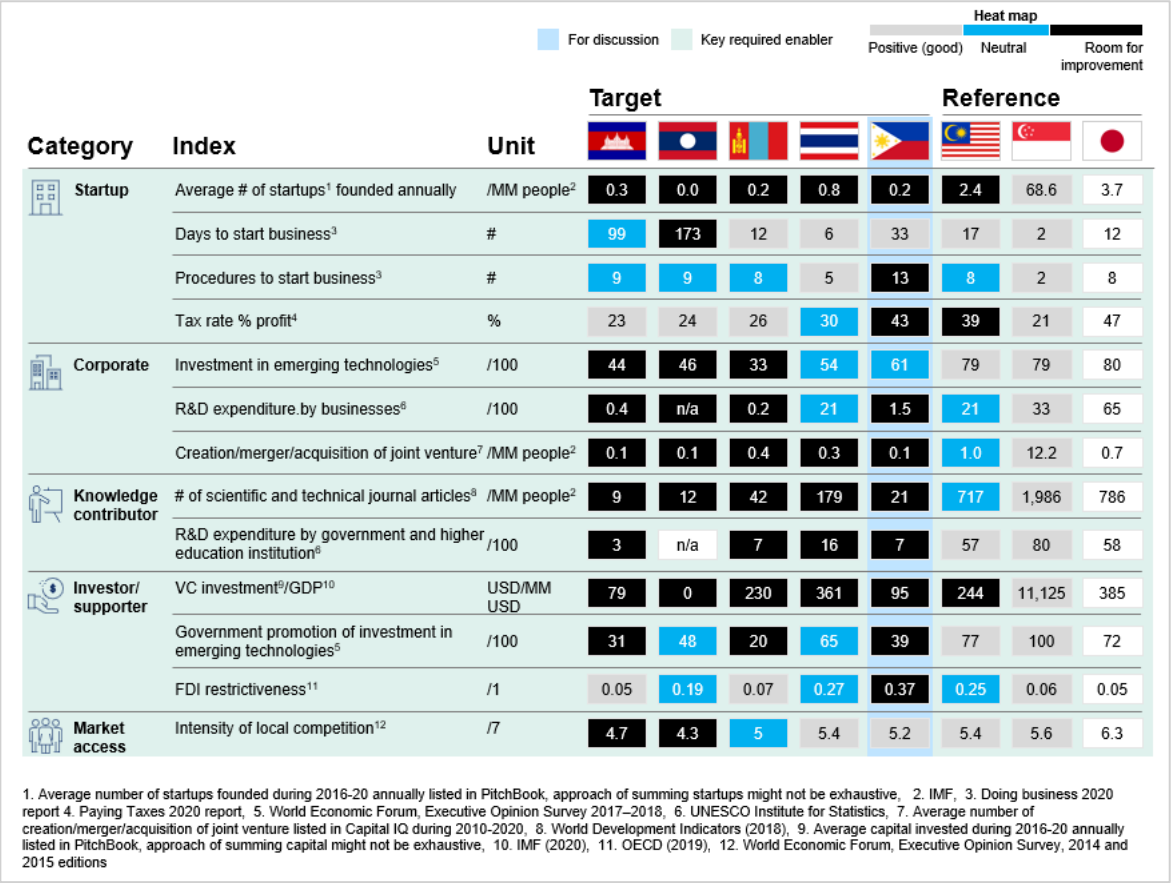
Based on the above, the team identified the following potential issues to assist in the area of HR maturity.

- Few professionals who understand both agriculture and digital technology enough to provide sweeping solutions for agriculture
- Highly-skilled workers leave the country
- The Philippines seem to lack sufficient advanced digital education at home

(4) Survey of maturity of the innovation ecosystem

Below are the results derived from various metrics.

- Startups: According to PitchBook, there are few startups established each year in the Philippines given its population. This may be due to the amount of red tape involved in starting a business compared to other countries (there are sixteen procedures) and the high corporate tax rate (43%).
- Corporate: Companies rarely take the initiative to invest in R&D or collaborate with one another (by establishing joint ventures, for example).
- Knowledge contributors: Governments and higher education institutions only make limited investments in R&D, which is a problem in terms of their contribution to innovation.
- **Investors and supporters:** VC investment is lower than in other target countries as a percentage of GDP, and the government does not do enough to promote investment in new technologies. There are also a lot of restrictions around direct foreign investment.
- **Market access:** There is enough healthy market competition to encourage innovation.



Category	Index	Unit								
Startup	Average # of startups[1] founded annually	/MM people[2]	0.3	0.0	0.2	0.8	0.2	2.4	68.6	3.7
	Days to start business[3]	#	99	173	12	6	33	17	2	12
	Procedures to start business[3]	#	9	9	8	5	13	8	2	8
	Tax rate % profit[4]	%	23	24	26	30	43	39	21	47
Corporate	Investment in emerging technologies[5]	/100	44	46	33	54	61	79	79	80
	R&D expenditure by businesses[6]	/100	0.4	n/a	0.2	21	1.5	21	33	65
	Creation/merger/acquisition of joint venture[7]	/MM people[2]	0.1	0.1	0.4	0.3	0.1	1.0	12.2	0.7
Knowledge contributor	# of scientific and technical journal articles[8]	/MM people[2]	9	12	42	179	21	717	1,986	786
	R&D expenditure by government and higher education institution[6]	/100	3	n/a	7	16	7	57	80	58
Investor/ supporter	VC investment[9]/GDP[10]	USD/MM USD	79	0	230	361	95	244	11,125	385
	Government promotion of investment in emerging technologies[5]	/100	31	48	20	65	39	77	100	72
	FDI restrictiveness[11]	/1	0.05	0.19	0.07	0.27	0.37	0.25	0.06	0.05
Market access	Intensity of local competition[12]	/7	4.7	4.3	5	5.4	5.2	5.4	5.6	6.3

1. Average number of startups founded during 2016-20 annually listed in PitchBook, approach of summing startups might not be exhaustive, 2. IMF, 3. Doing business 2020 report 4. Paying Taxes 2020 report, 5. World Economic Forum, Executive Opinion Survey 2017–2018, 6. UNESCO Institute for Statistics, 7. Average number of creation/merger/acquisition of joint venture listed in Capital IQ during 2010-2020, 8. World Development Indicators (2018), 9. Average capital invested during 2016-20 annually listed in PitchBook, approach of summing capital might not be exhaustive, 10. IMF (2020), 11. OECD (2019), 12. World Economic Forum, Executive Opinion Survey, 2014 and 2015 editions

Figure 157. Innovation ecosystem maturity

The team also received comments like these in interviews with experts and with staff at counterpart government agencies.

Figure 158. Potential issues to assist in innovation ecosystems

Category (Required enablers)	Respond-ents	Comments, assessment results	Potential issues
Startups	**President of an agricultural cooperative**	**"It's not an industry where smart agriculture is very popular. It's my understanding that there are fewer than ten companies offering digital services to Philippine farmers via smart apps. Most startups focus more on the ecommerce and market side of agriculture"**	**Lack of startups providing digital solutions for farmers and MSME manufacturers**
	CEO of a leading local IT company	"The Philippines has a great environment for startups, so there are quite a few of them. However, **we haven't seen many IT companies succeed here yet"**	
	CEO of an agri-tech startup	"The Department of Trade and Industry actually has a mentor program. They teach small business owners how to run a business, though they don't necessarily focus on digital"	

Category (Required enablers)	Respond-ents	Comments, assessment results	Potential issues
Corporate	**CEO of a small food manufac-turer**	"Nexus Technologies, Inc. and Coverage ICT Solutions Inc. are the big names among local IT companies. But there still **aren't enough good IT companies that can provide IT solutions to MSMEs**"	**Lack of outstanding companies motivated to build digital solutions for farmers and MSME manufacturers**
	CEO of an agri-tech startup	"Conglomerates have started to invest in startups through their own accelerator programs, but it's still on a small scale. Also, their **purpose is to prevent disruption and reinvent themselves** by outsourcing innovation to startups, rather than to create digital solutions for themselves"	
Know-ledge contribut-ors	**DICT employee**	"We've launched an AI roadmap in collaboration with DTI, and are actively leading the way in cutting-edge tech adoption in the ICT industry by organizing block chain webinars, for example"	**No major issues found**
Investors and supporters	**President of an agricultural cooperative**	"The government does provide low-interest loans up to 500,000 pesos and other financial assistance for agriculture startups, but this **assistance doesn't focus on digital-related startups**"	**Lack of investors and supporters** Examples: • The government has begun providing financial assistance, but it is still not directly related to digital • Investors are sluggish compared to other countries • There aren't enough investment-related events
	CEO of a leading local IT company	"**There are very few incubators or startup events in the Philippines**, so a lot of startups choose to go to neighboring Thailand or Malaysia to attend them"	
	CEO of an agri-tech startup	"**Government assistance used to be limited, but this has changed recently.** For example, the government recently approved a policy to establish a fund to assist startups. The fund makes it possible for a startup to get between USD 100,000 and 500,000. That means that five or ten startups could have access to the fund" "Philippine investors are relatively motivated, but not as active as those in Malaysia or Cambodia. Also, they tend to only invest in startups that have graduated from incubators and are already in the scaling-up phase"	
	Department of Agriculture employee	"**Government does not pay enough attention to the agri-tech sector.** As far as we know, DICT does have funds earmarked to develop ICT, but there is a limited budget for agri-tech"	
Market access	**CEO of an agri-tech startup**	"The most important factor in promoting digital solutions to farmers is **awareness**. A typical farmer will have no interest in using technology at first, because they have **no idea how beneficial it is or how to use it**. Because of that, we have to spend an average of three or four months to get farmers on board with using our digital solutions"	**Lack of awareness among smallholder farmers and MSME manufacturers about the effectiveness of digital solutions and**

Category (Required enablers)	Respond-ents	Comments, assessment results	Potential issues
	CIO of a leading local bank	"There are two main reasons why most manufacturing MSMEs **don't recognize the potential of digital solutions** aside from the market aspect. The first is that they lack an interest in IT solutions, and the second is that there aren't any companies or organizations promoting the benefits to them"	**a lack of training in how to use them**

Based on the above, the team identified the following potential issues to assist in the area of HR maturity.

- **Startups:** Lack of startups providing digital solutions for farmers and MSME manufacturers
- **Corporate:** Lack of companies motivated to build digital solutions for farmers and MSME manufacturers
- **Investors and supporters:** Lack of investors and supporters
- **Market access:** Lack of awareness among smallholder farmers and MSME manufacturers about the effectiveness of digital solutions and a lack of training in how to use them

2.5.4 Formulating assistance programs

(1) Assess potential issues

Following the approach mentioned above, we assessed the potential issues based on: (1) impact anticipated from solving the issue; (2) our counterparts' level of interest; and (3) JICA'S interests. The results are as follows. On the right side of the diagram are the issues that are expected to have a large impact if they are resolved, while issues of greatest interest to our counterparts are positioned on the top row of the diagram. Based on (1) and (2), the issues JICA prioritizes for assistance programs are highlighted in gray (E: innovation ecosystems; G: government policymaking; I: infrastructure building; T: training talent).

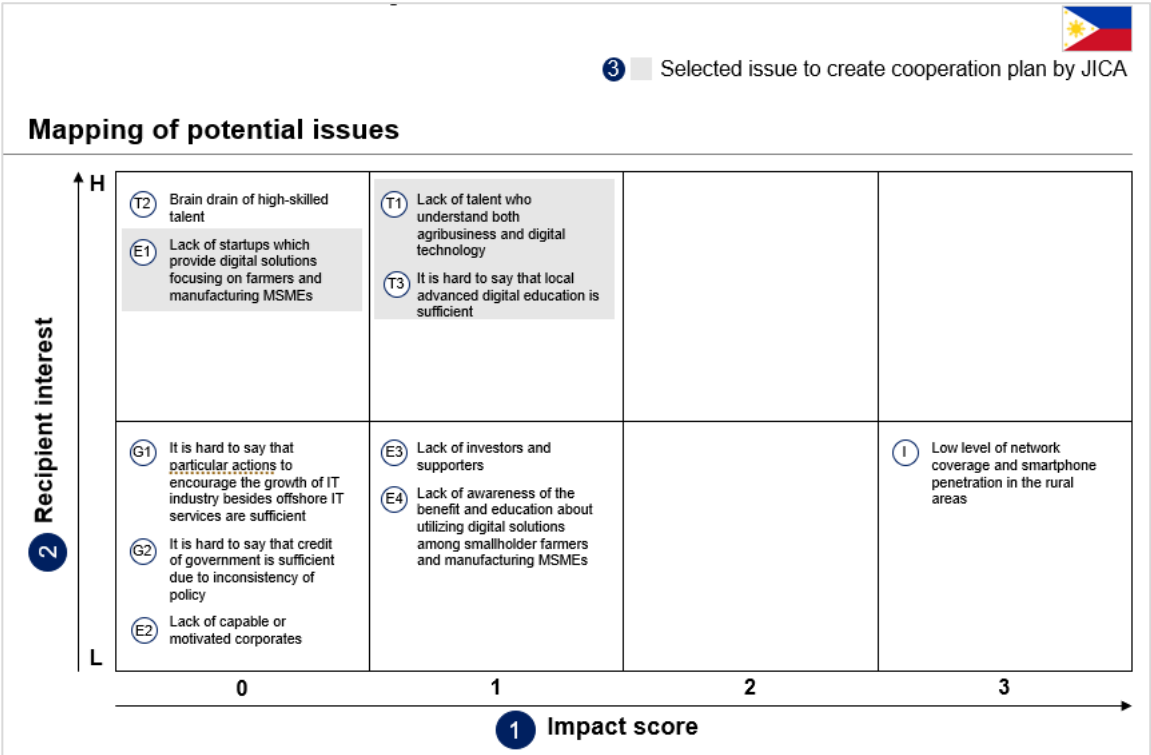


Figure 159. Assessment of potential issues

Below is a detailed explanation of the assessment based on each of the above three perspectives.

(1)-1 (1) Impact expected from solving the issue

Using the method outlined in the review process in 2.1.2, the team scored the expected impact of solving each potential issue and found it to be relatively high (score of 2 or 3) for the following issues.

- Low smartphone penetration and network coverage in rural areas

(1)-2 (2) Counterpart interests

Our counterpart DICT, on the other hand, expressed an interest in assistance for the following four issues.

- Few professionals who understand both agriculture and digital technology
- The Philippines seem to lack sufficient advanced digital education at home
- Highly-skilled workers leave the country
- Lack of startups providing digital solutions for farmers and MSMEs

We received the following comments from our counterpart on each of these issues.

Figure 160. Counterpart interests

C/P[1] interest level	Potential issues to assist	C/P comments
High	T1 Few professionals who understand both agriculture and digital technology	"The various training programs from JICA have benefited DICT, so we'd like to get its assistance

C/P[1] interest level	Potential issues to assist	C/P comments
	T3 The Philippines seem to lack sufficient advanced digital education at home	in capacity development initiatives for emerging technologies in the same way"
	T2 Highly-skilled workers leave the country	"**Stopping the brain drain in advanced technology fields** is also one of our priorities"
	E1 Lack of startups providing digital solutions for farmers and MSME manufacturers	"We would love it if JICA could help us **set up more advanced courses for startups**, sharing best practices from Japan and other countries"

1. Counterpart

(1)-3 (3) JICA's interests

The team mapped potential issues to assist based on the expected impact of resolving them and counterpart interest.It then selected priority issues to consider as JICA assistance programs. The following three potential issues were selected.

- Few professionals who understand both agriculture and digital technology
- The Philippines seem to lack sufficient advanced digital education at home
- Lack of startups providing digital solutions for farmers and MSMEs

Infrastructure issues were also expected to have a high impact, but they were excluded from this survey because they are already being seriously considered by JICA.

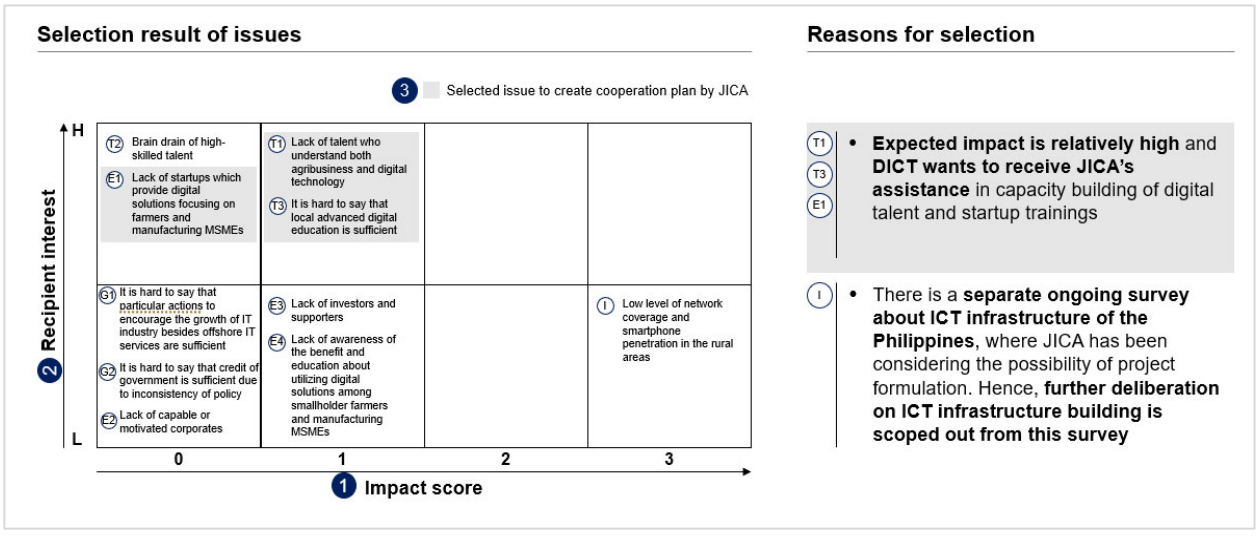


Figure 161. Selection of priority issues

(2) Draft assistance and solution proposals for potential issues

(2)-1 Formulating JICA assistance programs for priority issues

This section outlines JICA assistance programs for each of the priority issues.

Lack of professionals who understand both agribusiness and digital technology

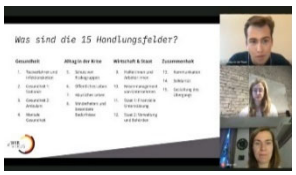
Below is a list of global best practices identified through reviews of reference projects (from other donors, for example) and expert interviews.

- Hold hackathons where agriculture, business, and tech talent co-create solutions
- Host lectures and learning sessions at university agricultural departments, bringing in business, startup, and tech talent to teach students entrepreneurial skills
- Utilize secondment/mentorship: Exchange talent between large agricultural/manufacturing cooperatives and IT corporations
- Establish digital learning academies: Reskill agricultural workers, training them to popularize digital tools and solutions

The WiVsVirus hackathon hosted by the German government is a good reference example. The event was held as a way to develop digital solutions for everyday life during the pandemic with two key characteristics:

- People of various backgrounds from all over the world participated, exchange ideas across occupational barriers (the event was attended by more than 40,000 people and about 3,000 mentors)
- The winners of the Hackathon received both financial and implementation assistance from the government

Figure 162. Best practice: WerVsVirus (We Vs. Virus) hackathon hosted by the German government

Initiative		
Purpose	• To find digital solutions for a variety of everyday situations encountered during the pandemic	  
Key activities	• **The hackathon was open to people of all backgrounds around the world** and entry forms could be completed online • The hackathon was organized online instead of in a physical location to prevent viral spread • The participants organized themselves based on topics they were interested, and mentors facilitated their discussion groups • Teams tackled specific challenges like coronavirus tracking, and mental health during isolation over a two-day period and came up with proposals through discussion • A panel of judges selected projects to receive follow-up assistance	
Out-comes	• More than 42,869 people participated along with 2,922 mentors. Participants worked on 810 projects organized around 49 topics • Winning projects selected by the panel received funding and implementation assistance from the government	

Initiative		
Features	• **Massive collaboration among people from different backgrounds**, including data scientists, entrepreneurs, researchers, and tech professionals) • **Winners received implementation assistance along with funding**	

The Philippines seem to lack sufficient advanced digital education at home

Below is a list of global best practices identified through reviews of reference projects (from other donors, for example) and expert interviews.

- Establishing digital academies: Roll out nationwide educational facilities to teach people with tech backgrounds how to use the latest technologies and boost performance
- Establish academic departments to teach the latest technologies
- In implementing the above initiatives, simultaneously consider reallocating/increasing government educational budgets

The best approach with digital learning academies is to go beyond classroom learning and have students simultaneously apply what they learn while providing them with opportunities to get feedback. The following strategies, which are based on behavioral science, can be used to facilitate this process. First, content must be presented in short segments to maintain high learning outcomes. Second, learning should utilize smartphones and other mobile devices to take advantage of small time windows. Third, strategic interventions should be carried out to properly guide students and boost engagement. Fourth, programs should be tailored to individual needs and promote independent study.

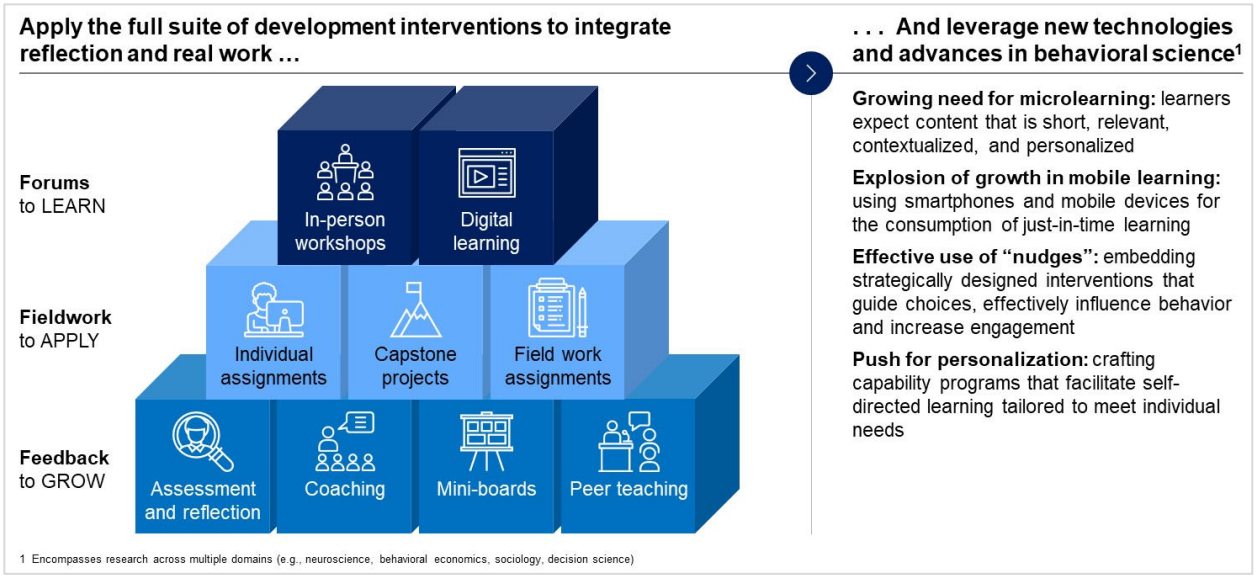


Figure 163. Establishing a digital learning academy

Lack of startups providing digital solutions for farmers and MSMEs

Below is a list of global best practices identified through reviews of reference projects (from other donors, for example) and expert interviews.

- Hold targeted events to raise awareness: Make entrepreneurs aware of the potential for digital solutions in agriculture and manufacturing, or hold events that give farmers and MSMEs an understanding of the benefits of digital solutions
- Promote the establishment of accelerators that focus on the development of solutions for agricultural workers or MSME manufacturing workers, encouraging the launch of startups and growth in those industries
- Provide incentives for startups to provide digital solutions to agricultural workers or MSME manufacturing workers (accelerate the business registration process, help startups procure funding, etc.)

The incentives that the Singapore government provides to startups are good reference examples. In financing, for example, there is a program where startups can get a certain amount of funding from the Singapore government depending on how much investment they've otherwise been able to procure. In terms of human resources, the government not only issues visas, but also helps bear a portion of the cost of salaries so that startups can secure exceptional talent. Under the SME Talent Program (STP), for example, the Singapore government provides grants to cover up to 70% of the cost of salaries when startups hire student interns. Singapore offers extensive assistance in the area of working capital as well. Startups in their first three years can get huge tax breaks (a **75% exemption** on their first SGD 100,000 of taxable income and a **50% exemption** on their next SGD 100,000), for example, and SMEs can easily secure loans from the government for working capital or capital investment.

Because there is not a lot of startup activity that targets agricultural or MSME manufacturing workers at present, assist measures like the ones described above could be specifically targeted to those areas as a means of stimulating relevant initiatives.

Figure 164. Initiatives by the Singapore government

Type of assistance	Overview
Funds	The Singapore government co-invests with private investment partners • For startups that are **improving existing technologies**, the government **provides 70% of the funding** in an initial investment round (up to SGD 250,000) and will match every SGD from private investors thereafter up to SGD 2 million. • Startups classified as "deep tech" can get **70% of their funding** from the government in an initial investment round (up to SGD 500,000). The government will then match every SGD from private investors thereafter up to SGD 4 million. Finally the government invest three SGD for every seven secured from private investors up to SGD 8 million. The government provides several grants for project funding as well as funds to new entrepreneurs based on their projects and the amount raised by the startups

Type of assistance	Overview
People	• Schemes include EntrePass, T-UP, and the SME Talent Programme (STP) for startups • EntrePass encourages **global entrepreneurial talent** to come to and stay in Singapore • T-UP and STP help startups hire from top universities to build their in-house R&D capabilities by helping them cover the cost of salaries The government helps cover the cost of **incubation teams and the hiring of mentors and experts** to guide startups
Operations	New startups are given a **75% tax exemption** on the first SGD 100,000 of taxable income and a **50% exemption** on the next SGD 100,000 during their first 3 years in business Singapore provides government-backed loans, which give startups much-needed working capital, equipment/factory financing, and trade financing

Summary

Based on the above, JICA could consider the following assistance programs for the Philippine government.

Figure 165. Overview of assistance programs for the Philippines: Training digital translators and digital talent, and promoting the development of solutions for farmers and manufacturing MSMEs

Program overview	Expected impact	Cost estimate via outside-in study
Institutions receiving assistance: • DICT **Target assistance activities:** • Train digital translators and digital talent at digital learning academies • Promote digital solutions for farmers and small manufacturing enterprises	**Improve the quality and quantity of educational institutions that train digital talent in the Philippines, and improve the quality and quantity of native digital talent** Make Philippine industries more competitive • Strengthen competitiveness in the IT and IT BPO industries • Propel the development of advanced, industry-oriented digital solutions (e.g. smart agriculture) **Establish superior digital solutions for farmers and small manufacturing enterprises** • Encourage higher quality and lower prices through competition between companies	**Total project cost estimate[1]: JPY 100 millions** • Labor costs and overhead • Training expenses (teaching materials, venues, etc.)

Program overview	Expected impact	Cost estimate via outside-in study
	• Offer different options at various points along the supply chain **Promote digitalization and improve productivity among farmers and small manufacturing enterprises** • Promote digitalization as a way to solve common issues associated with traditional manual labor • Eventually increase income	

1. These estimates reflect all costs needed to implement the project, and do not necessarily match JICA assistance amounts

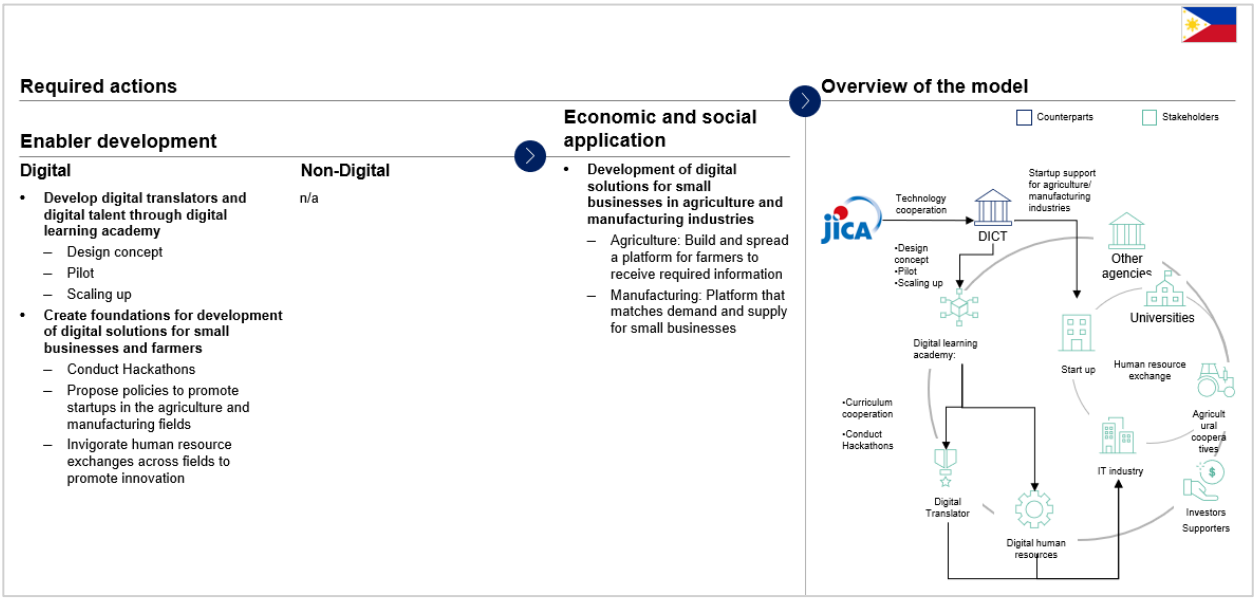


Figure 166. Overview of activities needed to maximize impact

Figure 167. Activity details: Developing talent and startups

Category	Steps	Activity details			Applicable JICA scheme	Considera-tions
		CIP	Other stakeholders	JICA		
Enablers: digital	Train digital translators and digital talent at digital learning academies	**DICT** • Design and launch a digital learning academy concept to train digital translators and digital talent, particularly in key target	**Ecosystem players** • (incubators, universities, tech companies, agricultural cooperatives, manufacturers, etc.) Suggest essential business	Assist the design of digital academies	Technical cooperation	Collaboration with innovation ecosystem players is critical

Category	Steps	Activity details			Applicable JICA scheme	Considera-tions
		CIP	Other stakeholders	JICA		
		sectors (agriculture and manufacturing)	content to be included in the curriculum and help out as instructors as well			
		DICT • Use pilot programs to test concepts		Assist pilot implementation	Technical cooperation	
		DICT • Promote courses and expand (consider using incentives as well)		Assist policy considera-tions related to promoting courses and expansion	Technical cooperation	Prevent trained pro-fessionals from finding work overseas
	Lay the ground-work for promoting digital solutions for farmers and MSMEs	**DICT** • Hold co-creation hackathons for various people working in the background (key aims: promoting the development of digital solutions to problems faced by farmers and manufacturing MSMEs, professional development for digital translators and others)		Assist hackathon events	Technical cooperation	
		DICT • Formulate policies to promote startups in the agricultural and manufacturing sectors		Policy-making assistance	Technical cooperation	

Category	Steps	Activity details			Applicable JICA scheme	Considera-tions
		CIP	Other stakeholders	JICA		
		DICT • Formulate policies to stimulate cross-sectoral professional exchanges to encourage innovation		Policy-making assistance	Technical cooperation	
Enablers: non-digital	Build road infrastruc-ture and distribution channels	**Related ministries** • Build road infrastructure and distribution channels		Fund the develop-ment of infrastruct-ure	Loan assistance or grant assistance Collaboration	
Apply to economic and social develop-pment	Develop digital solutions for farmers and small manufac-turing enterprises	**Department of Agriculture (DA)** • Develop and popularize a platform to get farmers the information they need		Assist platform develop-ment	Technical cooperation	Because the counterparts are different than the ones for digital enabler projects, counterpart coordination is essential for implementing any given project
		Department of Trade and Industry (DTI) • Supply and demand matching platform for small manufacturers		Assist platform develop-ment	Technical cooperation	Because the counterparts are different than the ones that assist digital enablers, counterpart coordination is essential for implementing any given project

(2)-2 List of initial solution proposals for potential issues that are outside priority issues

Below are initial solution proposals for potential issues that are not counted among the priority issues above.

Figure 168. Possible solutions for potential issues (capacity to formulate and implement policies)

Category	Potential issues to assistance	Possible solutions	Background
Policies and regulations	G1 Aside from offshore IT services aimed at other countries, the Philippines appear to lack concrete action steps for promoting the growth of the domestic IT industry	• Benchmark current regulations and policies against regional/global best practices • Provide the assistance needed for digitalization	• Policy assistance for the IT industry is currently **focused on offshore IT service providers**
Execution	G2 There is room for improvement in terms of consistency with policy, and people seem to lack faith in the government		• A year ago, the president canceled a contract with the largest water provider in the Philippines, ten years before it was scheduled to expire

Figure 169. Possible solutions for potential issues (communications infrastructure)

Category	Potential issues to assist	Possible solutions	Background
Mobile networks **Mobile devices**	**I:** Low smartphone penetration and network coverage in rural areas — No network coverage in agricultural areas — Smartphone prices are too high compared to average income — Farmers lack the skills and interest to use smartphones	• Increase 4G network coverage, making sure that upload and download speeds are sufficient — Base stations — Equipment — Transmission • Promote the spread of devices in rural areas (refer to the following examples) — Encourage device purchases: By migrating users from feature phones to smartphone, network operators can terminate assistance for older technologies (e.g. 2G), which will lead to lower network management costs — Install **shared devices** in public facilities — **Offer free or inexpensive broadband access** • Educate and spread awareness about how to use smartphones for economic and social activities	• Most farmers are older and do not know how to use technology, and average incomes are only around four or five thousand pesos a month

Figure 170. Possible solutions for potential issues (talent)

Category	Potential issues to assist	Possible solutions	Background
Digital translators **Digital engineers**	T1: Few professionals who understand both agriculture and digital technology	• **Hackathons** where agribusiness and engineers co-create solutions • **Host lectures and learning sessions at university agricultural departments, bringing in business, startup, and tech talent** to inspire students and teach them entrepreneurial skills • Secondment/mentorship: Exchange talent between agricultural/manufacturing and IT companies • **Digital learning academy**: Reskill farmers so they are able to translate their needs and communicate with digital engineers – Primary target profile: Relatively young farmers with an interest in digital Agriculture – Goal: Improve basic digital literacy in the industry and encourage people to adopt the existing digital applications that target it	• **Very few tech professionals understand the entire agricultural value chain** or the massive hidden potential on the production side
	T2: **Outflow of highly-skilled workers:** Top talent tends to look for better job opportunities overseas	• **Create an ecosystem to develop and hire talent at home**: Partner educational institutions with companies in the Philippines (e.g. those that provide high-quality internships as part of degree programs and hire top students immediately after graduation) • **Explore a variety of retention mechanisms,** such as offering scholarships requiring recipients to take jobs in-country, or incentives to stay in the Philippines (e.g. job opportunities, training, social services) Note: Partner companies provide job opportunities in Malaysia, but scholarships are an effective incentive for preventing brain drain in Morocco.	• Since **English is one of the official languages** in the Philippines, there are **virtually no barriers** to top talent earning much higher wages abroad in the Middle East, Russia, or the US
	T3 The Philippines seem to lack sufficient advanced	• **Digital learning academies**: Retrain tech professionals in the latest technologies and practices to	• Advanced digital education in the Philippines is in its infancy

Category	Potential issues to assist	Possible solutions	Background
	digital education at home	improve performance nationwide • Establish majors/departments at various educational institutions to teach the latest technologies • Secure sufficient funding for the above activities • Reallocate the current government education budget from traditional digital education to advanced digital education • Increase the government budget for advanced digital education to create more opportunities in the field	

Figure 171. Possible solutions for potential issues (innovation ecosystems)

Category	Potential issues to assist	Possible solutions	Background
Startups	E1: Lack of startups providing digital solutions for farmers and MSME manufacturers	• **Host targeted events to raise awareness** – Make entrepreneurs aware of the potential for digital solutions in agriculture and manufacturing – Give farmers and MSMEs an understanding of the benefits of digital solutions • Create accelerators focused on agricultural and manufacturing SMEs to establish and grow startups in those domains • Provide incentives to IT startups that provide digital solutions to farmers and MSMEs – Accelerate the business registration process – Help startups get financing (e.g. provide low-interest government loans or government funding)	
Companies	E2 Lack of outstanding companies motivated to build digital solutions for farmers and MSME manufacturers	• **Introduce tech solutions proven in other markets:** Help companies establish relationships with foreign tech solution companies • **Encourage companies to invest more in startups working on**	• Conglomerates have started to invest in startups through their own accelerator programs, but it is still small in scale

Category	Potential issues to assist	Possible solutions	Background
		agri-tech and manufacturing solutions • **Build interdisciplinary partnerships among government, business, and academic players** to create innovative solutions that leverage the resources of each	
Investors and supporters	E3 Lack of investors and supporters	• Create an environment that **attracts investors and supporters, including overseas players** — Create a platform where international funds and supporters can easily access Philippine startups — Hold a global roadshow to assist promising Philippine startups — Tailor incentives to individual investor interests (e.g. sustainable development) to attract mission-driven investors • **Further expand government financial assistance** by establishing public venture capital and subsidizing local startups	• The government has begun providing financial assistance, though it is not directly tied to digital activities • Investors are not sufficiently motivated compared to other countries • There are not enough investment-related events
Market access	E4 Lack of awareness among smallholder farmers and MSME manufacturers about the effectiveness of digital solutions and a lack of training in how to use them	• Raise awareness of digital solutions — Hold events such as expos of latest agri-tech and manufacturing solutions for farmers and MSMEs — Use event participants as evangelists to promote available digital tools and solutions to others • Conduct pilot activities to create successful digital solution use cases for the industry (by effectively providing government policies and risk money, for example)	• Most farmers and manufacturing MSMEs do not realize the potential of digital solutions

2.6 Considering assistance programs for Thailand

2.6.1 Basic country information

Thailand is a Southeast Asian country whose landmass occupies the central part of the Indochinese Peninsula and the northern half of the Malay Peninsula. It shares borders with Malaysia, the Kingdom of Cambodia, the Lao People's Democratic Republic, and the Republic of the Union of Myanmar. The country covers 510,890 km^2 and has a population of about 70 million people, giving it a population density of 136.92 people per square kilometer.

The vast majority of people are ethnically Thai as well, with smaller populations of people of Chinese and Malay descent. The country is 94% Buddhist and 5% Catholic. Thailand's population is aging, with people 65 and older making up 13% of the total population in 2020 (the general figure for ASEAN countries is 7.1%).

Thailand's nominal GDP was USD 543 billion in 2019, the highest of all the countries targeted for this survey. Real GDP growth rate, however, was the lowest at 2.4%--putting Thailand solidly in the middle income trap. Its key industries are manufacturing, agriculture, and tourism, with manufacturing in particular accounting for 26% of GDP. The most active manufacturing sectors are food processing, automotive, and chemical, with automobiles making up a large percentage of exports as well. Thailand exported USD 24 billion worth of automobiles in 2020. Per capita GDP in 2019 was USD 7,807 the highest of all the survey target countries.

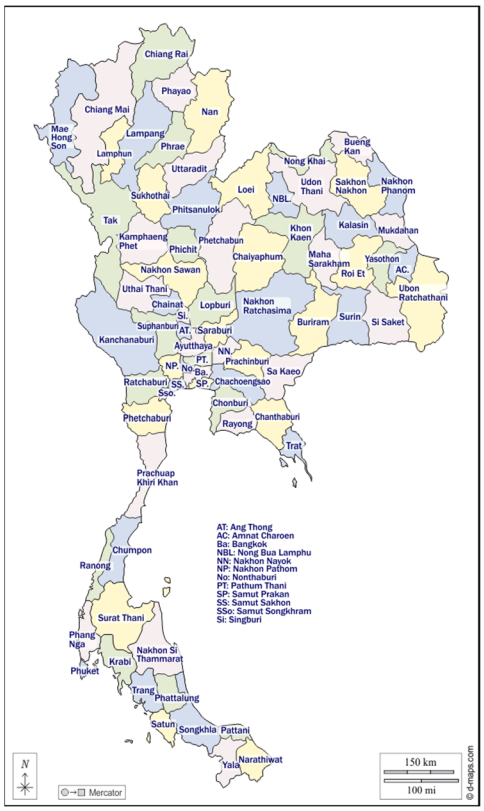


Figure 172. Thailand (source: d-maps.com)

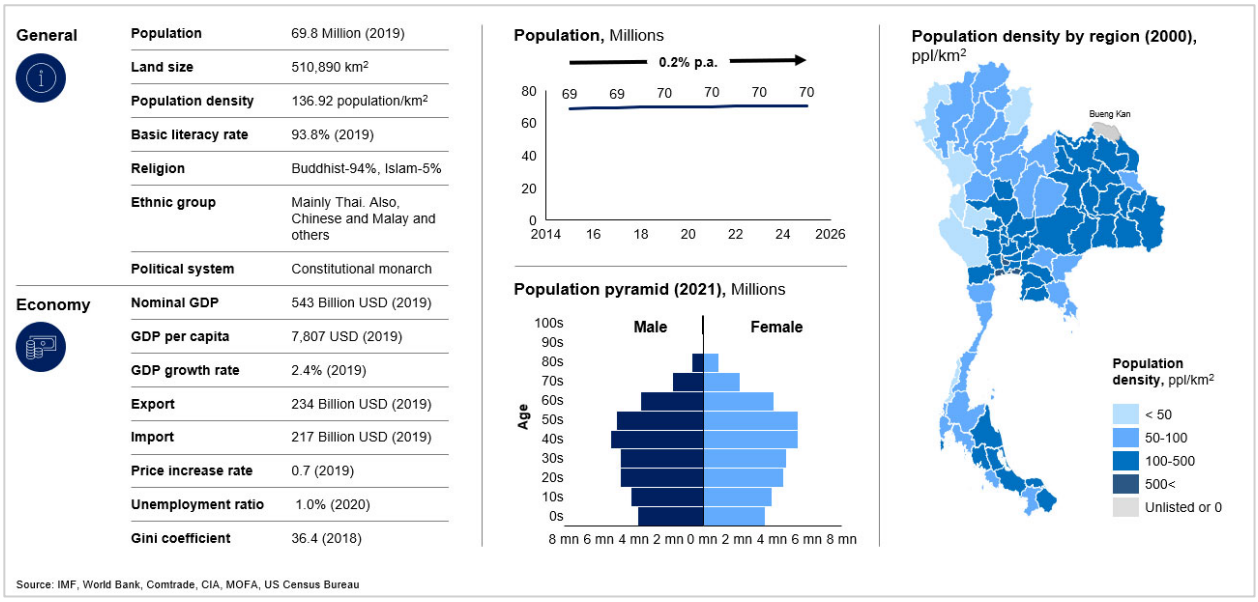


Figure 173. Overview of Thailand (1/2)

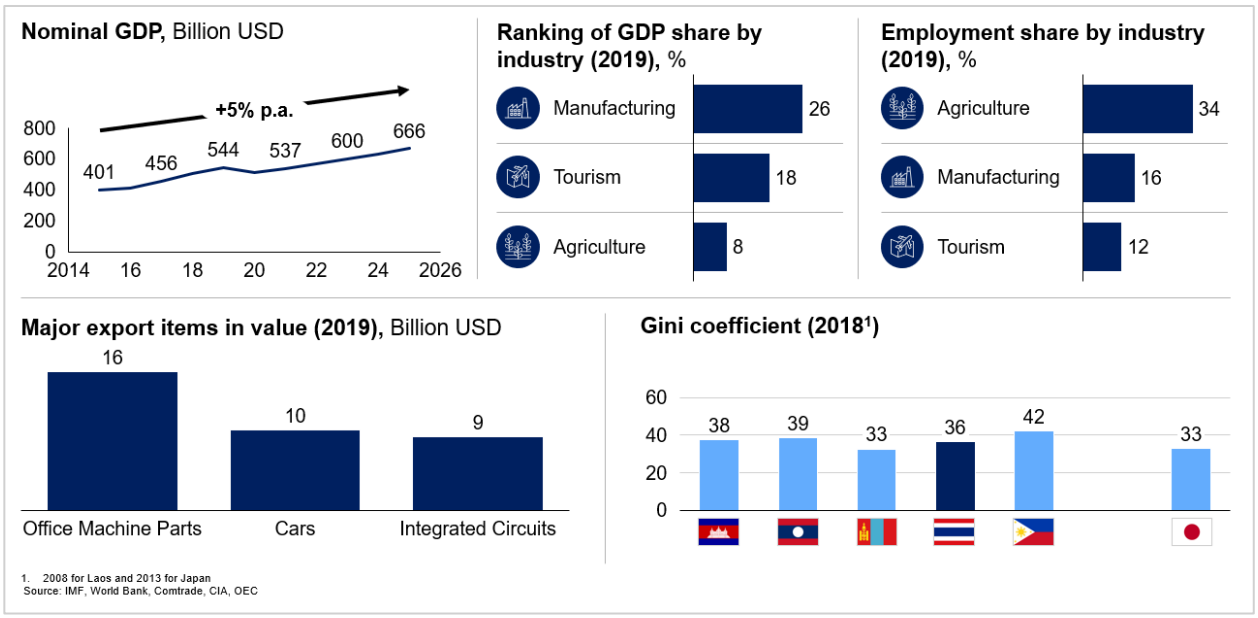


Figure 174. Overview of Thailand (2/2)

The Thai government formulated the Thailand Digital Economy and Society Development Plan in 2016, at the same time restructuring the Ministry of Information and Communication Technology (MICT) into the Ministry of Digital Economy and Society (MDES). The MDES is in charge of promoting the digital economy. More specifically, the Digital Economy Promotion Agency (DEPA) was established under the Digital Development for Economy and Society Act B.E. 2560 in order to develop digital industry and technological innovation and push for the introduction of new digital technologies in the economy, society, culture, and so on. The DEPA is promoting the development of digital professionals and digital innovation ecosystems under the Digital Economy Promotion Master Plan (2017–2021).

2.6.2 Organizing the orientation of digitalization

(1) Confirm strategically important sectors of the country

The team first identified the strategically important sectors of Thailand by reviewing the National Strategy (2018–2037), Thailand 4.0, and the Thailand Digital Economy and Society Development Plan issued by the government. Seven key industries were identified: manufacturing, tourism, agriculture, shipping and transport, public services, energy, and healthcare. The specific procedure for identifying these sectors was as follows. To start, the industries marked for national competitiveness enhancement in the Thai government's National Strategy (2018–2037) were taken as basic targets (the ICT industry was excluded because it is considered an enabler for the digitalization of all industries, while industries like defense were excluded because they fall outside assistance consideration targets). Next, this list of industries was compared against those listed as growth engines in the Thailand 4.0 document to make sure that nothing was left out. Finally, the team added public services to the list, primarily because of the Thailand Digital Economy and Society Development Plan.

(2) Selecting potential target sectors

The team evaluated these sectors on the basis of the following three perspectives, and selected the target sectors to be taken up in this survey.

- Consistency with JICA's assistance priorities
- Digital divide potential
- Each sector's overarching impact on the economy/society

Thailand keeps data on the percentage of internet users in each of its industries, so the team was able to use that data as a direct indicator for evaluating the country's digital divide potential.

Following the above selection criteria, the team analyzed the key strategic sectors in Thailand, and confirmed that the high priority sectors for JICA assistance were agriculture and manufacturing. The reasons are as follows.

- **Agriculture:** The Thai government has already requested cooperation to help it develop smart food chains, and Japanese government policy is to work towards popularizing smart agriculture technologies in Thailand--so JICA has a great deal of interest in this area.
- **Manufacturing:** The Thai government is promoting green manufacturing, and it is likely that JICA could assist this area through digital technologies.

Based on their consistency with JICA assistance policy and two additional perspectives, the team selected agriculture and manufacturing as being particularly well-suited as target sectors for the survey.

- **Agriculture:**
  - A full 54% of agricultural workers do not use the internet, so this sector has the highest digital divide potential

— Agriculture accounts for the largest percentage of jobs in Thailand (34%) along a good portion of GDP (8%), so digitizing this sector will likely have a significant impact on the economy and society

- **Manufacturing:**
  - — Manufacturing has the next-highest percentage workers (15%) who do not use the internet
  - — It also accounts for the greatest percentage of GDP (26%) and a good portion of jobs (16%), so further enhancing competitiveness in this sector through the promotion of digitalization will likely bring significant economic benefit to employers and society as a whole.

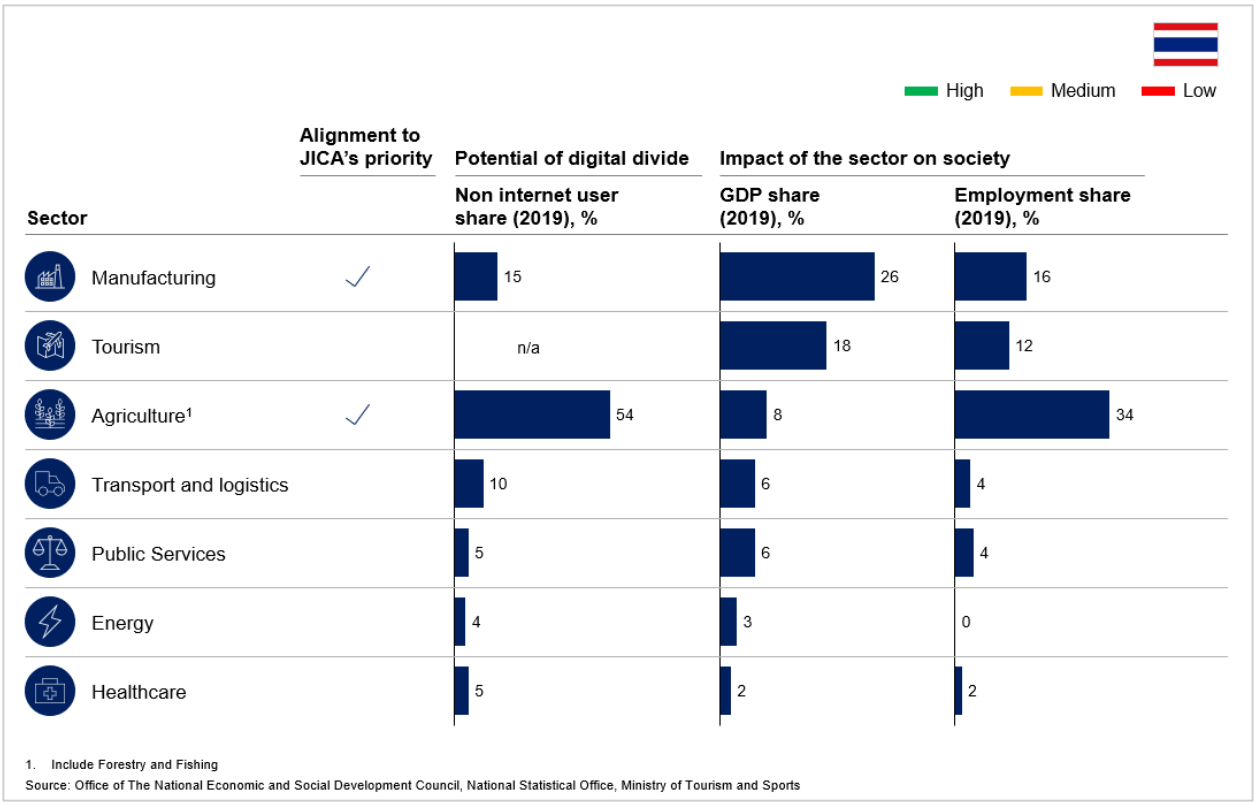


Figure 175. Selecting study target sectors

(3) Understand the vision and challenges in each potential target sector, and identify candidates for digitally-enabled solutions

The team examined the approach to digitalization in agriculture and manufacturing, two target sectors under consideration for Thailand. To sort out the approach to digitalization, the team started by confirming the vision and challenges to achieving that vision in each sector by reviewing government documents and interviewing experts. The team then conducted another survey, and listed potential candidates for digitally-enabled solutions to the challenges being faced.

(3)-1 Agriculture

The Twenty-year Agricultural and Cooperative Strategy (2017–2036) issued by the Thai Ministry of Agriculture and Cooperatives sets forth the vision "Secured Farmers, Prosperous Agriculture Sector and

Sustainable Agricultural Resources", with the goal of bringing average farmer incomes at least USD by 2036 (average farmer incomes were about USD 2,500 in 2020).

However, Thai agriculture is facing the following challenges in its efforts to realize the vision outlined above.

The first is that productivity is not high enough. More specifically, despite the fact that rice accounts for 46% of cultivated land in Thailand, productivity is stuck at about the same level as China's productivity in the 1960s. Thailand introduced agricultural machinery later than China, though it is still further along than the Philippines or Vietnam. The team compared the horsepower of farming equipment per hectare as a way to measure the progress of mechanization, and found that Thailand measured relatively high at 4 hp (vs. 1.3 hp in the Philippines and 1.4 hp in Vietnam).

The population of Thailand is also aging rapidly, so figuring out how to increase farmer productivity is an issue (Problem 1).

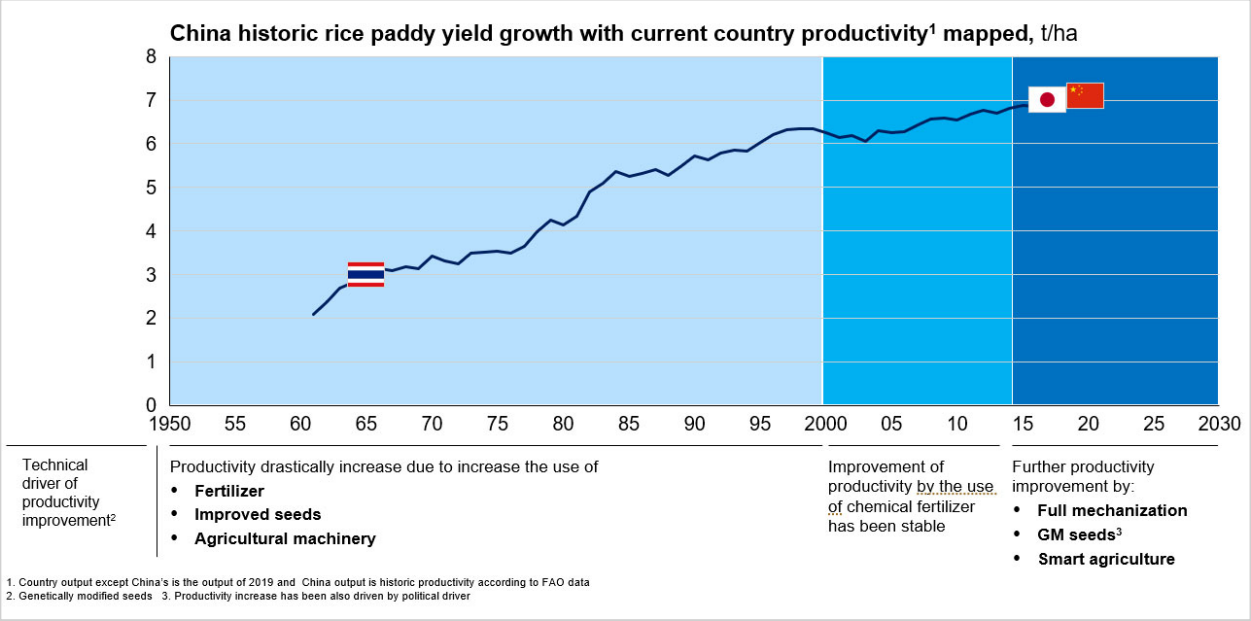


Figure 176. Agricultural productivity in Thailand

The second is that the added value of agriculture is low. Primary industry workers make up 34% of the total workforce, yet contribute only 8% of the country's GDP. Neither is the industry making progress in areas like crop standardization, food safety, or environmental protections (Problem 2).

The third challenge has to do with production risk issues. Thailand must address the natural disasters and climate change issues exacerbated by the environmental destruction caused by inappropriate farming methods (Problem 3).

The fourth challenge relates to supply chain problems. Thailand's infrastructure is relatively well-maintained in comparison with other target countries, but one of the government's policies is to improve

efficiency throughout the entire supply chain. They also consider the weak positioning of farmers and agricultural cooperatives in price negotiations to be a supply chain issue (Problem 4).

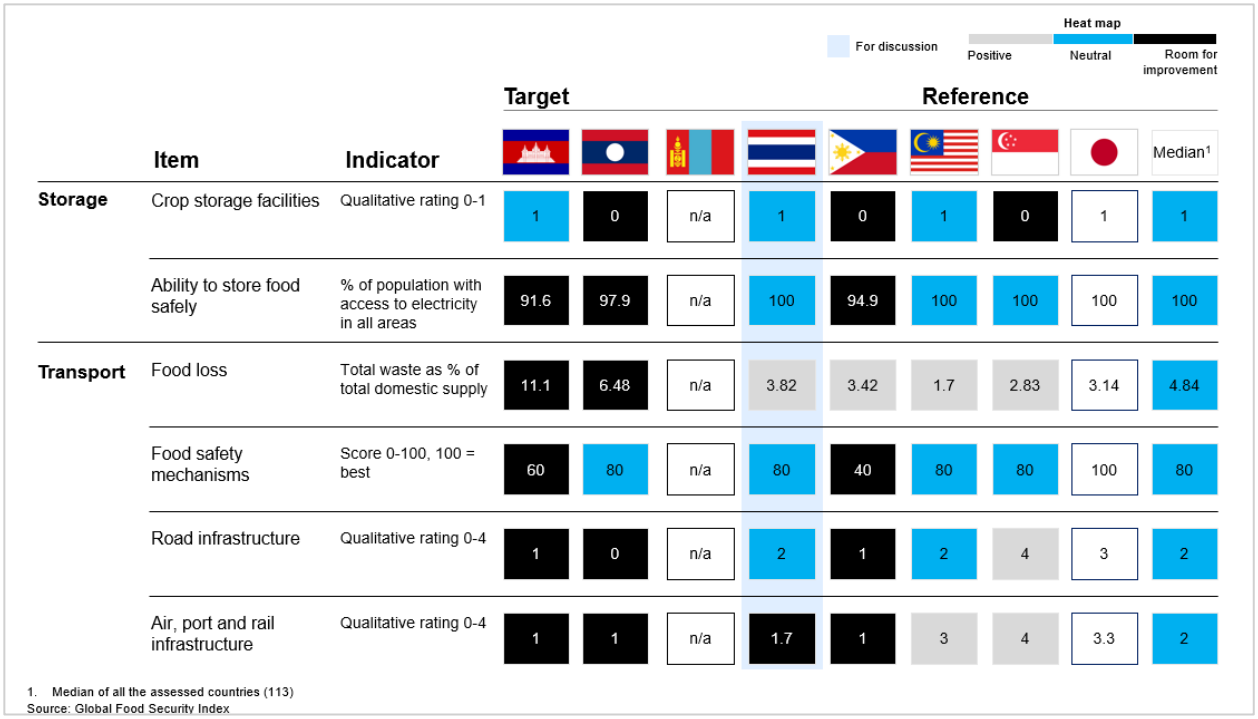


Figure 177. Maturity of the food distribution infrastructure

The fifth challenge is the lack of market knowledge and information. Many farmers do not fully understand how their own agricultural production is linked to processing and sales (Problem 5).

Digitally-enabled solutions to the above challenges could take two approaches: improving information access conditions for farmers, and introducing equipment and software powered by the latest technology. The team conducted expert interviews and other surveys with these approaches in mind, and identified the following to be promising concrete solutions for each challenge.

Improving information access conditions

- Problems 1–5: Set up and popularize a platform that allows farmers to get essential information (e.g. information on seeds, agrochemicals, fertilizers, sustainable cultivation techniques, crop prices, and markets)

Introduce equipment and software

- Problems 1–3: Use soil sensors to optimize water content, pH, NPK, and other indicators; use drones to manage fields; introduce smart agriculture technologies like precision farming
- Problem 4: Visually track supply chain information (e.g. using RFID tags) to reduce food loss and improve added value, thereby improving crop distribution
- Problem 5: Digital marketing

All of the potential solutions above are in line with Thai strategy. Even the Twenty-year Agricultural and Cooperatives Strategy (2017–2036) puts forth a policy to promote Agriculture 4.0, a strategy that involves developing systems to provide agricultural information, encouraging the introduction of soil sensors and precision agriculture, using IT to improve traceability, and ecommerce marketing.

Based on the above, this survey positions the potential solutions above as priority approaches to digitizing agriculture in Thailand.

Below is a visual overview of these candidate solutions.

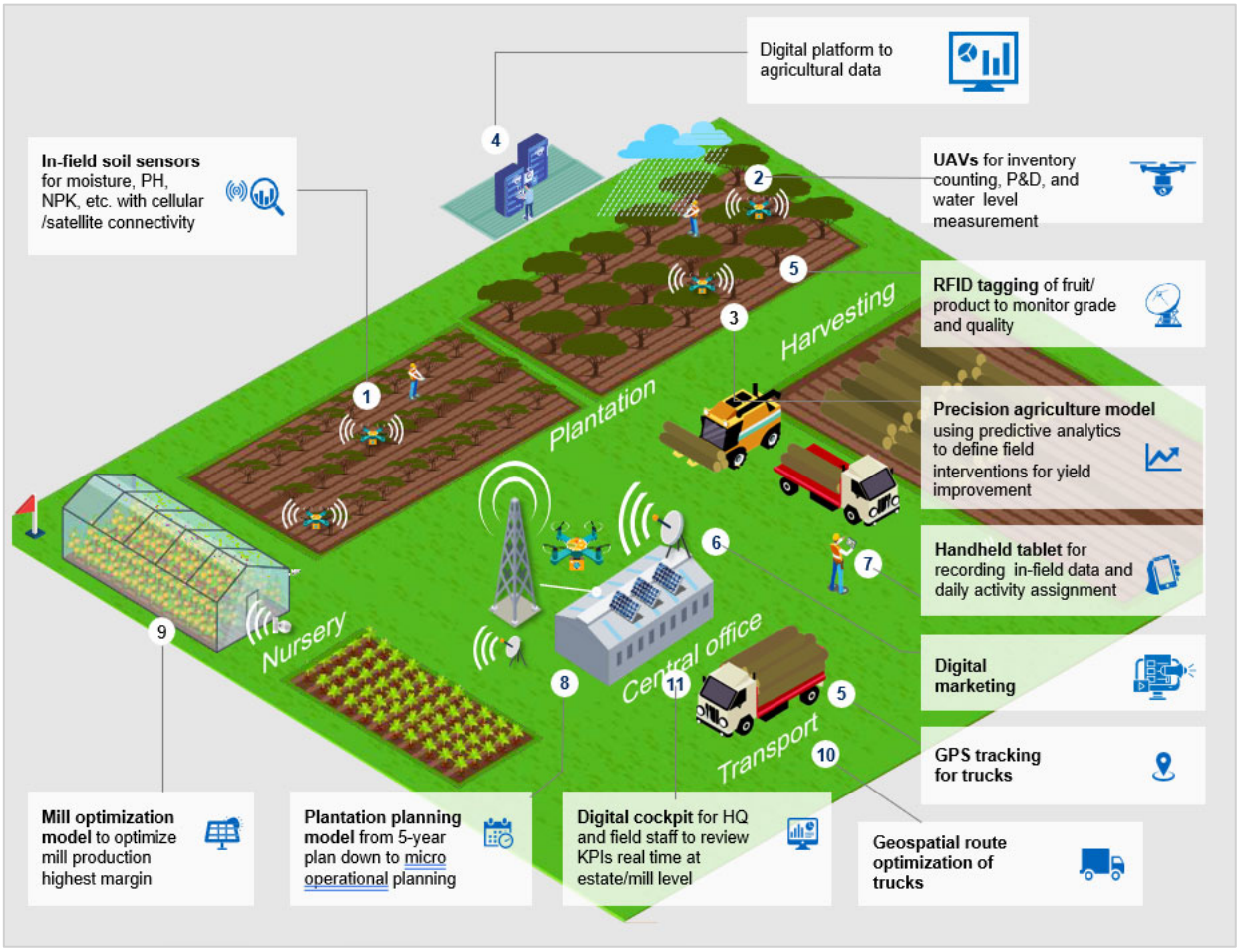


Figure 178. Digital ecosystem for smart agriculture

(3)-2 Manufacturing

Manufacturing is Thailand's largest sector, accounting for 26% of the nation's GDP. Its key components are food (24%), automobiles (22%), and chemicals (22%). Manufacturing is also at the core of Thai exports, with computers and similar devices, electronics, and automobiles accounting for 16%, 15%, and 11% of total export value, respectively. The government's Twelfth National Economic and Social Development Plan (2017–2021) lists two approaches: (1) developing and strengthening existing competitive industries towards more high-technology-based industries, and (2) establishing a sound foundation for future

industries. The first approach lists a shift towards production that utilizes more automation and other advanced technologies as a possible tactic, while the second cites the establishment of "future industries" like robotics and automation to assist productivity in existing industries.

The key challenges facing the manufacturing industry can now be summarized as follows.

The first is steeply rising labor costs. Thailand has many plants that assemble finished products, making its manufacturing industry quite labor-intensive. In the past, low labor costs were the source of its competitiveness. But government-backed minimum wage increases and a tightening labor market have contributed to an average wage increase of 57% in the manufacturing industry between 2011 and 2020, meaning that Thailand is losing its competitive edge (Problem 1).

The second challenge is that Thailand is heavily dependent on exports. Exports account for a high percentage of GDP (43%), and cooling demand for exports has an enormous impact on Thai industry (Problem 2).

The third challenge is sustainability. Mounting environmental concerns in recent years have made addressing the Sustainable Development Goals increasingly critical. With climate change, for instance, Thailand's National Determined Contribution under the Paris Agreement declared a GHG reduction target of 113 $MtCO_2eq$ by 2030 across the energy sector--yet it has so far only gotten 38% of the way toward this goal. Decarbonization in the manufacturing industry is hugely important in this regard, as it makes up the bulk of the sector (Problem 3).

Introducing smart factories powered by robotics and automation, a tactic that the Thai government mentions in the same document, will likely be a solid approach resolving this issue through digitalization.

- **Problems 1 and 2:** Maintain competitiveness and boost domestic market share by streamlining production with more effective HRD (e.g. virtual training that uses AR/VR glasses), robotics, automation, and similar technologies
- **Problem 3:** Streamline operations and save energy through the use of advanced analytics

Below is a more detailed smart factory setup.

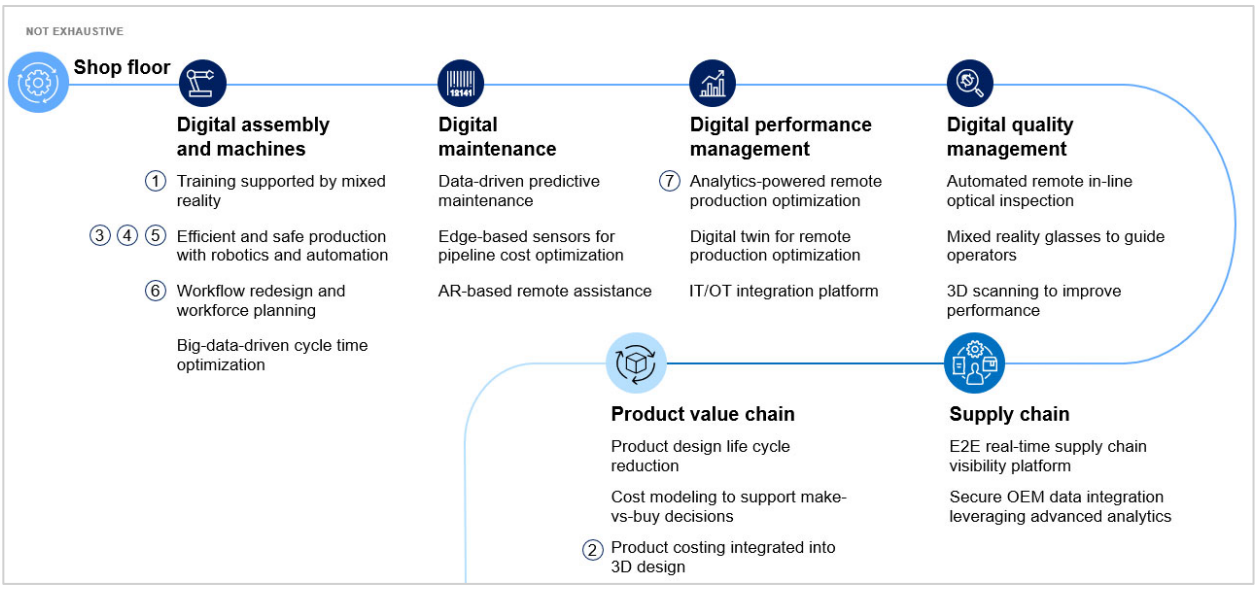


Figure 179. Smart factory setup

2.6.3 Identifying potential issues to assist

Given the digitalization approaches in the target sectors considered in the previous section, the team then looks at maturity level for the enablers required to drive this digitalization.

The results of their survey of the maturity level of enablers as a whole are as follows. The team confirmed that Thailand is facing some challenges with its human resources and innovation ecosystems.

Figure 180. Summary of potential issues to assist in Thailand

Priority sector	Enablers	Assessment results	Potential issues to assist
Agriculture	Capacity to formulate and implement policies	Policy focus on ICT Coordinated ICT regulation	No major issues found
Manufacturing	Communications infrastructure	A majority of citizens have broadband access through their smartphones	No major issues found
	Human resources	The number of digital translators and digital engineers needs to at least double over the next ten years	Digital translators: Shortages in certain industries are driven by the following factors A. Industry structure B. Uncertainty about the impact of the digital technologies that are introduced Digital engineers: The shortage of digital engineers at home is driven by the following factors

Priority sector	Enablers	Assessment results	Potential issues to assist
			C Educational institutions aren't doing a good job of giving students the skills they need D Highly-skilled workers leave the country E Strict visa requirements for foreign workers
	Innovation ecosystems	These stakeholders do not play a sufficient role in the innovation ecosystem • Startups • Knowledge contributors • Investors and supporters	A: The government does not provide enough assistance for startups in areas like visas and taxes, which makes it hard to foster entrepreneurs B The Thai educational system does not place enough focus on entrepreneurship C Academic institutions do not get enough funding to assist innovation D Investor withdrawal from Thailand and limited bank loan availability make it difficult to get financing E Undeveloped mentorship environment F Startups do not get enough help from the government in securing funding

Detailed results of the maturity survey are as follows.

(1) Survey of maturity in capacity to formulate and implement policies

According to a survey by the World Economic Forum, the Thai government's vision did not place much importance on ICT as of 2014–2015. But the government later firmly established the importance of digital when it issued Thailand 4.0 and further indicating its prioritization of ICT when it put together the Thailand Digital Economy and Social Development Plan in 2016--so it is likely that circumstances have changed since the time of this survey.

Regarding ICT regulations, the Philippines scored 84 points out of 100 on the 2020 ITU ICT Regulatory Tracker, indicating that the country is operating at a high level relative to other countries.

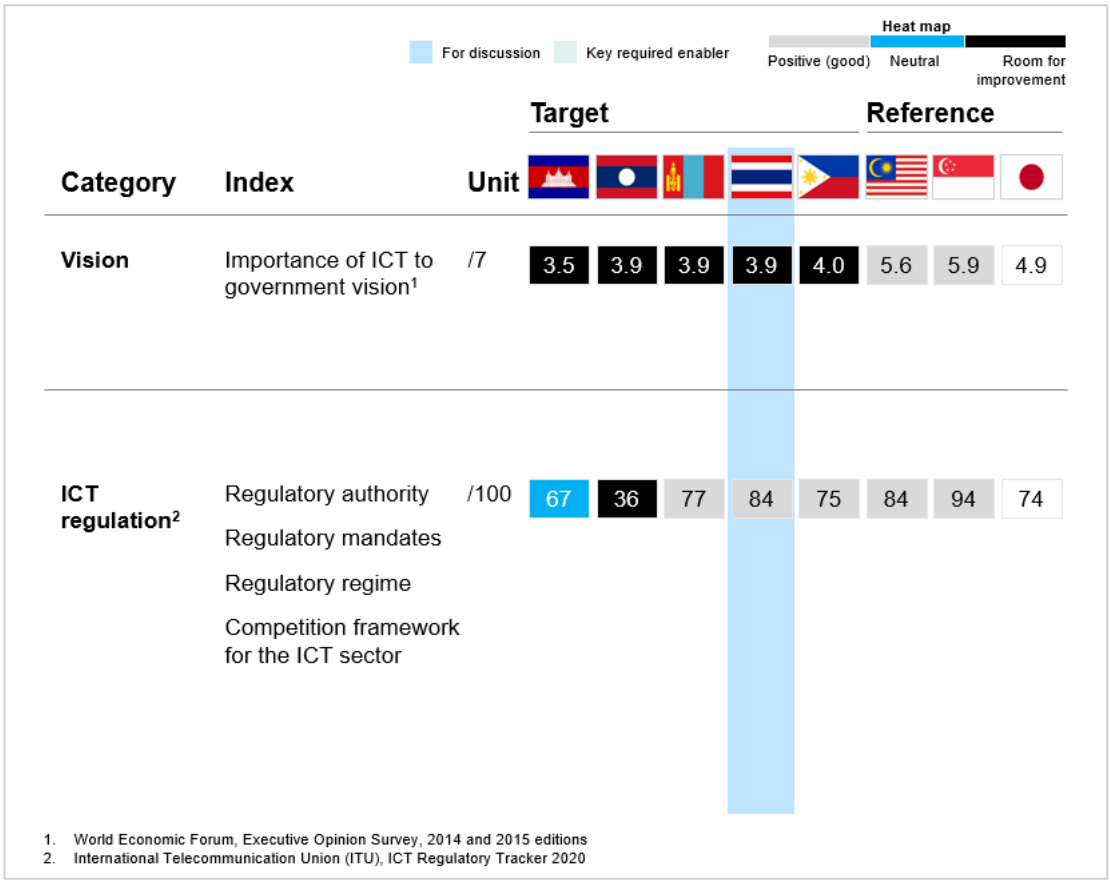


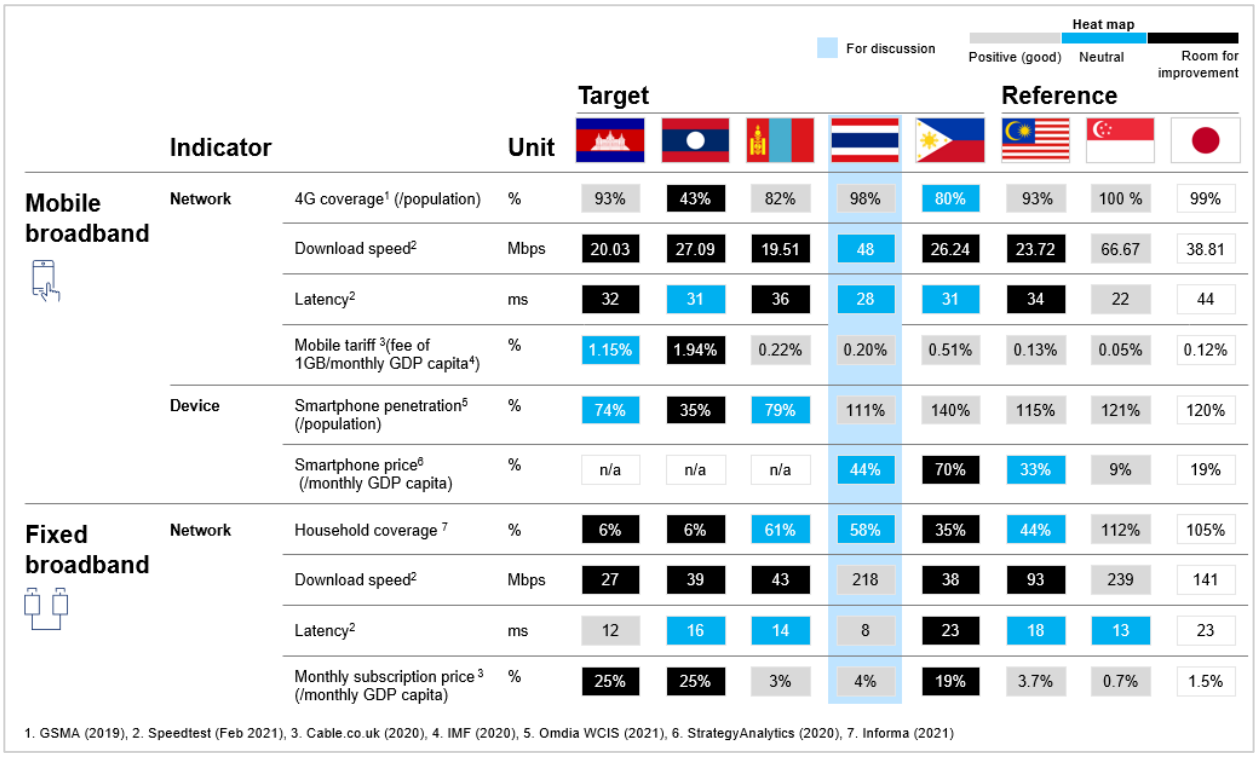
Figure 181. Maturity of capacity to formulate and implement policies

Based on the above, there seem to be no particular issues to assist in terms of the capacity to formulate and implement policies.

(2) Survey of communications infrastructure maturity

Below are the results derived from various metrics.

- Mobile broadband internet access is widespread, while fixed broadband has also penetrated to some extent: 4G coverage is at 98%, while 58% of households have fixed broadband
- 4G networks are largely established, and there is a great deal of smartphone penetration: as mentioned above, 4G coverage is at 98%, on par with Malaysia (93%) and Singapore (100%). Smartphone penetration is also strong at 111%, even compared to Malaysia (115%) and Singapore (121%).



Heat map: Positive (good) | Neutral | Room for improvement; For discussion

	Indicator		Unit	Target					Reference		
Mobile broadband	Network	4G coverage[1] (/population)	%	93%	43%	82%	98%	80%	93%	100 %	99%
		Download speed[2]	Mbps	20.03	27.09	19.51	48	26.24	23.72	66.67	38.81
		Latency[2]	ms	32	31	36	28	31	34	22	44
		Mobile tariff [3](fee of 1GB/monthly GDP capita[4])	%	1.15%	1.94%	0.22%	0.20%	0.51%	0.13%	0.05%	0.12%
	Device	Smartphone penetration[5] (/population)	%	74%	35%	79%	111%	140%	115%	121%	120%
		Smartphone price[6] (/monthly GDP capita)	%	n/a	n/a	n/a	44%	70%	33%	9%	19%
Fixed broadband	Network	Household coverage [7]	%	6%	6%	61%	58%	35%	44%	112%	105%
		Download speed[2]	Mbps	27	39	43	218	38	93	239	141
		Latency[2]	ms	12	16	14	8	23	18	13	23
		Monthly subscription price [3] (/monthly GDP capita)	%	25%	25%	3%	4%	19%	3.7%	0.7%	1.5%

1. GSMA (2019), 2. Speedtest (Feb 2021), 3. Cable.co.uk (2020), 4. IMF (2020), 5. Omdia WCIS (2021), 6. StrategyAnalytics (2020), 7. Informa (2021)

Figure 182. Maturity of telecom infrastructure

Meanwhile, 54% of farmers did use the internet in 2019. Still, it does not appear that Thailand's communication structure suffers from any dire issues, given the following.

- All of Thailand has 4G coverage: Agricultural areas are vast and data transmission is limited, so smart agriculture, for example, could effectively use mobile rather than fixed networks. These 4G networks cover nearly all of Thailand, including the north and northeastern parts of the country where the number of farmers is particularly high.
- Every single farmer does not need a smartphone: Having a tool to regularly review analyzed data is enough for smart agriculture. There is no need for farmers to be constantly monitoring data on their smartphones. In addition, though individual smartphone use in the north and northeast is less than 70%, some 90% of households have a smartphone, so farmers could share them within their homes if needed.

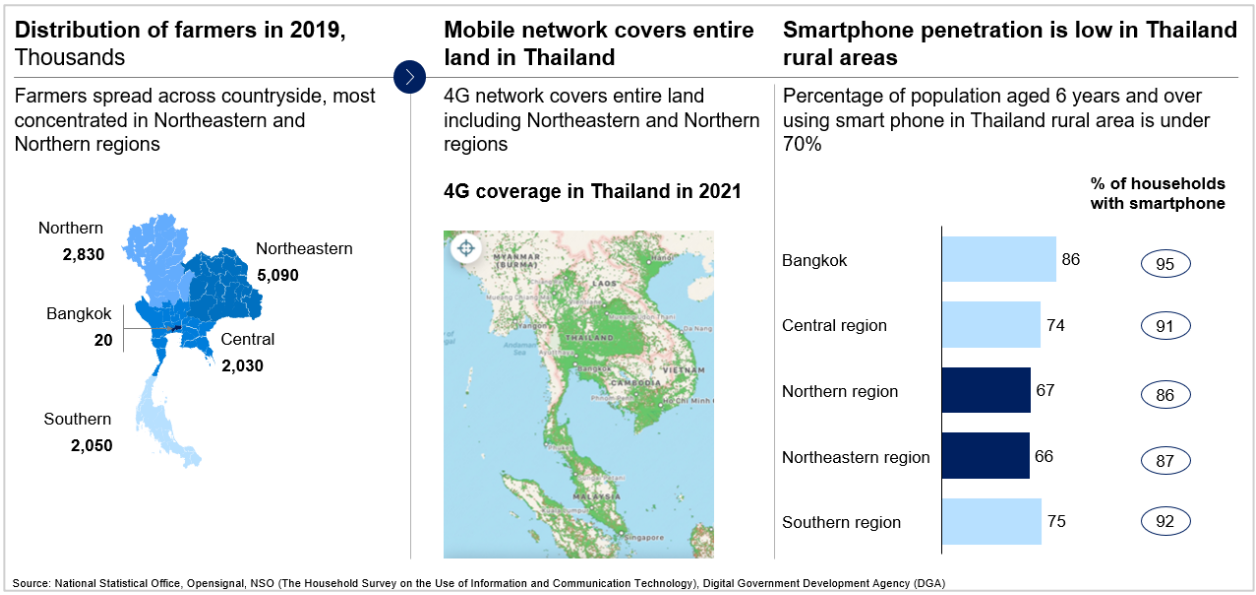


Figure 183. Mobile network and smartphone penetration in Thailand

Based on the above, there seem to be no particular issues to assist in terms of communications infrastructure.

(3) Survey of HR maturity

Unlike the other four countries, the Thai government has set a target to develop ICT professionals, so demand for these professionals in 2030 was estimated based on that target. More specifically, the team calculated the growth rate in ICT professionals based on this target (which the Thai government increased to 500,000 by 2022) and on the number of ICT professionals as of 2019. They then estimated demand for ICT professionals in 2030 on the assumption that demand would keep increasing at the same rate until then. This resulted in an estimate demand for around 730,000 ICT professionals in all by 2030. To figure out the breakdown of ICT professionals in 2030, the team assumed a similar structure as Singapore, which is ahead of Thailand in terms of digitalization. While the number of IT engineers needs to increase by 20%, the number of digital engineers and digital translators needs to increase by 120%. Given these estimates, it will be critical for Thailand to prioritize the development of digital engineers and digital translators in particular.

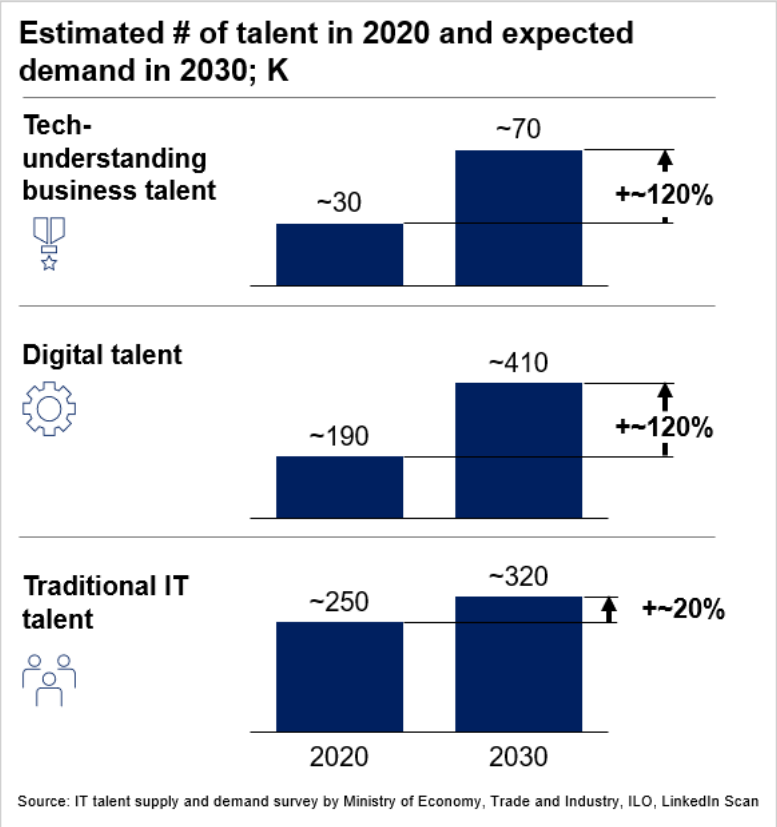


Figure 184. Demand for ICT professionals in Thailand

The team also received comments like these in interviews with experts and with staff at counterpart government agencies.

Figure 185. Potential issues to assist in human resources

Category (Required enablers)	Respondents	Comments, assessment results	Potential issues
Digital translators	Expert on agri-tech in Thailand	"For smart agri-tech companies to improve their products or services, they need assistance from farmers with a basic understanding of technology who can provide experimental land and advice in that area. But **it is difficult to find people like that in Thailand, which has an aging farming population**" "The ROI on smart agriculture has not been fully demonstrated, and **farmer skepticism regarding that ROI is a barrier to introducing it**"	**Some industries are structured such that few people have the required characteristics,** due to an aging population or the unbalanced way in which tech-savvy professionals are distributed, for example **The fact that the impacts of digitalization are ill-defined** is a factor driving the lack of talent in some industries
Digital engineers	Expert on digital technology in Thailand	"The Thai universities are isolated from industry, and their curriculum does not reflect business needs. Companies don't care too much about degrees"	**Some industries are structured such that few people have the required characteristics,** due to an aging population or the

Category (Required enablers)	Respondents	Comments, assessment results	Potential issues
		"Highly-skilled workers leave the country for more attractive opportunities"	unbalanced way in which tech-savvy professionals are distributed, for example **The fact that the impacts of digitalization are ill-defined** is a factor driving the lack of talent in some industries
	Expert on digital technology in Thailand	"Local talent **lacks English ability**, which probably keeps them from accessing overseas training programs"	**Educational institutions aren't doing a good job of giving students the skills they need** • Domestic IT university education does not address what businesses need right now in terms of digital engineers • A lack of English proficiency makes it difficult for people to take advantage of the high-quality international educational content available online **Highly-skilled workers leave the country** • Top talent tends to look for better job opportunities overseas **Strict visa requirements for foreign workers** • Smart visas were introduced in 2018 to attract highly-skilled foreign talent and investors • But given the strict requirements (such as a minimum monthly salary of THB 200,000), few people are eligible for them
	Domestic Managing Director at ABB	"As competition heats up and the demand for high-quality products rises, Thailand's F&B industry will be faced with the challenge of finding qualified workers"	
	Expert on digital technology in Thailand	"Due to the lack of talent in the market, large companies would like to hire talent from overseas or outsource jobs to places like Singapore, Malaysia, or Vietnam, but the visa requirements for foreign workers are too strict. I've personally never even met someone working on a smart visa	

Based on the above, the team identified the following potential issues to assist in the area of HR maturity.

- **Digital translators:** Few industries are structured so that there are people who can become digital translators, and the impacts that digital will bring are poorly defined
- **Digital engineers:** Educational institutions aren't doing a good job of giving students the skills they need, and some top talent goes overseas for work. Visa requirements are also strict, preventing Thailand from bringing in enough top talent from abroad

(4) Survey of maturity of the innovation ecosystem

Below are the results derived from various metrics.

- Startups: According to PitchBook, there are fewer startups in Thailand than in Malaysia or Singapore given the country's population. The tax rate in Thailand is also relatively high (37%) compared to Singapore (21%), Cambodia (23%), Laos (24%), and Mongolia (26%).
- **Corporate:** Joint venture activities are sluggish, though Thai companies do allocate about the same percentage of their budgets to R&D as Malaysia
- **Knowledge contributors:** R&D expenses are low, and there are issues with contribution to innovation.
- **Investors and supporters:** According to PitchBook, venture capital investment as a percentage of GDP is higher than in Malaysia, but it is still not enough
- **Market access:** Compared to other countries, there is healthy market competition in Thailand that encourages innovation

For discussion | Key required enabler | Heat map: Positive (good) / Neutral / Room for improvement

Category	Index	Unit	Target					Reference		
Startup	Average # of startups[1] founded annually	/MM people[2]	0.3	0.0	0.2	0.8	0.2	2.4	68.6	3.7
	Days to start business[3]	#	99	173	12	6	33	17	2	12
	Procedures to start business[3]	#	9	9	8	5	13	8	2	8
	Tax rate % profit[4]	%	23	24	26	30	43	39	21	47
Corporate	Investment in emerging technologies[5]	/100	44	46	33	54	61	79	79	80
	R&D expenditure.by businesses[6]	/100	0.4	n/a	0.2	21	1.5	21	33	65
	Creation/merger/acquisition of joint venture[7]	/MM people[2]	0.1	0.1	0.4	0.3	0.1	1.0	12.2	0.7
Knowledge contributor	# of scientific and technical journal articles[8]	/MM people[2]	9	12	42	179	21	717	1,986	786
	R&D expenditure by government and higher education institution[6]	/100	3	n/a	7	16	7	57	80	58
Investor/ supporter	VC investment[9]/GDP[10]	USD/MM USD	79	0	230	361	95	244	11,125	385
	Government promotion of investment in emerging technologies[5]	/100	31	48	20	65	39	77	100	72
	FDI restrictiveness[11]	/1	0.05	0.19	0.07	0.27	0.37	0.25	0.06	0.05
Market access	Intensity of local competition[12]	/7	4.7	4.3	5	5.4	5.2	5.4	5.6	6.3

1. Average number of startups founded during 2016-20 annually listed in PitchBook, approach of summing startups might not be exhaustive, 2. IMF, 3. Doing business 2020 report 4. Paying Taxes 2020 report, 5. World Economic Forum, Executive Opinion Survey 2017–2018, 6. UNESCO Institute for Statistics, 7. Average number of creation /merger /acquisition of joint venture listed in Capital IQ during 2010-2020, 8. World Development Indicators (2018), 9. Average capital invested during 2016-20 annually listed in PitchBook, approach of summing capital might not be exhaustive, 10. IMF (2020), 11. OECD (2019), 12. World Economic Forum, Executive Opinion Survey, 2014 and 2015 editions

Figure 186. Innovation ecosystem maturity

The team also received comments like these in interviews with experts and with staff at counterpart government agencies.

Figure 187. Potential issues to assist in innovation ecosystems

Category (Required enablers)	Respondents	Comments, assessment results	Potential issues
Startups	Expert in accelerators/digital in Thailand	"Thailand's educational system focuses on cramming and does not help students enhance their creativity"	**The government does not provide enough assistance for startups in areas like visas and taxes,** which makes it hard to foster entrepreneurs The Thai educational system **does not place enough focus on entrepreneurship**
	Document research	Unlike Singapore, Thailand lacks policy assists like relaxed visa requirements for foreign entrepreneurs and skilled workers, or tax exemptions for startups	
Knowledge contributors	Document research	Major agricultural firms **collaborate with universities** to develop agri-tech	**Academic institutions do not get enough funding to assist innovation**
Investors and supporters	Expert in accelerators/digital in Thailand	"The hype surrounding Thai startups has died down. Investors have realized that the startup ecosystem in Thailand lacks the talent and government assistance to be successful" "Venture capitalists **are shifting their focus to other countries,** while CVCs are concentrating on their own business areas **and have stopped actively developing related startups** "**English language barriers** prevent Thai entrepreneurs from building connections with foreign investors" "Assistance from domestic **accelerator programs is superficial**" "Thailand does **not have successful scaled startups**" "**Few people can get bank loans**, and it is difficult for middle or low income earners and foreigners to get the funds the need for test production. Entrepreneurs are forced to give up"	**Investor withdrawal from Thailand and limited bank loan availability make it difficult to get financing** **Undeveloped mentorship environment**, with little accumulated knowledge to help startups succeed **Startups do not get enough help from the government in securing funding**

Based on the above, the team identified the following potential issues to assist in the area of HR maturity.

- **Startups:** The government does not provide enough assistance for startups in areas like visas and taxes. Nor does the Thai educational system place enough focus on entrepreneurship.
- **Knowledge contributors:** Academic institutions do not get enough funding to assist innovation

- **Investors and supporters:** Investors are pulling out of Thailand, and it has become difficult to secure funding. Nor do startups get enough help from the government in securing funding. The mentorship environment is also undeveloped.

2.6.4 Formulating assistance programs

(1) Draft assistance and solution proposals for potential issues

The team then looked for global best practices to address the potential issues assistance identified so far by reviewing reference projects (from other donors, for example) and interviewing experts. Note that the solutions given for each potential issue assistance indicate the actions that Thailand should take, and do not necessarily tie into JICA assistance programs.

Figure 188. Potential issues to assist in human resources

Category	Potential issues to assist	Existing efforts in Thailand	Potential solutions	Background
Digital translators	**A. Some industries are structured such that few people have the required characteristics,** due to an aging population or the unbalanced way in which digital translators are distributed	DEPA positions the development of talent with digital knowledge and skills as one of its four strategies, and has established learning institutions such as the Digital Academy, Code Camp	**Digital learning academies**: Reskill industry talent who can introduce and promote useful digital tools and solutions to others • Primary target profile: People who are relatively young and have an interest in digital in industries where the working population is older or not digitally savvy • Goal: Improve basic digital literacy in the industry and encourage people to adopt the existing digital applications that target it	The aging agriculture industry lacks talent who understand both agriculture and basic digital technologies, who work with tech companies to develop solutions and who can educate other farmers
	B. Digital impact in use cases is ill-defined, which also drives the lack of talent in certain industries	In agriculture • DEPA and MOAC cooperate to develop smart agriculture technologies • Major food conglomerates like CPF are developing smart agri-tech in collaboration with universities and bringing in technology from overseas	Create successful digital solution use cases for the industry (**by effectively providing government policies and risk money, for example**) • In industries such as agriculture, where the ROI on digital solutions has not been fully demonstrated, identify companies developing promising solutions using a rigorous screening process and provide them with incentives and solutions, such as subsidies or testing sites	Farmer skepticism about ROI is a barrier to introducing smart agriculture

Category	Potential issues to assist	Existing efforts in Thailand	Potential solutions	Background
			• Actively publicize success stories to attract the attention of key industry players	
Digital engineers	**C. Educational institutions aren't doing a good job of giving students the skills they need** • Domestic IT university education does not address what businesses need right now in terms of digital engineers • A lack of English proficiency makes it difficult for people to take advantage of the high-quality international educational content available online	DEPA positions the development of talent with digital knowledge and skills as one of its four strategies, and has established learning institutions such as the Digital Academy, Code Camp Thailand must first recognize that its educational institutions need to acquire digital knowledge and skills Some private schools have been established, such as the True Digital Academy and Design School Asia	**Digital learning academies**: Retrain tech professionals in the latest technologies and practices to improve performance nationwide • Primary target profile: IT engineers • Goal: Upskill IT engineers to give them advanced knowledge and skills (such as IoT and AI) to help with career transitions	Workers have to be reskilled in order for Thailand to optimize the structure of its industrial population While demand for IT talent is expected to level off over the next ten years, many new graduates are expected to be trained in IT
			Build interdisciplinary networks across industries to match university education to business needs and improve the quality of both, thereby closing the gap between industry and academia • Have university students and researchers participate in internships at companies and/or engage in joint projects in cutting-edge technology fields like IoT or AI	What students learn at university does not match what businesses need
	D. Highly-skilled workers leave the country • Top talent tends to look for better job opportunities overseas	Thailand launched a brain drain reversal project in 1997	**Create an ecosystem to develop and hire talent at home**: Partner educational institutions with companies in Thailand (e.g. those that provide high-quality internships as part of degree programs and hire top students immediately after graduation) **Explore a variety of retention mechanisms,** such as offering scholarships requiring recipients to take jobs in-country, or incentives to stay in Thailand (e.g. job	**Since digital skills carry over to other countries with different business environments, brain drain occurs more often among digital engineers than among digital translators**

Category	Potential issues to assist	Existing efforts in Thailand	Potential solutions	Background
			opportunities, training, social services)	
	E. **Strict visa requirements for foreign workers**	Relax the requirements for smart visas for entrepreneurs (e.g. halve the minimum monthly income requirement)	**Continually review visa requirements and publish them to attract target talent** in a way that addresses shifting professional trends and attributes **Revise policies to create a business environment that attracts more foreign talent** (e.g. simplify the immigration process)	According to local experts, few foreigners are being granted smart visas

Figure 189. Possible solutions for potential issues (innovation ecosystems)

Category	Potential issues to assist	Existing efforts in Thailand	Potential solutions	Background
Startups	**A.** **The government does not provide enough assistance for startups in areas like visas and taxes, which makes it hard to foster entrepreneurs**	Relax the requirements for smart visas for entrepreneurs (e.g. add a short-term visa without a bank balance requirement) Create a corporate income tax exemption of 5–8 years for startups Promote the Eastern Economic Corridor (EEC) as innovation hub	**Continually review policies to create a business environment that attracts more foreign talent** (e.g. relax visa requirements, simplify the immigration process) • Benchmark against countries with regional and global best practices to identify ways to make further improvements	The entrepreneurs driving the global market want a business environment that is favorable not only in their own country, but to international activity as well

Category	Potential issues to assist	Existing efforts in Thailand	Potential solutions	Background
	B. **The Thai educational system does not place enough focus on entrepreneur-ship**		**Incorporate entrepreneurship training into education for young people** • Encourage public high schools to collaborate with entrepreneurs (e.g. boot camps where students interact with startups, incubators, and accelerators or workshops on entrepreneurship) • Introduce entrepreneurial programs in STEM academic departments	Many upper-income young people end up carrying on the family business, so the talent pool for entrepreneurs needs to be expanded Talent with a digital background and entrepreneurial mindset are promising candidates for becoming digital tech founders
Knowledge contribut-ors	**C.** **Academic institutions do not get enough funding to assist innovation**		Review the budget allocation for R&D to accelerate innovation	Historically, the Thai government spends very little on R&D
Investors and supporters	**D.** **Investor withdrawal from Thailand and limited bank loan availability make it difficult to get financing** **E.** **Undeveloped mentorship environment, with little accumulated knowledge to help startups succeed**	Establish Digital Park Thailand in the EEC as an economic cluster to bring in global digital players Provide tax incentives on income tax and dividends to target investors Offer smart visas for investors Have commercial banks like Siam and Krungsri establish CVC funds Have the communications conglomerate True company develop True	**Create an environment that attracts investors and supporters, including overseas players** • Build a platform that gives international funds/supporters easy access to startups • Assist global roadshows for promising startups • Relax regulations on cross-border M&As and attract top-tier investors • Tailor incentives to individual investor interests (e.g. sustainable development) to attract mission-driven investors • Incorporate local banks into existing startup networks	Create a database to remove the language barrier for entrepreneurs Easy access to bank loans would make Thai society more inclusive Thailand is facing a new set of challenges (such as sustainability) as its economy develops
			Encourage the accumulation of shared knowledge to drive successful innovation	Opportunities to learn from a variety of players would be

Category	Potential issues to assist	Existing efforts in Thailand	Potential solutions	Background
		Digital Park as a hub for startups Create co-working spaces such as Hubba	• Energize startup communities where entrepreneurs and supporters can interact at scale and drive innovation	beneficial in Thailand, since it has not yet produced successful large-scale startups
	F. Startups do not get enough help from the government in securing funding	Set up multiple funds and provide grants	Reinforce government assistance for startup financing • Set up purpose-driven loans, available government funds, or financing programs	Focus resources on areas which have a greater impact on inclusive digital economies

1. Science, technology, engineering, and mathematics

(2) Consideration of JICA assistance programs

The team then considered specific JICA assistance programs based on the potential solutions listed above. First, however, they reviewed the kinds of assistance that other donors were providing in HRD and innovation ecosystems as a reference. Three representative examples are given below.

The first is the Digital Explorers program. Implemented between 2019 and 2021, Digital Explorers was a program by the EU to assist talent development in Nigeria. The program selected up to 50 Nigerian ICT professionals and matched them with companies in Lithuania to provide them with job training opportunities for six months to a year. The participants not only received personalized training to boost their skills, but were also provided with assistance to extend their networks in a way that was suited to their environments both while they were in Lithuania and after they returned home. The program also had a track for female engineers, setting aside up to 15 slots for them. The program aimed to foster an entrepreneurial culture in both Lithuania and Nigeria while building participant skills.

The program provides two key takeaways.

- First, the program assisted women, who tend to be a minority in the tech industry as a result of a gender imbalance throughout the world. Thai agriculture is also suffering from a structural imbalance due to its aging farmers and a lack of talent who understand technology, so an approach that promoted inclusive digital economies by rectifying this imbalance through active assistance may be useful to consider there as well.
- Assistance for talent development should be comprehensive, extending beyond mere training to include assistance for participants after they return home as well.

The second example is the Scaling Frontier Innovations and Entrepreneurship program. The Australian Department of Foreign Affairs and Trade has been conducting this program since 2019 in the Asia-Pacific

region, including Thailand. The initiative provides assistance for social enterprises through the following three activities.

- Frontier Innovators is a program that provides AUD 100,000, training, and business development assistance to social entrepreneurs to scale their businesses and impact
- Frontier Incubators builds capabilities of incubators and accelerators to strengthen the quality and stability of assistance to social entrepreneurs, and to empower them to build their entrepreneurial ecosystems
- Frontier Brokers is designed to provide the funding that social entrepreneurs need

The third example is the Innovation for Social Impact Partnership program in the Philippines. This program, which started in 2018, is a collaborative effort between the United Nations Development Programme and the PhilDev Foundation with assistance from the Philippine Embassy in Australia. Initiatives include providing assistance to help future-ready social enterprises sustainable scale their operations, providing education and training to social enterprises and higher educational institutions to spark innovation, and making policy recommendations that give social enterprises a fair chance at competition.

The second and third examples provide the same key takeaways.

- Assist for building ecosystems that promote social enterprises appears to be a key theme in development cooperation
- Building innovation ecosystems requires comprehensive assistance that goes beyond entrepreneurs to include a variety of ecosystem players (incubators, investors, educational institutions, and so on)

Figure 190. Lessons from other forms of ODA assistance (reference)

Assistance	Project	Target country	Year	Type of assistance	Overview	Implications
	Digital Explorers	Nigeria (Implemented by public, private, and non-profit organizations in Lithuania)	2019 ～	Project format	Aims to contribute to better social and economic conditions in Nigeria The project: • Promotes stronger entrepreneurial skills among young Nigerian ICT specialists, **including women** • Encourages Lithuanian and Nigerian institutions to share their experiences in creating digital entrepreneurship ecosystems and favorable environments in which returning	**Digital economy minorities should be targeted** in order to promote inclusive digital economies Assistance should **cover the entire journey of talent development**

Assistance	Project	Target country	Year	Type of assistance	Overview	Implications
					participants can use their new skills	
	Scaling Frontier Innovations and Entrepreneurship	Indo Pacific (including Thailand) (implemented through a partnership across multiple organizations)	2019 ～	Project format	The Scaling Frontier Innovation (SFI) Program helps innovative social enterprises in the Indo Pacific scale their development impact, with a focus on economic recovery, climate resilience, and gender equality **It consists of three initiatives**: Frontier Innovators, Frontier Incubators, and Frontier Brokers.	A common theme among several of the projects is **building ecosystems that are geared towards social impact** Building innovation ecosystem requires bringing in **multiple players--not only entrepreneurs, but also incubators, investors, and educational institutions**
	Innovation for Social Impact Partnership	The Philippines (implemented by PhilDev and UNDP)	2018 ～	Project format	**Social enterprises (SEs)** are provided with technical assistance and to give them the capacity they need to access capital and attract impact-oriented investors **The project also provides instructor training in order to teach technopreneurship**	

After reviewing these activities from other donors, the team defined for each potential solution counterparts in the partner country and their activities, the kinds of assistance that JICA should provide, and project overviews and indicators in line with PDM.

Figure 191. Candidate proposal for JICA assistance (talent)
A. Digital learning academies to train digital translators

Background	Project overview		
• Promoting digitalization requires talent who understand how to apply digital solutions to their own industry • The agricultural industry is structured such that few people have the required	**Main goal**	Increase farmer incomes by encouraging the adoption of digital apps	
	Project target	Improve digital literacy among farmers	
	Output	• Train XXX digital translators in the agricultural sector	**C/P and supporters** • MOAC (C/P) • DEPA/MHESI • Tech companies
	Activity details	1. Have the DEPA and the Ministry of Higher Education, Science, Research and Innovation (MHESI) help the Ministry of	

Background	Project overview		
characteristics, due to an aging population or the unbalanced way in which tech-savvy professionals are distributed, for example	**(recipient country)**	Agriculture and Cooperatives (MOAC) to build networks with: • Companies offering digital learning courses • Agri-tech companies • Universities researching agri-tech **2.** Establish a **curriculum that teaches basic digital technologies and tools that can be applied to smart agriculture** 3. MOAC encourages its own officers, agricultural cooperative employees, and young farmers interested in tech to take the course 4. Alumni serve as promoters to familiarize other farmers with digital technology and solutions, and as a talent pool to work with digital engineers to develop new agri-tech	• Universities • Agricultural cooperatives **Timeline** • Phase 1: Establish a curriculum • Phase 2: Pilot (XXX participants) • Phase 3: Scale (XXX participants)
	JICA assistance	• Overall project coordination (technical cooperation) • Introducing Japanese agri-tech companies (technical cooperation)	

Figure 192. Candidate proposal for JICA assistance (talent)
B. Create model use cases for digital solutions in agriculture

Background	Project overview		
• Promoting digitalization requires talent who understand how to apply digital solutions to their own industry • Digital impact in use cases is ill-defined, which also drives the lack of talent in certain industries • In agriculture… – DEPA and MOAC cooperate to develop smart agriculture technologies – Major food conglomerates like CPF are developing smart agri-tech in collaboration with universities and	**Main goal**	Increase farmer incomes by encouraging the adoption of digital apps	
	Project target	Get more farmers interested in adopting technology	
	Output	• Create model use cases for digital solutions and demonstrate ROI	**C/P and supporters** • MOAC (C/P) • DEPA/MHESI • Tech companies • Universities • Agricultural cooperatives **Timeline** Phase 1: • Demonstrate ROI and improve technologies Phase 2:
	Activity details (recipient country)	1. Have MOAC work with DEPA and MHSI to create a list of smart agricultural technologies that can be introduced in Thailand and select the ones that best address farmer needs and make the most economic sense **2.** Have MOAC work with DEPA and MHSI to build partnerships among farmers, select agri-tech companies, and encourage them to demonstrate ROI through randomized controlled trials (RCT) Have MOAC bring in enough farmers to help with the project (by guaranteeing annual income, for example, even if the technology does not function as expected) 3. Once there are successes, have MOAC work with companies and agricultural	

Background	Project overview		
bringing in technology from overseas		cooperatives to actively publicize them and attract the attention of farmers	• Popularize and promote the tech
	JICA assistance	• **Joint research with the JICA Research Institute (other)** • Japanese agri-tech companies (technical cooperation)	

Figure 193. Candidate proposal for JICA assistance (talent)
C and D. Create model use cases for digital solutions in agriculture

Background	Project overview		
• Educational institutions do not provide sufficient skills – Domestic IT university education does not address what businesses need right now in terms of digital engineers – A lack of English proficiency makes it difficult for people to take advantage of the high-quality international educational content available online • Top talent tends to look for better job opportunities overseas • Have both the public and private sectors take steps to provide the Thai people with opportunities to learn digital	**Main goal**	Expand the talent pool of digital engineers in Thailand	
	Project target	Increase the number of homegrown digital engineers who contribute to the digitalization of the Thai economy	
	Output	1. Develop XXX digital engineers 2. Improve talent retention	**C/P and supporters** • DEPA (C/P) • Digital academy • Tech companies • Universities **Timeline** Phase 1: • Upgrade digital academy (DA) courses Restructure university digital programs • Assess the impact of incentives Phase 2: • Scale up the digital academy • Adopt incentives
	Activity details (recipient country)	1. Have companies that offer digital skills courses work with DEPA to **improve their curricula to better suit the Thai business environment** as well as offer on-the job training to upskill traditional IT talent 2. Scale up the digital learning academy by utilizing trainees as instructors 3. Have the DEPA build a interdisciplinary network between business and academia so that university education meets the needs of businesses, (e.g. sign a Memorandum of Cooperation) 4. Have universities work with companies to restructure their digital programs, incorporating high-quality internships as part of the curriculum 5. Have DEPA assess the impact of incentives and persuasion on talent retention 6. Have DEPA encourage companies to adopt the most effective approach for their segment (e.g. scholarships, job opportunities, social service)	
	JICA assistance	• Overall project coordination (technical cooperation) • Dispatch relevant experts (technical cooperation)	

Figure 194. Candidates for JICA assistance (talent and innovation ecosystems)
E/A. Create an attractive environment for highly-skilled digital engineers and entrepreneurs

Background	Project overview		
• The government does not provide enough assistance for digital engineers or startups in areas like visas and taxes • The Thai government has made multiple efforts so far — Relax the requirements for smart visas for entrepreneurs (e.g. add a short-term visa without a bank balance requirement) — Create a corporate income tax exemption of 5–8 years for startups — Promote the Eastern Economic Corridor (EEC) as innovation hub	**Main goal**	Get highly-skilled digital engineers and entrepreneurs to vitalize Thailand's innovation ecosystem	
	Project target	Improve immigration systems, procedures, and promotions to bring in more highly-skilled talent and entrepreneurs	
	Output	• Create a master plan for setting up an environment that attracts highly-skilled digital talent and entrepreneurs	**C/P and supporters** • DEPA (C/P) • EEC office • Other government agencies **Timeline** Phase 1: • Assess current regulations • Formulate a master plan Phase 2: • Implement the master plan
	Activity details (recipient country)	1. Have DEPA build a task force with other key government agencies **2.** Identify improvement opportunities and priorities by benchmarking countries with regional and global best practices against current business regulations and policies as well as implementation status (**particularly Special Economic Zones (SEZs)**). Examples: • Attractive tax systems, visas, and FDI policies for foreign highly-skilled digital engineers and entrepreneurs • Make it easier to start and operate businesses with one-stop procedures and talent matching 3. Create a master plan for taking advantage of improvement opportunities, set goals, and decide on initiatives **4.** Set up a delivery unit to manage the implementation of the master plan	
	JICA assistance	• Overall project coordination (technical cooperation) • Dispatch relevant experts (technical cooperation)	

Figure 195. Talent and innovation ecosystem
B. Train entrepreneurs

Background	Project overview		
• The educational system in Thailand does not sufficiently foster entrepreneurship • Many upper-income young people end up carrying on the family business, so	**Main goal**	Increase the number of startups in the Thai ecosystem	
	Project target	Create an environment that assists the development of homegrown entrepreneurs	
	Output	• Introduce entrepreneurial programs at XX high schools and XX university STEM departments	**C/P and supporters** • DEPA (C/P) • MHESI /MOE
	Activity details	1. Have the DEPA work with MHESI and MOE to build a network among regional	

Background	Project overview		
the talent pool for entrepreneurs needs to be expanded • Talent with a digital background and entrepreneurial mindset are promising candidates for becoming digital startup founders	**(recipient country)**	educational institutions, universities, and entrepreneurs 2. Have DEPA work with MHESI and MOE as well as with startups and educational institutions to guide the development and implementation of **multiple entrepreneurial education programs at high schools** (e.g., boot camps where students interact with startups, incubators, and accelerators or workshops on entrepreneurship) 3. Have DEPA work with MHESI and MOE to encourage universities to incorporate entrepreneurial programs into their STEM departments 4. Have DEPA drive widespread media coverage on success stories to build momentum and enthusiasm	• Public educational institutions • Universities **Timeline** Phase 1: • Build networks • Develop entrepreneurial programs Phase 2: • Drive extensive promotion and PR activities
	JICA assistance	• Overall project coordination (technical cooperation) • Dispatch relevant experts (technical cooperation)	

Figure 196. Talent and innovation ecosystem
C. Review the budget allocation for R&D

Background	Project overview		
• Academic institutions cannot get enough funding for innovation	**Main goal**	Stimulate innovation in academia	
	Project target	Increase university R&D spending	
	Output	• Create a master plan for reallocating government spending	**C/P and supporters** • DEPA (C/P) • Other key government agencies **Timeline** Phase 1: • Assess current budget • Formulate a master plan
	Activity details (recipient country)	1. Have DEPA build a task force with other key government agencies 2. Benchmark countries with regional and global best practices against current Thai government spending towards innovation 3. Create a master plan for budget reallocation	
	JICA assistance	• Overall project coordination (technical cooperation) • Dispatch relevant experts (technical cooperation)	

Figure 197. Talent and innovation ecosystem
D/E/F. Improve funding and mentorship

<table>
<tr><th>Background</th><th colspan="3">Project overview</th></tr>
<tr><td rowspan="4">• Investor withdrawal from Thailand and limited bank loan availability make it difficult to get financing
• Undeveloped mentorship environment, with little accumulated knowledge to help startups succeed
• The government does not actively assist startups in securing funding</td><td>Main goal</td><td colspan="2">Stimulate investment and mentorship within the innovation ecosystem</td></tr>
<tr><td>Project target</td><td colspan="2">Increase investment and knowledge sharing in Thailand</td></tr>
<tr><td>Output</td><td>1. Create an environment that attracts investors and supporters, including overseas players
2. Encourage the accumulation of shared knowledge to drive successful innovation</td><td rowspan="3">C/P and supporters
• DEPA
• MOF

Timeline
Phase 1:
• Analyze the current state of startup funding
• Assess the maturity of startup communities
Phase 2:
• Formulate initiatives and establish a delivery unit</td></tr>
<tr><td>Activity details (recipient country)</td><td>1. Have DEPA assess the ease with which startups can currently secure funding and identify what needs improvement
2. Have DEPA establish a delivery unit and carry out initiatives like the ones below to address needs
• Build a platform that gives international funds/supporters easy access to startups
• Assistance global roadshows for promising startups
• Regularly hold prestigious hackathons
• Relax regulations on cross-border M&As and attract top-tier investors
• Tailor incentives to individual investor interests (e.g. sustainable development) to attract mission-driven investors
• Incorporate local banks into existing startup networks with help from the Ministry of Finance (MOF)
3. Have DEPA assesses the maturity of startup communities and identify opportunities to improve and energize the ones that are driving innovation through extensive interactions between entrepreneurs and supporters
4. Have DEPA formulate initiatives to capture those opportunities and set up a delivery unit</td></tr>
<tr><td>JICA assistance</td><td>• Overall project coordination (technical cooperation)
• Dispatch relevant experts (technical cooperation)</td></tr>
</table>

Figure 198. Agriculture and digital engineers

Current status	Core factors	Implications
The agriculture industry has a scant supply of digital engineers: • Tech jobs in the food industry make up less than 1% of postings on Thai tech job search websites	Investors do not actively invest in agri-tech as their expectations are still low due to • Low digital literacy among users (farmers) and no established foundation to scale up digital solutions • The ROI in agri-tech has not been sufficiently demonstrated Reference: Thai startup fundraising trends in 2020[1] • Ecommerce/logistics: 60% (USD 217M) • Fintech: 35% (USD 127M) • Agri-tech: 1% (USD 4M) "You need plenty of money to attract top digital talent. Digital engineers want an environment with abundant learning opportunities. They don't care too much what sector they're in. Once a certain amount of top talent starts working in the agricultural sector, it will start becoming more attractive as a learning environment, and more people will want to work in it" (Business mentor in a Thai innovation program)	The initiatives being promoted in Thailand and the above solutions are likely to increase the number of digital engineers in the agricultural sector • Promoting digital learning academies to familiarize farmers with agri-tech should expand its customer base and make it easier for agri-tech companies to secure funding • If model use cases of digital solutions for agriculture can be developed with government assistance, this will serve as an endorsement for investors

1. Source: Techsauce

(3) Detailing assistance programs that match government interests in the partner country and JICA assistance policy

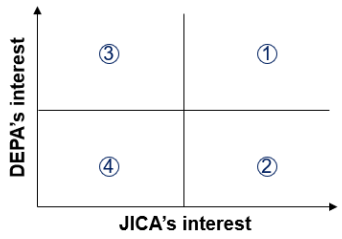
Based on the above assistance programs, the team met with the Digital Economy Promotion Agency (DEPA) to gauge their interest in assistance. The Thai counterpart showed interest in the following two proposals.

- Provision of Japanese educational content for digital learning academies set up for the purpose of training digital translators and engineers
- Technical assistance for establishing digital solution use cases in manufacturing and healthcare (DEPA already has initiatives in place for the agricultural sector and wants assistance in other areas)

Regarding the other assistance programs, DEPA already has similar initiatives, and did not indicate any particular interest in assistance.

Of the proposals that the counterpart showed interest in, JICA considers digital learning academies to be a particular effective form of assistance. This is because the Digital Economy Promotion Master Plan (2018–2021) sets forth the vision of "shaping a dynamic digital economy, with digital-ready manpower and greater digital awareness to propel change", and because the country is already carrying out Digital Academy initiatives to educate its people about digital. So it's clear that if DEPA receives assistance from JICA, it already has a fairly good system in place for continuing these activities independently after that assistance has concluded. As of 2021, Thailand is looking into a project to build smart food chains, and is considering assistance for developing digital translators in the agricultural sector as one component of that project.

Prioritization framework for further flesh out



Area	Mapped assistance ideas	Comments from DEPA	Comments from JICA
①	• Digital learning academy for tech-understanding business talent for agriculture industry • Training to increase the digital talent	• "It would be helpful if JICA could introduce good education content from Japan."	• "Since DEPA has already been working on the Digital Academy, it is highly likely that DEPA is ready to accept JICA's assistance and continue its activities on its own even after the assistance."
③	• Create a model use case of digital solutions for agriculture	• "Creating a use case in agriculture has been in our pipeline. Assistance in other fields such as manufacturing and healthcare would be beneficial."	• -
② ④	• Build attractive environment for foreign high-skilled digital talent and entrepreneurs • Embed entrepreneurial education • Review budget allocation for R&D • Improve financing and mentorship	• "Most of the recommendation is in line with the DEPA's plan"	• -

Figure 199. Prioritization of assistance programs

2.7 Suggestions for JICA

2.7.1 Survey results on assistance frameworks and arrangements from other donors

The team conducted a survey of assistance schemes, resource acquisition, and contract status among other donors for the purpose of identifying areas where JICA might improve its assistance offerings.

The public agencies offering international development assistance can be roughly classified into three groups based on country budgets and contributions.

- Bilateral assistance agencies: Donor government development agencies. Assist target countries through government funds (e.g. USAID, JICA< DFID, OPIC, KOICA).
- Multilateral assistance agencies: International assistance agencies with multiple member governments. Provide international development assistance through contributions from multiple national governments (e.g. EU, UNDP, The Global Fund)
- Development-oriented financial institutions: Financial institutions that provide funding for economic development on a non-commercial basis (e.g. World Bank, IDB, ADB)

Based on these descriptions, JICA falls into the bilateral assistance agency category--but the team also studied the other public assistance agencies (multinational assistance agencies and development-oriented financial institutions) in order to collect suggestions from a broader perspective. In selecting actual survey targets to interview, the team put the greatest weight on assistance amounts, deciding to speak primarily with the biggest donors in each category (USAID, the World Bank, and the EU).

(1) Assist procedures and other details

International assistance procedures at the World Bank, USAID, and the EU were as follows.

Figure 200. Standard steps for project formulation and decision-making at other donors

Donor	Standard steps	Decision-making authority	Evaluation criteria
World Bank	• National strategy development (every 4–5 years) — The World Bank (WB) formulates national strategy in the form of development targets, challenges, and assist plans • Identify challenges and make preparations (3–6 months) — A WB team drafts a Project Concept Note (PCN) — The team then gets a clear understanding of the current situation and identifies challenges — WB teams draft a Project Information Document (PID), pulling in information from (outside) expert consultants. They	• Department managers at WB headquarters and local managers then decide whether the project moves beyond the review stage • The WB management team reviews the project • WB teams and donors draft a	• Alignment with the following factors: — WB targets: National strategy, Sustainable Development Goals (SDGs) — Supporter expectations — National strategy documents — Country needs

Donor	Standard steps	Decision-making authority	Evaluation criteria
	then submit the PID to the WB management team, local governments, and supporters – Experts at the WB and academic institutions around the world then review the project • Review and negotiate the project (3–6 months) – Once the WB management team reviews the project based on the report, the WB drafts a legally-binding financing agreement and negotiates the contents with the local government • Approve the project (at least a month) – The WB Board of Directors approves the project	financing agreement • The WB Board of Directors officially approves the project	
USAID	• Formulate a central development cooperation strategy (CDCS) (every five years) – USAID collects sufficient information from partner country governments, corporations, the public, and development partners to formulate a national strategy • Draft the project (2–3 months) – USAID field offices design projects and activity requirements based on the CDCS • Competition and approval (2–3 months) – Candidate contract countries around the world submit proposals and negotiate with USAID to hammer out a joint approval – USAID field offices approve the project (does not apply to global or regionwide projects)	• USAID headquarters decides on a national strategy and budget allocation • Projects are decided upon at field offices	• Alignment with the CDCS • Funding allocation and results indicators • Sustainability: Importance varies by project
EU	• Creating programs – National strategy document (every seven years): › Draft a program based on discussions with the target country – Multiannual Indicative Programmes (MIPs) for countries or regions (every seven years): › The purpose of these multi-year programs is to define goals, expected impacts, and indicators as well as allocate funding towards various targets › They undergo an interim review, and proposed corrections to the MIP are approved for the final three years • Target clarification	• The European Commission and the recipient country both take charge of formulating the project • The European Commission decides on funding allocations • The EU delegation ambassador gives final approval for the project	• Country needs: Least-developed countries are given the highest priority • Country track record

Donor	Standard steps	Decision-making authority	Evaluation criteria
	— Project targets are defined in line with development targets indicated during the program creation stage — This is done with non-country players (citizens' groups, NGOs, multinational/regional development agencies) in addition to the government of the recipient country • Project formulation — Project suitability and feasibility are indicated on designated project sheets and reviewed, and a detailed project plan is formulated — Multiple stakeholders are involved in this process — The EU delegation approves the project		

Two key takeaways are of note here:

The first is that all assistance agencies start by drafting a long-term strategy in the applicable country, before considering individual assistance programs. Further, this strategy is not drafted by the assistance agency alone, but is instead created with input from the recipient country. This ensures that the strategy is comprehensive and does not conflict with the stance of the recipient country, which in turn should allow any projects to be implemented within the context of a bigger system.

The second takeaway is that some agencies have simplified their decision-making. All of them require decisions from HQ for strategy formulation and budget allocation, but USAID, for example, is also structured so that field offices or local delegations have the authority to execute/approve individual projects. This makes it possible for individual projects to be flexibly implemented while still remaining in line with general policy.

(2) Resource acquisition and contract status

The team next spoke with the World Bank, USAID, the EU--as well as with the ITU (the specialized ICT arm of the United Nations) and KOICA (another Asian bilateral assistance agency) about how they secure the human resources they need to implement their projects.

Figure 201. Resource acquisition and contract status at other donors

Donor	Resource acquisition	Evaluation	Contracting
World Bank	• Sourcing experts from around the world — The WB utilizes expert information networks like the following:	• Experts: Primarily sourced through CV reviews and interviews — Task leaders hire experts on short-term contracts with approval from HR	• Experts: Directly contracted • Consulting firms: Tendered • If the World Bank lacks expert

Donor	Resource acquisition	Evaluation	Contracting
	— Task leaders: Personal contacts of experts in various fields — Organizations: The WB leverages its connections with top-tier universities around the world to generate expert contacts — Information-sharing platforms within organizations — Folders with rosters of CVs managed by HQ • Online hiring platforms like LinkedIn, Devex, and Development assistance	— Contract amounts between HQ and field offices are based on years of experience: Amounts are the same across all regions — There are no evaluation programs for experts on short-term contracts • Consulting firms: Standardized bidding procedure — Jointly handled by HQ and field offices: › HQ: Technical assessments › Field offices: Provide local information on individuals and companies	knowledge, it tend to hire expert individuals rather than contract with large companies • Recipient countries are responsible for implementing projects
USAID	• USAID calls for proposals from US-run sites like sam.gov and grants.gov as well as from websites run by countries implementing projects • The agency primarily reaches out to companies rather than individual experts • Contract leads at field offices manage the entire sourcing process, from publishing information on competitive bidding to contracting. Major contracts require HQ approval	• Bids are evaluated based on the following criteria: — Capability: A technical review committee evaluates information on project track records and local reputation — Creditworthiness • Ultimately, American companies are overwhelmingly selected as contractors, which has to do with their technological strength and reputation for being able to successfully transfer the technologies needed for the project in an ongoing way.	• Names are added to the contract based on the bidding results at field offices • Primary contractors are typically approved by USAID; they then hire subcontractors. Contracts below a certain monetary amount or those whose contracting methods have been approved by the government in advance--or those that only involve fixed amounts--may not need these approvals
ITU	• The ITU only maintains regional offices, and does not have field offices in individual countries--so it relies on other organizations to get the local information it needs to find suitable candidates	• Bids are evaluated based on the following criteria: — Local government information — Credentials submitted by other donors — Track record on past projects	• Contracts are prepared based on bidding results • Contractors hire subcontractors based on approval • Local governments

Donor	Resource acquisition	Evaluation	Contracting
	— Local governments submit a list of suitable candidates — Other donors introduce candidates in the region		regularly track project progress with ITU
KOICA	• Key contractors — Solicited through the KOICA website — KOICA typically sources contracts from its existing contacts (the Korean government, NGOs, and universities) • Local talent: — Local networks › Korean embassy networks › Korea Trade-Investment Promotion Agency (KOTRA) networks › Local experts hired by field offices › Government agency and local government networks › Government employees who have been educated at Korean universities through assistance programs — Field offices conduct market surveys and announce projects to local companies	• Contractors with the highest ROI are identified during the bidding process based on the following criteria: — Business scalability › Activity track record in the recipient country (local networks, local counterpart management) › Project management capability › Financial capability — Technical strength of the sector — Declared expenses	• KOICA HQ must approve subcontractors • Most contracts are paid in fixed installments • If project liquidity is high or the training is simple, the contract can be set up so that payments are based on actual expenses incurred
EU	• Large-scale projects — Solicited through the EU website — Open tender • Small-scale projects: Less than EU 1M — Framework contract SIEA 2018 — Bidding takes place among multiple companies selected by a system from a list of those eligible to participate • In recent years, the EU has tended to mostly rely on other donors (like the UN) to implement its projects, including sourcing	• Bidding goes through the following stages: — Forecasting — An SPV1 notification is announced to encourage third-party organizations (juridical persons) to participate — A list of final candidates is prepared based on the selected organizations, and the EU requests technological and financing proposals once it indicates its terms of reference (ToR) — Selection results are announced • Technological and financing proposals are scored based on	• Names are added to the contract based on the bidding results at the EU delegation (embassy) • The EU typically requires that subcontractors be listed during the bidding process

Donor	Resource acquisition	Evaluation	Contracting
		the following evaluation criteria: — Technical (70–80%) › Whether the qualities and capabilities of key experts are up to standard (around 30–50%) › Logical grounds, scheduling and other methods (at least 40% or so) — Financial (around 20–30%)	

Two key takeaways are of note here:

First, assistance agencies maximize their use of individuals, organizations, and outside networks to ensure that they have the necessary resources. The World Bank uses the network platforms of individuals and organizations as well as external job platforms like LinkedIn, Devex, and Development assistance, while KOICA uses the Korea Trade-Investment Promotion Agency (KOTRA) as well as organizational networks. Agencies also tap into local employees at country field offices and the networks of partner country governments.

Second, agencies have frameworks for quickly securing the resources they need. The World Bank has to go through typical recruiting procedures when it contracts with companies (including consulting firms), but if it employs experts on short-term contracts, it can hire whomever it wants for the task teams and leaders responsible for implementing the project once HR approves them. The EU uses a framework called the Framework Contract SIEA 2018 for projects of EU 1M or less, allowing it to hire resources from preapproved companies. These frameworks allow for the rapid acquisition of the necessary resources so that projects can move ahead quickly.

(3) Assistance from other donors

Examples of assistance from the other donors identified in the survey are listed below for each enabler.

Governance and policy

Donor	Target country	Project name	Overview	Year finalized	Assistance amount
USAID	Asia-Pacific region	Digital Asia Accelerator	This project aims to introduce the necessary systems and/or lay the foundation for digital economies in order to ensure that advancing digital economies bring benefits to partner countries and afford equal protections for their	Undisclosed	-

Donor	Target country	Project name	Overview	Year finalized	Assistance amount
			citizens. With this in mind, the Accelerator, backed by the Digital Connectivity and Cybersecurity Partnership (direct assistance from the US government over several years) helps countries in Southeast Asia and the wider Indo-Pacific region develop human/organizational capabilities and establish sound policy frameworks to ensure safe participation in digital economies. The goal is to make countries more independent and develop them into strong US partners.		
Asian Devel-opment Bank (ADB)	Cook Islands, Marshall Islands, Palau, Tonga, Vanuatu	Pacific Information and Communication Technology Investment Planning and Capacity Development Facility	This facility provides technical assistance at the request of Pacific Island governments looking to strengthen their ICT capabilities. Technical assistance aims to (i) develop ICT policy and regulatory frameworks, (ii) develop ICT applications, and (iii) help countries adapt to technological innovations while protecting them from cybercrime.	2017	-
CIDCA	Laos	Upgrade Laos' ministry information system	This project upgrades the computer systems at the Laos Ministry of Industry and Commerce, installs a remote videoconferencing system, develops an electronic filing system, and provides information and training for Laotian engineers. It helps the ministry provide useful public services that are quick and easy to manage, promotes information-sharing between the central and local governments in Laos, and strengthens the country's data processing capabilities.	2021	-

Donor	Target country	Project name	Overview	Year finalized	Assistance amount
IFC	Nepal	SME A2F Nepal	1. Collect evidence for data-driven policy reform 2. Assistance policies for financial infrastructure and digital platforms 3. Develop and popularize new, groundbreaking tools for MESME finance	2019	-
ITU	Saudi Arabia	Advisory Services to Saudi Arabia's Communication and Information Technology Commission	This project advises the Saudi government on the formulation of telecommunications development programs in the field of radio frequency spectrum management.	Undisclosed	-
ITU	Asia-Pacific, Saudi Arabia	Child Online Protection (COP) policy framing	This project aims to protect children online in select countries in the Asia-Pacific region. It focuses on providing guidance, developing and popularizing guidelines, building talent and organizational capabilities, increasing stakeholder involvement, and raising awareness.	Undisclosed	-
ITU	ITU member states	Collaborative ICT policy and regulation	This project conducts detailed surveys and analyses in the areas of ICT policy and regulatory cooperation. The survey provides benchmarks to assist evidence-based decision-making in ITU member states.	Undisclosed	-
ITU	Paraguay	Development of CONATEL's Regulatory Capacity (Paraguay)	This project helps the National Telecommunications Commission, Paraguay (CONATEL) regulatory agency develop its organization and functionality while building organizational capability, thus promoting efficient performance in a competitive environment.	Not available	-

Donor	Target country	Project name	Overview	Year finalized	Assistance amount
ITU	ITU member states	Enhancement of National Emergency Telecommunication Plans	This project assists the formulation of emergency communications plans in ITU member states, particularly LDCs, LLDCs, and SIDS. Particular consideration is given to the importance of last-mile connectivity, early warning, monitoring, warning systems, and humanitarian assistance communities.	Undisclosed	-
KOICA	SEA + FEA	Government officials capability building	This project assists the formulation, implementation, and evaluation of ICT policy while promoting comprehensive capability improvements among government employees.	Annually	58+29 USD Mn
KOICA	SEA + FEA	Government officials capability building	This program strengthens local government employees and public workers by providing comprehensive educational programs on management skills and specialized policy analysis skills.	Annually	15.5+7.8 USD Mn
KOICA	Bangla-desh	Establishment of the e-Government Master Plan and Capacity Building for Digital Bangladesh	This project formulates a basic e-government plan for digital Bangladesh.	2014	-
KOICA	Indonesia	Establishment of Intelligent Transport Systems (ITS) Master Plan and Pilot system for Jakarta Metropolitan Area in Indonesia	• Formulate a basic plan for intelligent transport systems in Jakarta • Implement pilot projects to test the systems • Provide guidelines on regulations related to the systems • Assistance capability building among system employees through workshops, seminars, and training programs (both in-country and overseas)	2019	-

Donor	Target country	Project name	Overview	Year finalized	Assistance amount
KOICA	South/ Central Asia	Project for Establishment of Law Information System	This project develops information systems and databases for laws and ordinances, establishes basic plans for business process engineering and IT, provides training in systems management (for both high-level officials and frontline workers), and assists systems management and government procurement	2019	-
World Bank	Senegal	THIRD MULTI-SECTORAL STRUCTURAL REFORMS DEVELOPMENT POLICY OPERATION: SUPPLEMENTAL FINANCING	Assistance the government in its upcoming initiatives • Improve financial performances and reliability in the energy sector while promoting equal access • Set up regulatory systems in the ICT sector to encourage competition, investment, and equal access • Strengthen the policy, organizational, and financial foundations of the digital economy	2020	100 USD Mn
World Bank	Sudan, Somalia	Improve policy decision-making by leveraging data & analytics	Sudan: The project helps the government collect data on critical socioeconomic indicators and make provisionary poverty estimations at the national level so that it can be used for policy formulation and monitoring. Somalia: The project strengthens national statistical systems for collecting, processing, and disseminating poverty and macroeconomic data so that it can be used for policy formulation and poverty reduction activities.	2021	25 USD Mn

Donor	Target country	Project name	Overview	Year finalized	Assistance amount
World Bank	Global	Master's Degree Program in Techno-Entrepreneurship Competency Based on EE-ICT Convergence('18-'20)	This program was established to educate government employees in developing nations in electrical engineering and ICT convergence in order to strengthen capabilities across the board for the purpose of developing startups.	yearly	-
World Bank	Nigeria	Nigeria Digital Identification for Development Project	The purpose of this project is to increase the number of people with national identification numbers issued through a basic ID system that is both comprehensive and robust. • Strengthen legal and institutional frameworks • Establish a basic ID system that is both comprehensive and robust • Use the ID system to access services	2020	USD 430M

Communications infrastructure

Donor	Target country	Project name	Overview	Year finalized	Assistance amount
CIDCA	Africa	Expand your vison, expand your world: Access to satellite TV for 10,000 African villages	The purpose of this project is to give people living in more than 10,000 African villages access to satellite TV programs.	2015	-
CIDCA	Pakistan	Land-based China-Pakistan cross-border optical fiber	This is the first land-based, cross-border fiber-optic project between China and Pakistan. The project lays 820 km of underground cable from Rawalpindi to Kunjirap, linking it to the Chinese border and connecting it fiber optic cable on the China side.	2010	-
EU	East Africa	Seychelles East Africa Submarine Cable	This project lays a submarine fiber-optic cable linking the Seychelles Islands to the African mainland. The project is driven by the Seychelles Cable Systems Company Limited (SCS) PPP consisting	Not available	4 Euro Mn

Donor	Target country	Project name	Overview	Year finalized	Assistance amount
			of Airtel, Cable and Wireless Seychelles (CWS), and the Seychelles government.		
EU	Africa	Satellite enhanced Telemedicine and e-Health for sub-Saharan Africa	The purpose of this project is to use satellite infrastructure to put effective solutions in place assistanceing healthcare and improving overall healthcare systems in Sub-Saharan Africa. The infrastructure provides education, healthcare, surveys, and management services to the people and healthcare workers in Sub-Saharan Africa.	Not available	4 Euro Mn
EU	Africa	African Internet Exchange System (AXIS)	The purpose of this project is to assist and promote the establishment of internet exchange points (IXPs) and local internet carriers. More specifically, it carries out capacity building for internet community stakeholders while providing technological assistance for local internet exchange points (IXPs) and policy/regulatory reform at the local level.	Not available	5,1 Euro Mn
EU	Africa	EASSy	This project (EASSy) is a plan to create cable landing points in Djibouti, Somalia, Kenya, Tanzania, Madagascar, Mozambique, Mayotte, and Comoros while laying 10,000 km of submarine cable between Sudan and South Africa. EASSy is the second fiber optic cable linking these countries to the global fiber optic network. The EU-Africa Infrastructure Trust Fund (EU-AITF) was used to hire a core management team, with the remaining funds used to pay for the cost of a management team during the project construction phase.	Not available	2.6 Euro Mn
EU	Africa	Infrastructural Challenges in Smaller African	This innovative survey looks at water and digital infrastructure in the smaller cities of Sub-	Not available	0.2 Euro Mn

Donor	Target country	Project name	Overview	Year finalized	Assistance amount
		Cities: Digital Technologies and Water Infrastructure for Sustainable Towns	Saharan Africa. The survey assesses the status of digital technology adoption in water infrastructure.		
ITU	Thailand	DTTB Frequency Planning & Measurement (Thailand)	This is a project between the ITU and NBTC to achieve a smooth transition from analog to digital broadcasting.	Not available	-
ITU	Cambodia, Niger, Tanzania, Comoros, Palestine	Connect a School, Connect a Community	The purpose of this project is to give rural elementary schools in remote farming villages with a lack of services more broadband access, allowing them to function as community ICT centers. It aims to improve ICT access for local community members (including women, girls, indigenous people, local residents, seniors, and people with disabilities).	Not available	-
ITU	Global	GIGA - a Global School Connectivity Initiative	The purpose of this joint initiative between ITU and UNICEF is to connect every school to the internet.	Not available	-
USAID	Indonesia	Indonesia BroadBand Plan	Assistance the government in its upcoming initiatives • Improve financial performances and reliability in the energy sector while promoting equal access • Set up regulatory systems in the ICT sector to encourage competition, investment, and equal access • Strengthen the policy, organizational, and financial foundations of the digital economy	Not available	-
World Bank	Malawi	Digital Malawi Program Phase I: Malawi Digital Foundations Project	The purpose of this project is to give governments, the private sector, and citizens greater access to affordable, high-quality internet-based services while building the capabilities of governments providing digital public	2017	72.4 USD Mn

Donor	Target country	Project name	Overview	Year finalized	Assistance amount
			services. More specifically, it reduces the cost of internet access while making connections more stable and usable while helping develop the necessary infrastructure and government capabilities to promote the digitalization of public services.		

Human resources

Donor	Target country	Project name	Overview	Year finalized	Assistance amount
IFC	Vietnam	Building a Sustainable Agriculture Sector in Vietnam by Applying Ag Tech Innovations	The purpose of this project is to provide access to smart agriculture technologies to smallholder farmers in Vietnam to assist rice, coffee, black pepper, fruit, and cocoa production as well as improve agricultural productivity and sustainability. The project establishes smart agriculture models that are commercially viable for smallholder farmers and pushes for their widespread adoption.	2020	-
ITU	Global	Digital Skills Badges	This project addresses the digital gender divide by giving girls and young women around the world the digital skills they need to find regular employment and start their own businesses. The project targets girls and young women through the ITU Academy and online STEM workshops, offering free, high-quality, globally-recognized digital skills training as well as program certification. Participating women also serve as role models and mentors.	Not available	-
ITU	Zambia	Basic PC and Training Course in Zambia	This project provides students at designated schools in Zambia training on how to use computers and the internet.	Not available	-

Donor	Target country	Project name	Overview	Year finalized	Assistance amount
ITU	Ivory Coast, Kenya, Nigeria, Rwanda, Senegal, South Africa	Boosting decent jobs and enhancing skills for youth in Africa's digital economy	The purpose of this joint program is increase the number of young Africans with access to decent work in the digital economy. ITU and ILO secured subproject funding for six countries (Ivory Coast, Kenya, Nigeria, Rwanda, Senegal, and South Africa) in order to implement the program. The program is a collaborative effort between governments, social partners, the private sector, local communities, academia, and other existing international agency and development bank partners. It also built new partnerships for the purpose of developing cutting-edge skills and creating local job opportunities. It is complemented by programs already being implemented by other agencies.	Not available	-
ITU	Ghana and other countries	Boosting digital skills through Digital Transformation Centres (DTCs)	The International Telecommunication Union (ITU) and Cisco began this Digital Transformation Centre (DTC) initiative. The purpose of the initiative is to assist each country in improving digital skills (particularly at the beginner and intermediate level), prioritizing regions without sufficient access to services. At the heart of this aim is expanding digital skills training and building capabilities so that the majority of the population has access to it. The project seeks to provide expanded digital skills training opportunities to enhance digital literacy in rural communities and among others who have been left behind. The main focus of the project is to assist for DTC activities in Ghana, but it was expanded	2019	-

Donor	Target country	Project name	Overview	Year finalized	Assistance amount
			during the project stage (to nine countries) and will further broaden its reach during phase two. At the completion of the project, recipient countries had greatly increased the number of people who had received beginning and intermediate digital skills training that could be used on the job to help them succeed in their careers. It is hoped that more young entrepreneurs will undergo digital and entrepreneurial skills training as well.		
ITU	Ethiopia	Computer Training and Braille transcribing service in Ethiopia	The purpose of this project is to assist the use of ICT among persons with disabilities; namely, the blind and visually impaired. The project participants integrate into the wider community, including schools and employment agencies.	Not available	-
UNDP	Turkey	Beyond Recovery of SMEs through Digitalization	This project positions UNDP development workers and policy creators as advisors on digital transformation in the private sector (particularly SMEs) in Turkey. The project accelerates digitalization in the Turkish manufacturing and service industries by raising awareness, building capabilities, and providing resources. It also builds digital capabilities in development agencies, promoting further digitalization and ensuring development sustainability. Development agencies are using best practices developed in pilot regions to spread the project throughout the country.	Not available	0.2 USD Mn
World Bank	The Caribbean	Caribbean Digital Transformation Project	The purpose of this project is to give businesses and individuals greater access to digital services, technologies, and skills.	2020	94 USD Mn

Innovation ecosystems

Donor	Target country	Project name	Overview	Year finalized	Assistance amount
EU	Africa	Euro-African Open Biomedical Engineering e-Platform for Innovation through Education	Ubora is an open-source digital platform between the EU and Africa for jointly designing fresh solutions to existing and future challenges facing healthcare. The infrastructure makes it possible to network, quickly translate new ideas into prototypes, share safety standards and performance data, and more.	Not available	1 Euro Mn
EU	Africa	Open Innovation Platform for IoT-Big Data in Sub-Sahara Africa	The WAZIUP project is an open innovation platform for IoT and big data in Sub-Saharan Africa that uses cutting-edge IoT and big-data technology to improve working conditions in the rural ecosystem of Sub-Saharan Africa. First, WAZIUP involves end users of IoT and big data in order to define focused validation cases. Secondly, it engages the ICT ecosystem by fostering new tools and good practices among entrepreneurs and start-ups. Aimed at boosting the ICT sector, WAZIUP proposes solutions aiming at long term sustainability.	Not available	3 Euro Mn
IFC	Vietnam	AFIN SANDBOX	ASEAN Financial Innovation Network (AFIN) will create and operate a market platform and technical environment that enables fintech companies scale their businesses regionally, helping financial institutions (FIs) benefit from more competition and a robust ecosystem of fintech solutions. At the core of AFIN will be a fintech marketplace and Sandbox (e.g. systems and user testing) environment for FIs to access, develop, and design new or improved financial products/services. AFIN will set up this platform, establish legal and commercial service	2019	-

Donor	Target country	Project name	Overview	Year finalized	Assistance amount
			relationships with fintechs and FIs, and help create a dynamic community of FIs, fintechs, developers, and regulators that accelerate regional innovation and adoption.		
IFC	Pakistan	ISC Sarmayacar	This initial-stage venture capital fund provides USD 30M to invest in high-tech Pakistani companies. The investments assist startups and innovation during the initial stages through the IFC's Startup Catalyst initiative.	2019	30 USD Mn
KOICA	Nepal	The Project for Integrated Rural Development of Nepal through Strengthening Research and Development Capacity of Kathmandu University	This project builds a technology innovation center, formulates a basic plan for the sector, and implements capacity-building programs and pilot projects for technological development.	2015	-
UNDP	Indonesia	Global Pulse - Data Innovation for Development (PLJ)	This project assists ICT innovation for the purpose of formulating development plans and policies in the areas of trade, competitive strength, providing frontline services, government information management, and social protections.	Not available	1 USD Mn
UNDP	Malaysia	Designing Urban Observatory Governance and Data Analytics	This project designs an observatory for governance and data analytics in Iskandar, Malaysia.	Not available	-
USAID	India	India Catalyst's Incubator Program	Part of a partnership between USAID and the Indian Ministry of Finance, this project uses USAID's Digital Finance practice to assist the launch of the India Catalyst Program. The program aims to use affordable, scalable digital payments and tools to create an inclusive digital economy open to every person in India--particularly low-income earners.	Not available	-

Donor	Target country	Project name	Overview	Year finalized	Assistance amount
World Bank	Morocco	First Financial and Digital Inclusion Development Policy Financing	The purpose of this project is to assist financial inclusivity and digital entrepreneurship while improving access to digital infrastructure and services, enhancing resilience for both families and companies.	2020	500 USD Mn
EU	Africa	Euro-African Open Biomedical Engineering e-Platform for Innovation through Education	Ubora is an open-source digital platform between the EU and Africa for jointly designing fresh solutions to existing and future challenges facing healthcare. The infrastructure makes it possible to network, quickly translate new ideas into prototypes, share safety standards and performance data, and more.	Not available	1 Euro Mn

2.7.2 Proposed improvements for JICA's assistance frameworks and arrangements

(1) Challenges faced by JICA's office for STI and DX when implementing assistance in the ICT/digital sector

The survey identified several challenges that JICA's office for STI and DX is likely to face.

Drafting and project formulation process

- (Challenge 1) Difficulty of finalizing assistance programs for enablers in isolation: Assistance for digital enablers under the control of JICA's Office for STI and DX is not by itself directly tied to economic or social impacts. Initiatives that directly contribute to impacts are those implemented through established enablers. For this reason, it is difficult to estimate or control the impact of assistance programs that target enablers in isolation. In the case of developing broadband infrastructure, for example, it is unclear which sectors will use the broadband or in what form--making it difficult to figure out the kinds of economic impacts that will be generated from installing it. For this reason, JICA will have to have multiple departments working together to formulate projects in order to reliably generate specific economic and social impacts.
- (Challenge 2) Difficulty of formulating cross-sector projects in new areas like ICT and DX: The interests of managing and related departments must align in order to formulate cross-sector projects, but in some cases it may not be possible to make project formulation a shared priority across multiple issue-based or regional departments. Particularly in new areas where the organization has no internal experience implementing assistance, there is little understanding of the importance of that assist in related departments outside the lead department, coupled with a tendency to lean towards project

formulation in areas where there is established precedent. Individual JICA leads also handle numerous projects, and in many cases are unlikely to have the bandwidth to put together cross-sectoral projects involving multiple stakeholders, both counterparts and within JICA.

Assistance schemes

- (Challenge 3) Difficulty of building schemes that generate ongoing development impacts: As with assistance in other areas, assistance for digital solutions can end with the effects of development not persisting because the target country has not gained the capabilities to move forward on its own after the assistance period is over, or because there is no funding for outsourcing.
- (Challenge 4) Difficulty of applying existing financial assistance schemes in areas with rapid technological progress, such as systems development:
  - Grant assistance: When a project must be completed in a short period of time (two or three years), it can be impossible to accurately predict when systems development projects will be complete, and development may take a long time in some cases
  - Loan assistance: It takes several years to reach contractor agreements under the current process, making it highly likely that the systems that need introducing in fast-moving digital sectors will undergo major changes by time the contracts are signed, making it difficult to put these schemes into practice.

Securing implementation resources

- (Challenge 5) Difficulty of flexibly utilizing local and third-country resources: Even with untied assistance, it is sometimes difficult in practice to actually utilize third-country resources

(2) Suggestions for improvement

The following suggestions may help address the above challenges.

Drafting and project formulation process

- (Challenge 1) Difficulty of finalizing assistance programs for enablers under a single department
- (Challenge 2) Difficulty of formulating cross-sector projects in new areas like ICT and DX

The following two suggestions may help address the above challenges.

First, introduce a frameworks/activities to encourage the formulation of projects that involve ICT and DX. Making ICT and DX a greater priority within the organization would be an effective way to promote cross-sector project formulation. More specifically, JICA could start by introducing “DX screening” as an evaluation item during the project approval process. In other words, specifying and adopting a framework that allocates points to DX-related projects would likely push the entire organization--even other departments--to actively promote the formulation of projects that involve DX. Activities to raise awareness about the impact of DX would also be effective. Holding events to communicate the importance of DX and actively promoting joint tasks with the DX Office may cause leads in other departments to take an interest in DX and increase the number of cross-sector projects that incorporate DX from the ground up.

The second suggestion is to adopt frameworks and develop and organizational culture that promote the launch and implementation of cross-sector assistance programs. More specifically, JICA could (1) adopt a framework for evaluating performance in terms of increasing job assignments and promoting cross-sector projects; (2) simplify the reporting and decision-making process in order to streamline tasks by integrating/narrowing down projects to focus/efficiently utilize resources; and (3) standardize top-down approaches.

- (Challenge 3) Difficulty of building schemes that generate ongoing development impacts

The following two suggestions may help address this challenge.

First, make end-to-end capability improvements at counterparts. Since contractors are not generally strongly motivated to build on-site capabilities, it would be useful to plan incentives to have them to commit to doing so. As an example, when selecting contractors, JICA could establish an evaluation item to assess the degree to which the contractor is expected to independently maintain/operate the system once assistance has ended.

The second suggestion would be to create mechanisms that make counterparts continue to stick to the budget. This could be achieved by legally mandating that counterparts stick to the budget and spelling out efforts to maintain the budget in government policies.

- (Challenge 4) Difficulty of applying existing financial assistance schemes in areas with rapid technological progress, such as systems development

The following two suggestions may help address this challenge.

The first is to make use of schemes that can more dynamically respond to funding demands. This would likely involve coordinating with other donors and having them supplement funds in areas where it is difficult for JICA schemes to be applied. One idea would be to set up collaborations where, for example, a donor with a scheme that allows for flexible procurement could take charge of assisting system development, while JICA implements the capability-building assistance that the organization needs to use that system.

A second suggestion is to reevaluate procurement guidelines to make procurement more flexible. As a reference example, the UK Government Digital Service (GDS) uses agile methods to develop and upgrade the government's digital platform, gov.uk. More flexible assistance in line with technological advancement could be enabled under JICA financial cooperation schemes as well if procurement were defined within the scope of assistance in the time and materials contracts applied to agile development projects like these. Meanwhile, in addition to establishing participation and monitoring frameworks on the Japan side to make sure that funds are effectively utilized and that the required development is carried out, it may be important for JICA to ensure a member composition that enables counterparts to make agile decisions.

- (Challenge 5) Difficulty of flexibly utilizing local and third-country resources

One suggestion for addressing this challenge is to establish guidelines for utilizing third-country resources. If it is difficult to actually utilize third-country resources even with untied assistance, barriers to

that utilization need to be removed, including by clarifying rules and simplifying procedures. There are other assistance agencies that secure the necessary resources, including those from third countries, by utilizing their main contractors' existing networks or the networks of their field offices.

2.8 Attachments

2.8.1 List of related projects by relevant Japanese organizations

Category	Donor	Implementing institutions	Recipient countries	Overview	Timeframe
Governance and policy	Japan-ASEAN Integration Fund (JAIF)	-	ASEAN	Created a framework for policies and systems designed to develop cloud computing environments	Approved FY2018
Human resources	JETRO	The Asahi Shimbun Company	Thailand	Professional education media platform project for Thai university students • The Asahi Shumbun used its expertise in developing the *Oshigoto Nenkan* (*Job Yearbook*), which it publishes to assist professional education among elementary and junior high school students in Japan, to create a Thai version of the yearbook primarily aimed at local university students and provide it free via an online platform • The Asahi Shimbun teamed up with the company that runs jobsugoi.com, a job-hunting assistance site for new graduates and mid-career hires, to provide Thailand with articles and videos on jobs as well as internships providing critical training for university students. It also worked with local universities to provide them with job-finding information and similar resources.	Selected FY2020
Human resources	Japan-ASEAN Integration Fund (JAIF)	ASEAN inter-government human rights commission (AICHR)	ASEAN	AICHR held workshops on gender equality and promoting women in the workforce via ICT	November 2019
Innovation ecosystems	-	JASCA	ASEAN	The Japan Association for Smart Cities in ASEAN (JASCA) is using public-private partnerships to popularize and spread smart city technologies, experiences, and expertise to the ASEAN member states and their cities	-

Category	Donor	Implementing institutions	Recipient countries	Overview	Timeframe
Innovation ecosystems	JETRO	SkymatiX, Inc.	Cambodia	SkymatiX introduced its Japan-developed Iroha leaf color analysis service to Cambodia as part of a digitalization promotion project. Cambodia's primary crop is wetland rice. The service uploads images of farmland taken automatically by drones into the cloud and subjects them to image analysis	Selected FY2020
Innovation ecosystems	JETRO	Toyota Tsusho Corporation Nippon Koei Co., Ltd.	Cambodia	Project to develop and test a digital platform for tourist MaaS at the ruins of Angkor (Cambodia). The project is tracking tourist behaviors with the goal of constructing a smartphone application prototype capable of providing packaged sightseeing and transportation services for a more customized and stress-free travel experience	Selected FY2020
Innovation ecosystems	JETRO	Ryobi Systems	Laos	Provide a health management platform utilizing a personal health record (PHR) platform. This project uses an IT-powered personal health record (PHR) platform to track individual health information before problems arise, with the goal of extending healthy life expectancies and establishing a reliable everyday platform for alleviating health concerns	Selected FY2020
Innovation ecosystems	JETRO	Internet Initiative Japan Inc.	Thailand	This project aims to introduce IoT solutions to improve productivity at seafood farms. Internet Initiative Japan is installing IoT sensors at Thai shrimp farms to automatically collect water quality environment information such as water temperature, dissolved oxygen, and pH levels. The project is also visually tracking the relationship between the water quality environment and work operations by recording data on feeding, water changes, and other employee tasks, with the goal of improving work efficiency and productivity	April 2018–March 2019

Category	Donor	Implementing institutions	Recipient countries	Overview	Timeframe
Innovation ecosystems	JETRO	-	Thailand	Thailand's Office of the Prime Minister and the Ministry of Industry signed an MoU with Japan's Ministry of Economy, Trade and Industry, the Japan External Trade Organization (JETRO), and the AEM-METI Economic and Industrial Cooperation Committee (AMEICC) to promote open innovation between Japan and Thailand. The group is working on a proof of concept (PoC) aimed at identifying potentials for joint projects among six Japanese and Thai startups, major corporations, and financial conglomerates (as well as the companies under their control)	November 2019
Innovation ecosystems	—	Toppan Printing Co. Ltd.	Thailand	Toppan Printing established a local company (Toppan (Thailand) Co., Ltd.) and began providing full-scale, digitally-powered marketing solutions for Japanese and local companies in June 2019	June 2019–
Innovation ecosystems	JETRO	Hitachi, Ltd.	Thailand	Hitachi rolled out a service offering a detection model for disease risk factors. The company plans to develop a Thai version of their Risk Simulator to help local hospital groups organize and utilize their medical data in order to predict disease risks in patients. The simulator will be provided to life insurance companies, companies involved in health promotion, and other private companies to help control medical costs in Thailand and encourage health through disease prevention	Selected FY2020
Innovation ecosystems	JETRO	Nihon Agri, Inc.	Thailand	Experimental project for protected strawberry horticulture in hot climates. Nihon Agri introduced greenhouse facilities in the hottest parts of Asia, which are typically considered unsuitable for strawberry cultivation. The project team will	Selected FY2020

Category	Donor	Implementing institutions	Recipient countries	Overview	Timeframe
				collect data on indoor environments and cultivation status, and then use it to set up a food value chain (FVC) involving stable, highly replicable production of quality crops	
Innovation ecosystems	JETRO	Sagri Co., Ltd.	Thailand	This experimental project is looking at using satellite data to build a digital platform for rice farming information. The platform will be set up so that anyone can easily input digital information, and will use satellite data and AI technologies to collect farming status information over a wide area	Selected FY2020
Innovation ecosystems	JETRO	Umitron Pte., Ltd.	Thailand	Umitron is developing and testing a data platform for shrimp cultivation in ASEAN using IoT and AI technologies. Shimp production is one of Thailand's core industries, and the company has developed a proprietary technology--the first of its kind in the world--that uses IoT/AI to automatically analyze shrimp in ponds. Next, the project will test and introduce IoT devices capable of performing the analysis	Selected FY2020
Innovation ecosystems	JETRO	OPTEX Co., Ltd.	Thailand	The purpose of this experimental project is to localize and apply a digitally-powered water-quality monitoring service for seafood farming in Thailand. The company will set up a digitally-powered water-quality analysis service to manage water quality at seafood farms, leading to improved environmental conditions and productivity at small and midsize farms as well as large-scale operations. Next, the project will look at expanding the service to India as well as to other ASEAN countries with thriving aquaculture industries	Selected FY2020

Category	Donor	Implementing institutions	Recipient countries	Overview	Timeframe
Innovation ecosystems	JETRO	JERA Co., Inc.	Thailand	This project is verifying business models for thermal power generation equipment using digital technologies and electrical power infrastructure standards. The team is using digital technology to analyze operational data from thermal power plants in order to rapidly detect problem indications and maintain high thermal efficiency at the facilities. The goal is to reduce repair and fuel costs while further reducing the environmental impact of thermal power plants. The project also aims to create new business opportunities, such as helping plants reduce insurance costs by acquiring ISO certification	Selected FY2020
Innovation ecosystems	JETRO	Challenergy Inc.	Philippines	Making islands more sustainable by setting up decentralized energy platforms. Challengery is introducing microgrids that focus on renewable energy, which provides a cheap source of power that remains stable even under disaster conditions. The project is looking at all kinds of technologies with the goal of bringing in renewables and constructing a virtual energy platform that allows for remote monitoring and control of the electrical grids	Selected FY2020
Innovation ecosystems	Japan-ASEAN Integration Fund (JAIF)	Ministry of Land, Infrastructure, Transport and Tourism	ASEAN	ASEAN-Japan Smart Cities Network High Level Meetings are also being held with assistance from the ASEAN Smart City Network (ASCN) and the Japan-ASEAN Integration Fund (JAIF). The first meeting, held in October 2019, had some 800 participants that included ASEAN invitees. The event was an opportunity to present Japanese technologies and expertise as well as have ASEAN cities share their challenges and needs. The Japan Association for Smart Cities in ASEAN (JASCA), a framework consisting	2019/2020

Category	Donor	Implementing institutions	Recipient countries	Overview	Timeframe
				of both public and private partners, also reviewed collaborative efforts towards making smart cities a reality in ASEAN. At the second meeting, presenters shared smart city best practices in both Japan and ASEAN, while members discussed ways of resolving the issues faced by various ASEAN cities during the pandemic.	
Innovation ecosystems	Japan-ASEAN Integration Fund (JAIF)	-	Cambodia Laos	Business planning and training offered for entrepreneurs and SMEs.	-
Innovation ecosystems	Japan-ASEAN Integration Fund (JAIF)	BHN, Japanese Telemedicine and Telecare Association, Asia eHealth Information Network	ASEAN	ASEAN-Japan Medical ICT Forum: Sharing of knowledge and experience in healthcare ICT/e-health and information exchange between Japan and the ASEAN member states (AMS). The main focus of the forum was to share outstanding Japanese ICT innovations and experience in health and healthcare with the ASEAN member states as well as Japanese healthcare policy and detailed case studies in the ICT sector--including local healthcare networks, telehealth, and remote hospital management systems.	February 2017

Source: Press search

2.8.2 List of Japanese, local, and third-country resource candidates

(1) Telecom infrastructure

Local operators (Cambodia, Laos)

Country	Company	Address	Esta-blished	Key services	Annual sales
Cambodia	Cam GSM Co Ltd	246 Monivong Blvd, Phnom Penh, Cambodia	1998	Mobile network service providers	USD 55 million (estimated)
Cambodia	Smart Axiata Co Ltd	No. 464A Monivong Blvd, Sangkat Tonle Bassac Khan Chamkarmorn, Phnom Penh, Cambodia	2008	Mobile network service providers	USD 116 million (FY2018)

Cambodia	Viettel (Cambodia) Pte Ltd	Building #199, Mao Tse Tung Blvd, Sangkat Tuol Svay Prey2, Khan Chamkamon, Phnom Penh, Cambodia	2006	Mobile network service providers	USD 3 million (FY2016)
Cambodia	Xinwei (Cambodia) Telecom Co Ltd	Building No. B3 and No. C31 (CooTel Building), Street 169, Sangkat Veal Vong, Khan 7 Makara, Phnom Penh, Cambodia	1995	Mobile network service providers	USD 8.4 million (estimated)
Cambodia	South East Asia Telecom (Cambodia) Co Ltd	No. 149, St. 432, Village 5, Sangkat Boeung Trabek, Khan Chamkar Mon, 12305, Phnom Penh	2014	Mobile network service providers	USD 3 million (estimated)
Laos	Lao Telecommunications Co., Ltd.	Lanexang Avenue, Vientiane, Vientiane Prefecture 01000, LA	1993	Mobile network service providers	USD 232 million (FY2016)
Laos	Star Telecom Co. Ltd (Unitel)	Nongbone Road, Phonxay Village, Saysettha District, Vientiane Capital, Laos	2009	Mobile network service providers	USD 201 million (FY2014) USD 1.35 billion (accumulated revenue from 2009 to 2018)
Laos	Enterprise of Telecommunications Lao (ETL) Co., Ltd.	Saylom Road, Saylom Village, Chanthabouly District, Vientiane Capital 01000 Lao	2000	Mobile network service providers	USD 185 million (estimated)
Laos	VimpelCom Lao Company Ltd.	23 Singha Road, Saysettha District, Vientiane, Vientiane Capital P/O box 4693, LA	2003	Mobile network service providers	USD 55 million (estimated)

Mobile network infrastructure companies (serving Laos/Cambodia)

Branch location	Company	Address	Esta-blished	Key services	Annual sales
Cambodia	Telefonaktiebolaget LM Ericsson	Unit G01, Himawari Hotel, 313 Sisowath Quay Phnom Penh	1876	Mobile network infrastructure	USD 27.05 billion (FY2020)
Laos	Huawei Technologies Co., Ltd.	3 Floor Vientiane New World, Located at Anouvong Road, Phiavat Village, Sisattanak District, Vientiane Capital Lao	1987	Mobile network infrastructure	USD 136.7 billion (FY2020)

Branch location	Company	Address	Esta-blished	Key services	Annual sales
Cambodia	Nokia Corporation	315 Ang Doung St Wat Phnom Khan Daun P – L18 Canadia Tower Phnom Penh 120211 Cambodia	1865	Mobile network infrastructure	USD 26.06 billion (FY2020)
Cambodia	Samsung	445,Monivong Blvd Conner 232, Sangkat Boeung Pralit, Khan 7 Makara PP	1969	Mobile network infrastructure	USD 212.3 billion (FY2020)
Cambodia	ZTE Corporation	4th Floor H Building, Phnom Penh Center, Sangkat Tonle Bassac,Khan Chamkarmorn, Phnom Penh, Kingdom of Cambodia	1985	Mobile network infrastructure	USD 14.7 billion (FY2020)
-	NEC Corporation	80 Bendemeer Road, #05-01/02, Singapore	1899	Mobile network infrastructure	USD 29.42 billion (FY2020)
	Cisco Systems, Inc.	80 Pasir Panjang Road, Level 25, Maple Tree Business City 2, Singapore, 117372	1984	Mobile network infrastructure	USD 49.3 billion (FY2020)
-	Mavenir Plc	77 Science Park Drive CINTECH III Singapore Science Park I Unit No: 02-14/15 Singapore 118256	2017	Mobile network infrastructure	USD 0.427 billion (FY2020)
-	Fujitsu Limited	Nexus @ one north 1 Fusionopolis Link, #04-01 Singapore 138542	1935	Mobile network infrastructure	USD 35.49 billion (FY2020)
-	FiberHome Telecommunicati on Technologies Co., Ltd.	8 Wilkie Road 22 Singapore - Rochor Singapore - Singapore	1999	Mobile network infrastructure	USD 3.26 billion (FY2020)

Microwave transmission companies (serving Cambodia/Laos)

Branch location	Company name	Address	Esta-blished	Key services	Annual sales
-	NEC Corporation	80 Bendemeer Road, #05-01/02, Singapore	1899	- Public Solutions Business - Public Infrastructure Business - Enterprise Business	USD 29.42 billion (FY2020)

Branch location	Company name	Address	Esta-blished	Key services	Annual sales
				- Network Services Business - Global Business	
Laos	Huawei Technologies Co., Ltd.	3 Floor Vientiane New World, Located at Anouvong Road, Phiavat Village, Sisattanak District, Vientiane Capital Lao	1987	- Carrier Business - Enterprise Business - Consumer Business	USD 136.7 billion (FY2020)
Cambodia	Telefonaktiebolaget LM Ericsson	Unit G01, Himawari Hotel, 313 Sisowath Quay, Phnom Penh	1876	- Networks - Digital Services - Managed Services - Emerging Business and Other	USD 27.05 billion (FY2020)
-	Siae Microelettronica Group	Level 1, 1 Tech Park, Tanjung Bandar Utama - Bandar Utama, Petaling Jaya, Selangor Darul Ehsan - Malaysia	1952	Provider of microwave radio and wireless network solutions.	USD 0.171 billion (FY2019)
-	Intracom Telecom	P.O. Box 500517, Dubai Internet City, Bldg. No3, Office No204, Dubai, United Arab Emirates	1977	Provider of global telecommunication systems & solutions	USD 0.5339 billion (FY2020)
Cambodia	Nokia Corporation	315 Ang Doung St Wat Phnom Khan Daun P – L18, Canadia Tower, Phnom Penh, Cambodia	1865	Provides mobile and fixed network solutions worldwide. The company operates through four segments: Mobile Networks, Network Infrastructure, Cloud and Network Services, and Nokia Technologies.	USD 26.06 billion (FY2020)

Branch location	Company name	Address	Esta-blished	Key services	Annual sales
-	Anritsu	11 Chang Charn Road, #04-01, Shriro House, Singapore	1985	- Test and Measurement - Product Quality Assurance - Others	USD 1.02 billion (FY2020)
-	Aviat Networks, Inc.	51 Changi Business Park Central 2, #04-10 The Signature Building, Singapore	2007	Design, manufacturing and sale of a range of wireless networking products, solutions and services	USD 0.24 billion (FY 2020)
-	Ceragon Networks Ltd.	51 Cuppage Road #05-05, Singapore	1996	Wireless backhaul and fronthaul solutions provision	USD 0.26 billion (FY2020)
-	DragonWave-X	Room 401, Block C, Hi-Tech Building, 900 Yishan Road, Shanghai, China	2000	Provider of high-capacity packet microwave solutions that drive IP networks	USD 0.0404 billion (FY2017)

Smartphone manufacturers (serving Cambodia/Laos)

Branch location	Company name	Address	Esta-blished	Key services	Annual sales
-	Samsung	Samsung Electronics Southeast Asia - Device Solutions, 3 Church Street #26-01/02 Samsung Hub, Singapore	1968	• CE - Consumer Electronics • IM - Information Technology & Mobile Communications • DS - Device Solutions • Harman - Harman International Industries, Inc. and its subsidiaries produces automotive electronics components	USD 58.74 billion (FY2020)
-	Apple	7 Ang Mo Kio Street 64, Singapore	1977	Designs, manufactures and markets smartphones, personal computers, tablets, wearables and accessories,	USD 274.52 billion (FY2020)

Branch location	Company name	Address	Esta-blished	Key services	Annual sales
				and sells a variety of related services	
Laos	Huawei	3 Floor Vientiane New World, Located at Anouvong Road, Phiavat Village, Sisattanak District, Vientiane Capital Lao	1987	• Carrier Business • Enterprise Business • Consumer Business	USD 136.7 billion (FY2020)
Cambodia	Oppo	New World Borey, # P15, Street NW-21, Prek Samrong 3 Village, Sangkat Takhmao, Takhmao City, Kandal Province.	2004	Manufacturer of smart devices	USD 0.359 billion (FY2016)
Laos and Cambodia	Vivo	- Cambodia: vivo service center, # 618, Street 271, Village 6, Sangkat Phsar Doeum Thkov, Khan Chamkarmon, Phnom Penh - Laos: Vivo After Sales Service, No. 049, Air Village, Unit 05, Sikhottabong District, Vientiane Capital	1995	Production and provider of smartphones, smartphone accessories, software, and online services	USD 0.404 billion (FY2019)
-	Xiaomi	20 Cross Street, Singapore	2010	Manufactures and distributes mobile phones and consumer electronics.	USD 37.66 billion (FY2020)
-	LG	Suntec tower3, Temasek Blvd. Singapore	1947	Consumer electronics, home appliances and mobile communications	USD 58.13 billion (FY2020)
-	Lenovo	151 Lorong Chuan, #02-01 New Tech Park, Singapore	1984	• Intelligent Devices Group (IDG), consisting of the PCSD and MBG businesses, delivered many records and outperformed the sector in the fiscal year after	USD 60.742 billion (FY2020)

Branch location	Company name	Address	Esta-blished	Key services	Annual sales
				swiftly recovering from COVID-led turbulence. • Data Center Group (DCG) focuses on in-house design, manufacturing, product development, and customer diversification.	
Cambodia	ZTE Corporation	4th Floor H Building, Phnom Penh Center, Sangkat Tonle Bassac,Khan Chamkarmorn, Phnom Penh, Kingdom of Cambodia	1985	Provides integrated telecommunications and information technology (IT) solutions worldwide	USD 14.7 billion (FY2020)
-	Alcatel-Lucent Enterprise	Singapore ALE Pte. Ltd. Viva Business Park 750E Chai Chee Road #05-01/02 Singapore 469005	1898	Provides Internet protocol (IP) and cloud networking, and ultra-broadband access worldwide	USD 15.1 billion (FY2016)
-	SONY	https://www.sony.com/en/SonyInfo/Careers/locations/	1946	• ame & Network Services, Music, Pictures • Electronics Products & Solutions (Mobile Communications/ Imaging Products & Solutions/Home Entertainment & Sound) • Imaging & Sensing Solutions • Financial Services	USD 811.55 billion (FY2020)

Branch location	Company name	Address	Esta-blished	Key services	Annual sales
-	Sharp	https://global.sharp/corporate/info/outline/consolidated/oversea.html	1912	• Telecommunications equipment • electric and electronic application equipment • electronic components.	USD 218 billion (FY2020)
-	Fujitsu	https://www.fujitsu.com/global/about/our-business/locations/#map	1935	• Hybrid IT service • AI (artificial intelligence) • New architecture computer "Digital Annealer"	USD 323.71 billion (FY2020)
-	Kyocera	https://global.kyocera.com/company/location_gl/region/area/asia.html	1979	• Industrial & Automotive Components • Semiconductor Components • Electronic Devices • Communications • Document Solutions • Life & Environment/Others • Research & Development	USD 137.69 billion (FY2020)

(2) Human resources

Universities

Country	University	Address	Esta-blished	Public/ Private	Department
Cambodia	The University of Cambodia	Northbridge Road, P.O. Box 917, Sangkat Toek Thla, Khan Sen Sok, Phnom Penh, Kingdom of Cambodia 12000	2003	Public	The University operates six colleges and four schools: • College of Arts and Humanities • College of Education • College of Law • College of Media and Communications • College of Social Sciences • College of Science and Technology • School of Creative Arts

Country	University	Address	Esta-blished	Public/ Private	Department
					• School of Foreign Languages • Tech Sen School of Government and International Relations (TSS) • The Tony Fernandes School of Business
Cambodia	College of Science and Technology	Northbridge Road, Sangkat Toek Thla, Khan Sen Sok, Phnom Penh. P.O Box 917, Phnom Penh 12000, Cambodia	2003	Public	• Educational Science • Educational Administration • Curriculum Design and Instruction
Cambodia	National University of Management (NUM)	St.96 Christopher Howes, Khan Daun Penh, Phnom Penh, Cambodia	983	Public	• Management • Economics • Finance & Accounting • Tourism • Law • Information Technology
Cambodia	IIC University of Technology	Building No. 650, National Road 2, Sangkat Chak Angre Krom, Khan Mean Chey, Phnom Penh, 12353 Phnom Penh, Cambodia	2008	Private	• Arts & Humanities • Business & Social Sciences • Language & Cultural • Science & Technology
Cambodia	Institute of Technology of Cambodia (ITC)	PO Box 86, Russian Conf. Blvd. Phnom Penh, Cambodia	1964	Public	• Chemical Engineering and Food Technology • Civil Engineering • Electrical and Energy Engineering • Geo-Resources and Geotechnical Engineering • Information and Communication Engineering • Industrial and Mechanical Engineering - Rural Engineering
Cambodia	Phnom Penh Institute of Technology (PPIT)	Street 1003 corner street 1988, Phnom Penh Thmey, Phnom Penh, Cambodia	2012	Private	• Architecture • Civil Engineering • Computer Science and Engineering • English Literature • Mechanical Engineering • Electronic and Electrical Engineering

Country	University	Address	Esta-blished	Public/ Private	Department
Laos	National University of Laos	DongDok Campus, Xaythany District, Vientiane, 01080 Vientiane Prefecture, Laos	1996	Public	• Engineering (Civil/Mechanical/Electrical/ Electronics and Telecommunications Engineering, Computer Engineering and Information Technology, Roads and Bridges, Water Resources) • Agriculture • Environmental Science • Natural Science • Forest Science • Botany Architecture • Letters • Education • Economics and Business Administration • Law and Political Science • Social Sciences • Water Resources • Sports and Acrobatics Sciences
Laos	Savannakhet University	Naxeng Campus,Naxeng Village, Kaisonephomvihan e City, Savannakhet Province, Lao PDR	2009	Public	• Agriculture and Environment • Business Administration • Food Sciences • Linguistics and Humanities • Education • Natural Sciences • Information Technology (Information Technology, Multimedia, Network Technology) • Engineering
Malaysia	Asia Pacific University of Technology & Innovation (APU)	Technology Park Malaysia 57000, Bukit Jalil Kuala Lumpur, Malaysia	1993	Private	• Business and Management • Engineering • Computing & Technology • Design & Creative Media • Accounting & Finance • Marketing & Tourism • International Relations • Industrial Designs • Media & Communication Studies • Actuarial Studies • Computer Games Development • Banking and Finance • Psychology

Country	University	Address	Esta-blished	Public/ Private	Department
Malaysia	Multimedia University (MMU)	Persiaran Multimedia, 63100 Cyberjaya, Selangor, Malaysia	1994	Private	• Engineering • Information & Communication Technology • Creative Multimedia • Cinematic Arts • Business & Management • Finance • Accounting • Law • Life Science • Strategic Communication
Malaysia	Taylor's University	No. 1 Jalan Taylor's, 47500 Subang Jaya, Selangor Darul Ehsan, Malaysia	1969	Private	• Medicine • Pharmacy • Biosciences • Computer Science and Engineering (Business Intelligence and Analytics, Cyber Security, Data Science, Game Design, Internet Technologies, Mobile Computing, Applied Computing, Computer Science, Software Engineering, Information Technology, Robotic Design and Development, Chemical Engineering, Electrical and Electronic Engineering, Mechanical Engineering) • Architecture, Building and Design • Law • Business School • Liberal Arts and Sciences • Media and Communication • Education • Hospitality, Tourism & Events • Food Studies & Gastronomy • Culinary Institute
Malaysia	HELP University	No. 15, Jalan Sri Semantan 1, Off Jalan Semantan, Bukit Damansara 50490 Kuala Lumpur	1986	Private	• Behavioral Sciences, Education and Languages • Business, Economics and Accounting • University Foundation Studies • Law and Government

Country	University	Address	Esta-blished	Public/ Private	Department
					• Computing and Digital Technology (Information Technology, Data Analytics) • Arts and Communication • Crime and Criminology • ELM Graduate School • Centre for Continuing Professional Development
Malaysia	INTI International University	Persiaran Perdana BBN, Putra Nilai, 71800 Batu Pahat, Johor, Malaysia	1986	Private	• Biotechnology & Life Sciences • Business • Computing & IT (Network and Security, Software Engineering, Information Technology, Computer Science, Business Information Systems, Business Analytics, Cloud Computing, Mobile Computing) • Engineering • Fashion Design • Graphic Design • Health Sciences • Interior Design • Hospitality & Culinary Arts • Programmes for Working Professionals • INTI English Language Programs • Law • Mass Communication • Multimedia Desig • Social Science
Mongolia	National University of Mongolia	Ikh Surguuliin Gudamj -1 P.O. Box - 46A/523, 14201 Ulaanbaatar, Mongolia	1942	Public	• Arts and sciences • Engineering and Applied Sciences • Business School • International Relations and Public Administration • Law
Mongolia	Mongolian University of Science and Technology	8th khoroo, Baga toiruu 34, Sukhbaatar district Ulaanbaatar, Mongolia 14191	2013	Public	• Civil Engineering and Architecture • Business Administration and humanities • Industrial Technology • Geology and Mining Technology

Country	University	Address	Esta-blished	Public/ Private	Department
					• Information and Telecommunication Technology • Power Engineering • Mechanical Engineering and Transportation • Applied Sciences • Technology • Foreign Language
Mongolia	Mongolian University of Life Sciences	17024 Zaisan, Khan-uul District, Ulaanbaatar Mongolia	1958	Public	• Veterinary Medicine • Animal Science & Biotechnology • Engineering & Technology • Agroecology • Economics & Business
Mongolia	University of Humanities	Ulaanbaatar city, Sukhbaatar district, 8th khoroo, 14200, Sukhbaatar square-20.	1979	Public	• Language and Culture School • Business School • Information and Communication • International Relations and Sociology
Mongolia	Mongolia International University	13th Khoroo, Bayanzurkh District Ulaanbataar, Mongolia	2001	Private	• Business Administration • Hotel & Tourism Management • Human Resource Organization • Accounting • Biotechnology & Food Sciences • Computer Science • Energy, Resource & Environment Technology • International Relations • Fashion Design • English Education • Media & Communication • Music • Law
Philippines	University of the Philippines - Diliman	Fonacier Hall, Magsaysay Avenue, UP Diliman, Quezon City 1101	1908	Public	• Architecture • Arts and Letters • Asian Center • Asian Institute of Tourism • Business Administration • Economics • Education • Engineering • Fine Arts • Home Economics

Country	University	Address	Esta-blished	Public/ Private	Department
					• Human Kinetics • Institute for Small Scale Industries • Labor and Industrial Relations • Law • Library and Information Studies • Mass communication • Music • National College of Public Administration and Governance • Science • Social Sciences and Philosophy • Social Work and Community Development • Statistics • Urban and Regional Planning • University of the Philippines Diliman Extension Program in Pampanga • Archaeological Studies Program • Technology Management Center
Philippines	Ateneo de Manila University	Katipunan Avenue, Loyola Heights, 1108 Quezon City, Philippines	1859	Private	• Humanities • Management • Science and Engineering • Social Sciences • Education and Learning Design
Philippines	De La Salle University	2401 Taft Ave, Malate Manila, 1004 Metro Manila, Philippines	1911	Private	• Education • Economics • Business • Engineering • Sciences • Computer Studies • Law • Liberal Arts
Philippines	University of Santo Thomas	Espana Blvd., Sampaloc, Manila, Philippines 1008	1611	Private	• Accountancy • Architecture • Arts and Letters • Civil Law • Commerce and Business Administration • Education • Engineering

Country	University	Address	Esta-blished	Public/ Private	Department
					• Fine Arts and Design • Graduate School • Graduate School of Law • Institute of Information and Computing Sciences • Medicine and Surgery • Music • Nursing • Pharmacy • Physical Education and Athletics • Rehabilitation Sciences • Science • Tourism and Hospitality Management • Canon Law • Philosophy • Sacred Theology
Philippines	Mapua University	658 Muralla St., Intramuros, Manila 1002, Philippines	1925	Private	• Architecture and Planning, Industrial Design, & Built Environment • Electrical, Electronics, & Computer Engineering • School of Social Sciences and Education • Department of Arts & Letters • Business & Management • Information Technology • Industrial Engineering & Engineering Management • Civil, Environmental, & Geological Engineering • Chemical, Biological, & Materials Engineering & Sciences • Media Studies • Mechanical & Manufacturing Engineering • Mathematics • Physical Education & Athletics • Physics • Continuing Education
Singapore	Nanyang Technological University (NTU Singapore)	50 Nanyang Avenue, Singapore 639798	1991	Public	• Business Analytics • Technology and Information Management • Operations Management • Areas from the latest in everything from mobile

Country	University	Address	Esta-blished	Public/ Private	Department
					marketing to health analytics, robot usability to AI impact, and sustainability operations to digital transformation
Singapore	Singapore Institute of Technology (SIT)	10 Dover Drive Singapore 138683	2009	Public	• Engineering • Chemical Engineering and Food Technology • Infocomm Technology • Health and Social Sciences • Design and Specialised Businesses
Singapore	Singapore University of Technology and Design (SUTD)	8 Somapah Road Singapore 487372	2009	Public	• Architecture and Sustainable Design (ASD) Pillar • Design and Artificial Intelligence (DAI) Programme • Engineering Product Development (EPD) Pillar • Engineering Systems and Design (ESD) Pillar • Information Systems Technology and Design (ISTD) Pillar • Science, Mathematics and Technology (SMT) Cluster • Humanities, Arts and Social Sciences (HASS) Cluster
Singapore	National University of Singapore (NUS)	21 Lower Kent Ridge Road, Singapore 119077	1905	Public	• Arts & Social Sciences • Business • Computing Continuing and Lifelong Education • Dentistry • Design & Environment • Duke-NUS • Engineering • Integrative Sciences & Engineering • Law • Medicine • Music • Public Health • Public Policy • Science • University Scholars Programme • Yale-NUS
Singapore	Singapore Management	Administration Building,	2000	Public	• Accountancy • Business Management

Country	University	Address	Esta-blished	Public/ Private	Department
	University (SMU)	Singapore Management University, 81 Victoria Street, Singapore 188065			• Science (Economics) • Science (Information Systems) • Science (Computer Science) • Science (Computing & Law) • Laws • Social Science
Thailand	King Mongkut's University of Technology Thonburi	126 Pracha Uthit Rd, Bang Mot, Thung Khru, Bangkok 10140	1960	Public	• Industrial Education and Technology • Information Technology • Science • Engineering • Architecture and Design • Multidisciplinary Sciences
Thailand	Chiang Mai University	239 Huay Kaew Rd, Suthep, Mueang Chiang Mai District, Chiang Mai 50200	1964	Public	• Mass Communication • Agriculture • Dentistry • Associated Medical Science • Law • Business Administration • Nursing • Medicine • Pharmacy • Humanities • Political Science and Public Administration • Fine Arts • Science • Engineering • Education • Economics • Architecture • Social Sciences • Veterinary Medicine • Public Health • Agro-Industry • Graduate School • College of Marine Studies and Management • College of Art, Media and Technology • Chiang Mai University School of Public Policy • Biomedical Engineering Institute • International College of Digital Innovation

Country	University	Address	Esta-blished	Public/ Private	Department
Thailand	Chulalongkorn University	254 Phayathai Rd, Wang Mai, Pathum Wan District, Bangkok 10330	1917	Public	• Allied Health Sciences • Architecture • Arts • Commerce and Accountancy • Communication Arts • Dentistry • Economics • Education • Engineering • Fine and Applied Arts • Law • Medicine • Nursing • Pharmaceutical Sciences • Political Science • Psychology • Science • Sports Science • Veterinary Science – School of Integrated Innovation – School of Agricultural Resources – Graduate School
Thailand	Kasetsart University	50 Ngamwongwan Rd, Chatuchak Bangkok 10900	1943	Public	• Agriculture • Business Administration • Fisheries • Humanities • Forestry • Science • Engineering • Education • Economics • Architecture • Social Sciences • Veterinary Medicine • Agro-Industry • Veterinary Technology • Environment • Sports Science • Liberal Arts and Science • Natural Resources and Agro Industry • Public Health
Thailand	Khon Kaen University	123 Moo 16 Mittraphap Rd., Nai-Muang, Muang	1967	Public	• Agriculture • Engineering • Science • Technology

Country	University	Address	Esta-blished	Public/ Private	Department
		District, Khon Kaen 40002			• Architecture • Nursing • Medicine • Associated Medical Sciences • Public Health • Dentistry • Pharmaceutical Sciences • Veterinary Medicine • Education • Humanities and Social Sciences • Business Administration and Accountancy • Fine and Applied Arts • Law • Interdisciplinary Studies • Public Health
Cambodia	The University of Cambodia	Northbridge Road, P.O. Box 917, Sangkat Toek Thla, Khan Sen Sok, Phnom Penh, Kingdom of Cambodia 12000	2003	Public	The University operates six colleges and four schools: • College of Arts and Humanities • College of Education • College of Law • College of Media and Communications • College of Social Sciences • College of Science and Technology • School of Creative Arts • School of Foreign Languages • Techo Sen School of Government and International Relations (TSS) • The Tony Fernandes School of Business
Cambodia	College of Science and Technology	Northbridge Road, Sangkat Toek Thla, Khan Sen Sok, Phnom Penh. P.O Box 917, Phnom Penh 12000, Cambodia	2003	Public	• Educational Science • Educational Administration • Curriculum Design and Instruction

Educational content companies

Country	Company	Address	Esta-blished	Key services	Annual sales
Cambodia	DTP Online Corporation	No.53 Preah Monivong Blvd (93), Phnom Penh, Cambodia Building #148ABC (3rd Floor), St. 63, Chak Tomuk, Daun Penh 12207, Cambodia.	2010	• DTP TOTAL SOLUTION is a modern solution for interactive teaching and learning, a thorough combination of: interactive English teaching software specifically • Companies distributing ELT textbooks, materials and total education solution services in South-East Asia. • Mainly focus on improving the quality of education products and services and developing comprehensive solutions and innovative high technology to be the optimum choice of customers	3.27 (Factiva: 2019, estimated)
Cambodia	Edemy	#78, Street 02, Kandal Province, Cambodia	2017	• Edemy learning technology make teaching more efficient, it also enables teachers and trainers to provide timely and personalized assistance to students informed by the learning analytics. • Education team to develop online learning tools for our eLearning Platform and Tesdopi app	n/a
Cambodia	Step IT Academy	2nd floor, Pencil Supercenter Building, 12 Samdach Pan Ave (214), Phnom Penh 12206	1999	• Software Development • Computer Graphics and Design • Adobe Photoshop Intensive Course • Adobe Illustrator Intensive Course • Adobe Premiere Pro Intensive Course • Programming Language Python • Digital Marketing • Cyber Security Essentials	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
Cambodia	Sunrise Institute	#64 ABC Street 348 Sangkat Tuol Svay Prey 1, Khan Chamkarmorn Phnom Penh	2009	• CCNA 3 V7.0: Enterprise Networking, Security, and Automation (ENSA) • CCNA Cyber Security Essential • CCNA Security • CCNA1 V7.0 : Introduction to Networks (ITN) • CCNA2 V7.0: Switching, Routing and Wireless Essentials (SRWE) • CCNP Enterprise • CyberOps Associate (CA) v1.0 • International Networking Engineer and Cyber Security (V7.0) • IT Essential V7.0 • HCIA 1 R&S: Introduction to Huawei Networking • HCIA 2 R&S: Huawei Medium Networking • HCIA 3 R&S: Huawei Enterprise Networking • International Huawei Networking Engineer and CyberSecurity • Web Developer Courses • Video and Graphic Courses • International Autodesk Maya • System Administration Courses • Mobile Developer Courses • Security Course	n/a
Cambodia	SETEC Institute	No. 86A, Street 110, Russian Federation Boulevard, Sangkat Teuk Laak I, Khan Toul Kork, Phnom Penh, Cambodia	2014	• Management Information System • Business Information System • Design	n/a
Cambodia	E-School Cambodia	Yellow Tower, 5th Floor, Building 191, Tonle Sap Street, Sangkat Chroy Changva, Khan Chroy	2018	• Life Skills • Foreign Languages • Computer Literacy	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
		Changva, Phnom Penh, Kingdom of Cambodia			
Cambodia	Digital Business School Asia	No. 89A, St. 294, Beoung Keng Kang 1, Chamkarmon, Phnom Penh 12101	2019	• Digital Marketing • Content Marketing • Social Media Marketing • SEO (Search Engine Optimization) • Paid Search (PPC) with Google Ads • Display & Video Advertising • Email Marketing • Website Optimization • Analytics with Google Analytics • Digital Marketing Strategy	n/a
Cambodia	Nokor-Web	#818, Monivong Blvd, Sangkat Phsar Deom Thkov, Khan Chamkamorn, Phnom Penh, Cambodia	n/a	• Website Development • Website Training • SEO • PHP Framework • Open Source • Website Hosting • PHP MySQL • Website Design • Car Garage System • Mobile Apps Cambodia • Clinic system Cambodia • Restaurant System • Accounting system • System POS Cambodia • School Management • Hotel system	n/a
Cambodia	SabaiCode	No. 28,street 368, Sangkat Boeng Keng Kang, Phnom Penh, Cambodia	2019	• Coding and Computer Science • Robotics • Full-Stack Coding Bootcamp	n/a
Cambodia	Champion Coders	#03, Street 1019 (Hanoi), LSI Building, Level 2, Khan Sen Sok, Phnom Penh	2019	• Block-based Programming • Python Programming • Mobile App Development • Web Development • 3D Modelling and Printing	n/a
Laos	Soutsaka Institute of Technology	Box 390, Phonphanao-Phonetong Road, Phonephanao Village, Xaysetha	2002	• Orientation and Linguistics • Business Administration and Economics • Information Technology	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
		District, Vientiane Capital, Lao PDR			
Laos	National University of Lao	P.O.Box: 7322, Dongdok, Vientiane, Vientiane, Laos	1996	• Jan 2, 2020: The National University of Laos (NUoL) is to develop e-learning content with help from a South Korean university. • NUoL and Wonkwang Digital University signed a memorandum of understanding last week and agreed to jointly develop e-learning content, nurture necessary talent, and conduct joint research in various areas	n/a
Malaysia	SWIFT Assistance Services Malaysia Sdn. Bhd	No.8, Level 8, UOA Corporate Tower, Lobby B, Avenue 10, The Vertical, Bangsar South City, Jalan Kerinchi, 59200 Kuala Lumpur, Malaysia	2011	• Swift specialises in developing custom eLearning content based on modern instructional design and visual design principles • elearning solutions converting user's existing training content such as instructor-led, PDFs, PPTs and other paper-based learning content into custom interactive eLearning courses. • Convert Flash-based legacy content into an interactive eLearning HTML5 format that assists multi-device and responsive learning	n/a
Malaysia	John & Wiley & Sons, Inc.	47800 Petaling Jaya, Selangor, Bandar Damansara Perdana, No. 8, Jalan PJU 8/8A, PJ Trade Centre, Unit B-3A-3A, Menara BATA	1807	• Develop digital education, learning, assessment, and certification solutions to help universities, businesses, and individuals move between education and employment • Partnered with learned societies, company assist researchers to communicate discoveries that make a difference.	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
				Company's online scientific, technical, medical, and scholarly journals, books, and other digital content of quality publishing • SUBJECTS: Accounting, Agriculture, Arts & Architecture, Business & Management, Chemistry, Computing, Culinary & Hospitality, Earth & Space Sciences, Education, Engineering & Materials Science, Humanities, Law & Criminology, Life Sciences, Lifestyle	
Malaysia	Inchone Sdn Bhd	Inchone Sdn Bhd 906, Block A4, Leisure Commerce Square, 9 Jalan PJS 8/9, 46150 Petaling Jaya Malaysia	2000	3Cs of services, namely • Consultancy, Content Development and Content Distribution • Inchone's content development services started with Chartered Institute of Logistics and Transport (CILT Singapore). Inchone uses a variety of readily available content development tools such as Adobe, Articulate, Raptivity, udutu, etc. to suit each unique project requirements, timeline and budget.	
Malaysia	Internexia Sdn Bhd	C-1-05, Plaza Crystalville Jalan Vita 2 , Lingkaran Cyber Point Timur, Cyber 12, 63000 Cyberjaya, Selangor, Malaysia	1997	• E-Learning Content Development • Learning Management System • Training • Assessment • Courseware • Digital Storytelling • Compulsory Subjects Online • English Café • Assist Services	3 (Estimated)
Malaysia	Pukunui Sdn Bhd	Level 13A, Wisma Mont Kiara, No 1 Jalan Kiara, Mont Kiara, 50480,	2001	• E-learning Management Systems • Content design and training	5 (Estimated)

Country	Company	Address	Esta-blished	Key services	Annual sales
		Kuala Lumpur, Malaysia		• LMS hosting	
Malaysia	Appstronic Sdn. Bhd.	Unit 6, Level 4 (Block K) SetiaWalk Mall, Persiaran Wawasan, Pusat Bandar Puchong, 47160 Puchong, Selangor, Malaysia	n/a	• E-Learning content creation • Learning Management System (LMS) • Online E-Learning System	5 (Estimated)
Malaysia	Ezlearning	D-8-5, 10th Floor, Menara Uncang Emas, Block D, No. 85, Jln Loke Yew, 55200 Kuala Lumpur, Malaysia	n/a	• E-Learning Content Development • Learning Management System (LMS)	n/a
Malaysia	Cempaka Technology Sdn. Bhd.	Unit 6, Level 4, SetiaWalk Mall (Block K), SetiaWalk, Persiaran Wawasan, Pusat Bandar Puchong, 47160 Puchong, Selangor, Malaysia	n/a	• E-Learning Content Development • Learning Management System (LMS) • Training • System Integrator	4 (Estimated)
Malaysia	MMSC Sdn. Bhd.	80-4, Jalan Tasik Utama 5, Medan Niaga Tasik Damai, 57100 Kuala Lumpur, Malaysia	1997	• E-Learning Solution • Courseware Development Services • E-Learning Hosting Services • Learning & Content Management System • Training in Multimedia Content Development and IT Skill	10 (Estimated)
Malaysia	SMD Webtech (M) Sdn Bhd	No.708, Block B, Kelana Square, 47301 Petaling Jaya, Selangor, Malaysia.	2015	• E-learning Services • LMS eLearning Management System	0.192 (Estimated)
Malaysia	Cornerstone Corp.Sdn Bhd.	Ground Floor, No 27 SS 20 / 14, Damansara Utama, 47400 Petaling Jaya, Malaysia	1997	• e-Learning Content • Learning Management Systems (LMS)	2 (Estimated)
Malaysia	Content Capital Sdn Bhd.	Suite E06-03 Plaza Mont Kiara, Jalan Kiara, 50480, Kuala Lumpur, Malaysia	2003	• Learning Management System • Content Development • eLearning Content • eLearning Systems	1 (Estimated)

Country	Company	Address	Esta-blished	Key services	Annual sales
				• eLearning Training & Consultation	
Malaysia	eSource Technology	17 01, Kapitan Square, Buckingham Street,10300 George Town, Penang, Malaysia	2004	• E-learning consultancy • Content development (multilingual) • Instructional designing • Web based training (WBT) development • Computer based training (CBT) development - Online test • Media production • Scenario based learning • Simulation based CBT/WBT development • Testing and QA (CBT / WBT)	6 (Estimated)
Mongolia	Guren Academy	-	2015	• Guren Academy has been operating in the field of training and research • Conduct training in cooperation with internationally recognized schools and organizations, respect all copyrights and deliver all training and content with copyright	n/a
Mongolia	TomYo Edtech	TomYo Edtech, Olympic Street, Ulaanbaatar	2019	• Empower both learners and educational content providers through our personalized recommendation engine making it easy to connect based on an individual's favorite medium of learning or teachin • TomYo Edtech is an educational technology company with a mission to enable opportunities directly to the hands of developing nations' youth • This includes: Login Questionnaire Data Test Score Performance Data Course Completion Data Challenge Game Data Interest Based Data	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
				Content Consumption Data	
Mongolia	System Center Llc	#205, 2nd Floor, Tanan Center, 8th khoroo, Sukhbaatar District, Ulaanbaatar, Mongolia	2016	• Cisco • System Administration • Security • Mikotik • IT Audit • Data Analyst BI	n/a
Philippines	John & Wiley & Sons, Inc.	Unit 1002, 10/F, South Center Tower, 2206 Market MBP Ayala Alabang Muntinlupa City, 1780 Philippines	1807	• Develop digital education, learning, assessment, and certification solutions to help universities, businesses, and individuals move between education and employment • Partnered with learned societies, company assist researchers to communicate discoveries that make a difference. Company's online scientific, technical, medical, and scholarly journals, books, and other digital content of quality publishing • SUBJECTS: Accounting, Agriculture, Arts & Architecture, Business & Management, Chemistry, Computing, Culinary & Hospitality, Earth & Space Sciences, Education, Engineering & Materials Science, Humanities, Law & Criminology, Life Sciences, Lifestyle	n/a
Philippines	Computer Networking Career & Training Center. Inc.	2nd Flr. Dona Amparo Bldg Espana Blvd. corner G Tolentino St. Sampaloc, Manila 1008 Philippines	2000	IT Training	1.3 (Estimated)
Philippines	TechED Global Academy	Unit 15B Penthouse Atherton Place, Tomas Morato, Corner Don A. Roces Ave, Quezon City, 1103	n/a	• CompTIA • EC-Council	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
		Metro Manila, Philippines			
Philippines	Stanford IT Learning	704 SEDCCO 1 Bldg., 120 Rada St., Legazpi Village, Makati City 1229	1989	• Architecture, Engineering and Construction courses • Civil Infrastructure Courses • Product design and manufacturing courses • Project management courses	n/a
Philippines	Active Learning Ph	Home Studio, 63 Connecticut, San Juan, Metro Manila, Philippines	2006	• Java • Microsoft Office • CompTIA • Web Development • Cybersecurity • ITIL • Project Management • Service Design • Linux • Software Testing • Microsoft .NET • Systems Analysis • Mobile Development • Database • XML • Python • DevOps	n/a
Philippines	SG-IT Tutorial Center	2nd Floor, 2339 Marconi Street, Brgy. Palanan, Makati City Metro Manila, Philippines 1235	2018	• Cisco • Microsoft • LPIC • Cyber Security • Comptia • Data Protection • Windows 10 Network+ • Programming • Networking • Computer Systems Servicing NCII • RHCSA • Cloud computing • Management • Android • PC Troubleshooting • Net Programming • Office Training • Juniper • Web Design	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
Philippines	Acumen IT Training INC.	11th Floor, SM Aura Office Tower, 26th Street, McKinley Parkway, Fort Bonifacio, Taguig City, Metro Manila, Philippines	1992	• Technical Programs • Standard Process and Governance • Soft Skills • End-user courses	0.858 (Estimated)
Philippines	Phoenix One Knowledge Solutions Inc.	Unit 602 Greenbelt Mansion Condominium, No. 106 Perea St., Legazpi Village, Makati City	n/a	• Certification courses • Corporate Training • Corporate solutions • Fullstack Web Development	0.736 (Estimated)
Philippines	AR Network Consulting and Services	UG25 Cityland 8 #98 Sen. Gil Puyat Ave Makati City, Philippines 1230	2010	• Networking Services • Network Equipment Transactions • Design, Implementation, Optimization, Security and Assist • Cisco Technical Training	n/a
Philippines	Kairos PH	QUAD, 2nd Floor, Cristina Bldg., Lot 29 Block 40, Regalado Ave. corner Coronet St. Fairview Park, Quezon City, Metro Manila, Philippines	2014	• Web Development • Mobile Apps • Digital Marketing • Trainings and Seminars	n/a
Philippines	FIT Academy	G/F King's Court II Bldg , Chino Roces Ave. cor. Dela Rosa St., Makati City	2006	• Mobile Development • Business Analytics • Web Development • Information Technology • Programming and Cloud Computing	n/a
Singapore	Simplilearn Singapore Pte Ltd.	#14-302, The Plaza, 7500A Beach Rd, Singapore 199591.	2014	Provide online training in Cyber Security, Cloud Computing, Project Management, Digital Marketing, and Data Science, among others	n/a
Singapore	John & Wiley & Sons, Inc.	1 Fusionopolis Walk, #06-01 Solaris South Tower, Singapore 138628	1807	• Develop digital education, learning, assessment, and certification solutions to help universities, businesses, and individuals move between education and employment - Partnered with learned	50.26 (Factiva: 2019, estimated)

Country	Company	Address	Esta-blished	Key services	Annual sales
				societies, company assist researchers to communicate discoveries that make a difference. Company's online scientific, technical, medical, and scholarly journals, books, and other digital content of quality publishing • SUBJECTS: Accounting, Agriculture, Arts & Architecture, Business & Management, Chemistry, Computing, Culinary & Hospitality, Earth & Space Sciences, Education, Engineering & Materials Science, Humanities, Law & Criminology, Life Sciences, Lifestyle	
Singapore	Inchone Pte Ltd	Inchone Pte Ltd Block 1003 Bukit Merah Central #05-24 INNO Centre Singapore 159836	2000	• 3Cs of services, namely - Consultancy, Content Development and Content Distribution • Inchone's content development services started with Chartered Institute of Logistics and Transport (CILT Singapore). Inchone uses a variety of readily available content development tools such as Adobe, Articulate, Raptivity, udutu, etc. to suit each unique project requirements, timeline and budget	n/a
Singapore	Wizlearn Technologies	Wizlearn Technologies Pte Ltd 1 Commonwealth Lane, #08-08 One Commonwealth, Singapore 149544	2000	• An elearning provider. They offer LMSs (Learning Management Systems) for educational (Asknlearn) and corporate (Athenaeum) use as well as multimedia content (Smartclass) , training and games for learning • The company provides internet and intranet-based e-learning solutions with customized content	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
				services to many local and overseas corporate companies, government institutions and agencies.	
Singapore	Verztec	10 Jalan Besar #16-01/02 Sim Lim Tower Singapore 208787	2000	Verztec aim to deliver end-to-end learning solutions to their clients. They offer corporate on line training for businesses to educate their staff and have developed an online library of blended learning content. They also provide the Verztec Learning Management System (LMS) alongside learning content and learning content localization.	40.8 (Factiva: 2019, estimated)
Singapore	G-TEC Computer Education Center (G-TEC Education Services PTE LTD)	1 SOPHIA ROAD, #02-03, Peace Centre. Singapore 228149	2001	• Programming courses (C, C++, Java, etc.,) • Multimedia courses (Web designing, Adobe Photoshop, 3D Animation, etc.,) • Office skills (Word, Excel, PowerPoint, Access, etc.,) • Diploma & Certificate courses (Diploma in Computer Science, Diploma in Web Technology, etc.,)	n/a
Singapore	New Horizons Singapore	1 Maritime Square, HarbourFront Centre #10-24/25 (Lobby B) Singapore 099253	1997	• Adobe courses (Captivae, Flash, Dreamwaver, etc.,) • Microsoft Technical courses (SQL Server, Visual Studio, Windows Server, etc.,) • Office skills (Word, Excel, PowerPoint, Access, etc.,) • Other technical courses (Cloud & Big Data, Cisco, VMware,Mobile Application Development, etc.,)	n/a
Singapore	Republic Polytechnic	9 Woodlands Avenue 9, Singapore 738964	2002	• Applied Science • Engineering • Management and Communication • Events and Hospitality • Infocomm • Sports	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
				• Health & Leisure • Technology for the Arts	
Singapore	Content Capital	10 Anson Road, #27-15 International Plaza, Singapore 079903	2017	• Marketing • Social Media • Content Marketing • Digital • Blockchain • Crypto • Big Data • Advertising • Copywriting • Consultancy	n/a
Singapore	NTUC LearningHub	NTUC Trade Union House, 73 Bras Basah Road, #02-01, Singapore 189556	2004	• Infocomm Technology • Professional IT Certificates • Healthcare • Employability & Literacy • Business Excellence • Workplace Safety & Health Security • Human Resources • Foreign Worker Training	n/a
Singapore	Sapience Consulting Pte Ltd	69A Frankel Avenue, Singapore 458197	2008	Consulting and Training: Sapience is proud to be at the vanguard of the IT Service Management, GRC (Governance, Risk and Compliance), Project Management (Waterfall and Agile) and Security Management practices • Cyber Security and Risk • Governance and Service Management • Project Management and Agile • DevOps • Business Stimulations • Bid Data, Cloud and Enterprise Architecture • AI	n/a
Singapore	ALC Training Pte Ltd	3 Phillip Street, #16-02 Royal Group Building, Singapore 048693	1994	The ALC Training Portfolio focuses on enterprise IT and related areas of relevance to organizations • Cyber Security • ISO27001 and Standards • Cloud Computing	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
				• New ways of working: Agile, DevOps, Scrum • Project Management • ITIL (IT Service Management) • Enterprise • COBIT and Governance • Privacy • Management and People • Business Analysis	
Singapore	COMAT	10 Anson Road, #06-19/20 International Plaza, Singapore 079903	1984	Provides end-to-end certified IT training courses: • Cybersecurity • Data Science • Cloud • DevOps • Networking • Office Productivity	n/a
Thailand	Wisdom Center	77/177 Sinn Sathorn Tower., Floor 39 Krungthonburi Road,, Klongtonsai, Khlongsan, Bangkok 10600	n/a	• In-house training • Public training • IT security testing • Business and IT consulting	0.39
Thailand	Success Robotics	68/1 Highway 363, Thap Ma, Mueang Rayong District, Rayong 21000	n/a	• Industrial and Educational Robot Training • Industrial consulting (Robotic products)	0.33
Thailand	Net Design	Fortune Town 22nd Fl. Ratchadapisek rd. Dindang, Bangkok 10400	2000	• Graphic design • Web design • Programming • 3D animation • Architecture • Microsoft Office	0.08
Thailand	SIAMCOMPUTER & LANGUAGE SCHOOL	471/19 Ratchawithi RdKhwaeng Thanon Phaya Thai, Khet Ratchathewi, Krung Thep Maha Nakhon 10400	1979	• Computer for Office • Graphic Design & Web Design • Programming	n/a
Thailand	Codecamp-thailand	Software Park Building 99/31 Moo 4 Chaengwattana Road, Klong Kluea, Pak	n/a	• CSS • HTML • Bootstrap framework • SQL framework • Javascript • API • React framework	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
		Kret, Nonthaburi 11120		• Cloud server • Docker	
Thailand	Reporting-engineer	169/18 Karnjanapisek Rd. Dok Mai Prawet Bangkok	n/a	• MS Excel • PowerBI	0.08
Thailand	BorntoDev	144/25 Seri Thai Rd, Khwaeng Khlong Kum, Khet Bueng Kum, Krung Thep Maha Nakhon 10240	2017	• Software development • Computer/IT • Data science/Analytic • Computer grapgic/Art	0.17
Thailand	Expert programming tutor	486 155 Phetchaburi 16 Alley, Thanon Phetchaburi, Ratchathewi, Bangkok 10400	n/a	• JAVA • C • C++ • Python • C# • Fullstack • iOS • Machine learning • Deep learning • Computer science • etc.,	n/a
Thailand	Skilllane	5 Liang mueng rd. Tambon Talat Kwan, Amphoe Mueang Nonthaburi, Chang Wat Nonthaburi 11000	2014	• MS office • Programming • Computer graphic • AI and machine learning • etc.	4.51
Thailand	Coding Consultants (Thailand)	539/5 Moo 11, Rai noi, Mueang, Ubonrachatani	2019	• HTML • CSS • PHP • SQL • JAVA script • J query	0.04
-	EdX	No location at Cambodia, Laos, Malaysia, Mongolia, Philippines, Singapore and Thailand	-	-	-
-	Udemy	No location at Cambodia, Laos, Malaysia, Mongolia, Philippines,	-	-	-

Country	Company	Address	Esta-blished	Key services	Annual sales
		Singapore and Thailand			
-	Coursera	No location at Cambodia, Laos, Malaysia, Mongolia, Philippines, Singapore and Thailand	-	-	-

(3) Innovation ecosystems

Investors

Country	Company	Main type of investment	AUM (Asset Under Management): Million USD	Esta-blished
Cambodia	Belt Road Capital Management	PE/Buyout	50	2017
Cambodia	Uberis Capital	Venture Capital	-	2012
Cambodia	OBOR Capital	Venture Capital	-	2016
Cambodia	Smart Axiata Company	Corporation	-	2009
Cambodia	Tanncam Investment	Venture Capital	-	
Cambodia	Camboticket	VC-Backed Company	-	2015
Cambodia	Daun Penh Cambodia Group	Holding Company	-	2005
Cambodia	Ooctane	Venture Capital	-	2018
Cambodia	Pi Pay (digital payment platform)	Corporation	-	2016
Mongolia	Irbis Ventures	Venture Capital	-	
Mongolia	MCS Holding	Holding Company	-	1993
Mongolia	Mongolia Opportunities Partners	PE/Buyout	-	2009
Mongolia	Ummp	Other	-	2009
Philippines	Kickstart Ventures	Corporate Venture Capital	432	2012
Philippines	Asian Development Bank	Lender/Debt Provider	58,160	1966
Philippines	Ayala (PHS: AC)	Corporation	180	1833
Philippines	IdeaSpace Foundation	Accelerator/Incubator	-	2012
Philippines	ICCP SBI Venture Partners	Venture Capital	-	1997
Philippines	Katalyst Philippines	Accelerator/Incubator	1	
Philippines	San Miguel (PHS: SMC)	Corporation	-	1890
Philippines	Philippine Long Distance Telephone (PHS: TEL)	Corporation	-	1928
Philippines	MFT Group	PE/Buyout	-	

Country	Company	Main type of investment	AUM (Asset Under Management): Million USD	Esta-blished
Philippines	International Container Terminal Services (PHS: ICT)	Corporation	-	1987
Philippines	Eden Holdings	Venture Capital	-	2015
Philippines	Globe Telecom (Philippines) (PHS: GLO)	Corporation	-	1935
Philippines	ADB Ventures	Venture Capital	-	2020
Philippines	StartUp Village (Philippines)	Accelerator/Incubator	-	
Philippines	Aboitiz (PHS: AEV)	Corporation	-	1989
Philippines	Alliance Global Group (PHS: AGI)	Corporation	-	
Philippines	Hatchd Digital	Accelerator/Incubator	-	2010
Philippines	Navegar	PE/Buyout	347	
Philippines	Foxmont Capital Partners	Venture Capital	-	
Philippines	GT Capital Holdings (PHS: GTCAP)	Corporation	-	2007
Philippines	Launchgarage	Accelerator/Incubator	-	2012
Philippines	Emperador (PHS: EMP)	PE-Backed Company	-	1990
Philippines	JG Summit Holdings (PHS: JGS)	Corporation	-	1957
Philippines	Oak Drive Ventures	Venture Capital	-	2010
Philippines	Monde Nissin	PE-Backed Company	-	1979
Philippines	CORE Capital (Manila)	Venture Capital	-	2018
Philippines	First Asia Venture Capital	Venture Capital	-	1977
Philippines	Incubix Technologies	Accelerator/Incubator	-	2014
Philippines	ADP Pharma	Corporation	-	
Philippines	American Orient Capital Partners	PE/Buyout	-	
Philippines	ISOC Holding	Real Estate	-	
Philippines	Next Century Associates	PE/Buyout	190	
Philippines	Bounty Agro Ventures	Corporation	-	1997
Philippines	Cyber City Teleservices	PE-Backed Company	-	1999
Philippines	Dennis Uy	Angel (individual)	-	
Philippines	Gaku Nakamura	Angel (individual)	-	
Philippines	Investing in Women	Impact Investing	-	2016
Philippines	Januarius Holdings	Asset Manager	100	2008
Philippines	JGDEV	Corporate Venture Capital	-	
Philippines	John Dang	Angel (individual)	-	
Philippines	Sierra Madre	PE/Buyout	50	2015
Philippines	Stream International Global Services Philippines	Corporation	-	1999
Philippines	917Ventures	Accelerator/Incubator	-	2015

Country	Company	Main type of investment	AUM (Asset Under Management): Million USD	Esta-blished
Philippines	Alpha Omega Capital Partners (Philippines)	Venture Capital	-	
Philippines	ATR Asset Management	Asset Manager	-	1995
Philippines	Bridge Financial Services	Impact Investing	-	2013
Philippines	Nexus Technologies	Corporation	-	1994
Philippines	Nutramedica	Corporation	-	
Philippines	Philippine Airlines	Corporation	-	1941
Philippines	Profriends Group	Corporation	-	2010
Philippines	Xeno Pharmaceuticals Phils	Corporation	-	2006
Thailand	Dtac Accelerate	Accelerator/Incubator	-	2012
Thailand	Indorama Ventures Public (BKK: IVL)	Corporation	-	1994
Thailand	Ardent Capital	Venture Capital	350	2011
Thailand	Thai Union Group (BKK: TU)	Corporation	-	1977
Thailand	InVent by Intouch Holding	Corporate Venture Capital	14	2012
Thailand	SCB 10X	Corporate Venture Capital	350	2020
Thailand	AddVentures by SCG	Corporate Venture Capital	-	2017
Thailand	PTT Public Company (BKK: PTT)	Corporation	-	1978
Thailand	Charoen Pokphand Group	Corporation	306	1921
Thailand	Rise Accelerator (Bangkok)	Accelerator/Incubator	10	2016
Thailand	Bangkok Bank InnoHub	Accelerator/Incubator	-	
Thailand	Beacon Venture Capital	Corporate Venture Capital	-	2017
Thailand	Krungsri Finnovate	Venture Capital	-	
Thailand	Bangchak Corporation (BKK: BCP)	Corporation	-	1984
Thailand	Siam Cement Group (BKK: SCC)	Corporation	-	1913
Thailand	Kasikornbank (BKK: KBANK)	Corporation	-	1945
Thailand	Nvest Venture	Venture Capital	-	2014
Thailand	Stonelotus Ventures	Venture Capital	-	2010
Thailand	True Corporation (BKK: TRUE)	Corporation	-	1990
Thailand	B. Grimm (BKK: BGRIM)	Corporation	-	1877
Thailand	Ookbee	Other	-	2012
Thailand	Cetelem	Corporation	-	
Thailand	Siam Alpha Equity	PE/Buyout	-	
Thailand	Bualuang Ventures	Growth/Expansion	60	2016
Thailand	Compass Hospitality	Corporation	-	1941
Thailand	Intouch (BKK: INTUCH)	Asset Manager	8	1983

Country	Company	Main type of investment	AUM (Asset Under Management): Million USD	Esta-blished
Thailand	Kuvera Capital Group	PE/Buyout	-	2011
Thailand	Mitr Phol	Corporation	-	1946
Thailand	Digital Ventures (Bangkok)	Corporate Venture Capital	-	2016
Thailand	ECG-Research	PE/Buyout	-	
Thailand	GC Ventures	Corporate Venture Capital	30	2018
Thailand	GMM Grammy (BKK: GRAMMY)	Corporation	-	1983
Thailand	Hoya Optical Laboratories	Corporation	-	1998
Thailand	Singha Ventures	Corporate Venture Capital	-	
Thailand	Bank of Ayudhya (BKK: BAY)	Corporation	-	1945
Thailand	Boon Rawd Brewery	Corporation	-	1933
Thailand	K2 Venture Capital	Venture Capital	-	2017
Thailand	Siri Ventures	Corporate Venture Capital	-	
Thailand	The International Engineering	Other	-	1922
Thailand	Big C Supercenter	Corporation	-	1993
Thailand	Chilindo	Corporation	-	2013
Thailand	Osotspa (BKK: OSP)	Corporation	-	1891
Thailand	Trapp Lewis	Angel (individual)	-	
Thailand	Adrian Vanzyl	Angel (individual)	-	
Thailand	Finansa (BKK: FNS)	Corporation	-	1991
Thailand	Kasper Kragelund	Angel (individual)	-	
Thailand	Knight Asia	Hedge Fund	-	
Thailand	MFC Asset Management (BKK: MFC)	Real Estate	81	1975
Thailand	Moonshot Venture Capital	Venture Capital	-	2018
Thailand	Premier Advisory Group	Corporation	-	
Thailand	Shift Ventures	Venture Capital	-	
Thailand	SPCG (BKK: SPCG)	Infrastructure	-	1993
Thailand	SSI		-	1970
Thailand	Aimspire	Venture Capital	-	2013
Thailand	Asean Nomad Capital	Venture Capital	-	
Thailand	Asset Plus Fund Management	PE/Buyout	906	
Thailand	Digital Telecommunications Infrastructure Fund	Infrastructure	-	2013
Thailand	DSAFC Thailand	PE/Buyout	13,400	1999
Thailand	Finansa Asset Management	Investment Bank	600	1969
Thailand	K.E. Group	Real Estate	-	2001
Thailand	Kiatnakin Phatra Asset Management Company	Asset Manager	-	
Thailand	Royal Thai Government	Government	-	

Country	Company	Main type of investment	AUM (Asset Under Management): Million USD	Esta-blished
Thailand	Strategic Hospitality Extendable Freehold and Leasehold Real Estate Investment Trust (BKK: SHREIT)	Real Estate	154	
Thailand	Thai Plastic & Chemicals Public Co.	Corporation	-	
Thailand	Thip Capital	Family Office	-	

(4) Shared categories

Think tanks/consulting firms

Country	Company	Address	Esta-blished	Key services	Annual sales
Cambodia	Cambodia Development Resource Institute (CDRI)	#56 Street 315, Tuol Kork, PO Box 622, Phnom Penh, Cambodia	1990	• Policy Research in Agriculture and Rural Development • Development Economics and Trade • Educational Research and Innovation • Natural Resource and Environment • Governance and Inclusive Society • Health	n/a
Cambodia	Cambodian Institute for Cooperation and Peace (CICP)	No.204, Street 1966, Phum Paung Peay, Sangkat Phnom Penh Thmey, Khan Sen Sok, Phnom Penh, Kingdom of Cambodia	1993	Promotion of both domestic and regional dialogue on peace, democracy, civil society, security, foreign policy, conflict resolution, economics and national development	n/a
Cambodia	Economic Institute of Cambodia (EIC)	#2012ABC, National Road 5, Sangkat Tuol Sangke, Khan Russei Keo, P.O.Box: 1008, qPhnom Penh, KH	2003	• Macro-economic monitoring and forecasting • Policy-oriented research • Project monitoring and evaluation (M&E) • Social research • Market research • Data collection and processing	n/a
Cambodia	Future Forum	1st Floor, Building 2, No. 1159, National Road 2, Sangkat Chak	2015	• Evidence-based policy research and analysis • Strategic foresight	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
		Angre Leu, Khan Meanchey, Phnom Penh		• Youth capacity building in research and analysis	
Cambodia	Asian Vision Institute	#24 Street 566, Boeung Kok 2, Toul Kork, Phnom Penh.	1991	• Publications • Consulting Services (Data Collection and Analysis, Leadership Development, Geopolitical Risk Analysis, Governance Solutions, Cyber Security Solutions, Sustainability Solutions) • Multimedia and Events	n/a
Cambodia	Heinrich Böll Foundation	#8, Street 476, Sangkat Toul Tompoung I, Khan Chamkar Mon, Phnom Penh, Cambodia	1993	• Resource Governance • Gender Democracy	n/a
Cambodia	PwC	58C Sihanouk Boulevard Sangkat Tonle Bassac Khan Chamkarmon Phnom Penh 12210 Cambodia	1995	• Alliances and Ecosystems • Audit and assurance services • Consulting • Deals • Entrepreneurial and private business • Family business • Forensics • Crisis management • Legal • People and organization • Strategy& • Sustainability and climate change • Tax	n/a
Cambodia	EY	5th Floor, Emerald Building, #64 Norodom Boulevard corner Street, 178, Sangkat Chey Chumneah, Khan Daun, Penh, 12206 Phnom Penh, Phnom Penh 855	2008	• Financial Services EMEIA Webcasts • NextWave Financial Services: Financial Well-being • Financial services • Managed Services • Intelligent automation in financial services • Financial Services, EMEIA • Financial Accounting Advisory Services • Financial Services Technical Resources	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
				• COVID-19 in Financial Services in Financial Services • Brexit in Financial Services in Financial Services • EY Nexus: a digital platform for financial services • Climate Change and Sustainability Services	
Cambodia	KPMG	4th floor, Delano Center No. 144, Street 169, Sangkat Veal Vong	1994	• Audit • Tax • Advisory	n/a
Cambodia	Deloitte	Floor 8, Unit 8, #66, Monivong Blvd Sangkat Voat Phnum Khan Doun Penh, Phnom Penh	2014	Audit & Assurance • Assurance Services Consulting • Strategy, Analytics and M&A • Customer and Marketing • Core Business Operations • Human Capital • Enterprise Technology & Performance Financial Advisory • Mergers & Acquisitions • Restructuring Services • Deloitte Forensic Legal • Legal Management Consulting • Legal Advisory Services • Legal Managed Services • Dbriefs Legal • Deloitte Legal Around the World Risk Advisory • -Strategic & Reputation Risk • Regulatory Risk • Financial Risk • Operational Risk • Cyber Risk Tax • Global Business Tax • Indirect Tax • Global Employer Services	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
Laos	Economic Research Institute for Industry and Trade (ERITT)	P.O. Box 4107, Vientiane, Lao PR	1999	• Trade • Economic • Finance	n/a
Laos	Project Consult Institute PCI Co Ltd	#17, Khounboulom Road, Watchan, Chanchaboury, Vientiane, Lao PDR	1999	• Agriculture • Asset Management • Civil Engineering • Climate Change • Coastal and Ocean • Construction Management • Cultural Resources and Heritage • Economic • Education • Emergency Management • Energy & Extractives • Environment • Financial Sector • Food Security • Gender and Social Inclusion • Geotechnical Engineering • GIS, Mapping and Survey • Health • Industry & Trade • Infrastructure • Land management • Law and Justice • Natural Resources, Biodiversity and Forestry • Private Sectors Development • Public Admin • Rehabilitation • Social Protection • Transportation • Urban Development • Water/Saint/Waste	n/a
Laos	Enterprise & Development Consultant Company Limited	Green Building, Naxay Village, Saysettha District, Vientiane Capital, Lao PDR, P.O Box 9997	1999	• SMEs, Startups, and Entrepreneurs • Growth and Scaling Solutions • Surveys and Analytics • Impact, Policy, and Reforms • Leadership and Strategic Actions	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
				• Learning Journeys and Implementation • Planning for Innovations • People Management and Administration • Developing Innovation Enablers (Trainers, Coaches, Mentors, and Facilitators) • CEO Coaching • Design, Feasibility, Proposal, and Investment Writing • Digital Monitoring and Evaluation • Innovative Funding and Financing • Training for Impact • Special Events, Summits, and Conferences • Payrolls and Business Processes • Translations and Interpretations • People Recruitment	
Laos	Deloitte (Lao) Sole Company Limited	Lao Securities Exchange Building Phonthan Village, T4 Road Saysettha District, P.O. Box 2017, Vientiane	2016	• Audit & Assurance • Assurance Services Consulting • Strategy, Analytics and M&A • Customer and Marketing • Core Business Operations • Human Capital • Enterprise Technology & Performance Financial Advisory • Mergers & Acquisitions • Restructuring Services • Deloitte Forensic Legal • Legal Management Consulting • Legal Advisory Services • Legal Managed Services • Dbriefs Legal • Deloitte Legal Around the World Risk Advisory	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
				• Strategic & Reputation Risk • Regulatory Risk • Financial Risk • Operational Risk • Cyber Risk Tax • Global Business Tax • Indirect Tax • Global Employer Services	
Laos	KPMG Lao Company Limited	10th Floor, Royal Square Office Building, Samsenthai Road, Nongduong Nua Village, Sikhotabong District, Vientiane Laos	1997	• Audit • Tax • Advisory (Management Consulting, Risk Consulting, Deal Advisory)	n/a
Laos	Ernst & Young Lao Co., Ltd	23 Signha Road, Kolao Tower I, Level 6, Nongbone Village, Saysettha District, Vientiane Capital, Lao PDR	n/a	• Audit & Assurance • Accounting & Tax Advisory • Consulting & Strategy • Transaction Advisory • Information Technology Consulting • Financial Accounting Advisory Services	n/a
Laos	PwC	4th Floor ANZ Commercial Building 33 Lane Xang Avenue Ban Hatsady/ Chanthaboury Vientiane	1996	• Alliances and Ecosystems • Audit and assurance services • Consulting • Deals • Entrepreneurial and private business • Family business • Forensics • Crisis management • Legal • People and organization • Strategy& • Sustainability and climate change • Tax	n/a
Laos	EY	23 Signha Road, Kolao Tower I, Level 6, Nongbone Village, Saysettha District, Vientiane	n/a	• Financial Services EMEIA Webcasts • NextWave Financial Services: Financial Well-being	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
		Capital, Lao PDR, Vientiane		• Financial services • Managed Services • Intelligent automation in financial services • Financial Services, EMEIA • Financial Accounting Advisory Services • Financial Services Technical Resources • COVID-19 in Financial Services in Financial Services • Brexit in Financial Services in Financial Services • EY Nexus: a digital platform for financial services Climate Change and Sustainability Services	
Laos	KPMG	Vientiane 10th Floor, Royal Square Office Building Samsenthai Road, Nongduong Nua Village, Sikhotabong District	1997	• -Audit • Tax • Advisory	n/a
Laos	Deloitte	Lao Securities Exchange Building Phonthan Village, T4 Road Saysettha District P.O. Box 2017	2016	Audit & Assurance • Assurance Services Consulting • Strategy, Analytics and M&A • Customer and Marketing • Core Business Operations • Human Capital • Enterprise Technology & Performance Financial Advisory • Mergers & Acquisitions • Restructuring Services • Deloitte Forensic Legal • Legal Management Consulting • Legal Advisory Services • Legal Managed Services • Dbriefs Legal	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
				• Deloitte Legal Around the World Risk Advisory • Strategic & Reputation Risk • Regulatory Risk • Financial Risk • Operational Risk • Cyber Risk Tax • • Global Business Tax • Indirect Tax • Global Employer Services	
Malaysia	ANBOUND	Suite 25.5, Level 25, Menara AIA Sentral, 30 Jalan Sultan Ismail, 50250 Kuala Lumpur, Malaysia	2012	Specialize in public policy research covering geopolitics and international relations, urban and social development, industrial issues, and macro-economy.	n/a
Malaysia	FTI Consulting, Inc.	Level 15.01, 1 First Avenue, 2A Dataran Bandar Utama, Damansara, Petaling Jaya, SL 47800, Malaysia	n/a	Kuala Lumpur office primarily provides Financial Communications, Investor Relations, Corporate Communications and Brand Management services. In addition, we provide expert advice on Reputation Management, Social Responsibility, Governance, Mergers and Acquisitions, Regulatory Issues, Risk and Restructuring. We are uniquely positioned to advise executive teams, boards of directors and other senior decision makers on how best to leverage communications to address opportunities, threats and challenges that have the potential to affect enterprise value.	n/a
Malaysia	Asia Group Advisors	Q Sentral (East Wing), #39-02, 2A Jalan Stesen Sentral 2, Kuala Lumpur 50470, Malaysia	2013	A strategic advisory firm specializing in market entry, government affairs and public policy in Southeast Asia. Public Affairs & Government Engagement services include:	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
				• Political & Economic Analysis • Strategic Communication • Government Engagement • Regulatory Advocacy • Third Party Activation	
Malaysia	Centre for Public Policy Studies (CPPS)	Khazanah ASLI Suite 1, Sunway Lagoon Club, No 3, Jalan Lagoon Timur Bandar Sunway 47500 Selangor Darul Ehsan	n/a	CPPS upholds an independent, non-partisan and non-racial stance in its research and other policy-oriented activities. Amongst the priority areas that the Centre is working on are the following: • National Unity • Women and Gender Equality • National Competitiveness • Education • Transparency and Good Governance • Sustainable Development	n/a
Malaysia	Institute of Strategic Analysis and Policy Research (INSAP)	163, Jalan Ampang, 55000 Kuala Lumpur, Malaysia	1986	Political-Economic Research	n/a
Malaysia	Institut Rakyat	Petaling Jaya, Selangor	n/a	Research and Policy Formulations=	4.1 (Estimated)
Malaysia	Institute of Strategic and International Studies (ISIS)	No. 1, Persiaran Sultan Salahuddin, P O Box 12424, 50778 Kuala Lumpur, Malaysia	1983	• Foreign Policy and Security Studies • Economics, Trade and Regional Integration • Social Policy and National Integration • Technology, Innovation, Environment and Sustainability	n/a
Malaysia	KSI Strategic Institute for Asia Pacific	A-07-09, Plaza Mont' Kiara, 2 Jalan Kiara, Mont' Kiara, 50480 Kuala Lumpur, Malaysia	2018	• Policy Research and Studies • Business Advisory and Investor Services • High Level Conferences and Business Summits • Forums and Roundables • CEO Peer Group Programmers	4 (Estimated)
Malaysia	Institute for Democracy and	1, Jalan Hang Lekir, The Lower Penthouse, Kuala	2010	• Economic and Business Research • Public Finance Research	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
	Economic Affairs (IDEAS)	Lumpur, Wilayah Persekutuan Kuala Lumpur 50000, Malaysia		• Democracy and Governance Research • Social Policy Research	
Malaysia	Sedar Institute	Lot 3.04, Level 3, Tower 1, Menara Pgrm, No. 6 & 8 Jalan Pudu Ulu, Cheras, Kuala Lumpur 56100, Malaysia	2001	• Research • Strategies	n/a
Malaysia	Boston Consulting Group	Level 28, Menara IMC No. 8 Jalan Sultan Ismail Kuala Lumpur 50250	1992	• Business and Organizational Purpose • Business Transformation • Corporate Finance and Strategy • Customer Insights • Digital, Technology, and Data • Diversity, Equity, and Inclusion • Innovation Strategy and Delivery • International Business Manufacturing • Marketing and Sales M&A, Transactions, and PMI • Operations • Organization • People Strategy • Pricing and Revenue Management	n/a
Malaysia	Bain & Company	Lot 6.02 Level 6 Menara BRDB 285 Jalan Maarof Bukit Bandaraya 59000 Kuala Lumpur Malaysia	2010	• Agile • Cost Transformation Customer Experience • Diversity, Equity & Inclusion • Learning & Development • Mergers and Acquisitions • Divestitures • Post-Merger Integration • Operations • Manufacturing • Supply Chain • Assistance Functions • Organization • Leadership and Talent • Operating Model Design	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
				• Private Equity • Procurement • Sales and Marketing • Pricing • Strategy • Business Strategy Corporate Strategy and Finance • Sustainability • Full Potential Transformation • Change and Implementation • Digital Transformation • Vector℠ Digital Delivery • New Business Ventures • Product & Experience Innovation • Marketing Optimization • Advanced Analytics • Automation • Enterprise Technology	
Malaysia	Accenture	'Level 15 & 16, Vertical Tower B Avenue 10, The Vertical, Bangsar South City, No. 8 Jalan Kerinchi, Kuala Lumpur, Malaysia, 59200	1979	• Application Services • Artificial Intelligence • Automation • Business Process Outsourcing • Business Strategy • Change Management • Cloud • Customer Experience • Data & Analytics • Digital Commerce • Ecosystem Services • Finance Consulting • Industry X • Infrastructure • Marketing • Mergers & Acquisitions (M&A) • Operating Models • Security • Supply Chain Management • Sustainability • Technology Consulting • Technology Innovation • Zero Based Budgeting (ZBB)	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
Malaysia	PwC	Level 10, 1 Sentral, Jalan Rakyat, Kuala Lumpur Sentral, 50706 Kuala Lumpur, Wilayah Persekutuan Kuala Lumpur, Malaysia	n/a	• Alliances and Ecosystems • Audit and assurance services • Consulting • Deals • Entrepreneurial and private business • Family business • Forensics • Crisis management • Legal • People and organization • Strategy& • Sustainability and climate change • Tax	n/a
Malaysia	EY	Level 23A, Menara Milenium, Jalan Damanlela, Pusat Bandar Damansara, Kuala Lumpur 50490	n/a	• Financial Services EMEIA Webcasts • NextWave Financial Services: Financial Well-being • Financial services • Managed Services • Intelligent automation in financial services • Financial Services, EMEIA • Financial Accounting Advisory Services • Financial Services Technical Resources • COVID-19 in Financial Services in Financial Services • Brexit in Financial Services in Financial Services • EY Nexus: a digital platform for financial services Climate Change and Sustainability Services	n/a
Malaysia	KPMG	Level 17, Ipoh Tower, Jalan Dato' Seri Ahmad Said, 30450 Ipoh	1928	• Audi • Tax • Advisory	n/a
Malaysia	Deloitte	Level 16, Menara LGB 1, Jalan Wan Kadir	1968	Audit & Assurance • Assurance Services Consulting	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
		Taman Tun Dr. Ismail, Kuala Lumpur 60000 Malaysia		• Strategy, Analytics and M&A • Customer and Marketing • Core Business Operations • Human Capital • Enterprise Technology & Performance Financial Advisory • Mergers & Acquisitions • Restructuring Services • Deloitte Forensic Legal • Legal Management Consulting • Legal Advisory Services • Legal Managed Services • Dbriefs Legal • Deloitte Legal Around the World Risk Advisory • Strategic & Reputation Risk • Regulatory Risk • Financial Risk • Operational Risk • Cyber Risk Tax • Global Business Tax • Indirect Tax • Global Employer Services	
Malaysia	McKinsey & Company	Petronas, Level 27, Menara 3, Persiaran KLCC, 50088 Kuala Lumpur, Malaysia	n/a	• Accelerate • Digital • M&A • Marketing & Sales • Operations • Organization • Risk • Strategy & Corporate Finance • Sustainability • Transformation	n/a
Mongolia	International Think Tank for Landlocked Developing Countries (LLDCs)	UN House, United Nations Street-14, Sukhbaatar district, Ulaanbaatar 14201, Mongolia	2009	Harness opportunities and overcome difficulties of Landlock Developing countries	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
Mongolia	Mongolian Development Research Center	PO Box 63 Ulaanbaatar 20A , Mongolia	1998	Development concept for economy in Mongolia	n/a
Mongolia	Economic Research Institute	ERI, Suite 1100, Bodi Tower, Jigjidjav street 3 /Great Chinggis Khaan square/, Chingeltei district Ulaanbaatar, Mongolia 15160	2010	• Applied policy research addressing current needs of the nation in professional analyses of economic development and reform problems • Enhancing indigenous capacity for modem applied economic research	n/a
Mongolia	The Defacto Institute	Ulaanbaatar, Mongolia	n/a	• Democracy promotion • Good Governance • Free market solutions • Economic Innovation and diversification	n/a
Mongolia	Zaigal Research Institute	Lux center Door #1001, Ch.Chagdarjav street, Bayanzurkh district, Ulanbaatar, Mongolia.	2018	• Health • Social Policy	n/a
Mongolia	Asian Khuleg Mongolia	Ulaanbaatar, Sukhbaatar district, 8th quarter, Gb plaza, 304	2016	Social Policy	n/a
Mongolia	Independent Research Institute of Mongolia (IRIM)	1503, Building (Pro ONE), Nogoon nuur street, 11th Khoroo, Sukhbaatar District, Ulanbaatar, Mongolia	2008	• Research • Monitoring and Evaluation • Training • Advocacy • Consulting Projects	n/a
Mongolia	Economic Policy and Competitiveness Research Center	Sukhbaatar district, Prime Minister Amar street, Foundation business center 9th floor, Ulaanbaatar, Mongolia	2010	Research on competitiveness of the country	n/a
Mongolia	PwC	Central Tower, Floor 6, Suite 601 Sukhbaatar Square 2, SBD-8 Ulaanbaatar 14200 Mongolia	2010	• Alliances and Ecosystems • Audit and assurance services • Consulting • Deals	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
				• Entrepreneurial and private business • Family business • Forensics • Crisis management • Legal • People and organization • Strategy& • Sustainability and climate change • Tax	
Mongolia	EY	Suite 200, 8 Zovkhis Building, Suite 200, Seoul Street 21, Ulaanbaatar 14251	1999	• Financial Services EMEIA Webcasts • NextWave Financial Services: Financial Well-being • Financial services • Managed Services • Intelligent automation in financial services • Financial Services, EMEIA • Financial Accounting Advisory Services • Financial Services Technical Resources • COVID-19 in Financial Services in Financial Services • Brexit in Financial Services in Financial Services • EY Nexus: a digital platform for financial services • Climate Change and Sustainability Services	n/a
Mongolia	KPMG	Suite #602, 6th floor, Blue Sky Tower, Peace Avenue 17, Sukhbaatar District, 1 khoroo, Ulaanbaatar, 14240	2012	• Audi • -Tax • Advisory	n/a
Mongolia	Deloitte	15/F, ICC Tower, Jamiyan-Gun Street	2004	Audit & Assurance • Assurance Services Consulting	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
		1st Khoroo, Sukhbaatar District		• Strategy, Analytics and M&A • Customer and Marketing • Core Business Operations • Human Capital • Enterprise Technology & Performance Financial Advisory • Mergers & Acquisitions • Restructuring Services • Deloitte Forensic Legal • Legal Management Consulting • Legal Advisory Services • Legal Managed Services • Dbriefs Legal • Deloitte Legal Around the World Risk Advisory • Strategic & Reputation Risk • Regulatory Risk • Financial Risk • Operational Risk • Cyber Risk Tax • Global Business Tax • Indirect Tax • Global Employer Services	
Philippines	Institute for Strategic and Development Studies (ISDS)	40-E Maalalahanin Street, Teachers Village East, Diliman, Quezon City 1101 Philippines	1991	Research on national and international affairs	n/a
Philippines	Philippine Institute for Development Studies (PIDS)	18F Three Cyberpod Centris - North Tower, EDSA corner Quezon Avenue, Quezon City	1977	PIDS serves as the Philippine government's primary socioeconomic policy think tank. Since its establishment, PIDS has been engaged in the conduct of policy-oriented studies to assist policymakers and planners in crafting development policies, plans, and programs that are based on sound research evidence. It has completed numerous	4.5 (Estimated)

Country	Company	Address	Esta-blished	Key services	Annual sales
				studies on a wide range of development topics.	
Philippines	Asian Institute of Management Policy Center	3/F, Asian Institute of Management, Eugenio Lopez Foundation Bldg., 123 Paseo de Roxas, Makati City, 1260 Philippines.	1996	• Development • Policy • Economic Research • Working papers • Publications • Events	n/a
Philippines	Center for International Relations and Strategic Studies (CIRSS)	5/F DFA Building, Roxas Boulevard, Pasay, Metro Manila	1991	• Defence, Peace, Security • International affairs/ Development	n/a
Philippines	Initiatives for International Dialogue (IID)	27 Galaxy Street, GSIS Heights Matina, 8000 Davao City Philippines	1988	• Human Security • Democratization • People to people solidarity	n/a
Philippines	Ateneo Center for Economic Research and Development (ACERD)	Ateneo de Manila University, Ricardo & Dr. Rosita Leong Hall, Room 409, 4/F Department of Economics, Katipunan Avenue, Loyola Heights, Quezon City, Philippines 1108	1989	• Economics • Public research work • Policy studies • Programs and projects	n/a
Philippines	International Rice Research Institute	Pili Drive, Los Baños, Laguna 4031, Philippines	1960	Offers extensive range of solutions and offerings to empower stakeholders of rice value chain	1.8 (Estimated)
Philippines	Action for Economic Reforms	Unit 1403 West Trade Center, 132 West Avenue, Quezon City, Philippines 1104	1996	Economic Issues	1.1 (Estimated)
Philippines	iLEAD	Unit 604 FSS Building II, No. 18 Scout Tuazon corner Scout Castor, Barangay Laging Handa, Quezon City	n/a	Policy work to strengthen democratic institutions	n/a
Philippines	National Competitiveness Council	2nd Floor HPGV Building (Former Accelerando), 395	2006	Promote and develop national competitiveness	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
		Sen. Gil Puyat Avenue, Makati City, Philippines 1200			
Philippines	Boston Consulting Group	23rd Floor Menarco Tower 32nd Street, Bonificio Global City Taguig 1630	n/a	• Business and • Organizational Purpose • Business Transformation • Corporate Finance and Strategy • Customer Insights • Digital, Technology, and Data • Diversity, Equity, and Inclusion • Innovation Strategy and Delivery • International Business • Manufacturing • Marketing and Sales • M&A, Transactions, and PMI • Operations • Organization • People Strategy • Pricing and Revenue Management	n/a
Philippines	Bain & Company	Manila office has launched virtually, with a physical space to come in 2021	2021	• Agile • Cost Transformation • Customer Experience • Diversity, Equity & Inclusion • Learning & Development • Mergers and Acquisitions • Divestitures • Post-Merger Integration • Operations • Manufacturing • Supply Chain • Support Functions • Organization • Leadership and Talent • Operating Model Design • Private Equity • Procurement • Sales and Marketing • Pricing • Strategy • Business Strategy	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
				• Corporate Strategy and Finance • Sustainability • Full Potential Transformation • Change and Implementation • Digital Transformation • Vector^{SM} Digital Delivery • New Business Ventures • Product & Experience Innovation • Marketing Optimization • Advanced Analytics • Automation • Enterprise Technology	
Philippines	Accenture	Capitol Site, Robinsons Cybergate, 5/F Don Gil Garcia Street, Cebu City, Cebu, Philippines, 6000	1985	• Application Services • Artificial Intelligence • Automation • Business Process Outsourcing • Business Strategy • Change Management • Cloud • Customer Experience • Data & Analytics • Digital Commerce • Ecosystem Services • Finance Consulting • Industry X • Infrastructure • Marketing • Mergers & Acquisitions (M&A) • Operating Models • Security • Supply Chain Management • Sustainability • Technology Consulting • Technology Innovation • Zero Based Budgeting (ZBB)	n/a
Philippines	PwC	29th Floor Philamlife Tower 8767 Paseo de Roxas Makati City 1226 Philippines	n/a	• Alliances and Ecosystems • Audit and assurance services • Consulting • Deals	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
				• Entrepreneurial and private business • Family business • Forensics • Crisis management • Legal • People and organisation • Strategy • Sustainability and climate change • Tax	
Philippines	EY	6760 Ayala Avenue, Makati City, Metro Manila, 1226	1946	• Financial Services EMEIA Webcasts • NextWave Financial Services: Financial Well-being • Financial services • Managed Services • Intelligent automation in financial services • Financial Services, EMEIA • Financial Accounting Advisory Services • Financial Services Technical Resources • COVID-19 in Financial Services in Financial Services • Brexit in Financial Services in Financial Services • EY Nexus: a digital platform for financial services Climate Change and Sustainability Services	n/a
Philippines	KPMG	11/F The KPMG Center, 6787 Ayala Ave, Makati, 1226 Kalakhang Maynila, Philippines	n/a	• Audit • Tax • Advisory	n/a
Philippines	Deloitte	19th Floor Six/NEO 5th Avenue, corner 26th St, Taguig, 1634 Metro	1997	Audit & Assurance • Assurance Services • Consulting • Strategy, Analytics and M&A • Customer and Marketing	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
		Manila, Philippines		• Core Business Operations • Human Capital • Enterprise Technology & Performance Financial Advisory • Mergers & Acquisitions • Restructuring Services • Deloitte Forensic Legal • • Legal Management Consulting • Legal Advisory Services • Legal Managed Services • Dbriefs Legal • Deloitte Legal Around the World Risk Advisory • Strategic & Reputation Risk • Regulatory Risk • Financial Risk • Operational Risk • Cyber Risk Tax • Global Business Tax • Indirect Tax • Global Employer Services	
Philippines	McKinsey & Company	7/F Zuellig Building Makati Avenue Corner Paseo de Roxas Makati City, 1225 Philippines	1999	• Accelerate • Digital • M&A • Marketing & Sales • Operations • Organization • Risk • Strategy & Corporate Finance • Sustainability • Transformation	n/a
Singapore	Singapore Institute of International Affairs (SIIA)	60A Orchard Road, #04-03 Tower 1 The Atrium@Orchard, International Involvement Hub, Singapore 238890	1962	• Environmental sustainability • International Affairs	1.4 (Estimated)
Singapore	Institute of Southeast Asian Studies (ISEAS)	30 Heng Mui Keng	1968	• Socio-political • Securit	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
		Terrace, Singapore 119614		• Southeast Asia economic trends and developments	
Singapore	Centre on Asia and Globalization (CAG)	Lee Kuan Yew School of Public Policy, National University of Singapore, 469A Bukit Timah Road, Level 10, Tower Block, Singapore 259770	2006	• Future of globalization • Regional orders and global order • China- India relations	n/a
Singapore	Asia Competitiveness Institute (ACI)	Lee Kuan Yew School of Public Policy, National University of Singapore, 469C Bukit Timah Road, Wing A, Level 3, Oei Tiong Ham Building, Singapore 259772	2006	• Sub-national economies level competitiveness analysis and city-level livability analysis • Firm-level competitiveness analysis in 16 Asia economies • Singapore's long-term growth strategies and public policy analysis	n/a
Singapore	Institute of Defense and Strategic Studies (IDSS)	Nanyang Technological University, Block S4, Level B3, 50 Nanyang Avenue, Singapore 639798	1996	Geopolitical developments in the Asia Pacific Region namely in the: • China • Malaysia • Indonesia • Maritime Security • Military Studies • Military Transformations • Regional Security Architecture • South Asia • United States	1.4 (Estimated)
Singapore	East Asian Institute (EAI)	East Asian Institute, 469A Bukit Timah Road, Tower Block #06-01, Singapore 259770	1997	Academic and policy-oriented research on East Asian development, particularly the political, economic and social development of contemporary China (including Hong Kong and Taiwan), and China's growing economic relations with the region and the world at large, including Japan, Korea and ASEAN	n/a
Singapore	Institute of Policy Studies (IPS)	Institute of Policy Studies, National University of	1988	Public Policy	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
		Singapore, 1C Cluny Road House 5, Singapore 259599			
Singapore	National Environment Agency	Public Service Centre, Our Tampines Hub, 1 Tampines Walk, Singapore 529649	n/a	Clean and sustainable environment for Singapore	n/a
Singapore	Institute of Water Policy	Lee Kuan Yew School of Public Policy, National University of Singapore, 469C Bukit Timah Road, Level 2, Wing A, Oei Tiong Ham Building, Singapore 259772	2008	Water policy and governance	n/a
Singapore	Energy Studies Institute	29 Heng Mui Keng Terrace	n/a	• Energy trends and issues • Energy policy development	n/a
Singapore	Boston Consulting Group	50 Raffles Place, #44-02/03, Singapore Land Tower, Singapore 048623, Singapore	1995	• Business and Organizational Purpose • Business Transformation • Corporate Finance and Strategy • Customer Insights Digital, Technology, and Data • Diversity, Equity, and Inclusion • Innovation Strategy and Delivery • International Business Manufacturing • Marketing and Sales • M&A, Transactions, and PMI • Operations • Organization • People Strategy • Pricing and Revenue Management	-
Singapore	Bain & Company	38 Beach Road, Level 15, South Beach Tower, Singapore, 189767	1993	• Agile • Cost Transformation • Customer Experience • Diversity, Equity & Inclusion • Learning & Development	-

Country	Company	Address	Esta-blished	Key services	Annual sales
				• Mergers and Acquisitions • Divestitures • Post-Merger Integration • Operations • Manufacturing • Supply Chain • Support Functions • Organization • Leadership and Talent • Operating Model Design • Private Equity • Procurement • Sales and Marketing • Pricing • Strategy • Business Strategy • Corporate Strategy and Finance • Sustainability • Full Potential Transformation • Change and Implementation • Digital Transformation • Vector^{SM} Digital Delivery • New Business Ventures • Product & Experience Innovation • Marketing Optimization • Advanced Analytics • Automation • Enterprise Technology	
Singapore	Accenture	Raffles City Towe, 250 North Bridge Rd #33-00, Singapore 179101	1975	• Application Services • Artificial Intelligence • Automation • Business Process Outsourcing • Business Strategy • Change Management • Cloud • Customer Experience • Data & Analytics • Digital Commerce • Ecosystem Services • Finance Consulting • Industry X • Infrastructure • Marketing	-

Country	Company	Address	Esta-blished	Key services	Annual sales
				• Mergers & Acquisitions (M&A) • Operating Models • Security • Supply Chain Management • Sustainability • Technology Consulting • Technology Innovation • Zero Based Budgeting (ZBB)	
Singapore	PwC	7 Straits View, Marina One, Singapore 018936	n/a	• Alliances and Ecosystems • Audit and assurance services • Consulting • Deal • Entrepreneurial and private business • Family business • Forensics • Crisis management • Legal • People and organization • Strategy& • Sustainability and climate change • Tax	-
Singapore	EY	Level 18 North Tower, One Raffles Quay, Singapore	n/a	• Financial Services EMEIA Webcasts • NextWave Financial Services: Financial Well-being • Financial services • Managed Services • Intelligent automation in financial services • Financial Services, EMEIA • Financial Accounting Advisory Services • Financial Services Technical Resources • COVID-19 in Financial Services in Financial Services • Brexit in Financial Services in Financial Services	-

Country	Company	Address	Esta-blished	Key services	Annual sales
				• EY Nexus: a digital platform for financial services • Climate Change and Sustainability Services	
Singapore	KPMG	16Raffles Quay, #22-00 Hong Leong Building, Singapore 048581	1987	• Audit • Tax • Advisory	-
Singapore	Deloitte	6 Shenton Way, OUE Downtown 2 #33-00, Singapore	1967	Audit & Assurance • Assurance Services Consulting • Strategy, Analytics and M&A • Customer and Marketing • Core Business Operations • Human Capital • Enterprise Technology & Performance Financial Advisory • Mergers & Acquisitions • Restructuring Services • Deloitte Forensic Legal • Legal Management Consulting • Legal Advisory Services • Legal Managed Services • Dbriefs Legal • Deloitte Legal Around the World Risk Advisory • Strategic & Reputation Risk • Regulatory Risk • Financial Risk • Operational Risk • Cyber Risk Tax • Global Business Tax • Indirect Tax • Global Employer Services	-
Singapore	McKinsey & Company	One Raffles Quay, Level 24, South Tower, Singapore 048583	1998	• Accelerate • Digital • M&A • Marketing & Sales • Operations • Organization • Risk	-

Country	Company	Address	Esta-blished	Key services	Annual sales
				• Strategy & Corporate Finance • Sustainability • Transformation	
Thailand	Sasin Management Consulting	Sasa Patasata Building Soi Chula 12 Phyathai Road,Bangkok 10330	n/a	• Policy Consultancy • Strategy Development & Implementation • Organizational Change & Human Capital	n/a
Thailand	CLC Asia	26th Floor, Capital Tower, All Seasons Place, 87/1 Wireless Road, Bangkok 10330, Thailand	2009	• Government relations & communications • Policy advisory • Industry analysis • Country risk analysis	0.02
Thailand	Bolliger & Company	No. 98 Sathorn Square Office Tower, 31st Floor, Room No. 3107 North Sathorn Road, Silom, Bangrak, Bangkok 10500	2008	• Policy & Strategic Planning • Trade & Investment • Customised Training	1.79
Thailand	BowerGroupAsia	999 Gaysorn Plaza, 6th Floor Unit 6A-4/1-1, Ploenchit Road Lumpini, Pathumwan, Bangkok, 10330	2017	• Government Engagement & Public Affairs • Public Policy • Political-Economic Forecasting & Risk Assessment • Market Entry • Crisis Management • Strategic Communications	0.00
Thailand	ABeam Consulting	Q.House Lumpini Building, 18th, 23rd Floor, 1 South Sathorn Road, Tungmahamek, Sathorn, Bangkok 10120 Thailand	2005	• Strategy • Supply chain management • Customer experience and contact • Financial Accounting and Business Management • Digital technology • Technology consulting • Thailand unique service	34.08
Thailand	Bluebik Group Public Company Limited	Arayasub building silom 51 Naradhiwas Rajanagarindra Rd. Silom, Bangrak, Bangkok, Thailand	2013	• Management Consulting • Strategic PMO • Digital Excellence & Delivery • Design Consulting • Big Data & Advanced Analytics	6.22

Country	Company	Address	Esta-blished	Key services	Annual sales
Thailand	Grant Thornton	11th Floor Capital Tower All Seasons Place 87/1 Wireless Road Lumpini Pathumwan Bangkok 10330 Thailand	1991	• Audit and assurance • Talent Acquisition Management and Executive Recruitment • Advisory • Business Consulting – Management consulting – Strategic insourcing • Tax and legalTax and legal • Japanese Business Practice • Business Process Outsourcing	0.88
Thailand	Claris	193/27 Lake Rajada Office Complex, 6th Floor Ratchadapisek Road, Bangkok, 10110 Thailand	2004	• Operational Improvement • Sales Effectiveness • Risk Management • Customer Relationship Management • Profit improvement • Growth/Competition • Market Diversification • Portfolio Management • Value Management • Product Development and Pricing • Strategic Planning • Change Management • Corporate Restructuring • Strategic Partnerships	0.27
Thailand	YAMADA Consulting & Spire	Level 16, 689 Bhiraj Tower at EmQuartier, Unit 1608-1610 Sukhumvit Road (Soi 35), Klongton Nuea, Vadhana, Bangkok 10110, Thailand	2015	• Management Consulting • Mergers & Acquisitions (M&A) • Market Research	1.32
Thailand	TIME Consulting	89 AIA Capital Center 9th, 10th, 15th Floor Ratchadapisek Road, Dindaeng, Bangkok 10400	2013	• Strategy & Management Consulting • Business Research • Digital Skill Training • Digital Transformation • Data Science & Advanced Analytics • Digital Ventures & Solutions	2.02

Country	Company	Address	Esta-blished	Key services	Annual sales
Thailand	Boston Consulting Group	968 Rama IV Rd, Silom, Bang Rak, Bangkok 10500	1995	• Business and Organizational Purpose • Business Transformation • Corporate Finance and Strategy • Customer Insights • Digital, Technology, and Data • Diversity, Equity, and Inclusion • Innovation Strategy and Delivery • International Business • Manufacturing • Marketing and Sales • M&A, Transactions, and PMI • Operations • Organization • People Strategy • Pricing and Revenue Management • Social Impact and Sustainability • Zero-Based Budgeting	36.96
Thailand	Bain & Company	388 Exchange Tower Level 36, Unit 3602, Sukhumvit Road Khwaeng Klongtoey, Khet Klongtoey Bangkok 10110	n/a	• Agile • Cost Transformation • Customer Experience • Diversity, Equity & Inclusion • Learning & Development • Mergers and Acquisitions – Divestitures – Post-Merger • Integration • Operations – Manufacturing – Supply Chain – Support Functions • Organization – Leadership and Talent – Operating Model Design • Private Equity • Procurement • Sales and Marketing – Pricing Strategy – Business Strategy	n/a

Country	Company	Address	Esta-blished	Key services	Annual sales
				– Corporate Strategy and Finance • Sustainability & Responsibility • Full Potential Transformation – Change and Implementation • Digital Transformation • Vector℠ Digital Delivery – New Business Ventures – Product & Experience Innovation – Marketing Optimization – Advanced Analytics – Automation – Enterprise Technology	
Thailand	Accenture	30th Floor, Abdulrahim Place, 990 Rama IV Rd, Bang Rak, Bangkok 10500	1978	• Application Services • Artificial Intelligence • Automation • Business Process Outsourcing • Business Strategy • Change Management • Cloud • Customer Experience • Data & Analytics • Digital Commerce • Ecosystem Services • Finance Consulting • Industry X • Infrastructure • Marketing • Mergers & Acquisitions (M&A) • Operating Models • Security • Supply Chain Management • Sustainability • Technology Consulting • Technology Innovation • Zero Based Budgeting (ZBB)	147.89

Country	Company	Address	Esta-blished	Key services	Annual sales
Thailand	PwC	15th Floor, Bangkok City Tower 179/74-80 South Sathorn Road Bangkok, 10120	2007	• Actuarial • Audit & Assurance • Consulting • Customs & Trade • China Business Desk (CBD) • Deals • Entrepreneurial and Private Businesses • Global Mobility Services (GMS) • Japanese Business Desk (JBD) • Myanmar Business Desk • Risk Assurance • Sustainability & Climate Change • Tax & Legal Services • Worldtrade Management Services (WMS)	4.44
Thailand	EY	33 rd Floor, Lake Rajada Office Complex, 193/136-137 Rajadapisek Road, Klongtoey, Bangkok 10110	1992	• Assurance • Consulting • Strategy and Transactions • Tax	71.90
Thailand	KPMG	48th - 50th Floor, Empire Tower 1 South Sathorn Road Yannawa, Sathorn Bangkok, 10120	2002	• Audit and Assurance • Advisory • Tax • KPMG Law • Private Enterprise • ASEAN+ • Global Japanese Practice • China Practice • Korea Desk	30.97
Thailand	Deloitte	AIA Sathorn Tower, 23rd – 27th Floor 11/1 South Sathorn Road Yannawa, Sathorn	1998	• Audit & Assurance – Assurance Services – Accounting and Reporting Advisory – Accounting Operations Advisory – Disruptive Events Advisory – Business Assurance • Consulting – Strategy, Analytics and M&A	19.95

Country	Company	Address	Esta-blished	Key services	Annual sales
				– Customer and Marketing – Core Business Operations – Human Capital – Enterprise Technology & Performance • Deloitte Private – Family Enterprise • Financial Advisory – Mergers & Acquisitions – Restructuring Services – Deloitte Forensic • International Specialist Services – Japanese Services Group • Legal – Legal Management Consulting – Legal Advisory Services – Legal Managed Services – Dbriefs Legal – Deloitte Legal Around the World	
Thailand	McKinsey & Company	M. Thai Tower, 24th floor All Seasons Place 87 Wireless Road Bangkok 10330 Thailand	2011	• Accelerat • Analytics • Design • Digital • M&A • Marketing & Sales • Operations • Organization • Risk • Strategy & Corporate Finance • Sustainability • Transformation	58

Chapter 3. Consideration of proposals to assist better cybersecurity

3.1 Overall approach to cybersecurity project formulation

Cyberattacks have become an increasing threat in recent years, making it imperative that both private companies and government agencies address them as quickly as possible. Cybersecurity threats pose particular risk to the safety and security of everyday life in developing countries, and although they are one of the primary factors inhibiting corporate economic activities, most of these countries do not have sufficient human resources or skills at home to handle these threats.

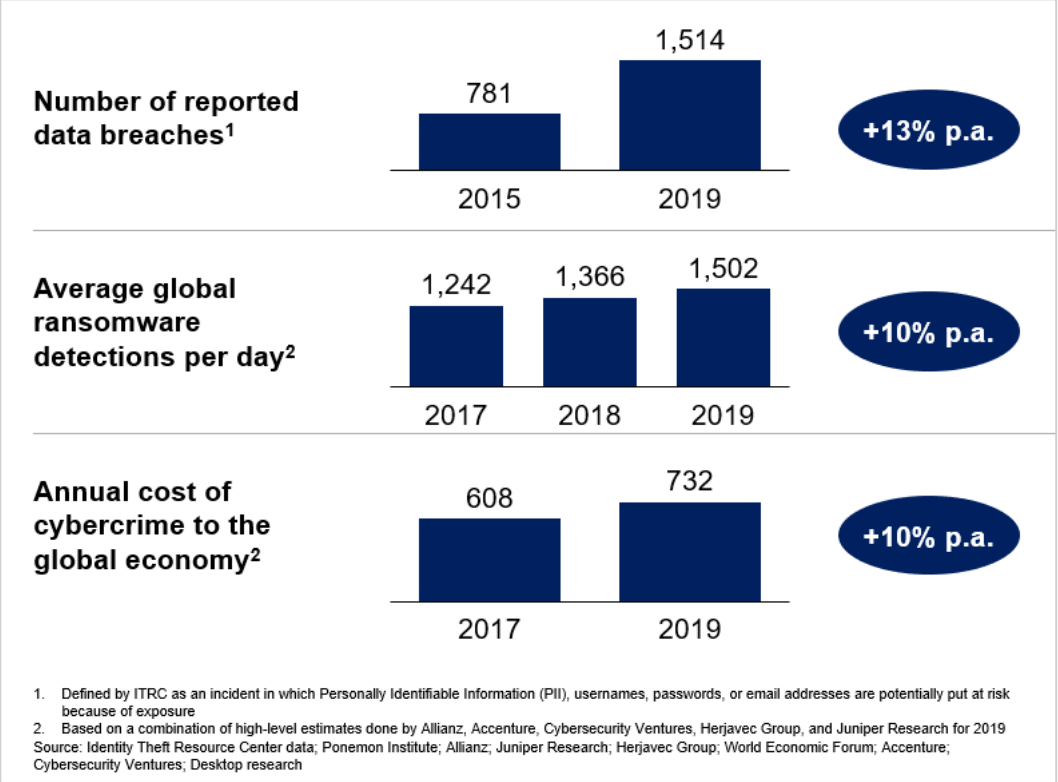


Figure 202. Global trends in cyberthreats

The use of information and communication technology (ICT) is rapidly spreading to all parts of life, with nearly every sphere of human activity--from daily life and socioeconomics to national and public security--increasingly dependent on online spaces. Meanwhile, the attacks that target these activities transcend national borders, and are increasingly sophisticated and complex. At the same time, smartphones, tablets, and other devices are rapidly increasing in popularity among the general public. As more people use technologies like social media and cloud services, there is more malware targeting them, causing new threats to emerge. Cyberattacks come in all varieties, going beyond those that go after state secrets to target personal information and funds as well. Government agencies, therefore, need to reach beyond themselves and implement public awareness campaigns that reach general users of smartphones and other devices, making everyday people more aware of the dangers as well.

The Japanese Cabinet decided on a Cybersecurity Strategy on July 27, 2018, which it announced both at home and overseas. The strategy laid out Japan's basic stance towards cybersecurity as well as its policy

targets and implementation approaches for the coming three years (2018–2020), with a focus on developing an ideal setup for 2020 and beyond. The Cybersecurity Strategy states Japan's basic position (objectives of the Basic Act on Cybersecurity, basic ideals--"a free, fair, and secure cyberspace", and basic principles) as well as its basic vision of cybersecurity as a goal. It also sets forth three approaches to promoting initiatives on cybersecurity for ongoing development (the "Cybersecurity Ecosystem"): (1) mission assurance of service providers; (2) risk management; and (3) participation, coordination and collaboration). The specific policy approaches towards achieving this objective are organized into the following categories.

(1) Enabling socioeconomic vitality and sustainable development

(1)-1 Advancing cybersecurity as a value creation driver

(1)-2 Achieving a supply chain that creates value through diverse connections

(1)-3 Building secure IoT systems

(2) Building a safe and secure society for the people

(2)-1 Measures for the protection of people and society

(2)-2 Protection of critical infrastructure through public and private sector cooperation

(2)-3 Strengthening and improving security in governmental bodies and government-related entities

(2)-4 Ensuring a safe and secure educational and research environment at universities and similar institutions

(2)-5 Initiatives for the Tokyo 2020 Summer Olympics and beyond

(2)-6 Building an information sharing/collaboration framework that extends beyond traditional frameworks

(2)-7 Strengthening incident readiness against massive cyberattacks

(3) Contribution to the peace and stability of the international community and Japan's national security

(3)-1 Commitment to a free, fair, and secure cyberspace

(3)-2 Strengthening capabilities for defense, deterrence, and situational awareness

(3)-3 International cooperation and collaboration

JICA established an office for STI and DX in 2020 to promote digitalization in developing nations along the lines defined in the government cybersecurity policies and assist innovation as part of its activity goals. In order to define assistance needs and assistance programs in the cybersecurity arena, this survey targeted five countries during Phase 1 and two priority target countries (Cambodia and Mongolia) during phases 2 and 3, as indicated below. Below are the objectives defined for each phase.

- **Phase 1:** Diagnose the maturity of cybersecurity in the target countries
- **Phase 2:** Identify JICA's areas of concern and priority areas in counterparts
- **Phase 3:** Evaluate the developmental and economic impact of assistance programs

Each phase involved interviews with survey team cybersecurity experts, Japan's cybersecurity organizations, counterpart candidates, and others. It also included document reviews primarily focused on reports issued by public organizations in order to get a good understanding of quantitative information. assistance programs were then shortlisted based on the above. The figure below shows the schedule and detailed activities in each phase.

Figure 203. Approach to the cybersecurity assistance program formulation project

3.2 Analytical tools used to review cybersecurity assistance programs

3.2.1 Task implementation schedule (1A)

Phase 1: In diagnosing the maturity of cybersecurity in the target countries, the team evaluated twelve items across four areas based on a diagnostic framework that would allow them to comprehensively assess the cybersecurity functionality and capabilities that governments and countries should have. In evaluating the twelve items, the team surveyed public government records for each country, looked at the maturity studies issued by external research institutions, conducted document reviews, and so on, assigning different weights to multiple evaluation indicators in order to conduct a multidimensional analysis that did not rely on a single information source. Below is a list of external research institution reports that the team referred to for all countries.

- Global Cybersecurity Index (GCI) 2017
- The United Nations Institute for Disarmament Research 2019
- APCERT Annual Report 2019
- FIRST website
- Cybersecurity Alliance for Mutual Progress (CAMP) website

Based on the results of the survey, the team used a 0–5 scale to numerically rate maturity level for each of the twelve items, making it possible to visually represent the maturity of each country and evaluation item. Evaluation criteria and weights are given below.

- Organizational structure within the government
  - a1. National cybersecurity strategy: Maturity of the government's centralized strategy for IT and cybersecurity
  - a2. National organizations for cybersecurity strategy: Maturity of government organizations for cybersecurity strategy, government departments and agencies, and independent agencies
  - a3. Internal auditing structure: Maturity of internal auditing structures and independent auditing structures
  - a4. Legal frameworks relevant to cybersecurity: Maturity of nongovernmental regulatory bodies for cyber issues and other organizations
- Cooperative structure
  - b1. International agreements (bilateral and others): Maturity of bilateral agreements and agreements between industry associations
  - b2. Public-private partnerships: Maturity of shared infrastructure, human resource development, and procurement PPPs
  - b3. Government-academic partnerships: Maturity of cybersecurity education in public schools and budget for IT education projects
  - b4. Inter-agency cooperation: Maturity of cooperative efforts across government departments and agencies
- Establishment of cyber-culture
  - c1. Cybersecurity guidance and standardization for the public and private sectors: Maturity of guidelines, restrictions, and regulations
  - c2. Public awareness and alerts: Maturity of alerts and notifications aimed at the general public
  - c3. Safety of data ecosystems: Maturity of data protection laws
  - c4. Professional training and certification: Maturity of certification agencies (non-academic) and number of certified professionals
  - c5. Domestic growth industries: Maturity of domestic cybersecurity startups
- Cyber defense and response
  - d1. Critical information infrastructure protection (CIIP): Maturity of critical infrastructure protection plans and assistance
  - d2. Incident/crisis management (CERT): Maturity of the national CERT
  - d3. Legal framework: Maturity of legal framework functions

Formulating a strategy/vision and setting up an organization responsible for implementation are the top priorities that need to be considered when strengthening cybersecurity capabilities in countries that lack

mature cybersecurity countermeasures. The first step is formulating a strategy and putting together an implementation organization. It is then recommended that countries start taking concrete steps to implement measures in each area. Below are the twelve survey items listed in order of priority.

- **Priority #1 (infrastructure is critical and must be prioritized ahead of specific measures)**
  - a1. National cybersecurity strategy: Maturity of the government's centralized strategy for IT and cybersecurity
  - a2. National organizations for cybersecurity strategy: Maturity of government organizations for cybersecurity strategy, government departments and agencies, and independent agencies
- **Priority #2 (priorities in each category must be considered in light of the priorities listed in national strategy and government implementation capabilities)**
  - b1. International agreements (bilateral and others): Maturity of bilateral agreements and agreements between industry associations
  - b2. Public-private partnerships: Maturity of shared infrastructure, human resource development, and procurement PPPs
  - b3. Government-academic partnerships: Maturity of cybersecurity education in public schools and budget for IT education projects
  - c2. Public awareness and alerts: Maturity of alerts and notifications aimed at the general public
  - c4. Professional training and certification: Maturity of certification agencies (non-academic) and number of certified professionals
  - d2. Incident/crisis management (CERT): Maturity of the national CERT
- **Priority #3 (some of these may be unnecessary depending on how the national strategy is written, and can be implemented after maturity level increases)**
  - a3. Internal auditing structure: Maturity of internal auditing structures and independent auditing structures
  - a4. Legal frameworks relevant to cybersecurity: Maturity of nongovernmental regulatory bodies for cyber issues and other organizations
  - b4. Inter-agency cooperation: Maturity of cooperative efforts across government departments and agencies
  - c1. Cybersecurity guidance and standardization for the public and private sectors: Maturity of guidelines, restrictions, and regulations
  - c3. Safety of data ecosystems: Maturity of data protection laws
  - d1. Critical information infrastructure protection (CIIP): Maturity of critical infrastructure protection plans and assistance
  - d3. Legal framework: Maturity of legal framework functions

Figure 204. Overview of the four categories/twelve items and evaluation indicators used for maturity diagnostics

	Overview	Evaluation indicators
a1.	• Is there a national cyber strategy? • Are the incremental ratings in the strategy being adopted and implemented? • Is the scope of the strategy being widened/narrowed based on the status of the public and private sectors (e.g. CIII)? • How is the government cooperating on overall policy and objectives when formulating its strategy? • Has the government adopted a national resilience plan and action plan for cybersecurity governance?	• Is there a national cyber strategy? (60%) • Has a budget been allocated for cybersecurity? (20%) • Cyber strategy maturity score in the GCI Report (2017) (20%)
a2.	• (If there is a strategy) Which government agency is in charge of coordinating the cyber strategy? • Degree of collaboration and centralization/decentralization in the agency coordinating cyber strategy • Have key partners been identified in both the public and private sectors? • Are roles and responsibilities clearly defined in the operational model? • Are there national agencies/ministries in charge of cybersecurity and critical information infrastructure protection (CIIP) or of handling spam-related issues?	• Is there a national center or government agency in charge of cybersecurity? (60%) • Dedicated government agencies or departments (20%) • Responsible cyber agency maturity score in the GCI Report (2017) (20%)
a3.	• Has a cybersecurity strategy been adopted and implemented? • Degree to which compliance is measured and corrective action taken • Degree of centralization/decentralization in cybersecurity strategy introduction audits • Trust in external partners (e.g. corporate groups, certification agencies, private companies) (if any)	• Cybersecurity audit/risk assessment evaluation results in the GCI Report (2017)
a4.	• Has the government imposed its cybersecurity strategy on the private sector? If so, to what degree? • Authority and preparedness of government agencies (e.g. regulatory agencies) • Degree of regulatory centralization/decentralization	• Cybersecurity regulations
b1.	• Are there any bilateral or multilateral agreements with other countries, member states, or international cybersecurity organizations? If so, how strong are they?	• Bilateral agreements (25%) • Multilateral agreements (25%) • Membership in international bodies (20%) • Results of GCI Report (2017) evaluations on bilateral agreements (10%), multilateral

	Overview	Evaluation indicators
	• Adherence to MOUs promoting joint G2G work, shared standards (e.g. data privacy), international agreements, and the like	agreements (10%) and international participation
b2.	• Are there PPPs designed to address cybersecurity? If so, how mature are they? • Cyber strategy design, cyber capability development CII protections, etc. • How are joint tasks being supervised? To what extend is the government supplying funding? • Are those projects at the national level or the sector level?	• Are there PPPs designed to address cybersecurity? (60%) • Maturity level of PPP financing models (20%) • Public-private partnership maturity score in the GCI Report (2017) (20%)
b3.	• Is there any industrial-academic cooperation? How mature is it? • Includes public education (e.g. primary/secondary schools), higher education (e.g. universities), and adult education (e.g. continuing education programs) • How is private-sector input used in curricula? To what degree has government-academic collaboration been extended to the private sector?	• Government-led measures (40%) • Cybersecurity research (R&D) (20%) • Maturity scores for educational programs (20%) and R&D programs (20%) in the GCI Report (2017)
b4.	• Is there any inter-agency cooperation? How mature is it? • Includes the sharing of incident reports, vulnerability reports, and threat detection IOCs	• Inter-agency cooperation
c1.	• To what extent is the government promoting its policies and standards to the private sector (e.g. cyber frameworks, required roles, certification requirements) • Level of compliance with the above setup • Are the guidelines voluntary or mandatory? • Tow hat extent has the private sector contributed to this design?	• Organizational governance • Are there standardization agencies? • Is there ISO certification?
c2.	• Is the government involved in activities to raise awareness about cybersecurity? What is the scope/depth of these activities? • Do the initiatives aim to raise awareness for both G2B and G2C interactions? • Can government-academic partnerships and regulatory agencies work together to raise awareness and communicate essential knowledge?	• Policies to raise awareness and develop capabilities (40%) • Media reports, public discussions (20%) • Maturity scores for public awareness activities and sharing of cybersecurity success stories in the GCI Report (2017)
c3.	• Are there highly reliable, unique identifiers for identifying citizens? • Is the system mandatory or voluntary? • Level of data protection and privacy	• Protections for children online • Regulatory setup for data protection

	Overview	Evaluation indicators
	• Data-related initiatives unique to each sector (e.g. healthcare, banking) • How are organizations encouraged to adopt them (e.g. regulations, fines)?	
c4.	• Is there assistance for training cyber professionals? Are there defined career paths? • Shared tasks with certification programs and the ability to provide resources to private-sector employers for upskilling	• Number of CISSP certifications issued (20%) • Number of cybersecurity professionals in the country (20%) • Are any global cybersecurity vendors located in the country? (20%) • Are any major certification agencies located in the country? (10%) • Maturity scores for level of cyber experts (10%), general education and training (10%), and professional education and training (10%) in the GCI Report (2017)
c5.	• Are there any home-grown cybersecurity industries (e.g. cyber insurance market, assistance for cybersecurity startups)? How mature are they?	• Evaluation of home-grown industries • Are there any incentive schemes?
d1.	• Which government departments (if any) coordinate CII protection? • Are critical sectors defined? • To what extent does the government see CIIP as relevant to national security? • Coordination between national agencies and the sector level (if any)	• Critical telecom infrastructure protection plans • Are there consortiums that address cyberthreats on the sector level?
d2.	• Is there a national CERT, CIRT, or CSIRT to address cyber risks? • Directives and authority of organizations that handle cyber risks • Are their funds for maintaining capabilities? • Continuing cybersecurity training	• Is there a national CERT, CIRT, or CSIRT? (30%) • Is there an international cooperation framework? (20%) • Are their CERT activists? (20%) • GCI Report (2017) maturity scores for national CERT/CIRT/CSRT (10%), government CERT/CIRT/CSRT (10%), and CERT/CIRT/CSRT in individual sectors
d3.	• Coordination between cybersecurity and legislation (e.g. proper awareness of cybercrime, cybercrime investigations backed by law) • Coordination with transnational agencies (e.g. INTERPOL) in combating cybercrime • Legal frameworks effectively address cybercrime and offer education and training	• Status of regulatory frameworks related to cybercrime

Assessment criteria		Definition of assessment criteria (Illustrative)
Intra-governmental structures	a1 National cyber strategy	Maturity of government's centralized IT/Cybersecurity strategy
	a2 National coordinating body	Maturity of government coordinating body, ministry, single national authority
	a3 Auditors	Maturity of internal auditors, independent auditors
	a4 Regulators	Maturity of non-government cyber related regulator, organization
Partnerships	b1 Inter country agreements	Maturity of bilateral agreements, economic group agreements
	b2 Public private partnerships	Maturity of PPP, in terms of common infra, talent development, procurement
	b3 Academic partnerships	Maturity of Cybersecurity education in public school. IT budget for education
	b4 Interagency partnerships	Maturity of collaboration among ministry/agent
Secure cyber culture	c1 Private sector guidance and standardization	Maturity of guideline, restriction and regulation
	c2 Public awareness and alerts	Maturity of alerts and notification to public sector
	c3 Secure data ecosystem	Maturity of data protection law
	c4 Professional training and certification	Maturity of certification organization(Not school), Number of certified people
	c5 Home-grown industry	Maturity of home grown Cybersecurity start-up
Cyber defense and response	d1 Critical infrastructure defense	Maturity of plan and support to defense critical infrastructure
	d2 Incident and Crisis mgmt.(CERT)	Maturity of national CERT
	d3 Law enforcement	Maturity of law enforcement functions

Figure 205. Overview of the four categories/twelve items used for maturity diagnostics

3.2.2 Framework for the private sector maturity assessment (1B)

The Digital Resilience Assessment (DRA) was used as a cybersecurity maturity diagnostic for the private sector. The DRA is a diagnostic tool that has been used to assess cybersecurity maturity through interviews with over 200 private organizations around the world. It is maintained as a database sorted by sector and region to enable further analysis. The assessment itself is based on the NIST Cyber Security Framework, which works across five stages (identify, protect, detect, respond, and recover) to see what kinds steps target companies are taking to address cyberthreats and assigning a numerical score between of 1, 2, or 3 to indicate maturity level. For this survey, the team interviewed a total of 40 professionals with experience working at major telecoms and bank IT departments in the five target countries and performed a quantitative assessment.

Figure 206. Companies interviewed

	Telecom companies	Financial services
Cambodia	• Smart Axiata • Sotelco	• ABA Bank • ACLEDA Bank Plc. • Foreign Trade Bank of Cambodia • Vattanac Bank
Laos	• Star Telecom • Global Digital Management Solutions • Lao Telecom Company Ltd.	• Bank of the Lao P.D.R • MARUHAN Japan Bank Lao • Banque Pour Le Commerce Extérieur Lao Public
Mongolia	• MobiCom Corporation LLC • Skytel LLC • MobiCom	• Khan Bank • Golomt Bank
Thailand	• DTAC • AIS	• Siam Commercial Bank • Kasikorn Bank • CIMBT • Krung Thai Bank
Philippines	• Globe Telecom	• Bank of the Philippine Islands

	Telecom companies	Financial services
		• Banco de Oro • Metropolitan Bank and Trust Company

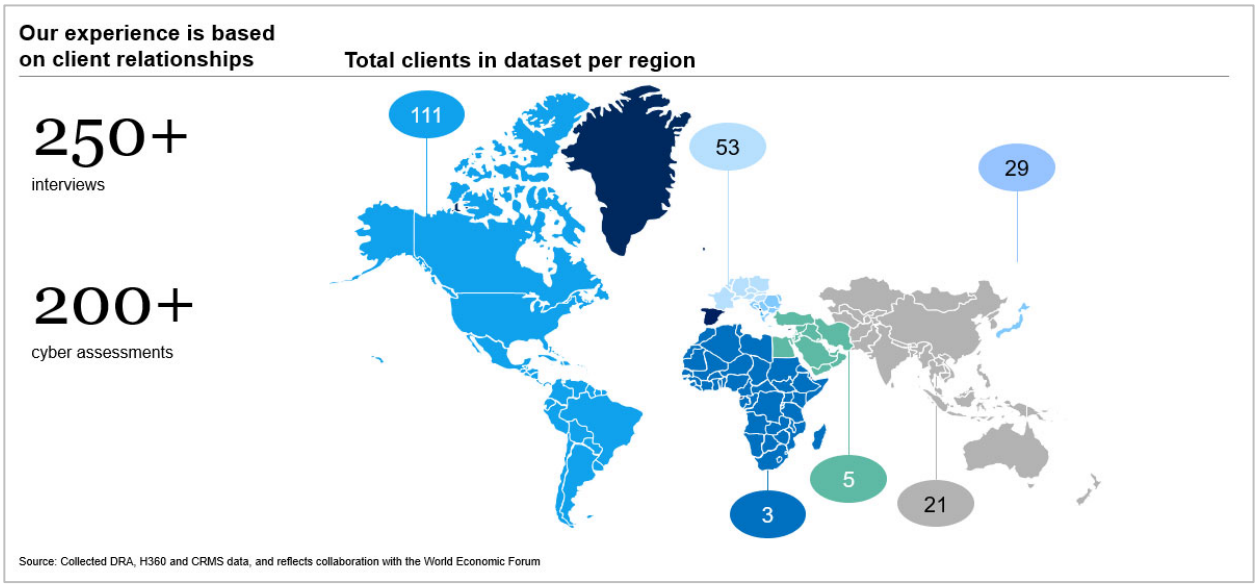


Figure 207. DRA data set distribution

The DRA maturity diagnostic items are listed below. These diagnostic items assess the maturity level of individual companies by looking at cybersecurity measures in the private sector at each stage. The scores make it clear which items companies should prioritize in their initiatives.

- Identify
  - Asset management: Identification and management of information assets that should be protected
  - Business environment: Management of key business risks
  - Governance: Establishment of governance to mitigate risk
  - Risk assessment: Regular implementation of risk assessments
  - Risk management strategy: Formulation of a risk management strategy
  - Supply chain risk management: Management of risk at suppliers as well as at the company itself
- Protect
  - Awareness and training: Regular employee training
  - Data security: Implementation of data point protection measures
  - Identity management, authentication, and access control: Controlling access permissions
  - Information protection processes and procedures: Process standardization and execution
  - Maintenance: Reliable maintenance and upgrades to critical infrastructure and systems
  - Protective technology: Continual technical updates and upgrades
- Detect
  - Anomalies and events: Anomalous activity is detected and an escalation process is in place

- ― Detection processes: Status of procedural setup
- ― Security continuous monitoring: Monitoring is carried out constantly

- Respond
  - ― Analysis: Analysis tools used for security attacks
  - ― Communications: Communication with stakeholders regarding incidents
  - ― Improvements: Root causes of incidents and breaches are analyzed (forensics) and systems are improved
  - ― Mitigation: Measures are put in place to mitigate the effects of security attacks
  - ― Response planning: Formulation of mid- and long-term improvement plans
- Recover
  - ― Communications: Communication processes are in place until business services have been restored
  - ― Improvements: Lessons are summarized and improvement measures are implemented
  - ― Recovery planning: Formulation of a business services recovery plan

3.2.3 Impact assessment framework (3A)

When looking at assistance programs in priority cybersecurity assistance areas, the team assessed the impact that implementing assistance would have on the target countries.

The purpose of the Impact assessment was to make a comprehensive comparison of multiple assistance programs to determine which would be most effective for the partner country or best achieve defined targets. The team referred to the six indicators used by the Organization for Economic Co-operation and Development (OECD) Development Assistance Committee (DAC) to evaluate development assistance. They then defined three detailed KPIs for each indicator in order to evaluate cybersecurity assistance programs in more detail. The proposals were then scored from 0–3 to reflect their level of impact.

- Relevance: Is the intervention doing the right and necessary things for the partner country?
- Effectiveness: Is the intervention effectively achieving its objectives?
- Impact: Is the intervention achieving significant impacts and clear results?
- Coherence: How well does the intervention fit in with other assistance measures?
- Efficiency: How well are funds and resources being used?
- Sustainability: Is there a system in place to ensure that the benefits are ongoing?

It is preferable to conduct feasibility assessment in addition to impact assessment to evaluate the practical value of the systems and environments used to implement the assistance program and serve as an input to help select the best one. The survey focused on securing resources in third countries and Japan as well as in the target countries because cybersecurity is a relatively new area of assistance for JICA to get involved in, and because obtaining cybersecurity professionals in Cambodia and Mongolia was expected to be difficult. The survey doesn't score feasibility because the point of focus is not comprehensive for scoring.

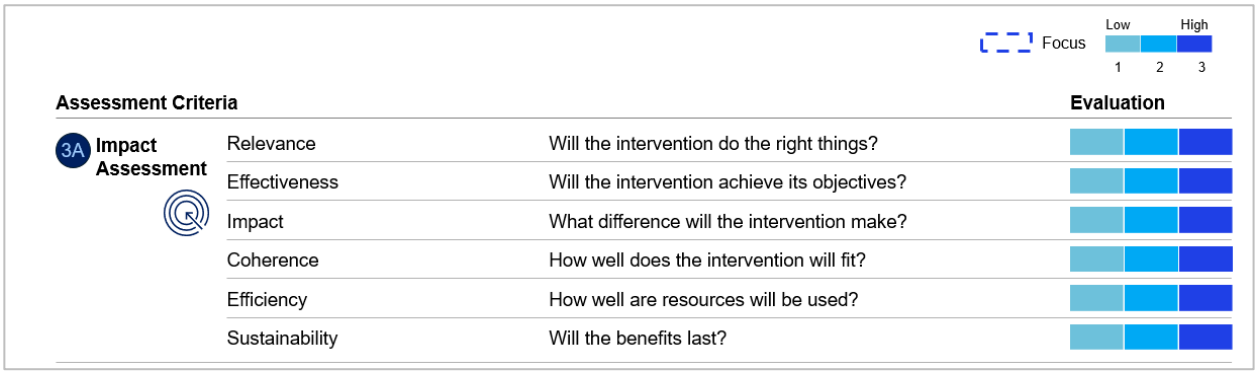


Figure 208. Impact assessment framework

Below are the specific indicators used to evaluate the impact of each assistance program. (Evaluation scores in parentheses)

- Relevance (3)
  - Assistance addresses economics and the environment (1)
  - Assistance addresses cybersecurity (rather than other IT projects) (1)
  - Assistance addresses the country's priority issues/needs (1)
- Effectiveness (3)
  - Assistance can generate concrete impacts within a year (1)
  - Assistance will directly improve cybersecurity capabilities (1)
  - Assistance will address most priority issues (1)
- Impact (3)
  - Assistance will address long-term (three-year)) concerns (1)
  - Assistance has a broad scope (1)
  - Assistance will be over JPY 5 oku (1)
- Coherence (3)
  - Assistance is related to other forms of JICA assistance (1)
  - Assistance targets the same counterparts or organizations as other forms of assistance (1)
  - Assistance in this area will continue over the long term (1)
- Efficiency (3)
  - Assistance will promptly deliver results (1)
  - Assistance will deliver results via economical means (1)
  - The counterpart will also provide resources (1)
- Sustainability (3)
  - The assistance will built sustainable counterpart capabilities (1)
  - The assistance will create sustainable schemes and financing (1)
  - The assistance will create a cyber ecosystem at the counterpart (1)

The team couldn't conduct feasibility assessment in this survey, but below are ideal specific indicators for feasibility assessment of each assistance program. (Evaluation scores in parentheses)

- Feasibility for JICA's finance scheme (3)
  - Single scheme covers the assistance (1)
- Complexity of situation and capability of counterpart (3)
  - Single counterpart (1)
  - Counterpart commits to provide resources and time (1)
  - Less hard-pressure on Counterpart's resource (1)

3.3 Target country evaluations

3.3.1 Results of the national cybersecurity maturity assessment (1A)

In addition to the five countries targeted for JICA cybersecurity assistance that were within the scope of this survey, we also added Japan and Singapore (two countries leading cybersecurity in Asia for which information was easy to obtain) as benchmarks when conducting our government cybersecurity maturity assessment. We then roughly categorized the seven countries into three groups: those with low maturity (Cambodia, Mongolia, and Laos), those with moderate maturity (Thailand and the Philippines), and those with high maturity (Japan and Singapore). The three countries assessed as having the lowest maturity level have not even formulated a national cybersecurity strategy (a1), so they have not addressed indicators that are included in national strategies, such as public-private partnerships (b2) and critical infrastructure industry protections (d1). Their maturity level was therefore assessed as being low overall. Of the three low-maturity countries, Mongolia did receive some isolated high scores (such as in coordinating organizations (a2), public-private partnerships (b2), and critical infrastructure industries (d1)) thanks to NATO providing the country with ongoing assistance to enhance its cybersecurity capabilities. For further detail on the results of the assessment, see the reference materials provided in **3.6.1. Details on the national cybersecurity maturity assessment**.

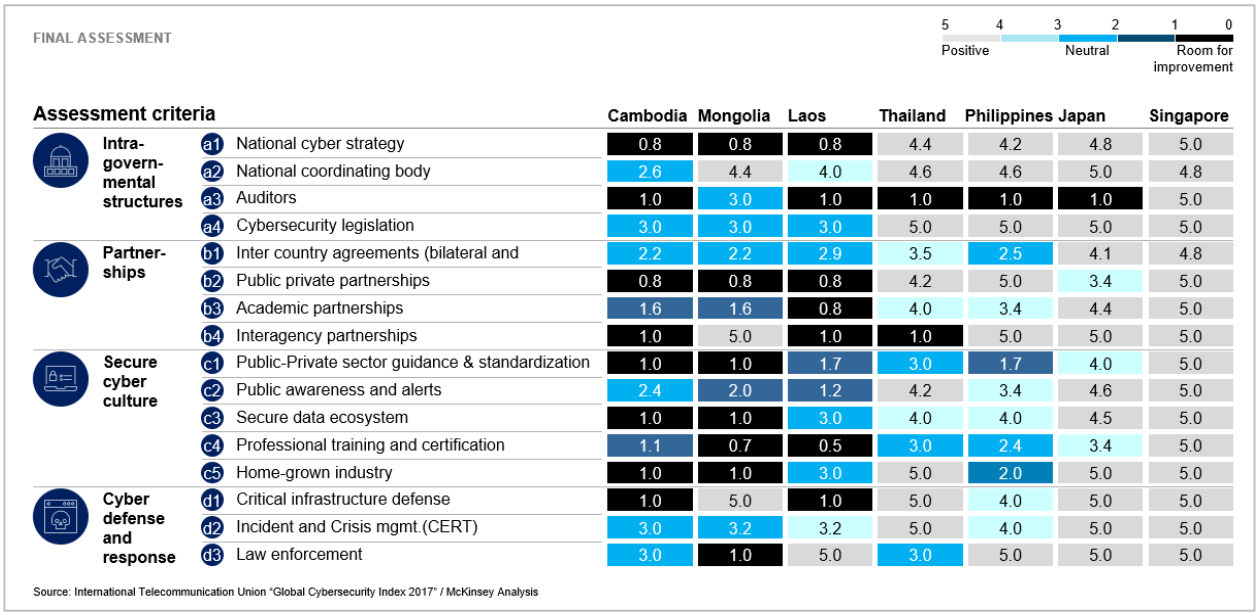


Figure 209. Results of the national cybersecurity maturity assessment

3.3.2 Results of the private sector maturity assessment (1B)

As with the national cybersecurity maturity assessment, Cambodia, Mongolia, and Laos fell far short of the global average in terms of private sector maturity.

The gap between Cambodia and the world average was particularly stark, especially for the initial "identify" and "protect" cybersecurity countermeasure stages under the "identify, protect, detect, respond, and recover" evaluation framework. Education on cyber measures is needed in non-IT areas and business areas like asset management (ID.AM), risk assessment (ID.RA), awareness and training (PR.AT), and information protection processes and procedures (PR.IP) as well. Cambodia's overall score of 0.9 is also well below the global average of 2.1, again throwing into sharp relief the country's lack of maturity in cybersecurity measures both in the private sector and at the national level.

Mongolia's overall score was 1.2, and similar trends were observed there as in Cambodia, with the largest shortfalls against the world average in the initial "identify" and "protect" cybersecurity countermeasure stages.

Laos showed similar assessment results as Cambodia and Mongolia, pointing to the conclusion that of all the countries targeted in the survey, these three had the most room for cybersecurity assistance.

Meanwhile, Thailand and the Philippines scored close to the world average on all of their evaluation items, indicating that the maturity of their private sectors is at an average level globally.

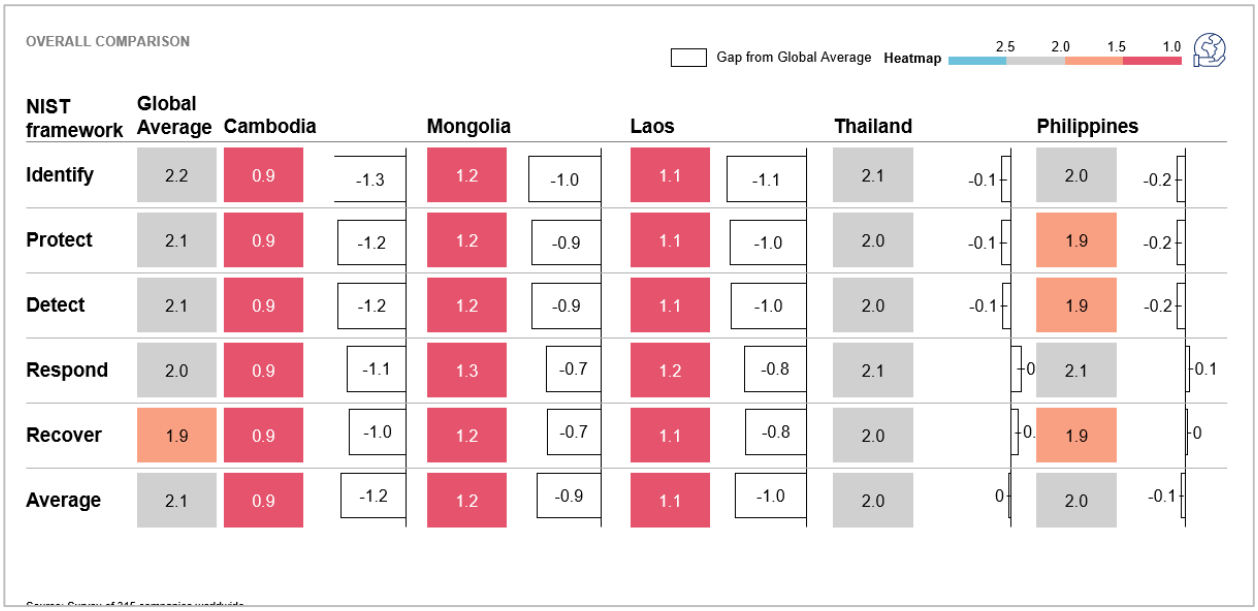


Figure 210. DRA private sector maturity assessment results

Heatmap 2.5 2.0 1.5 1.0

Cyber area level 1	Cyber area level 2	Cambodia		Mongolia		Laos		Thailand		Philippines	
		Banking	Telecom	Banking	Telecom	Banking	Telecom	Banking	Telecom	Banking	Telecom
Identify	Asset Management (ID.AM)	1.1	1.0	1.3	1.1	1.2	1.2	2.3	2.0	2.2	1.7
	Business Environment (ID.BE)	1.0	0.8	1.4	1.2	1.3	0.9	2.4	2.1	2.1	1.9
	Governance (ID.GV)	1.0	0.8	1.4	1.0	1.1	1.0	2.2	1.8	2.2	1.9
	Risk Assessment (ID.RA)	1.0	0.8	1.3	1.1	1.4	0.9	2.3	1.7	2.3	1.8
	Risk Management Strategy (ID.RM)	1.0	0.8	1.5	1.1	1.4	1.0	2.4	2.0	2.5	1.7
	Supply Chain Risk Management (ID.SC)	0.9	0.6	1.0	0.9	1.2	0.8	2.4	1.5	2.3	1.5
Protect	Awareness and Training (PR.AT)	1.2	0.8	1.4	1.2	1.0	1.1	1.9	1.9	1.7	1.7
	Data Security (PR.DS)	1.2	0.8	1.5	1.1	1.3	1.3	2.2	1.9	2.2	1.8
	Identity Management, Authentication and Access Control (PR.AC)	1.0	0.9	1.3	1.0	1.2	0.9	2.2	1.5	2.2	1.9
	Information Protection Processes and Procedures (PR.IP)	1.1	0.7	1.3	1.0	1.2	0.9	2.2	1.8	2.0	1.8
	Maintenance (PR.MA)	1.1	1.0	1.5	1.0	1.3	1.1	2.1	1.1	2.5	2.0
	Protective Technology (PR.PT)	1.1	0.9	1.4	1.0	1.3	1.0	2.3	2.1	2.1	1.9
Detect	Anomalies and Events (DE.AE)	1.1	0.7	1.3	1.0	1.1	0.9	2.2	1.9	2.0	1.9
	Detection Processes (DE.DP)	1.0	0.7	1.3	0.9	1.0	0.8	2.1	1.7	1.8	1.9
	Security Continuous Monitoring (DE.CM)	1.1	0.7	1.3	0.9	1.2	0.8	2.2	1.7	2.0	1.9
Respond	Analysis (RS.AN)	1.1	0.7	1.4	1.0	1.3	0.9	2.3	2.1	1.9	1.8
	Communications (RS.CO)	1.2	0.8	0.9	0.9	0.6	0.9	2.6	2.1	2.0	2.0
	Improvements (RS.IM)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Mitigation (RS.MI)	1.1	0.6	1.4	0.9	1.2	0.8	2.1	1.8	1.8	1.8
	Response Planning (RS.RP)	0.9	0.6	1.0	0.9	1.2	0.8	2.4	1.5	2.3	1.5
Recover	Communications (RC.CO)	1.1	0.6	1.0	0.9	1.0	0.8	2.2	1.9	1.8	1.8
	Improvements (RC.IM)	1.0	0.6	1.4	1.0	0.5	0.9	2.3	1.3	2.2	1.7
	Recovery Planning (RC.RP)	1.1	0.5	0.9	0.9	1.3	0.6	1.9	2.1	1.5	1.7

Figure 211. DRA private sector maturity assessment results (details)

From this assessment, it can be concluded that among the candidates for assistance, the lack of cybersecurity professionals in both government organizations and the private sector, as well as the lack of maturity in organizations that address cybersecurity, resulted in low scores for Cambodia and Mongolia as well as for Laos. In terms of policies to address this lack of professionals, it may be useful to turn to Singapore or other countries with a high level of cybersecurity maturity, where government-led measures to train homegrown cybersecurity professionals are being implemented.

Training channel	Description	Benchmark countries
Central coordinating body	• **Develop a Cybersecurity scheme** that develops a core of Cybersecurity specialists to be deployed across agencies	CSA Cybersecurity Professional Scheme
	• Build an academy to **train Cybersecurity professionals in government and CII sectors** in partnership industry players	CSA Academy Cybersecurity online school
	• Create **international partnerships** to build capabilities in cooperation with other countries through knowledge sharing and cross-training	CSA – UK MOC
	• Develop a one-stop **shop for Cybersecurity careers and studies** that connects the public with information on Cybersecurity awareness, degree programs, training, careers, and talent management	Cybersecurity Career Mentoring Program Federal Virtual Training Environment
	• Encourage the **next generation** of cyber professionals by creating competitions and hackathons targeted at high school and elementary school students	CyberFirst Nuti Labor
Formal education institutions	• Develop **degrees dedicated to Cybersecurity** designed **to provide higher education** in the area of Cybersecurity engineering by integrating the software development and information system administration	TALtech Cybersecurity engineering degree
Private sector training providers	• The NCSC accredits a **large number of training providers** and is working on setting up a **Cybersecurity council** that creates a collaboration between private and public sector entities and academia to unify Cybersecurity certifications	NCSC accreditations

Figure 212. Policies to address lack of professionals

The team considered two approaches to priority initiatives that target governments should engage in to address cybersecurity at home in the event that JICA decides to offer assistance to help increase cybersecurity maturity in target countries like these, which are suffering from a lack of cybersecurity professionals.

- Human resource development through educational channels
  - In general, the maturity of IT professionals is significantly lower than the world average, so educational programs to develop future IT talent will likely be needed
    - Network operators, communications infrastructure operators
    - Data administrators, data analysts
    - Systems administrators, systems architects
    - Systems developers, software developers
    - Risk managers
- Establishing and strengthening organizations to address cybersecurity
  - The CII sectors in Cambodia, Mongolia, and Laos are insufficiently prepared to handle cybersecurity, so there is room to implement the following measures
    - Establish a national agency for cybersecurity strategy (e.g. NISC, CSA, National Center of Incident Readiness and Strategy for Cybersecurity): *identify*, *protect*
    - Establish an ISAC in each sector to promote information-sharing: *protect*, *detect*
    - Strengthen public-private partnerships (PPP): *protect*, *detect*, *respond*
    - Participate in international and regional CERT (e.g. APCERT, ENISA, FIRST): *protect*, *detect*, *respond*, *recover*

3.3.3 Priority areas for cybersecurity assistance

Based on the status of cybersecurity initiatives in Cambodia, Mongolia, and Laos as revealed in the government and private-sector cybersecurity maturity assessments, the team identified areas recommended for priority initiatives in both countries where assistance is being considered. In defining these priority areas, cybersecurity experts on the survey team conducted an evaluation while referring to the National Cybersecurity Strategies Guidelines & Tools issued by the European Union Agency for Cybersecurity (ENISA) as well as to case examples of cybersecurity initiatives from US government agencies.

Of the twelve evaluation items, the two most critical are formulating a national cybersecurity strategy (a1) and setting up a national organization for cybersecurity strategy (a2). Neither of these are sufficiently functioning in Cambodia, Mongolia, or Laos, and they are also priority areas where JICA would do well to focus its efforts. Items that are included in national strategy are of similarly critical importance and the team recommends that these be promptly targeted for assistance as well. Specifically, these are international agreements (bilateral and others) (b1), public-private partnerships (b2), government-academic partnerships (b3), public awareness and alerts (c2), professional training and certification (c4), and incident/crisis management (CERT) (d2).

See: ENISA National Cybersecurity Strategies Guidelines & tools https://www.enisa.europa.eu/topics/national-cyber-security-strategies/national-cybersecurity-strategies-guidelines-tools

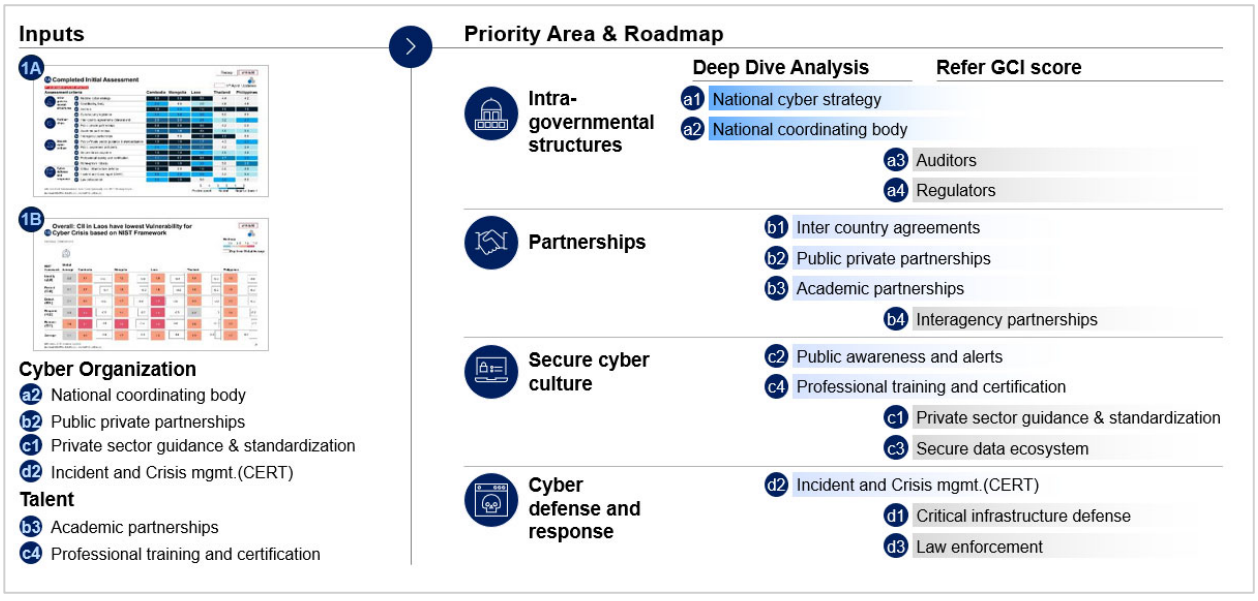


Figure 213. Priority area roadmap for addressing cybersecurity

The team also put together the following standard introduction schedule so that each initiative can be sufficiently implemented, based on the experience it has had assistanceing the governments of these countries so far. This timeline can be used as a standard in countries like Cambodia, Mongolia, and Laos, which are not yet mature in terms of their national cybersecurity strategies and administrative agencies. Laos, for example, is not a priority country targeted for assistance but, according to the above assessment results, also lacks maturity in its national cybersecurity strategy and administrative agencies--so the timeline

could be applied there as well. Cyberspace attacks have continued to become more sophisticated and complex in recent years, so there is a need for comprehensive, long-term assistance across multiple areas. Piecemeal assistance limited to areas like legislation and training human resources, for example, will not be enough to raise cybersecurity maturity to a sufficient level in developing countries.

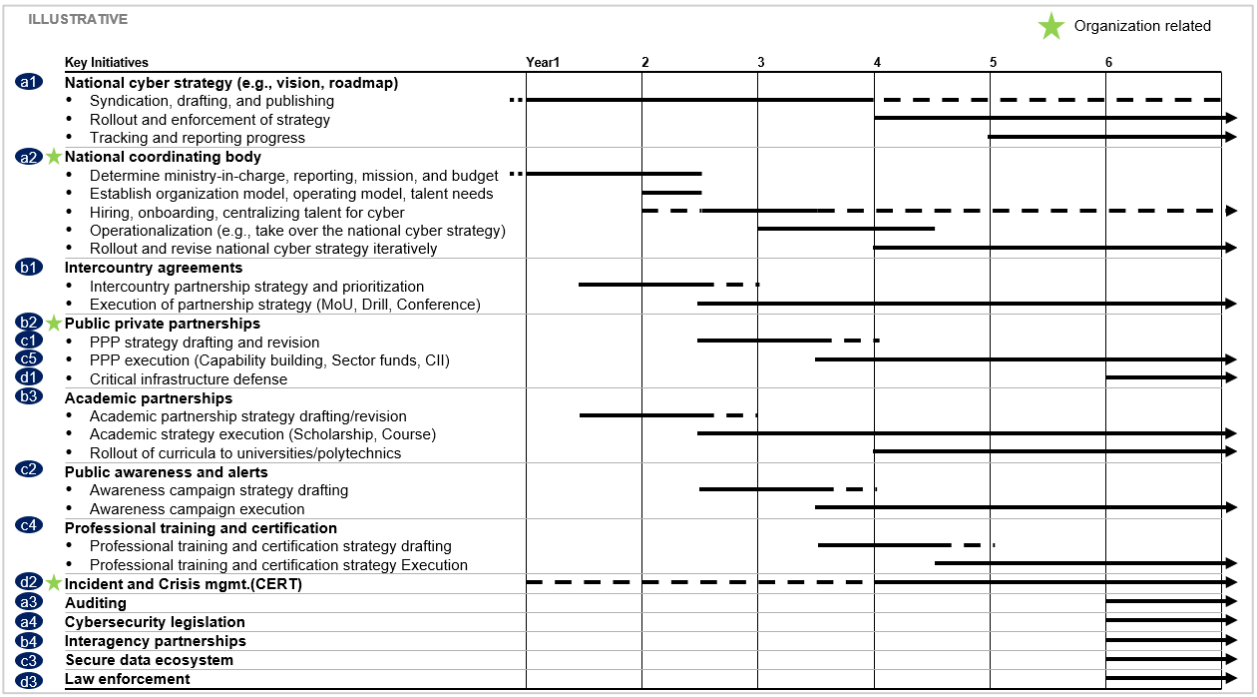


Figure 214. Standard cybersecurity assistance schedule

Details on specific programs tied to the above measures are given below.

Figure 215. Specific cybersecurity initiatives

#	Priority area	Initiative	Example programs
a1	**National cybersecurity strategy**	Draft a national cybersecurity vision (roadmap, strategy)	Carry out activities requiring definition based on the ITU CS strategy framework • Governance • National cybersecurity risk management • Preparedness and resilience • Services tied to critical infrastructure and essential services • Building organizational response capacity and raising awareness • Laws and regulations • International cooperation
a2.	**National organization for cybersecurity strategy**	• Establish a cybersecurity team (department, committee, etc.) working under a specific	• Strengthen national efforts to assistance cybersecurity careers and education

#	Priority area	Initiative	Example programs
		government agency and define the team's roles and mission • Strengthen the cybersecurity team (department, committee, etc.)	
b1	**International cooperation**	• Strengthen the national CERT to enable participation in collaborative international efforts (cooperation, agreements)	• Strengthen the national CERT to enable participation in cooperative international bodies like FIRST and APCERT
b2	**Public-private partnerships**	• Draft a PPP vision (roadmap, strategy) • Establish a sector ISAC (sector collaboration, information-sharing group, etc.)	• Professional interactions and development strategy (e.g. education and training, incentives) • Job-matching programs • Establish top cybersecurity degrees at private universities
b3	**Government-academic partnerships**	• Draft a government-academic partnership vision (roadmap, strategy) • Establish academic courses (degrees, institutions, etc.) • Design scholarship programs	
c2	**Public awareness and alerts**	• Draft a vision for raising public awareness (roadmap, strategy) • Implement public awareness programs	• Create a roadshow and hold cybersecurity demonstrations • Appoint cybersecurity ambassadors at schools and companies • Educational program for volunteer "cyber-defenders" • Cybersecurity portal • Initiatives to raise cybersecurity awareness within education programs • Infomercials distributed through social media • Posters and bulletin boards showing infographics • Activities to promote cyber awareness on government websites • Awareness-raising activities aimed at homemakers (husbands) and retirees • Messaging to raise cyber awareness through consumer touchpoints

#	Priority area	Initiative	Example programs
			• Anti-phishing scam campaigns at key entities in each sector • Declare a Cybersecurity Awareness Month (hold career events, publish blogs on cybersecurity topics, etc.)
c4	**Professional training and certification**	• Draft a cybersecurity professional strategy (roadmap, vision) • Establish professional education and training organizations	Strengthen educational channels • National organization for cybersecurity strategy (government-led organization) • Official educational institutions (e.g. universities, public schools) • Private sector (e.g. private universities, CII) • Global cybersecurity education and training institutions (e.g. ISC2, Cisco)
d2	**Incident/crisis management (CERT)**	• Draft a CERT strategy (roadmap, vision) • Assistance/strengthen CERT	Assistance the introduction of the following capabilities based on the ENISA framework: • Initial • Replicable • Definitions • Management • Optimization

3.3.4 NISC interviews

The National Center of Incident Readiness and Strategy for Cybersecurity (NISC) is the general coordinator for cybersecurity policy based on Japan's national cybersecurity strategy. It was established under the Cabinet for the purpose of creating a "free, fair and secure cyberspace", and engages in a variety of activities in close collaboration with both the public and private sectors.

The survey team conducted interviews with an expert at NISC to get their views on the assistance programs for priority assistance areas in Cambodia and Mongolia during Phase 1 of the project. As a result of these interviews, three proposed measures were identified as being the most effective: setting up a national organization for cybersecurity strategy (a2), government-academic partnerships (b1), and public awareness and alerts (c2). Note that the comments given here are those of the person in charge of assistanceing overseas coordination bodies and similar organizations, and do not reflect the official views of the NISC.

Figure 216. NISC interview results

#	Comments
a1.	• Agree that a comprehensive strategy is necessary • However, Japan should not insist that the country apply "their own" cybersecurity strategy. In general, the local government needs to see the importance of a strategy and what it requires for themselves
a2.	• The NISC is not aware of the existence of a national agency for cybersecurity strategy in Cambodia. We're not sure Mongolia has one, either. But both countries, without a doubt, need this kind of organization
b1.	• To get those countries into regional or international CERT organizations, JPCERT may be able to help improve their quality/operational requirements or invite them in
b2.	• Both countries should start by setting up simple PPPs, primarily in the financial sector. NISC can share some PPP case examples • Given their cybersecurity maturity, it seems a little premature for sector ISACs in Cambodia and Mongolia
b3.	• Human resource development needs to be prioritized ahead of other initiatives. Japan has quite a bit of experience in this area (basic training, meetings, training seminars, etc.)
c2	• NISC is deeply involved in activities to raise public awareness in the ASEAN countries. They're incredibly actionable and the local governments certainly have a demand for them, so project implementation is likely to get results
c4	• Japan is eager to make IPA certificates widespread in the ASEAN countries, but progress has been slow. There is a demand in these countries for Western certification courses and organizations
d2.	• It would be better to discuss this issue with JPCERT/CC for details

3.3.5 JPCERT/CC interview results

The Japan Computer Emergency Response Team Coordination Center (JPCERT/CC) is an information-sharing organization that was established in order to address harmful unauthorized internet access. It is a general incorporated association whose primary function is to put out information related to computer security.

As with our NISC interview, the survey team met with JPCERT/CC to discuss assistance programs for priority assistance areas during Phase 1 of the project. As a result of these interviews, five proposed measures were identified as being the most effective: setting up a national organization for cybersecurity strategy (a2), government-academic partnerships (b3), and public awareness and alerts (c2), professional training and certification (c4), and incident/crisis management (CERT) (d2). Note that the comments given here are those of the person in charge of assisting CERT, APCERT, and similar organizations overseas, and do not reflect the official views of JPCERT/CC.

Figure 217. JPCERT/CC interview results

#	Comments
a1.	• This is a solid proposal • However, the situation with local stakeholders is complicated, and there's no guarantee that a Japanese organization will be able to provide end-to-end assist for drafting a cyber strategy. Japan will need to make a long-term commitment. ITU has published a standard template for developing countries ITU：Guide to developing a national cybersecurity strategy https://www.itu.int/pub/D-STR-CYB_GUIDE.01-2018
a2.	• It would be better to start by establishing an organization rather than with formulating a strategy. JICA then may be able to work with that organization to draft the strategy. It will require a long-term commitment
b1.	• JPCERT is considered a "business-type" target for b1 and b2 assistance, meaning that those initiatives require cooperation, interaction, and strategy formulation. JPCERT considers technical cooperation to be one of Japan's advantages, and strives to make the most of it
b2.	• Same as above
b3.	• Financial assistance for technical professional development is something that can be explicitly reviewed and measured after program implementation, so the ROI is relatively high
c2	• IPA and NISC assistance awareness-raising activities in several countries. Japan is able to provide added value in this area
c4	• Financial assistance for technical professional development is something that can be explicitly reviewed and measured after program implementation, so the ROI is relatively high
d2.	**Cambodia:** • CamCERT has been reluctant to participate in APCERT, for which JPCERT serves as administrator. We're not exactly sure why they've been hesitant • JPCERT and JICA provided assistance for the National Information Communications Technology Development Authority (NiDA) in 2009 • Cambodia is less frequently the target or source of cyberattacks than Mongolia **Mongolia** • The people committing cyberattacks in Mongolia are potentially the same people that are attacking Japan • There is also value for Japan, therefore, in sharing data with Mongolia and analyzing those attackers • The private Japanese companies that participate as expert resources don't believe there's any business profit in entering Mongolia.

3.3.6 Counterpart overview

The survey team conducted a document review of organizations that could serve as promising counterpart candidates for assistance projects in Cambodia and Mongolia. They also conducted interview surveys of multiple counterpart candidates. Potential counterpart organizations should ideally be government

organizations with authority over national cybersecurity strategy and organizations with jurisdiction over a national CERT implementing countrywide cybersecurity measures.

In Cambodia, the team interviewed CamCERT and the Ministry of Posts and Telecommunications (MPTC) and determined that the MPTC, which takes a central role in promoting ICT development throughout Cambodia, would likely be the best counterpart candidate. The Department of ICT Security within the MPTC has jurisdiction over CamCERT (the national CERT organization), and is the only organization in Cambodia that addresses and studies cybersecurity issues. CamCERT currently operates with nine full-time members and three members holding joint posts. However, it not only needs more people, but also needs to upgrade its Enterprise Incident Tracking System, Security Information and Event Management, and other software. The MPTC is looking to continue strengthening CamCERT's functions. The Cambodia Academy of Digital Technology, which operates under the MPTC, also has a mission to education cybersecurity professionals for government and private sector positions. Given the complexity of assisting cybersecurity, the MPTC is likely to be the best counterpart candidate.

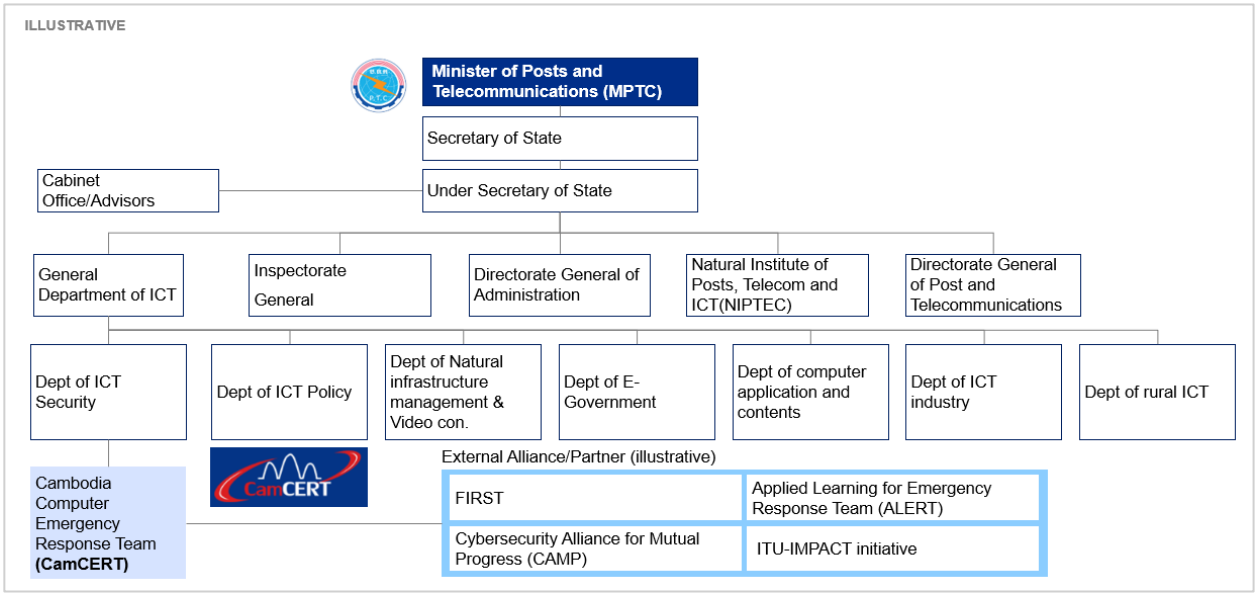


Figure 218. Organizational chart for the MPTC in Cambodia

In Mongolia, the team interviewed the Communications and Information Technology Authority (CITA), MNCERT/CC, and MONCIRT, and determined that CITA, which is under direct control of the prime minister and in charge of ICT development policy (including e-government) was likely the best counterpart candidate. CITA handles the digital services that link government agencies with private companies and the general population, and is in charge of e-government as well. It is also responsible for organizations and functions related to cybersecurity, such as Mongolian government databases and the National Data Center (NDC), the country's shared electronic service infrastructure. The team also confirmed plans to establish a national CERT under CITA to integrate Mongolia's cybersecurity functions, which are currently scattered across several government ministries. In addition to the NDC, CITA also has three full-time members working in the Information Security Department. It is also thought that CITA will play a central role in developing a future national cybersecurity strategy, since a cabinet decision was made at the November 12,

2021 parliament meeting to elevate CITA to the role of ministry starting in January 2022. The team also determined that MNCERT/CC and MONCERT, organization that it initially thought were equivalent to national CERT organizations, were actually private groups.

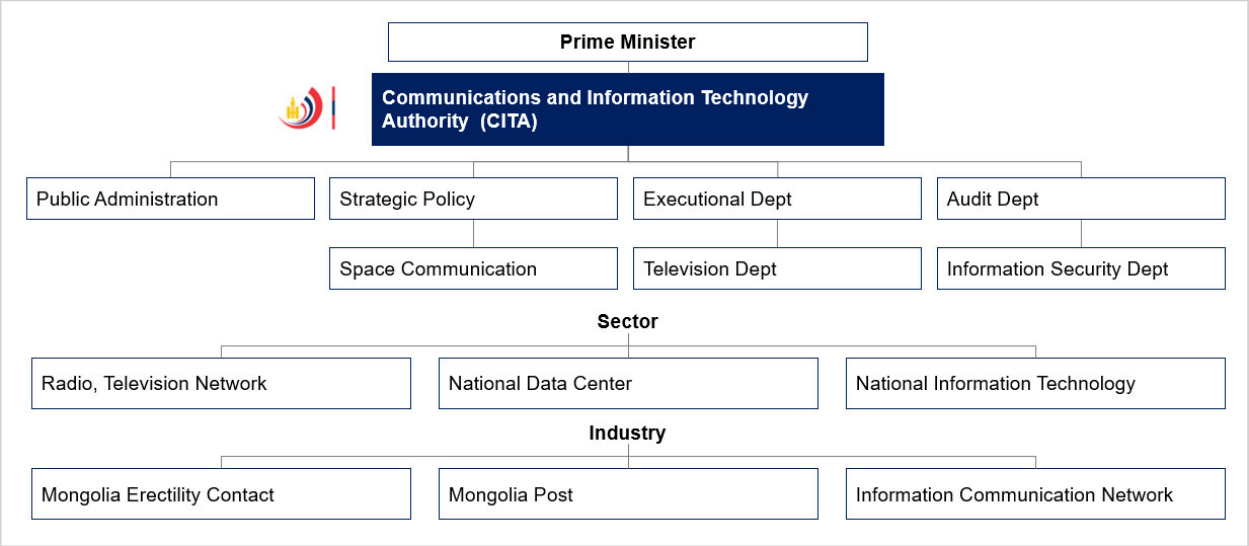


Figure 219. Organizational chart for CITA in Mongolia

3.3.7 Counterpart interview results (Cambodia)

The survey team conducted multiple interviews on the issues and assistance needs in Cambodia with the Cambodian counterparts in priority assistance areas for cybersecurity as defined in the previous section. Interviewees were the Minister of Posts and Telecommunications (head of the MPTC) and Director of ICT at CamCERT (which operates under the MPTC). Issues were concentrated in three areas: high-level strategy, human resource development, and CamCERT assistance. Of those, it was determined that the need for direct assistance for CamCERT was the most pressing.

National cybersecurity strategy (a1) and national organization for cybersecurity strategy (a2)

- Cambodia has plans to set up a National Cyber Security Committee/Council sometime during FY2022. However, at the time of the basic survey in June 2021, there was no mandate to the MPTC regarding this organization, so it is not possible for the MPTC to be in charge as a counterpart if assistance is provided to the new entity.
- After the organization has been established and its positions filled, it will be in charge of strengthening cyber security and related regulations, as well as drafting legislation.
- MPTC will serve as the main executive body, selecting personnel and defining the roles of the agency, but because it will not receive assistance from other countries' governments or donors, assistance from JICA will be needed in the long term.

Government-academic partnerships (b3) and professional training and certification (c4)

- There are a number of professional development programs underway as part of the activities at the Cambodia Academy of Digital Technology, an organization that operates under the MPTC, but we are aware that the fill rate for required talent is low
- We feel that further security training, innovation agencies, and professional training are issues in the context of activities involving e-government and social innovation, and that JICA's assistance is needed
- The main goal in developing cybersecurity professionals has been to strengthen CamCERT, so the greatest demand is assistance for CamCERT professionals rather than training human resources for the private sector or academic fields

Incident/crisis management (CERT) (d2)

- CamCERT is currently the only organization in Cambodia that addresses and studies cybersecurity issues, so we would like to continue strengthening these functions. This is an active organization and one that works under the MPTC, so it has an obvious impact on assistance and the highest demand for it
- In addition to expanding the functions of CamCERT and developing human resources, we would also like JICA's assistance in monitoring tool introduction and training
- We understand the need to strengthen CamCERT's functions (since it lags behind other countries), but we do not have a clear understanding of what specific technologies should be used to strengthen which types of human resources

3.3.8 Counterpart interview results (Mongolia)

As in Cambodia, the survey team conducted interviews on the issues and assistance needs in Mongolia with its counterpart, the Communications and Information Technology Authority (CITA), in priority assistance areas for cybersecurity as defined in the previous section. Interviewees were two CITA executives, head of the department for strategy and policy formation and head of the cybersecurity department. The interviews revealed that the lack of a national cybersecurity strategy/vision was resulting in a limited number of organizations for training cybersecurity professionals in Mongolia, and the team determined that for the need human resource development is particularly urgent.

National cybersecurity strategy (a1) and national organization for cybersecurity strategy (a2)

- Separate government agencies are responsible for cybersecurity in different fields, hindering organizational collaboration and making division of duties difficult
- There are plans to delegate authority to teams with jurisdiction over cybersecurity within CITA, and to create related legislation and promote collaboration among organizations; in this context, JICA's assistance is needed in creating roadmaps and execution
- CITA is planning to establish an organization responsible for national CERT and digital business development in the form of a government agency with jurisdiction over digital communications, once legislation currently under review has been passed.

Government-academic partnerships (b3) and professional training and certification (c4)

- Cybersecurity training courses are being conducted by the Mongolian University of Science and Technology and CITA, but we are aware that these courses are insufficient
- We would like to have assistance from JICA via the dispatch of cybersecurity professionals and specialists
- National universities are under the jurisdiction of the Ministry of Education, so it is difficult for CITA to supervise and manage these directly. Should professional training be conducted at national universities, we would have to submit a request to the MOE and assess their position. Future cooperation with the Ministry of Education is also something we want
- We would like assistance from JICA in creating cybersecurity training assistance measures

Inter-agency cooperation (b4)

- In relation to the high-level strategies noted above, assistance is required in the context of specialized knowledge and coordination across government agency so that we can organize roles and collaborations among multiple related organizations
- The General Intelligence Agency (GIA), Ministry of Defense (MOD), and National Police Agency (NPA) are insular organizations with strong regulations, making it difficult to share information with them or build collaborative structures.
- We would like to have JICA's assistance with practices involving collaborative structures between governments and safe data management systems, for example

International agreements (bilateral and others) (b1)

- Around 2019, Mongolia set up a partnership with the Korea Information Society Development Institute (KISDI). The cybersecurity evaluation of Mongolia revealed that the country needs to establish a national CERT
- At present, there are no countries or organizations offering strong assistance, so we need comprehensive assistance from JICA
- Assistance from JICA and JPCERT is requested with regard to participation in collaborative organizations and international alliances involving the Mongolian national CERT, scheduled to be newly established under CITA

3.3.9 Results of assistance program Impact assessments (Cambodia)

Impact assessments were conducted for each assistance program across the six indicators indicated above. The assessment revealed that in Cambodia, the greatest impact can be achieved by assisting incident/crisis management (CERT) (d2). Below are the reasons that this area was evaluated higher than other assistance programs.

- **Relevance:** The counterpart itself (the MPTC) has a desire to help strengthen CamCERT, and this assistance will directly improve cybersecurity capability

- **Effectiveness:** CamCERT already functions as a national CERT in Cambodia, making it the perfect assistance target for improving the country's ability to address cybersecurity nationwide
- **Impact:** JICA expects to assist CamCERT over the long term (three years), and the ripple effects of strengthening cybersecurity capabilities through CamCERT will extend broadly into the private sector and academia as well
- **Efficiency:** CamCERT itself has pledged to provide resources, making it possible to implement the project with fewer outside resources
- **Sustainability:** Rather than providing transitory assistance, this project will transfer the technologies to CamCERT and allow its staff members to take ongoing cybersecurity measures

Low High
0 1 2 3

3A Impact Assessment

Assistance program	scheme	Relevance	Effectiveness	Impact	Coherence	Efficiency	Sustainability	Average
a1 National cyber strategy	Technical cooperation	2	1	3	1	1	2	1.7
a2 National coordinating body	Technical cooperation	2	1	3	1	1	2	1.7
b1 Inter country agreements	Technical cooperation	2	1	0	0	0	1	0.7
b2 Public private partnerships	Technical cooperation	1	2	1	0	1	1	1.0
b3 Academic partnerships	Technical cooperation	2	3	1	0	1	2	1.5
c2 Public awareness and alerts	Technical cooperation	0	2	1	0	1	1	0.8
c4 Professional training and certification	Technical cooperation	2	3	1	0	1	2	1.5
d2 Incident and Crisis mgmt. (CERT)	Technical cooperation	3	3	3	1	3	3	2.7

Figure 220. Impact assessment (Cambodia)

3.3.10 Results of assistance program Impact assessments (Mongolia)

As in Cambodia, the impact assessment for Mongolia revealed that the greatest impact can be achieved by assisting incident/crisis management (CERT) (d2).

- **Effectiveness:** MNCERT is a non-government organization, but it already functions as a national CERT in Mongolia, making it the perfect assistance target for improving the country's ability to address cybersecurity nationwide
- **Efficiency:** MNCERT has staff members with a high level of cybersecurity maturity, making it possible to efficiently transfer technology
- **Sustainability:** Rather than providing transitory assistance, this project will transfer the technologies to MNCERT and allow its staff members to take ongoing cybersecurity measures

Assistance program	Scheme	Relevance	Effectiveness	Impact	Coherence	Efficiency	Sustainability	Average
a1 National cyber strategy	Technical cooperation	3	1	3	1	1	2	1.8
a2 National coordinating body	Technical cooperation	3	1	3	1	1	2	1.8
b1 Inter country agreements	Technical cooperation	3	1	1	0	0	1	1
b2 Public private partnerships	Technical cooperation	1	2	1	0	1	1	1
b3 Academic partnerships	Technical cooperation	2	3	1	0	1	2	1.5
c2 Public awareness and alerts	Technical cooperation	0	2	1	0	1	1	0.8
c4 Professional training and certification	Technical cooperation	2	3	1	0	1	2	1.5
d2 Incident and Crisis mgmt. (CERT)	Technical cooperation	2	3	2	1	3	3	2.3

Figure 221. Impact assessment (Mongolia)

3.4 Formulating the assistance programs

3.4.1 Cybersecurity assistance program (Cambodia)

In Phase 1, it was determined that there is a great deal of room assistance in Cambodia from the perspective of cybersecurity maturity. The evaluation results obtained in phases 2 and 3 led to the consideration of cybersecurity assistance programs based on discussions with JICA's Office for STI and DX, interviews with counterparts (to determine interest and assistance needs), and other data. The assistance programs that counterparts agreed to incorporated local assistance needs and conditions identified through previous interviews and presented as a blueprint in the form of a project design matrix (PDM).

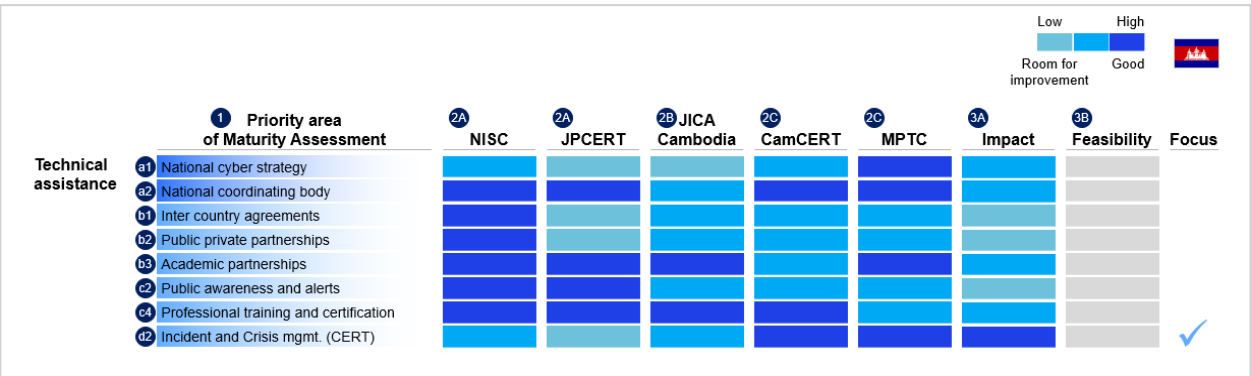
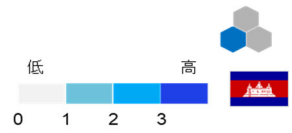


Figure 222. Summary of evaluation results (Cambodia)

Initiative overview

d2: Incident/crisis management



Overall target	• Strengthen cybersecurity capabilities as a way of achieving inclusive digital economics (shared across all forms of cybersecurity assistance)
Objective	• Work towards greater maturity for the CamCERT organization in order to improve cybersecurity incident management
Outputs	• Upgrade CamCERT activities (basic training, meetings, collaboration, number of reports, etc.) • Upgrade technical devices • Give CamCERT staff members more mature skills • Increase the number of cyberthreat reports and detections
Actions	5. **Have the MPTC define a new scope and level of authority for CamCERT** 5. Define CamCERT's roles and core responsibilities under normal conditions, when cyber incidents occur, and after they have occurred 6. Identify the gaps in technology and human resource capabilities between CamCERT now and its ideal state 7. Draft an innovation roadmap and timeline for CamCERT based on the ENIST Framework 8. Define, establish, and document standards and processes for providing core services 6. **Have the MPTC develop cybersecurity professionals for CamCERT** 3. Identify human resource needs and provide education and training 4. Work with external partners to secure a human resource development ecosystem (job matching schemes, scholarships, academic institutions, professional organizations) 7. **Have the MPTC address CamCERT's technical and facility needs** 2. Set up software and hardware, provide the necessary education and training 8. **Set up a CamCERT financing/funding scheme** 2. Establish an organization that has the authority and responsibility to supply CamCERT with sufficient funding for its activities
JICA scheme	• Technical cooperation
Timeline/schedule	• 3 years
Required resources	• JICA: Cyber experts • CERT: CamCERT
Overall assessment	• 2A: Comments from NISC • 2A: Comments from JPCERT • 2B: Insights from JICA KH • 2C: Priority items at CamCERT • 2C: Priority items at MPTC • 3A: Impact • Feasibility

Figure 223. assistance program overview: Incident/crisis management (CERT)

3.4.2 Cybersecurity assistance program (Mongolia)

Like Cambodia, it was determined in Phase 1 that there is also a great deal of room assistance in Mongolia from the perspective of cybersecurity maturity. The evaluation results obtained in phases 2 and 3 led to the consideration of cybersecurity assistance programs based on discussions with JICA's Office for STI and DX, interviews with counterparts, and other data. The assistance programs that counterparts agreed to incorporated local assistance needs and conditions identified through previous interviews and presented as a blueprint in the form of a project design matrix (PDM). The analysis in the basic survey indicated that CERT assistance would be most ideal, but Mongolia had not established a national CERT at the time of the study, and both organizations that the team initially thought corresponded to national CERTs (MNCERT/CC and MONCERT) turned out to be private organizations. For this reason, it was decided to postpone CERT assistance. However, it was also determined that initiatives aimed at expanding courses that contribute to better cybersecurity skills among private sector and government employees by strengthening the existing IT department at the Mongolian University of Science and Technology would help raise the bar for cybersecurity capabilities throughout Mongolia. For this reason, the assistance program focuses on strengthening the capabilities of professionals in the private and public sectors at the Mongolian University of Science and Technology.

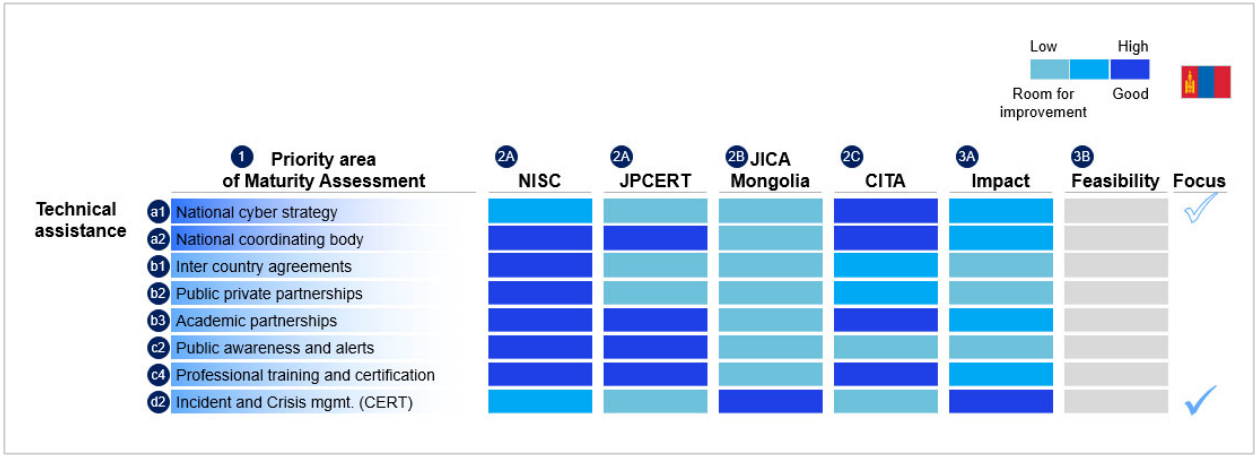
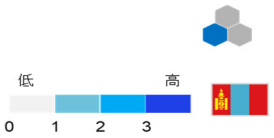


Figure 224. Summary of evaluation results (Mongolia)

Initiative overview

d2: Incident/crisis management



Overall target	• Strengthen cybersecurity capabilities as a way of achieving inclusive digital economics (shared across all forms of cybersecurity assistance)
Objective	• Work towards greater maturity for a national CERT organization in order to improve cybersecurity incident management
Outputs	• Upgrade national CERT activities (basic training, meetings, collaboration, number of reports, etc.) • Upgrade technical devices • Give national CERT staff members more mature skills • Increase the number of cyberthreat reports and detections
Actions	**5. Have CITA define a new scope and level of authority for a national CERT** 5. Define the roles and core responsibilities of a national CERT under normal conditions, when cyber incidents occur, and after they have occurred 6. Identify the gaps in technology and human resource capabilities between the national CERT now and its ideal state 7. Draft an innovation roadmap and timeline for a national CERT based on the ENIST Framework 8. Define, establish, and document standards and processes for providing core services **6. Have CITA develop cybersecurity professionals for a national CERT** 3. Identify human resource needs and provide education and training 4. Work with external partners to secure a human resource development ecosystem (job matching schemes, scholarships, academic institutions, professional organizations) **7. Have CITA address the national CERT's technical and facility needs** 2. Set up software and hardware, provide the necessary education and training **8. Set up a national CERT financing/funding scheme** 2. Establish an organization that has the authority and responsibility to supply CamCERT with sufficient funding for its activities
JICA scheme	• Technical cooperation
Timeline/schedule	• 3 年
Required resources	• JICA: Cyber experts • CERT: National CERT organization or future organization
Overall assessment	• 2A: Comments from NISC • 2A: Comments from JPCERT • 2B: Insights from JICA MN • 2C: Priority items at CITA • 3A: Impact • Feasibility

Figure 225. assistance program overview: Incident/crisis management (CERT)

3.5 Suggestions for JICA

The following section presents suggestions in areas where it would appear that JICA needs to transform in order to flexibly generate significant impact through its assistance initiatives. These suggestions are based on the basic survey, which was conducted with a specific assistance area (cybersecurity) in mind. Note that the suggestions presented are not necessarily comprehensive, as they have been prepared during the course of the survey based on information gathered in interviews with leads in JICA's Office for STI and DX and with other relevant experts.

3.5.1 Review the systems and rules for development assistance

First, it will likely be necessary for JICA to review its systems and rules for development assistance in the area of cybersecurity (general IT). As an example, in comparison to social infrastructure development, an area with which JICA has been heavily involved, cybersecurity and IT constantly demand cutting-edge expertise and innovation. As a result, there may be situations in which JICA would do well to partner with vendors with whom it would normally be difficult to sign contracts under its current external vendor procurement and contracting standards, which impose limitations on things like service term, unit price, percentage of Japanese nationals, and reemployment. In order to deliver truly meaningful assistance to the countries receiving it, JICA is urged to flexibly reconsider new procurement and contracting standards for the IT sector. At the same time, fast-changing sectors like IT require that partner country governments review their strategies frequently. If JICA sticks to its conventional two- or three-year cycle for determining assistance details as outlined in its existing basic survey/field survey procedures, it may be difficult to keep pace with those changes and implement the kind of assistance that is truly needed. As indicated in the case examples from other donors presented earlier, delegating decision-making authority to local offices is ideal as it can greatly reduce the deliberation time leading up to assist implementation.

3.5.2 Clarify the significance and scope of assistance

JICA is urged to clearly define the significance of providing assistance to the cybersecurity sector and the specific areas in which it intends to do so. There are many reasons to strengthen a country's cybersecurity, among them national defense, the growth of private industry, human resource development, tightening regulations, stronger diplomatic and internal relations, and so on. The areas that JICA and Japan should primarily get involved in need to be defined, while paying attention to trends among other donors as well. For example, as mentioned earlier, NATO has been helping Mongolia strengthen its cybersecurity as a form of national defense to keep the country democratic. The Korea International Cooperation Agency (KOICA) is extending assistance to several Asian countries to address cybercrime as well as policing and intelligence. Having each donor clarify the areas in which its organization is strongest and has the greatest interest will make it possible to provide ongoing, end-to-end assistance. Going forward, JICA will need to define the significance of cybersecurity assistance, strengthen its internal capabilities in its areas of focus while securing external resources, and accumulate project experience in those areas as well. This will allow it to provide assistance with the greatest developmental impact in the area of cybersecurity.

3.5.3 Make use of delivery units

Most international cooperation projects involve multiple counterparts, implementing organizations, and local resources, which often creates complex communication and decision-making processes. At the same time, it is not uncommon for these projects to fail to generate the required involvement and interest from the relevant ministries, making it impossible to achieve the expected development outcomes. Cybersecurity technical cooperation projects in Cambodia and Mongolia in particular involve a complicated set of stakeholders beyond the counterpart ministries (such as universities, private educational institutions, national CERTs like CamCERT, and so on). And given the limitations of these organizations in terms of maturity and capabilities, their ability to execute the project and drive it forward are concerns. Under conditions like these, a delivery unit can be an effective way of enhancing the propulsive force of the project. Below is a summary of the specific ways in which a delivery unit can function.

Figure 226. When a delivery unit is necessary

Obstacle	Description
Lack of leadership	Leaders lack the ambition or desire to proactively engage with the project through prompt decision-making and real-time execution
Lack of collaboration among relevant government agencies	Allocation/positioning of responsibility or the scope of overlapping responsibilities are only vaguely defined, making it difficult to engage in priority actions that cut across multiple government agencies
Internal barriers (apathy)	Government offices are weak in execution capabilities and processes (compared to their policy formulation capabilities), and lack the desire to rapidly generate significant impacts (apathy)
External barriers	Lack of assistance among the general public, companies, and other stakeholders due to a combination of skeptics of rapid/significant impacts, powerful opponents, and unrealistically high expectations
Insufficient data	Proper monitoring is difficult due to a lack of basic data and transparency and/or major data quality issues
Lack of capabilities	Lack of understanding about root causes, clear problem definitions, knowledge necessary to execute tasks, management skills, and/or soft skills
Tight funding	Funding for priority items is stalled because spending plans have already been formulated and cannot be reduced--particularly in situations where finances are getting tighter

The major difference between a delivery unit and a project management office is that delivery units are not limited to simple project progress management. They also get involved in hands-on implementation tasks like conducting the surveys that decision-makers need to move forward and coordinating stakeholders. When governments engage in cross-cutting transformation, delivery units are set up under the direct control of the cabinet office or other agency with powerful executive ability and authority, giving them a great deal of administrative authority over project organizations and players.

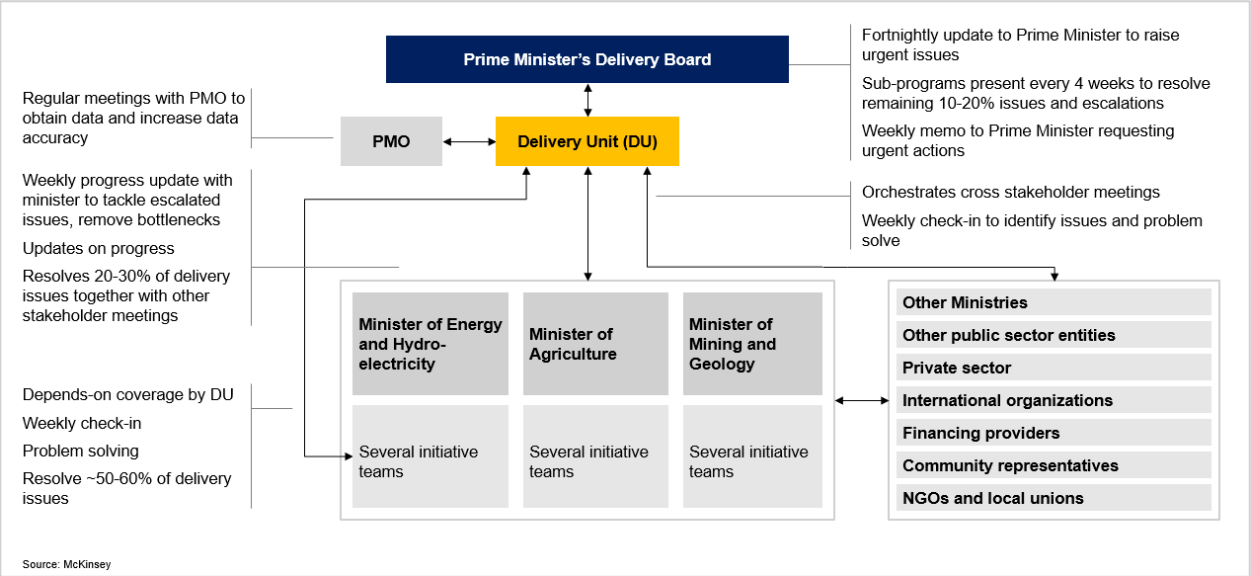


Figure 227. Typical delivery unit setup

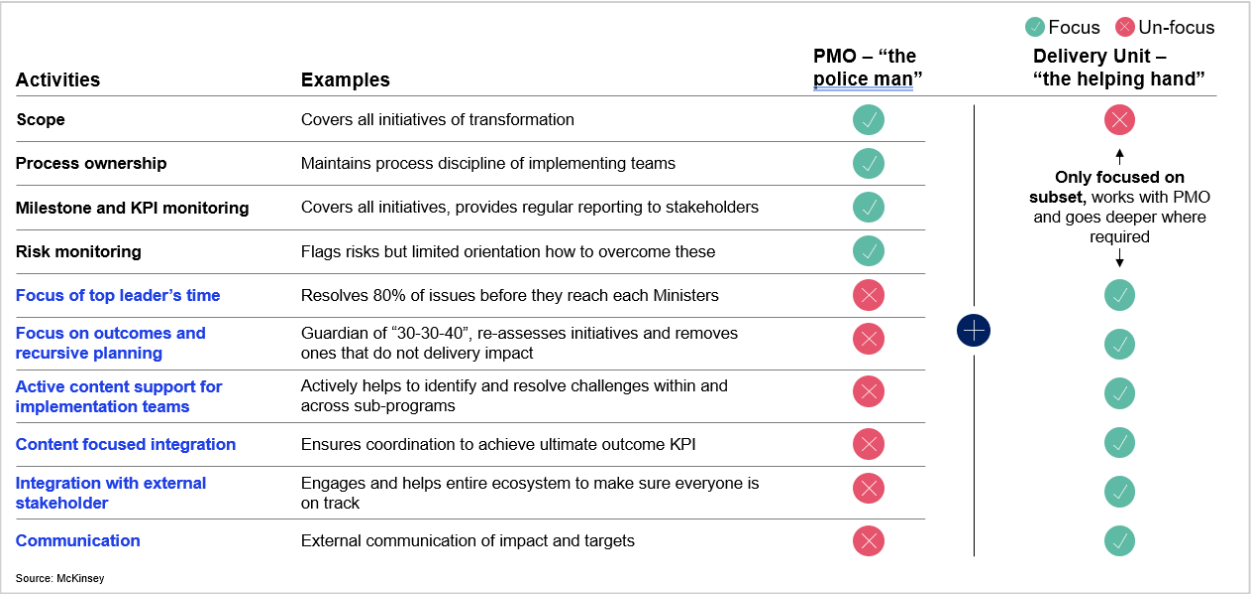
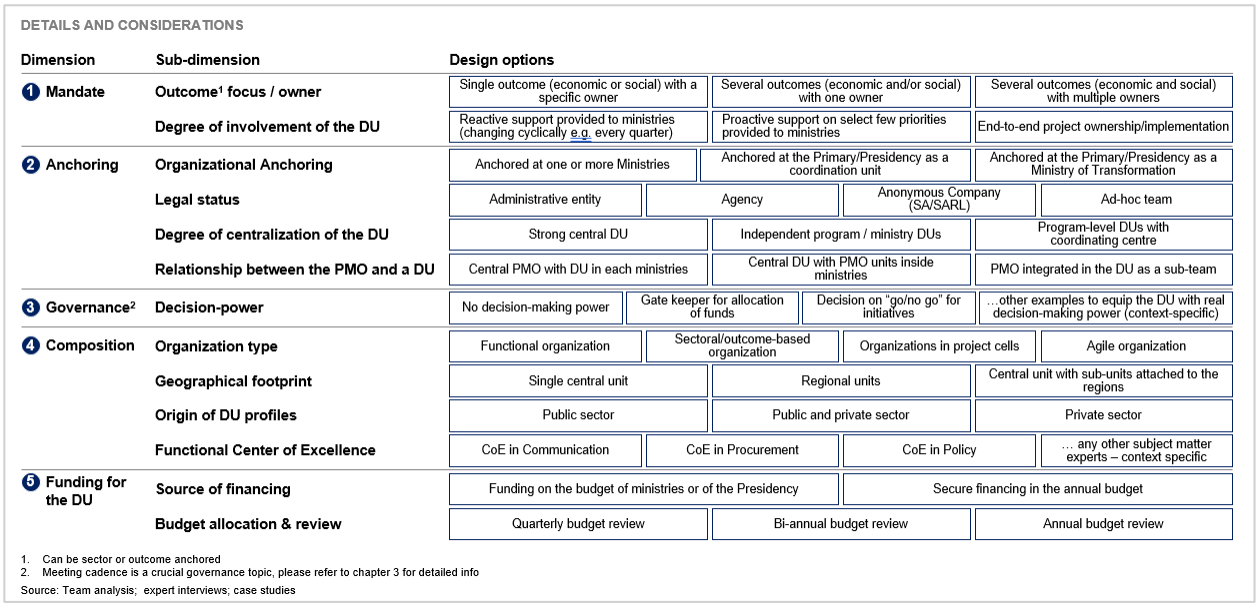


Figure 228. Delivery unit functions and roles

When putting together a delivery unit, care must be taken to create an organization that brings together the necessary functionality to execute assistance, based on factors like project difficulty, timeframe, and counterpart maturity. There are several design choices to make during this process, particularly when it comes to authority, configuration, governance, structure, and funding.



DETAILS AND CONSIDERATIONS

Dimension	Sub-dimension	Design options			
1 Mandate	Outcome[1] focus / owner	Single outcome (economic or social) with a specific owner	Several outcomes (economic and/or social) with one owner	Several outcomes (economic and social) with multiple owners	
	Degree of involvement of the DU	Reactive support provided to ministries (changing cyclically e.g. every quarter)	Proactive support on select few priorities provided to ministries	End-to-end project ownership/implementation	
2 Anchoring	Organizational Anchoring	Anchored at one or more Ministries	Anchored at the Primary/Presidency as a coordination unit	Anchored at the Primary/Presidency as a Ministry of Transformation	
	Legal status	Administrative entity	Agency	Anonymous Company (SA/SARL)	Ad-hoc team
	Degree of centralization of the DU	Strong central DU	Independent program / ministry DUs	Program-level DUs with coordinating centre	
	Relationship between the PMO and a DU	Central PMO with DU in each ministries	Central DU with PMO units inside ministries	PMO integrated in the DU as a sub-team	
3 Governance[2]	Decision-power	No decision-making power	Gate keeper for allocation of funds	Decision on "go/no go" for initiatives	…other examples to equip the DU with real decision-making power (context-specific)
4 Composition	Organization type	Functional organization	Sectoral/outcome-based organization	Organizations in project cells	Agile organization
	Geographical footprint	Single central unit	Regional units	Central unit with sub-units attached to the regions	
	Origin of DU profiles	Public sector	Public and private sector	Private sector	
	Functional Center of Excellence	CoE in Communication	CoE in Procurement	CoE in Policy	… any other subject matter experts – context specific
5 Funding for the DU	Source of financing	Funding on the budget of ministries or of the Presidency	Secure financing in the annual budget		
	Budget allocation & review	Quarterly budget review	Bi-annual budget review	Annual budget review	

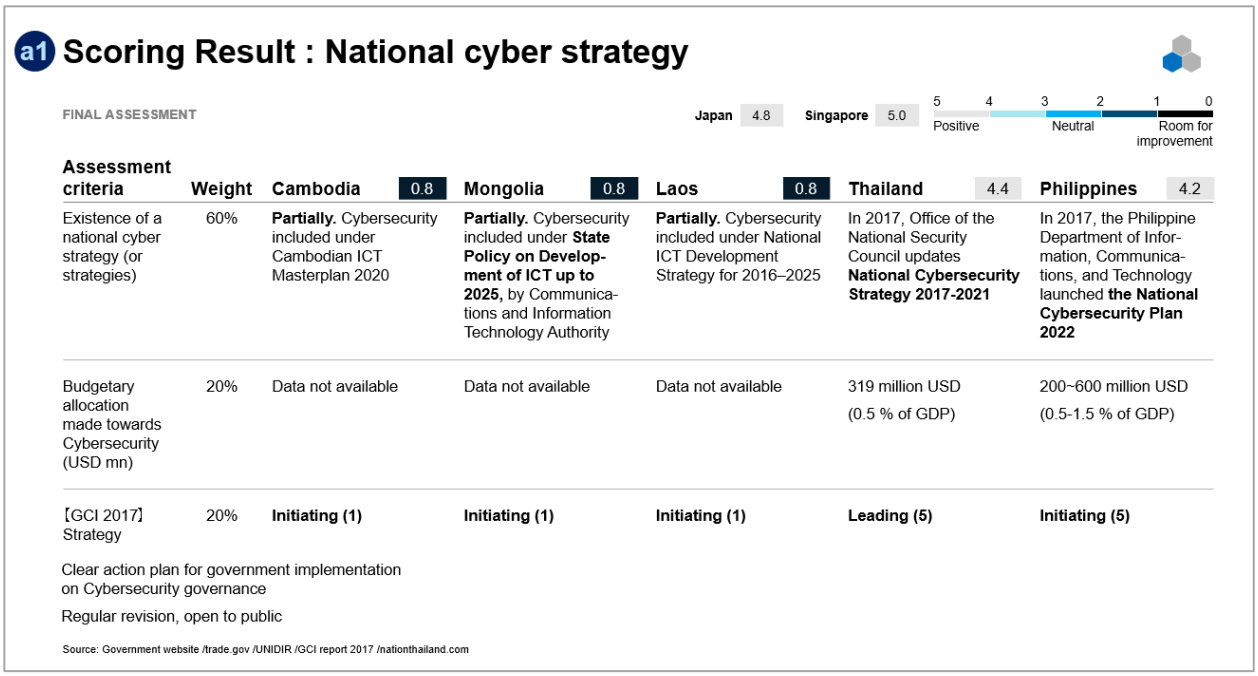
1. Can be sector or outcome anchored
2. Meeting cadence is a crucial governance topic, please refer to chapter 3 for detailed info

Source: Team analysis; expert interviews; case studies

Figure 229. Delivery unit design choices

3.6 Reference materials

3.6.1 Details on the national cybersecurity maturity assessment



a1 Scoring Result : National cyber strategy

FINAL ASSESSMENT

Japan 4.8 Singapore 5.0

5 4 3 2 1 0
Positive Neutral Room for improvement

Assessment criteria	Weight	Cambodia 0.8	Mongolia 0.8	Laos 0.8	Thailand 4.4	Philippines 4.2
Existence of a national cyber strategy (or strategies)	60%	**Partially.** Cybersecurity included under Cambodian ICT Masterplan 2020	**Partially.** Cybersecurity included under **State Policy on Development of ICT up to 2025,** by Communications and Information Technology Authority	**Partially.** Cybersecurity included under National ICT Development Strategy for 2016–2025	In 2017, Office of the National Security Council updates **National Cybersecurity Strategy 2017-2021**	In 2017, the Philippine Department of Information, Communications, and Technology launched **the National Cybersecurity Plan 2022**
Budgetary allocation made towards Cybersecurity (USD mn)	20%	Data not available	Data not available	Data not available	319 million USD (0.5 % of GDP)	200~600 million USD (0.5-1.5 % of GDP)
【GCI 2017】 Strategy	20%	**Initiating (1)**	**Initiating (1)**	**Initiating (1)**	**Leading (5)**	**Initiating (5)**

Clear action plan for government implementation on Cybersecurity governance

Regular revision, open to public

Source: Government website /trade.gov /UNIDIR /GCI report 2017 /nationthailand.com

Figure 230. Scoring result national cyber strategy

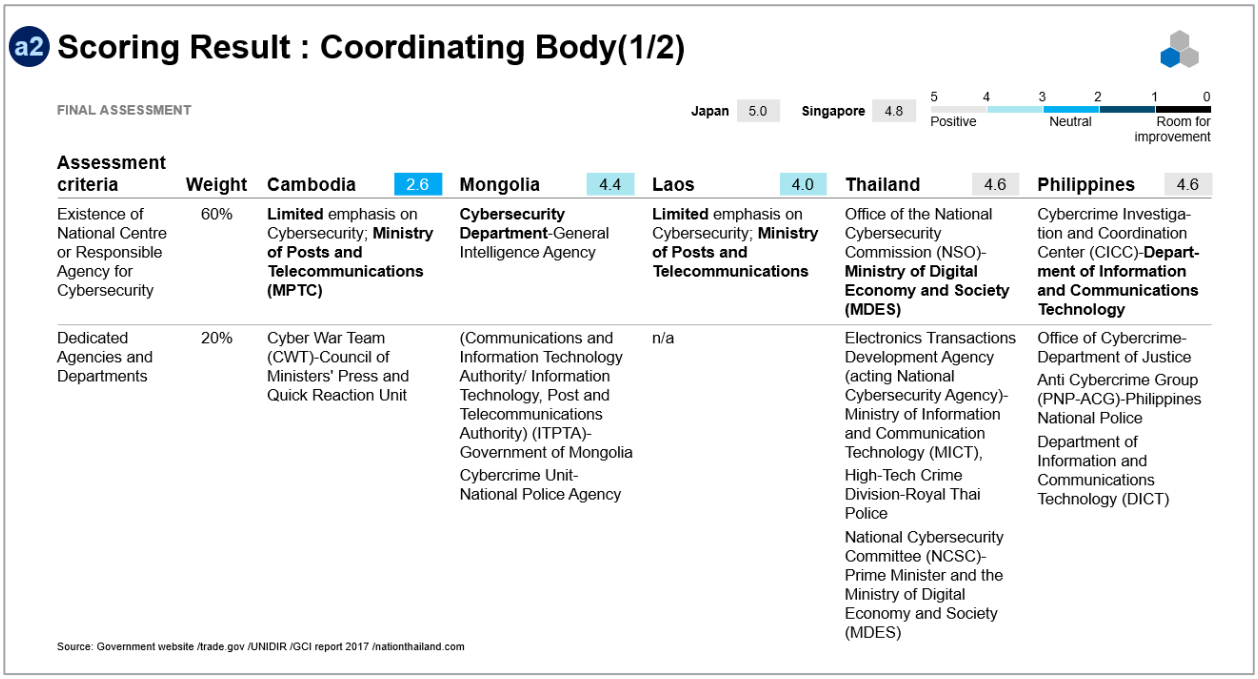


Figure 231. Scoring result coordinating body(1/2)

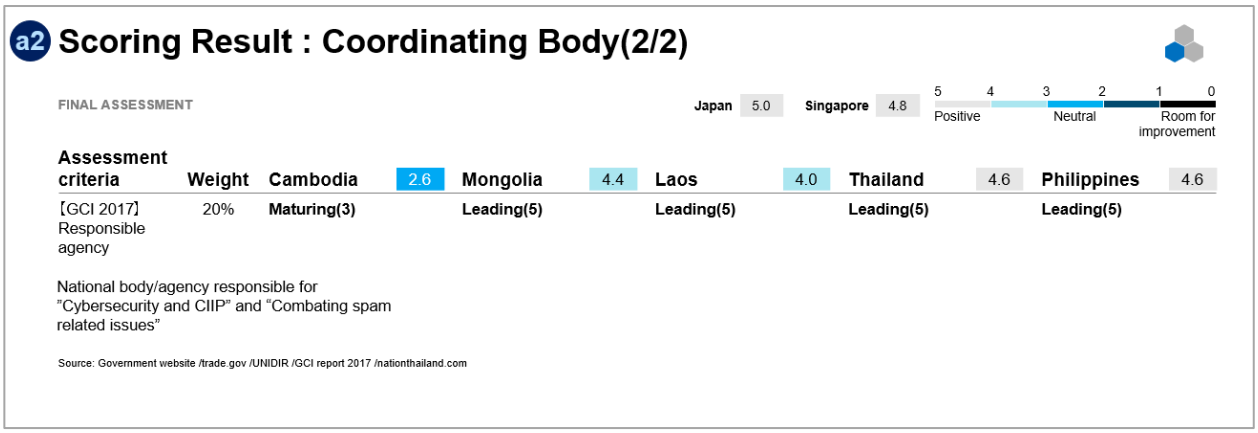


Figure 232. Scoring result coordinating body (2/2)

b1 Scoring Result : Intercountry agreements(1/3)

FINAL ASSESSMENT — Details in following page — Japan 4.1 — Singapore 4.8

5 4 3 2 1 0 (Positive — Neutral — Room for improvement)

Assessment criteria	Weight	Cambodia 2.2	Mongolia 2.2	Laos 2.9	Thailand 3.5	Philippines 2.5
Number of instances of bilateral cooperation	25%	None	1 instance: Joint Statement for **India-Mongolia Strategic Partnership**	1 instance: Memorandum of Understanding, **China-Laos**	8 instances: Cooperation with **Australia** (2 agreements), **Russia, Iran, Portugal, Bangladesh, Singapore and Montenegro**	1 instance: Memorandum of Understanding, **Malaysia-Philippines**
Number of instances of multilateral cooperation	25%	**2 instances:** Member of **Cybersecurity Alliance for Mutual Progress** (CAMP) Participation in Workshop on **International Cybersecurity Policy and Diplomacy** for CLMV countries	**1 instance:** Member of **Cybersecurity Alliance for Mutual Progress** (CAMP)	**2 instances:** Member of **Cybersecurity Alliance for Mutual Progress** (CAMP) Participation in Workshop on **International Cybersecurity Policy and Diplomacy** for CLMV countries	**4 instances:** Member of **Cyber-security Alliance for Mutual Progress** (CAMP) Member of The Global Forum on Cyber Expertise **(GFCE)** **Host** of workshop on Strengthening and Enhancing Cyber-security Cooperation in the **ASEAN Region** Host of Regional Workshop on Norms in Cyberspace for **ASEAN member states**	**4 instances:** Member of **Cyber-security Alliance for Mutual Progress** (CAMP) Member of Global Forum on Cyber Expertise **(GFCE)** Jointly organized with the **Council of Europe**, a Conference on Cyber-crime for **Southeast Asian region** Trilateral Meeting on Security, **Indonesia-Malaysia-Philippines**

Source: Government website /trade.gov /UNIDIR /GCI report 2017 /nationthailand.com

Figure 233. Scoring result intercountry agreements (1/3)

b1 Scoring Result : Intercountry agreements(2/3)

FINAL ASSESSMENT — Japan 4.1 — Singapore 4.8

5 4 3 2 1 0 (Positive — Neutral — Room for improvement)

Assessment criteria	Weight	Cambodia 2.6	Mongolia 4.4	Laos 4.0	Thailand 4.6	Philippines 4.6
Affiliation to International (intergovern-mental) unions	20%	**3 affiliations:**	**3 affiliations:**	**3 affiliations:**	**3 affiliations:**	**3 affiliations:**
Association of Southeast Asian Nations (ASEAN)		✓		✓	✓	✓
International Telecommuni-cations Union (ITU)		✓	✓	✓	✓	✓
United Nations (UN)		✓	✓	✓	✓	✓
Organization for Security and Co-operation in Europe (OSCE)			✓			

Source: Government website /trade.gov /UNIDIR /GCI report 2017 /nationthailand.com

Figure 234. Scoring result intercountry agreements (2/3)

b1 Scoring Result : Intercountry agreements(3/3)

FINAL ASSESSMENT

Japan 4.1 Singapore 4.8

5 4 3 2 1 0
Positive Neutral Room for improvement

Assessment criteria	Weight	Cambodia 2.2	Mongolia 2.2	Laos 2.9	Thailand 3.5	Philippines 2.5
【GCI 2017】Bilateral agreements	10%	Initiating(1)	Maturing(3)	Initiating(1)	Maturing(3)	Maturing(3)
【GCI 2017】Multilateral agreements	10%	Initiating(1)	Initiating(1)	Maturing(3)	**Leading(5)**	Initiating(1)
【GCI 2017】International participation	10%	Initiating(1)	**Leading(5)**	**Leading(5)**	**Leading(5)**	**Leading(5)**

Source: Government website /trade.gov /UNIDIR /GCI report 2017 /nationthailand.com

Figure 235. Scoring result intercountry agreements (3/3)

b2 Scoring Result : Public private partnerships (1/2)

FINAL ASSESSMENT

☐ Details in following page Japan 3.4 Singapore 5.0

5 4 3 2 1 0
Positive Neutral Room for improvement

Assessment criteria	Weight	Cambodia 0.8	Mongolia 0.8	Laos 0.8	Thailand 4.2	Philippines 5.0
Presence of PPPs focused on cybersecurity (Including designing cyber strategy, developing cyber capability and protecting CII)	60%	ICT **endorsed by the Ministry of Post and Telecom** (MPTC)	Limited information available - **one PPP** project named Mongolia Telecom Company in ICT industry with financial closure in 1995	Information not found	Existence of **National Cybersecurity Committee** ("NCSC") and **Cybersecurity Regulatory Committee ("CSRC")** having directors from the government and the private sector from areas that benefit Cybersecurity	**Private sector** cognizant of the government's budgetary and manpower limitations. It **goes beyond the protection of critical national infrastructure** and augments the **Cybersecurity capabili-ties** of the resource-poor Philippine military (e.g. PLDT - PAF and DITO - AFP partnerships)
Presence of Industry-led financing initiatives	60%	Information not found	Investment of $4.5 million in the PPP	Information not found	Financed by the government	Financed by the industry

Source: Government websites /trade.gov /UNIDIR /GCI report 2017 /nationthailand.com

Figure 236. Scoring result public private partnerships (1/2)

b2 Scoring Result : Public private partnerships (2/2)

FINAL ASSESSMENT

Japan 3.4 Singapore 5.0

5 4 3 2 1 0
Positive Neutral Room for improvement

Assessment criteria	Weight	Cambodia 0.8	Mongolia 0.8	Laos 0.8	Thailand 4.2	Philippines 5.0
【GCI 2017】 Public Private Partnerships • Public-private partnerships in place with local companies or foreign companies	20%	**Initiating(1)**	**Initiating(1)**	**Initiating(1)**	**Maturing(3)**	**Leading(5)**

Source: Government website /trade.gov /UNIDIR /GCI report 2017 /nationthailand.com

Figure 237. Scoring result public private partnerships (2/2)

b3 Scoring Result : Academic partnerships (1/2)

FINAL ASSESSMENT

Japan 4.4 Singapore 5.0

5 4 3 2 1 0
Positive Neutral Room for improvement

Assessment criteria	Weight	Cambodia 0.8	Mongolia 0.8	Laos 0.8	Thailand 4.2	Philippines 5.0
Government-led initiatives towards Cybersecurity training	40%	The **Cambodian ICT Masterplan 2020** for government was launched in 2014 to focus on human resources, training and enhancing digital literacy, computer access of government employees, expanded ICT infrastructure, Cybersecurity and more	The **National Program of Information Security plan** provides educational and professional training programs for raising awareness with the general public, promoting Cybersecurity courses in higher education and promoting certification of professionals in either the public or the private sectors	National University of Laos (NUOL) has **e-learning centers** established under the ASEAN Cyber University project	The ETDA and the Thailand Information Security Association created the **Information Security Expert Certification (ISEC)**, a Cybersecurity course for Thais, in 2013. The ETDA launched a Cybersecurity personnel-development project to train 12,000 people by 2021 Proposed **National Cybersecurity Agency and Hacking Training Centre**	DICT has signed a partnership with the Commission on Higher Education for the development of a **bachelor degree in Cybersecurity**
No of cyberse-curity research publications (R&D)	20%	None	None	None	2 publications	1 publication

Figure 238. Scoring result academic partnerships (1/2)

Scoring Result : Academic partnerships (2/2)

FINAL ASSESSMENT

Japan 4.4 Singapore 5.0

5 4 3 2 1 0
Positive Neutral Room for improvement

Assessment criteria	Weight	Cambodia 1.6	Mongolia 1.6	Laos 0.8	Thailand 4.0	Philippines 3.4
【GCI 2017】 Education Programmes Support to educational programs or academic curricular in Cybersecurity (primary, secondary schools, higher educations)	20%	Initiating(1)	Initiating(1)	Initiating(1)	Maturing(3)	Maturing(3)
【GCI 2017】 R&D Programmes Investment in Cybersecurity research & development (public and private sector, higher educational institutions, etc.)	20%	Initiating(1)	Initiating(1)	Initiating(1)	**Leading(5)**	Maturing(3)

Source: Government website /trade.gov /UNIDIR /GCI report 2017 /nationthailand.com

Figure 239. Scoring result academic partnerships (2/2)

Benchmark countries take initiatives to promote Cyber to young generation with academic cooperation

Initiative	Description	Benchmark example
Cyber-security scholarships	**Sponsor citizens** willing to study for Masters and Doctorate Degrees (locally and abroad) with a contract to work for the public sector for 2 years Offer **internships** in the Cybersecurity or technology departments of major companies with a co-sponsorship between companies and universities	CyberCorps US provides **scholarships** that fully fund full-time students while attending school whereby, **recipients must agree to work after graduation for a Government agency** or equivalent
Cyber-security degrees	**Offer formal undergraduate and postgraduate degrees specializing in the study of Cybersecurity** **Offer Cybersecurity electives** (e.g., Cybersecurity policies and laws, Cybersecurity, cryptography programming, product management, information security, etc.) in all relevant faculties	**Top US universities provide Cybersecurity degrees** (e.g. Georgia Institute Of Technology, Purdue University, etc.)[1] TALtech Cybersecurity engineering degree
Cyber First	Cyber First is developing UK's next generation of cyber professionals through: • **Student bursaries** – a bursary that offers financial assistance and paid Cybersecurity work experience for undergraduates • **Courses** – courses that are free and aimed at 11–17-year-olds and based at universities and colleges across UK with a focus on diversifying the workforce • **Competitions** - a competition to inspire and encourage young girls to consider a career in cyber	NCSC.GOV.UK

Figure 240. Benchmark countries take initiatives to promote Cyber to young generation with academic cooperation

c2 Scoring Result : Public awareness and alerts (1/2)

FINAL ASSESSMENT

Japan 4.6 Singapore 5.0

5 4 3 2 1 0
Positive Neutral Room for improvement

Assessment criteria	Weight	Cambodia 2.4	Mongolia 2.0	Laos 1.2	Thailand 4.2	Philippines 3.4
Policy developments for awareness and capacity building	40%	**No education strategy**; CERTs are responsible for general awareness	**Limited,** State Policy on Development of ICT up to 2025	**No education strategy**; CERTs are responsible for general awareness	Digital Forensics Centre provides services and training; MDES currently promotes awareness, **no overarching strategy in place**	Under National Cybersecurity Plan 2022, **no current strategy** is in place; Plan to establish **CISO program** in government agencies
【GCI 2017】 R&D Programmes	20%	Cambodia's **awareness of cyber issues remains limited**. Awareness of basic safeguards is low, and studies show that the vast majority of Cambodian computers use pirated software, contributing to the nation's high vulnerability to malware	State Policy on Development of ICT up to 2025 focuses on improving education and awareness of Cybersecurity issues. **Limited information** on the KPI available	The Ministry of Posts and Telecommunications has made **significant efforts to increase digital literacy and awareness** of cyber issues through the e-Education program. Genuine domestic debate and media coverage of cyber issues in Laos are **stymied by low levels of internet connectivity**	Efforts are being taken to **raise cyber awareness** e.g. in 2017, the MDES held **Digital Thailand Big Bang**, a tech exhibition that featured a variety of different stakeholders, with the goal of driving digital advancement. However, much of the cyber debate is still **centered on censorship and the challenges** associated with it	Philippines displays evidence of public awareness of cyber issues. In Apr 2017, DICT began a '**Cybersecurity caravan' campaign**, where cyber experts are sent into the community to teach students about cyber safety. Awareness in the Philippines is tied up with issues relating to freedom of expression, fake news, data speeds and e-literacy

Source: Government website /trade.gov /UNIDIR /GCI report 2017 /nationthailand.com

Figure 241. Scoring result public awareness and alerts (1/2)

c2 Scoring Result : Public awareness and alerts (2/2)

FINAL ASSESSMENT

Japan 4.6 Singapore 5.0

5 4 3 2 1 0
Positive Neutral Room for improvement

Assessment criteria	Weight	Cambodia 2.4	Mongolia 2.0	Laos 1.2	Thailand 4.2	Philippines 3.4
【GCI 2017】 Public awareness campaigns Public awareness campaigns (targeting organizations, civil society, adults, youth, children)	20%	**Maturing(3)**	Initiating(1)	Initiating(1)	Leading(5)	**Maturing(3)**
【GCI 2017】 Cybersecurity good practices Good practices for Cybersecurity	20%	**Leading(5)**	Initiating(1)	Initiating(1)	**Leading(5)**	**Leading(5)**

Source: Government website /trade.gov /UNIDIR /GCI report 2017 /nationthailand.com

Figure 242. Scoring result public awareness and alerts (2/2)

c4 Scoring Result : Professional training and certification(1/2)

FINAL ASSESSMENT

Japan 3.5 Singapore 5.0

5 4 3 2 1 0
Positive Neutral Room for improvement

Assessment criteria	Weight	Cambodia 1.1	Mongolia 0.7	Laos 0.5	Thailand 3.0	Philippines 2.4
Number of CISSP Certifications issued	20%	1	3	0	251	166
Number of CSSP Certifications issued	30%	0	0	0	8	4
Local presence of global Cybersecurity vendors/ (ISC)2/ISACA	20%	None	None	None	(ISC)2 ISACA	(ISC)2 ISACA
Local presence of major Global Certifiers	20%	Initiating(1)	Initiating(1)	Initiating(1)	**Leading(5)**	Initiating(1)

Source: Government website /trade.gov /UNIDIR /GCI report 2017 /nationthailand.com

Figure 243. Scoring result professional training and certification (1/2)

c4 Scoring Result : Professional training and certification(2/2)

FINAL ASSESSMENT

Japan 3.4 Singapore 5.0

5 4 3 2 1 0
Positive Neutral Room for improvement

Assessment criteria	Weight	Cambodia 1.1	Mongolia 0.7	Laos 0.5	Thailand 3.0	Philippines 2.4
【GCI 2017】 Standards for Professionals Setting standards for professionals	10%	Initiating(1)	Initiating(1)	Initiating(1)	**Leading(5)**	Initiating(1)
【GCI 2017】 Cybersecurity training Existence of Cybersecurity training for law enforce-ment officers, judicial and other legal actors	10%	Initiating(1)	Initiating(1)	Initiating(1)	**Leading(5)**	Maturing(3)
【GCI 2017】 Professional training courses Professional Cybersecurity training courses	10%	**Leading(5)**	Initiating(1)	Initiating(1)	**Leading(5)**	Maturing(3)

Source: Government website /trade.gov /UNIDIR /GCI report 2017 /nationthailand.com

Figure 244. Scoring result professional training and certification (2/2)

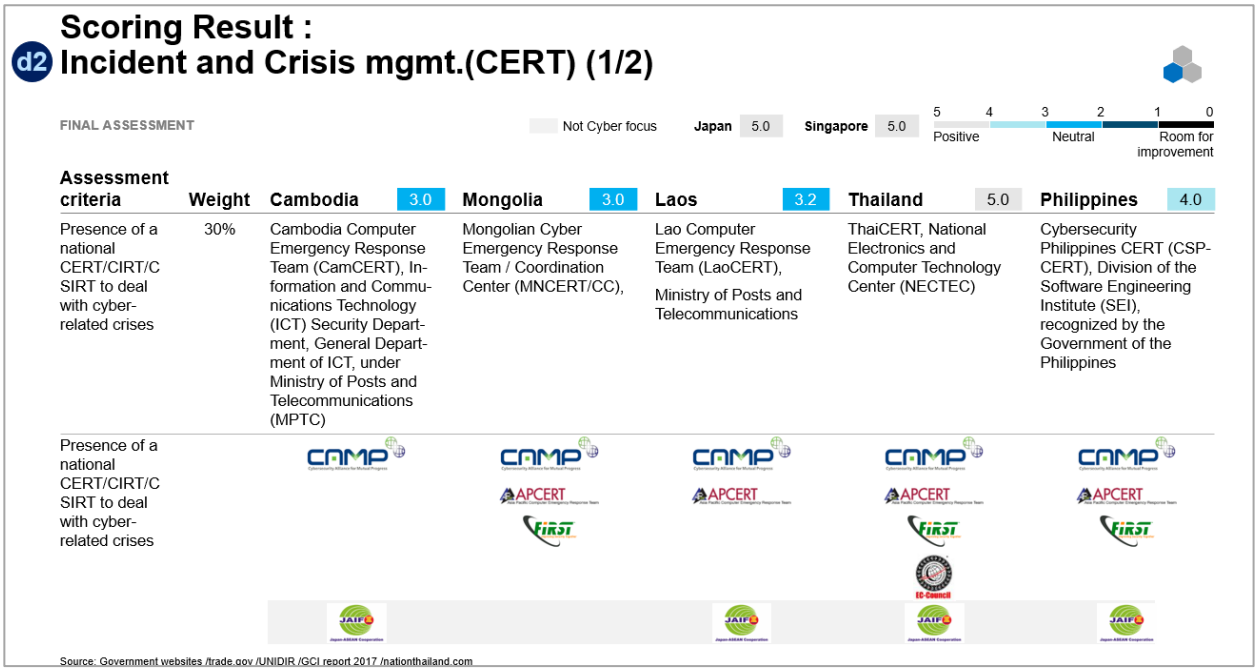


Figure 245. Scoring result incident and crisis management (CERT) (1/2)

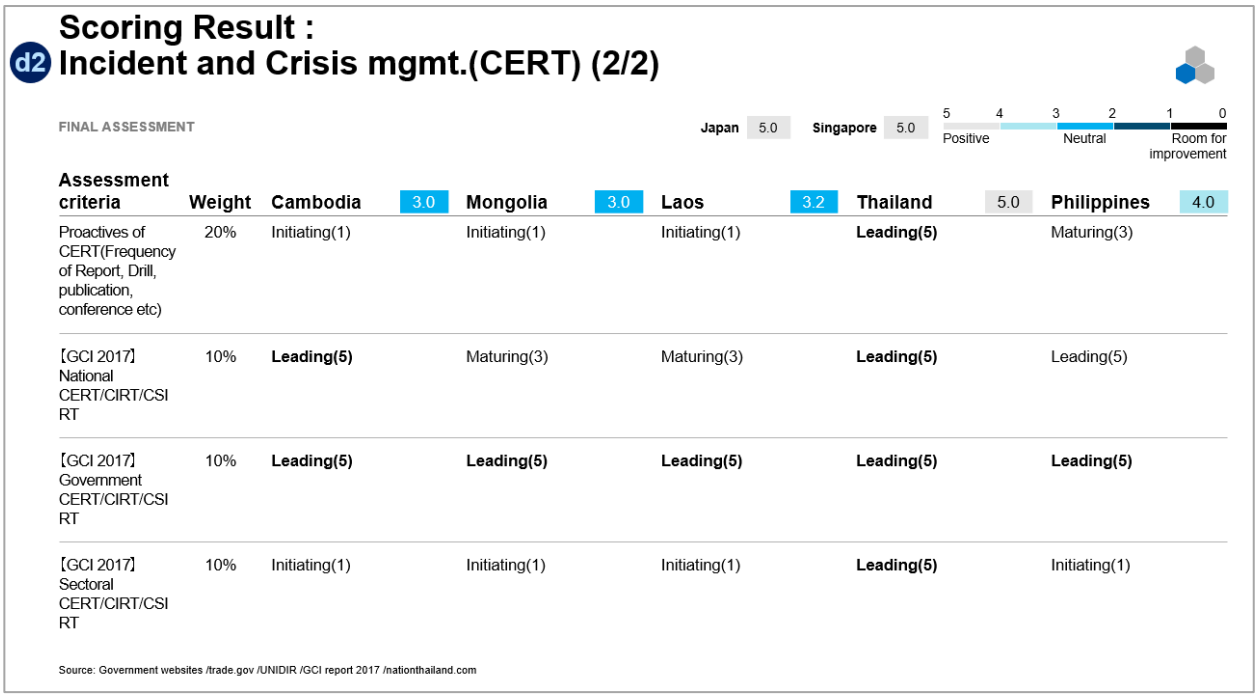


Figure 246. Scoring result incident and crisis management (CERT) (2/2)

3.6.2 Reference cases from other countries

Leading case studies from Singapore were also considered for several of the evaluation items in order to clearly illustrate the maturity gaps with countries targeted by the survey.

Overall national strategy

Vision

"Create a resilient and trusted cyber environment […] to realise the benefits of technology and so secure a better future for Singaporeans"

Pillars / themes

1. Building a Resilient Infrastructure
2. Creating a Safer Cyberspace
3. Developing a Vibrant Cybersecurity Ecosystem
4. Strengthening International Partnerships

National CS agency

Name: CSA (Cybersecurity Agency of Singapore)

Formed: 2015

Employees: n/a

Governance

Part of the Prime Minister's Office and is managed by the Ministry of Communications and Information

Main activities

- Nurture ties with local and global industry and thought leaders, heightening Cybersecurity awareness through public outreach programmes
- Develop a robust Cybersecurity ecosystem, i.e., a vibrant industry equipped with manpower to respond to attacks
- Strengthen security in critical sectors
- Ensure effective coordination and deployment in response to cyber threats

Examples of best practices

Regulations and governance

The "Instruction Manual (IM) 8" specifies policies, standards and regulations for IT security implemented by government agencies, that private vendors serving the government also need to comply with

Talent and people

The CSAT program focuses on upskilling and re-skilling Cybersecurity professionals through cooperative education courses offered in collaboration with Info- communication Media Development Authority (IMDA)

Partnerships

Partnered in 2017 with Information Systems Audit and Control Association (ISACA), an international professional organization, to advance vulnerability assessments

Figure 247. Overview of cybersecurity measures in Singapore

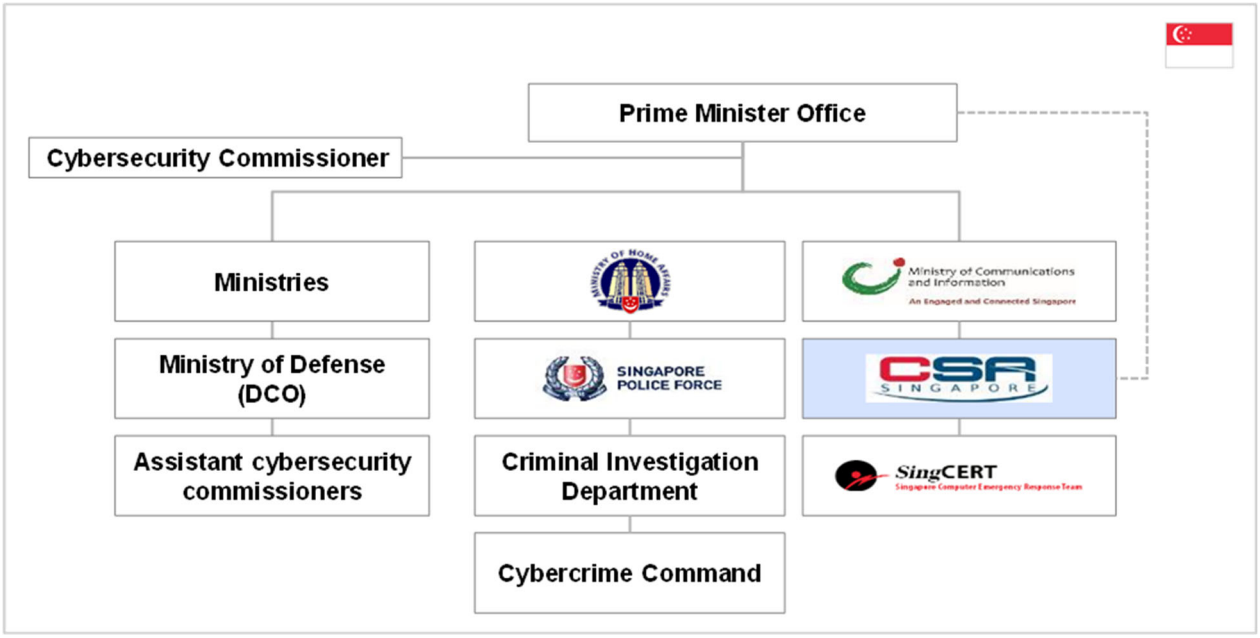


Figure 248. Cybersecurity governance model

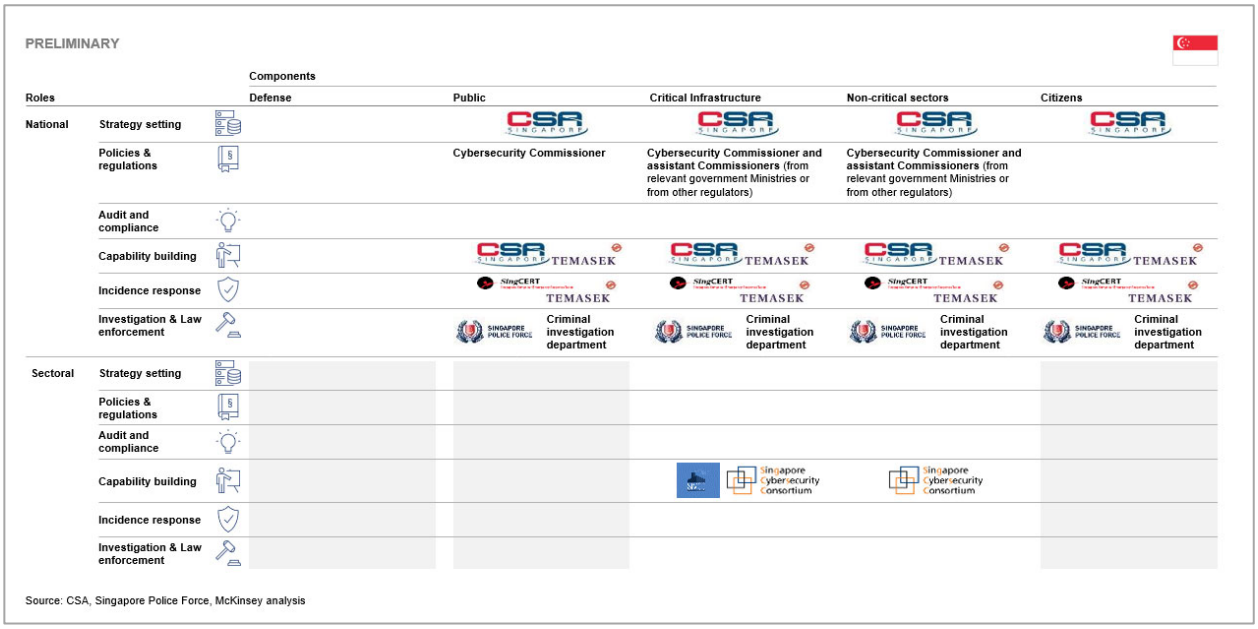


Figure 249. Governance ecosystem

Cybercrime and policies

- The Monetary Authority of Singapore (MAS) establishes cybersecurity standards for the financial services industry
- In 993, Singapore enacted a special law on cybercrime entitled the Computer Misuse and Cybersecurity Act
- The government enacts special laws to protect children online
- Companies are provided with the publicly-accessible Technology Risk Management Guidelines to guide their cyber risk management efforts

Data privacy and protection

- Government agencies issue Instruction Manuals (IMs) outlining IT security standards, regulations, and codes of practice which must be followed, and regular evaluations are also mandatory
- In 2012, Singapore passed a special law on data protection called the Personal Data Protection Act, which also regulates telemarketing
- Government agencies act in line with the Internal Securities Department Greenbook, which includes cybersecurity best practices
- The government uses internationally-recognized cybersecurity standards when formulating its security policies and standards

Emerging technologies

- In 2017, Singapore joined the Unmanned Aircraft Systems Advisory Group, which formulates international and other regulations on the safe use of drones and other unmanned aircraft

- MAS had planned to exclude cryptocurrency from its regulations, but in 2014 announced that intermediaries would fall under MAS regulations in cases of terrorism, money laundering, and taxation issues
- The Infocomm Media Development Authority (IMDA), in cooperation with international experts, required that stakeholders (including government and industry partners) participate in order to set up a joint regulatory structure for AI ecosystems

Public awareness programs

- The National Infocomm Competency Framework (NICF) created by the Infocomm Media Development Authority (IMDA) serves as a national roadmap defining ICT skills requirements as a reference for human resource management of ICT professionals
- The purpose of the National Cybersecurity Masterplan 2018 was to raise awareness and adopt best practices
- The Cyber Security Awareness Alliance overseen by the Infocomm Media Development Authority (IMDA) frequently holds campaign events and puts out cyber news and security alerts
- The Association of Information Security Professionals (AISP) plans seminars and events to promote information-sharing among professionals

Training and certification programs

- The National University of Singapore (NUS) offers executive courses, seminars, and testing on cybersecurity
- COMAT and other private technology groups offer globally-recognized cybersecurity training and certification programs such as CISSP and the SANS series
- The Critical Infocomm Technology Resource Programme (CITREP) established by the IMDA provides grants to help local ICT professionals earn certification
- Like the IMDA, the National Research Foundation (NRF) provides scholarships to graduate students in cybersecurity

National partnerships

- National Infocomm Security Committee (NISC): NISC is a platform that deliberates on national cybersecurity policy, shares information, and plans activities implemented via cross-organizational partnerships. It mobilizes senior leadership from stakeholders in related public-sector agencies
- Partnership for Cybersecurity Awareness: This is a national cooperative organization made up of representatives from government agencies, companies, industry groups and engaged primarily in raising awareness and sharing best practices. It is co-chaired by the Cyber Security Agency of Singapore

International cooperation

- ASEAN CERT Incident Drill (ACID): ACID is a cyber incident drill that Singapore has led every year since 2006. Every ASEAN member state CERT participates

- Forum of Incident Response and Security Teams (FIRST): An international nonprofit organization that primarily engages in joint cybersecurity tasks and coordination among various government agencies and organizations

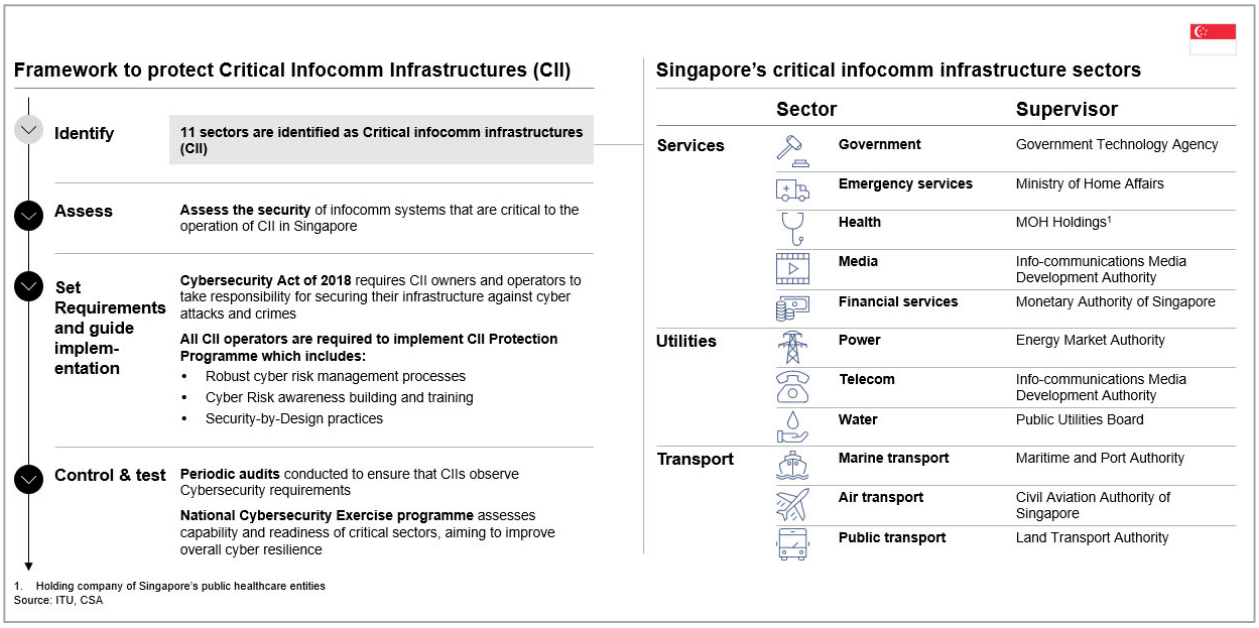


Figure 250. Singapore's critical infrastructure industry activities

The team also conducted benchmark analyses for countries outside of Singapore. The results are given below.

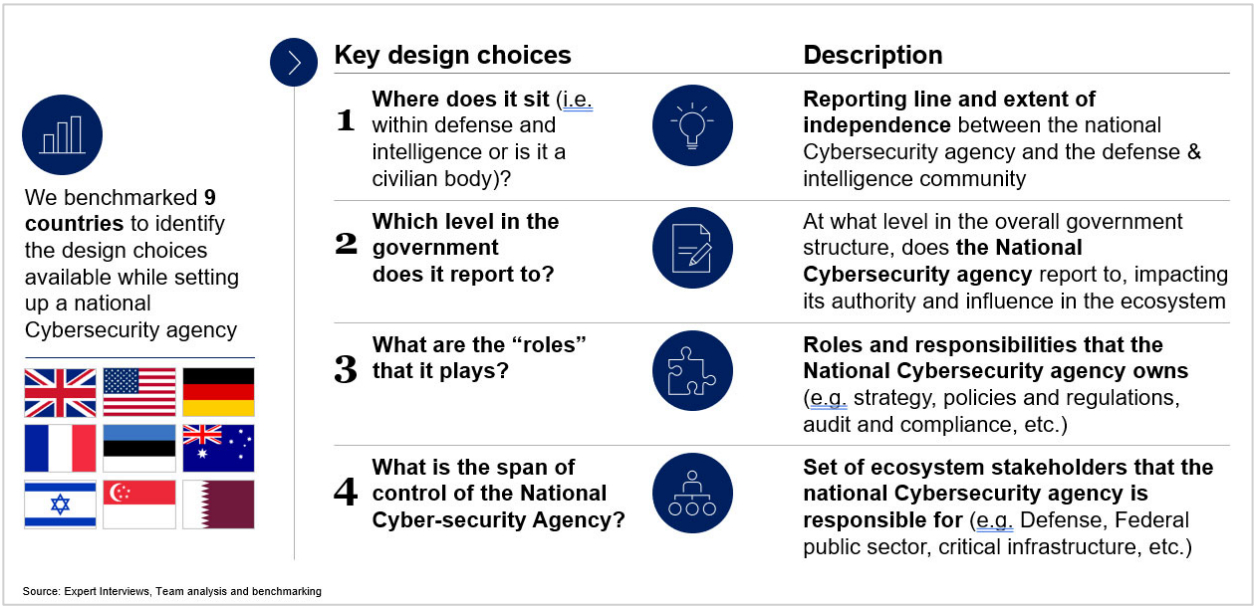


Figure 251. Design choices to be considered when establishing a national cybersecurity organization

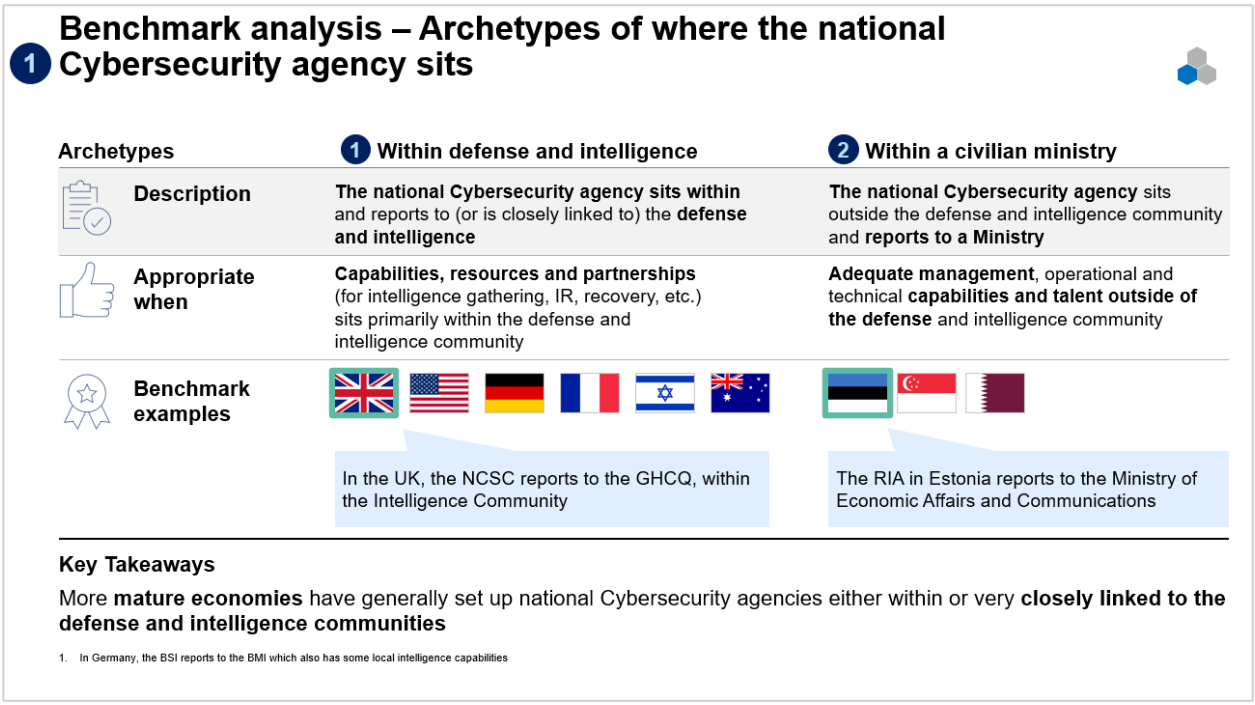


Figure 252. Archetypes of where the national cybersecurity agency sits

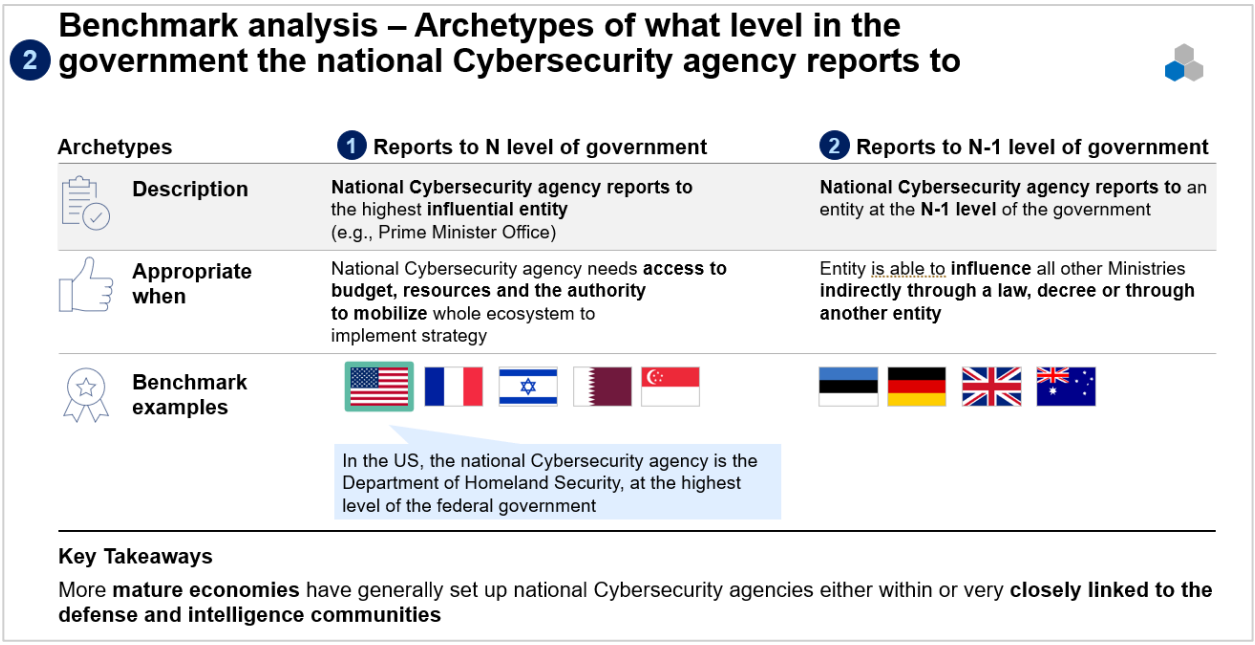


Figure 253. Archetypes of what level in the government the national Cybersecurity agency reports to

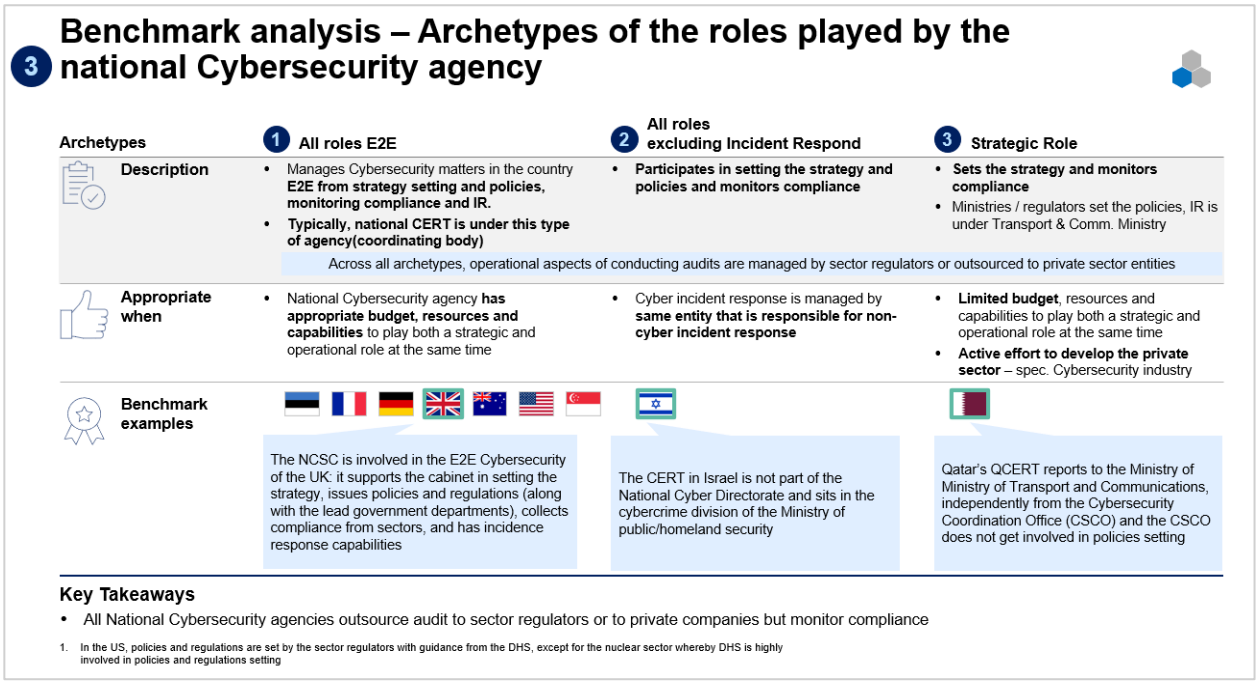


Figure 254. Archetypes of the roles played by the national Cybersecurity agency

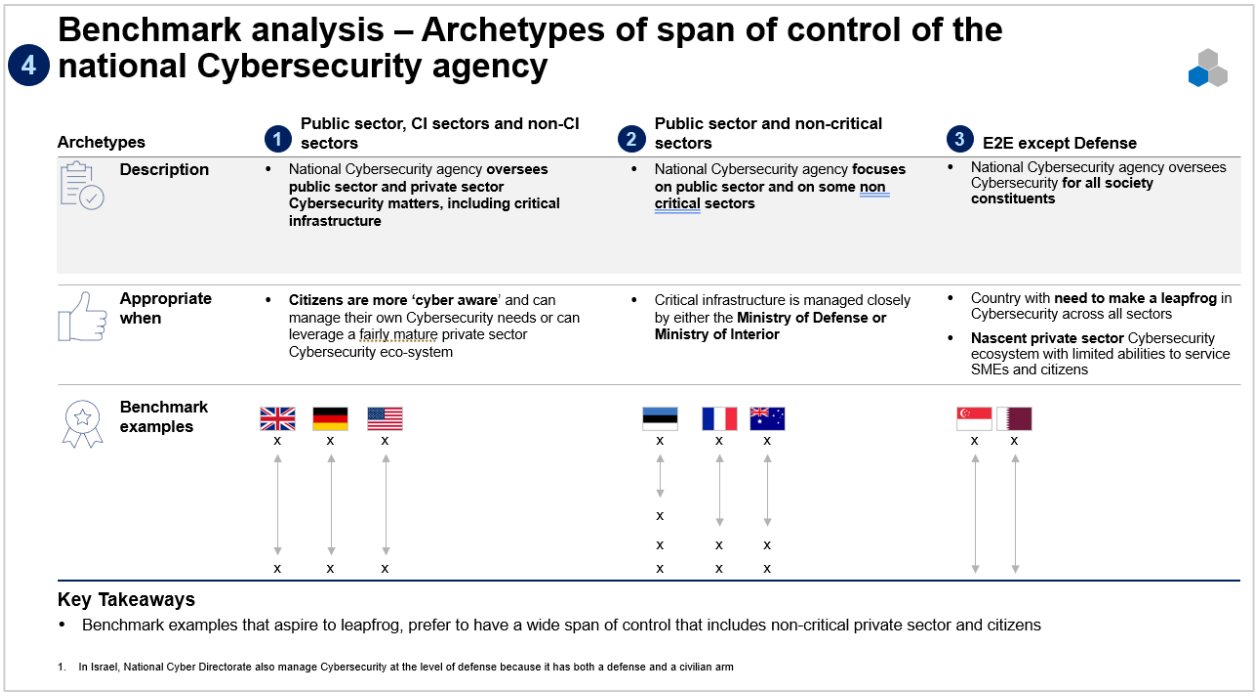


Figure 255. Archetypes of span of control of the national Cybersecurity agency

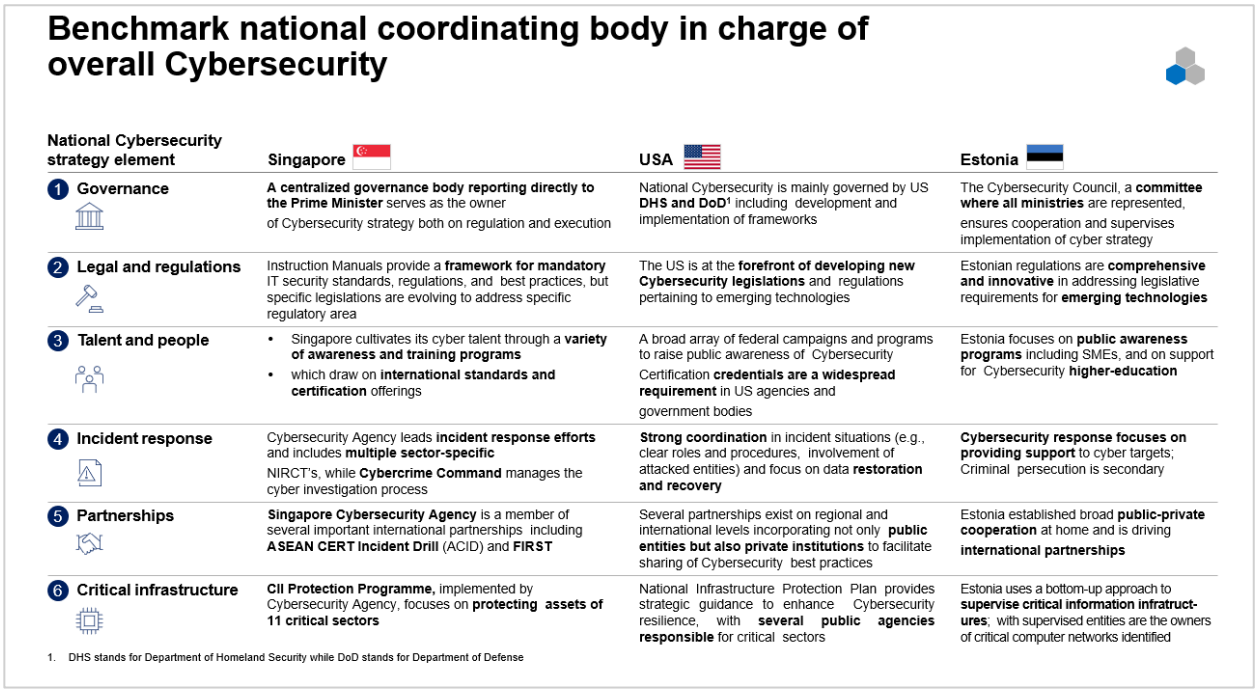


Figure 256. Benchmark national coordinating body in charge of overall Cybersecurity

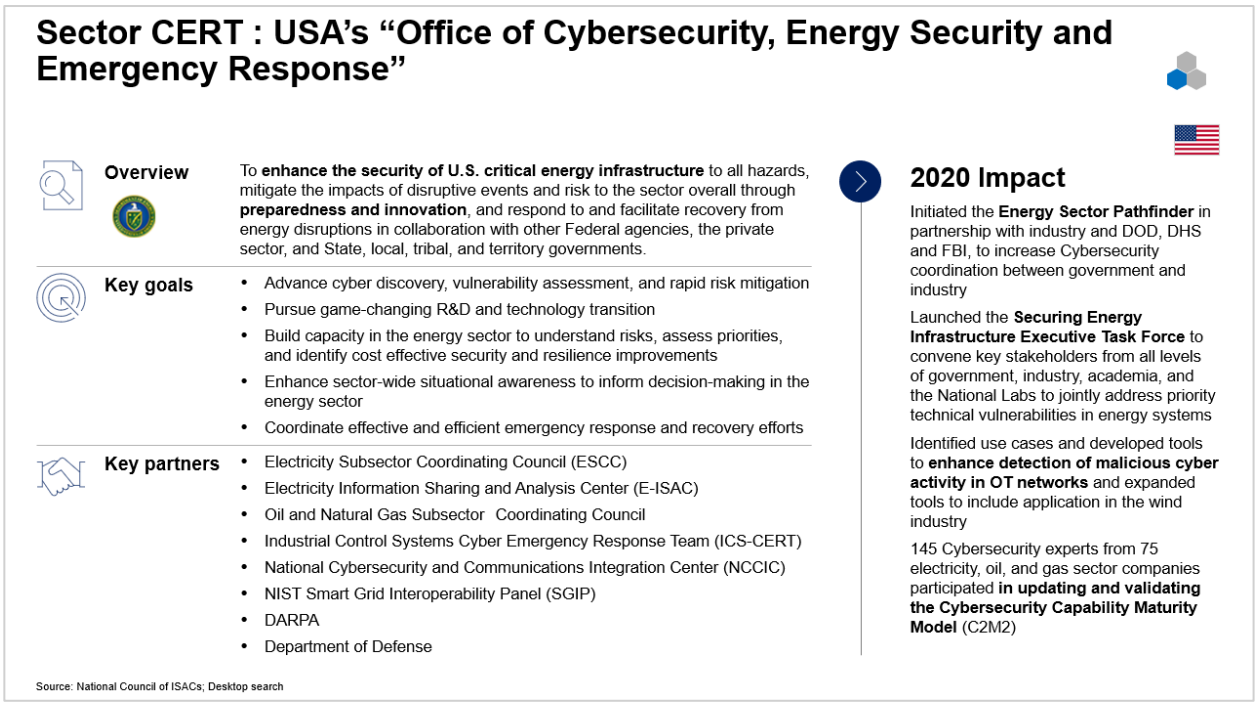


Figure 257. Examples of sector CERTs

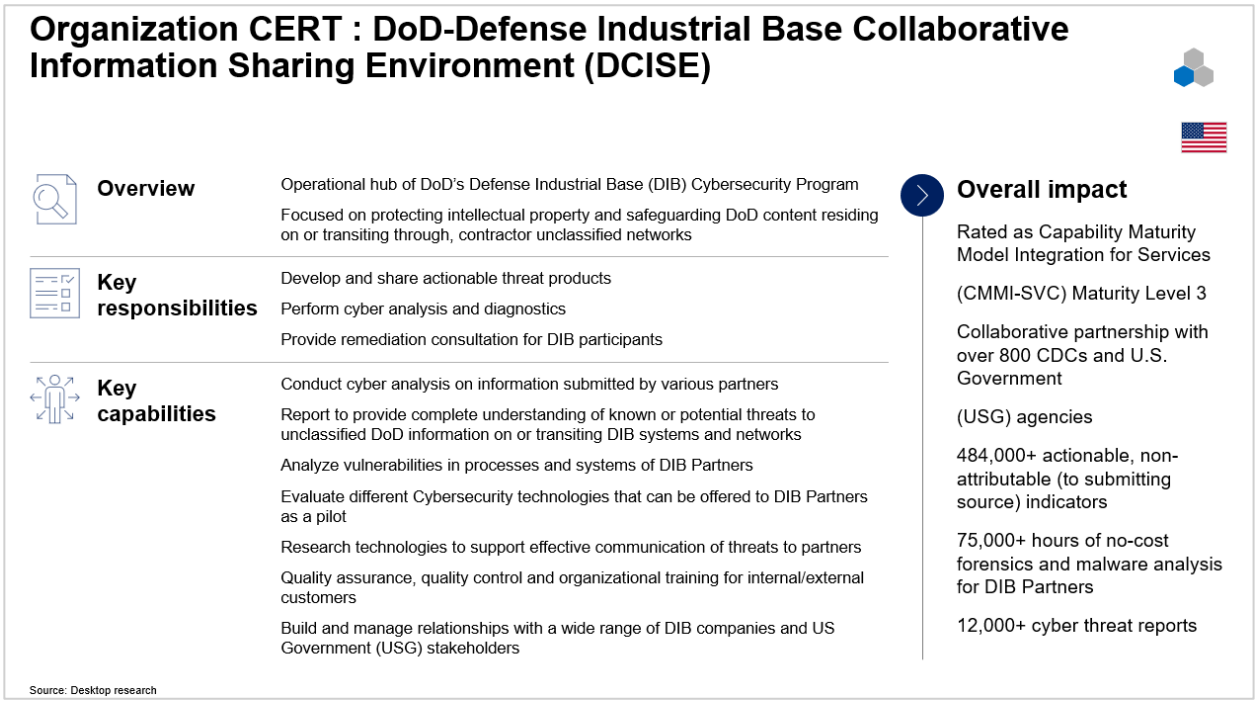


Figure 258. Examples of organization CERTs

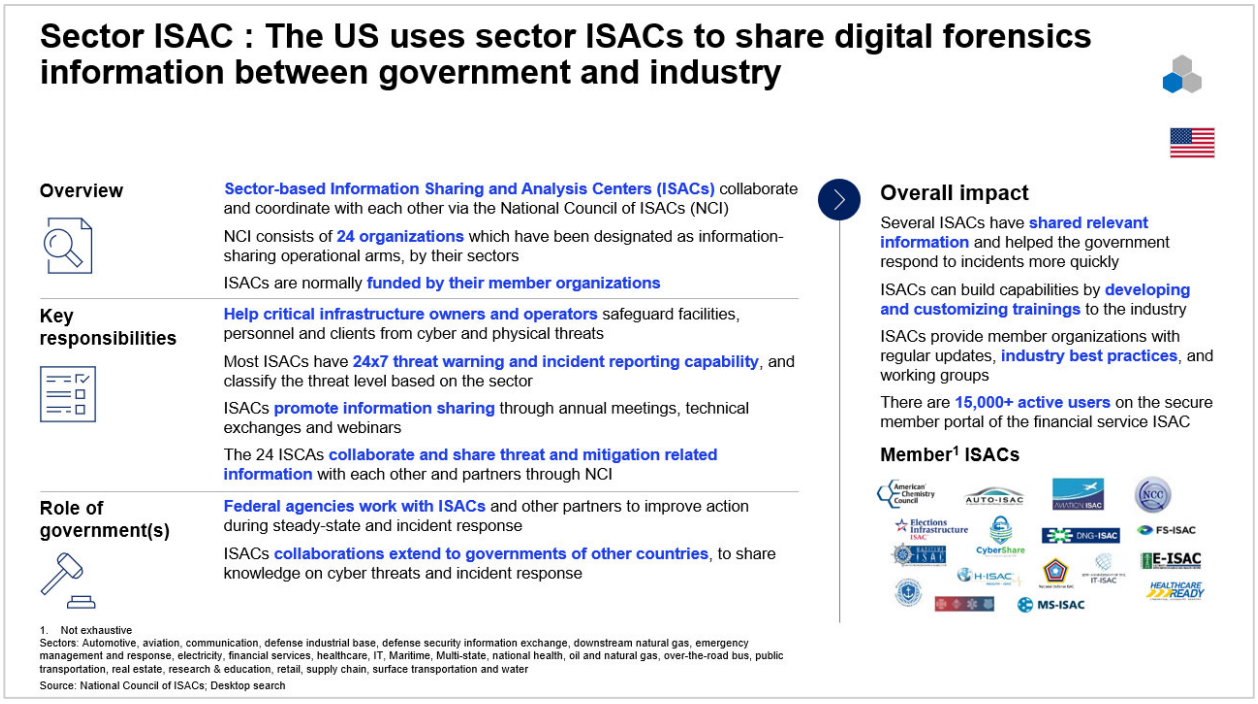


Figure 259. Examples of sector ISACs

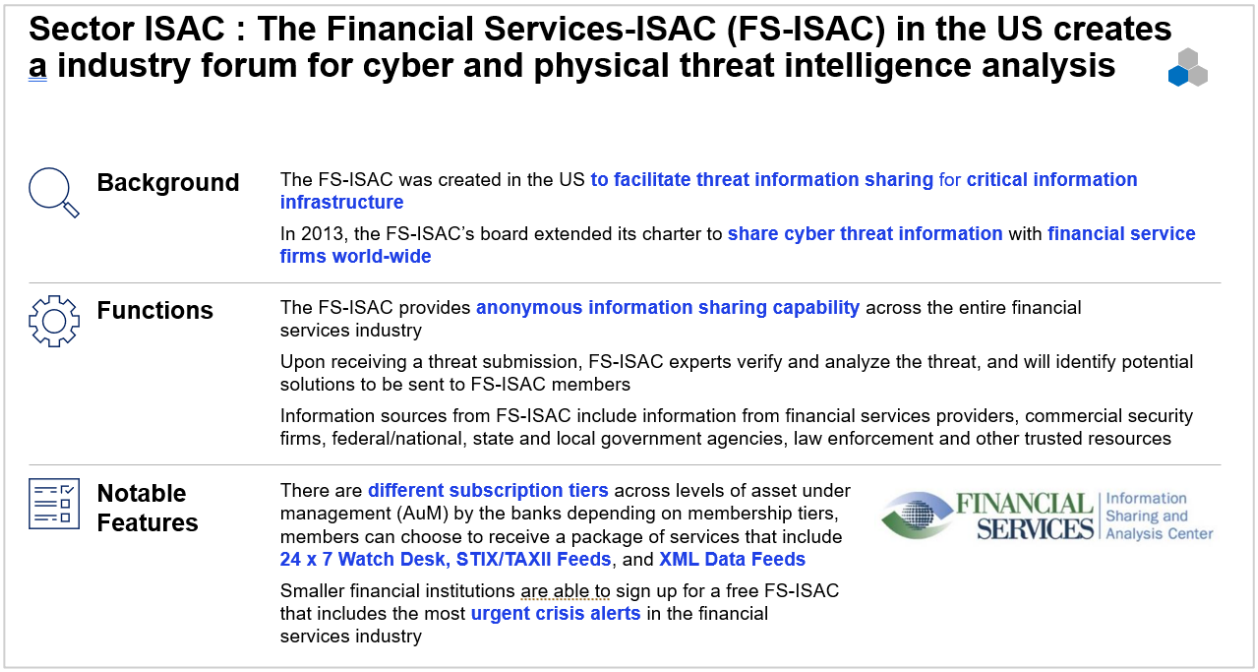


Figure 260. Examples of sector ISACs

3.6.3 Recent trends in cybersecurity

Cybercrime has a long history, and has been around since the invention of computers themselves. But the ingenuity of cybercrime tactics and their impact continue to increase. The threat of cyberattacks has increased over the last few years in particular, making it imperative that both private companies and government agencies address them as quickly as possible.

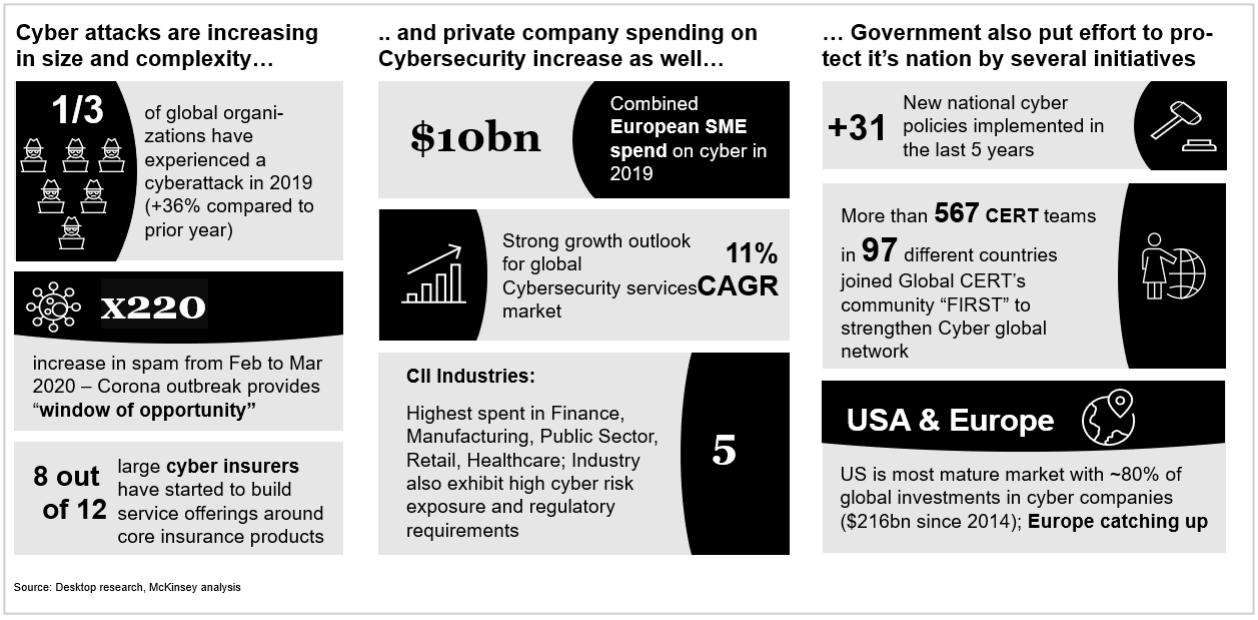


Figure 261. Global trends in cybersecurity

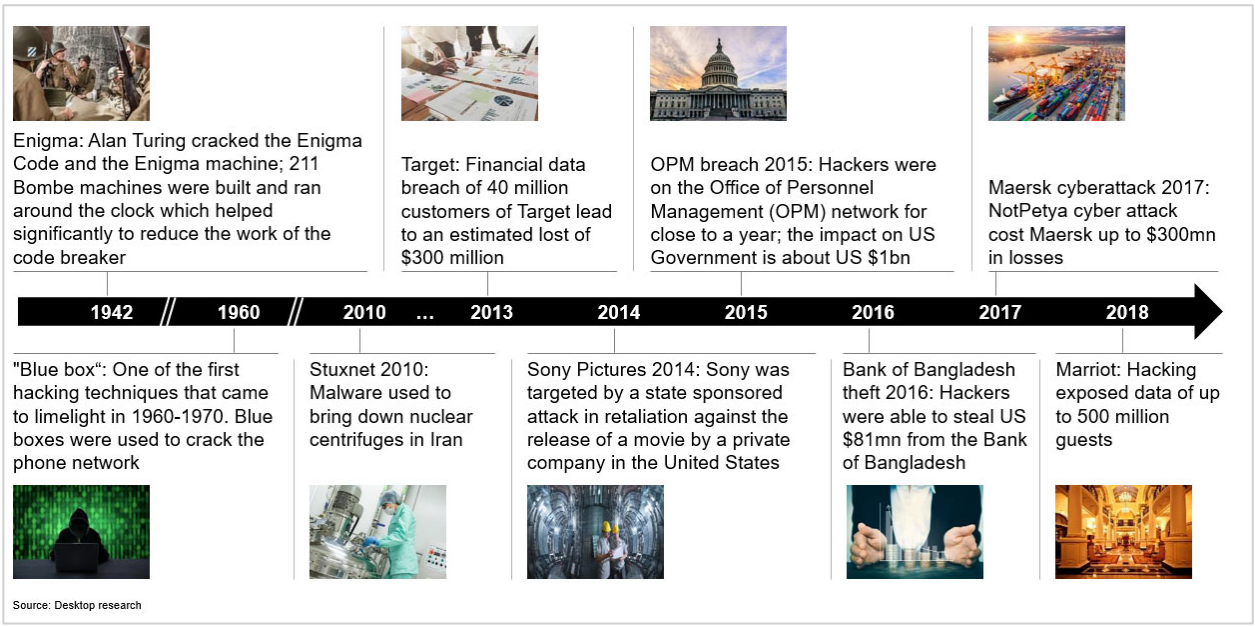


Figure 262. Cyberattacks over the years

Cyberattacks come in two basic types: indiscriminate and targeted. Phishing and ransomware are examples of indiscriminate attacks, while spearfishing and zero-day exploits are examples of targeted attacks. These kinds of attacks are now being carried out worldwide, impacting people in every country. The total damage is estimated at between 1.0 and 1.6% of global GDP.

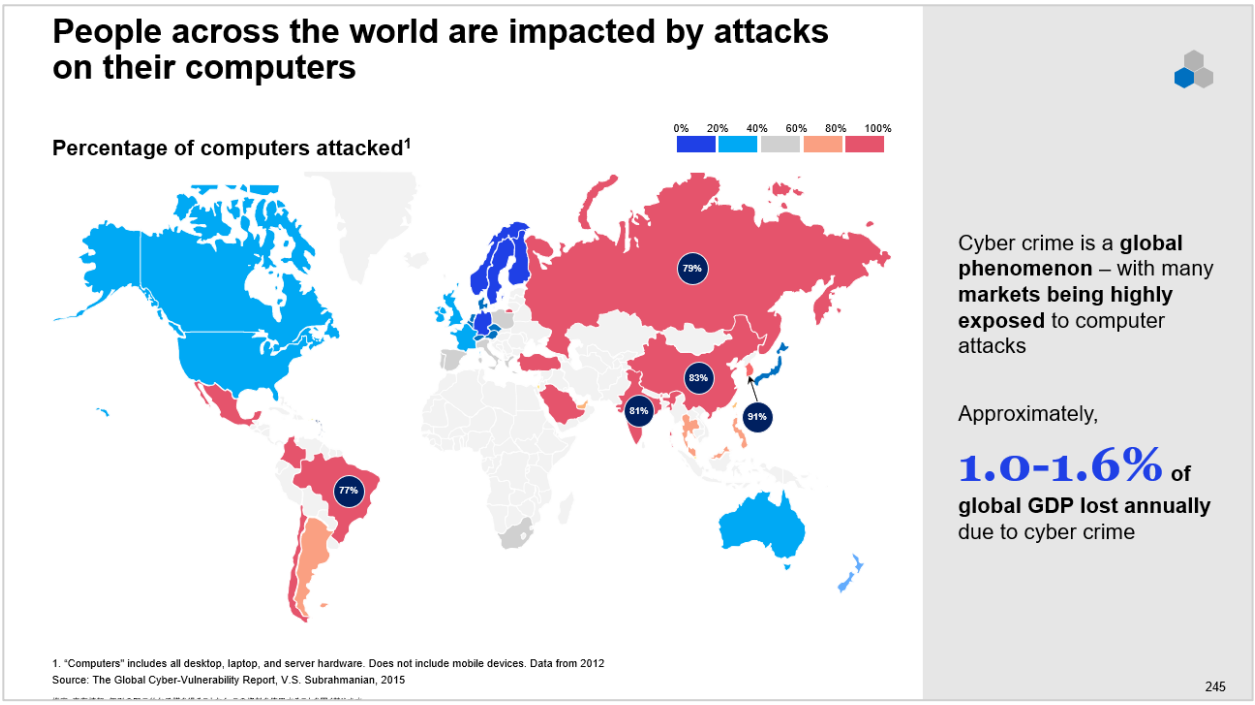


Figure 263. Percentage of computers attacked by region

3.6.4 Overview of general-purpose cybersecurity organizations (National Coordination body, CERT, ISAC)

Generally speaking, there are three types of organizations that play a critical role in enhancing a country's cybersecurity: a national coordination body, a cyber emergency response team (CERT) and an information-sharing and analysis center (ISAC).

National coordination bodies primarily handle legislation, interagency regulation, and the promotion of industrial-government-academic partnerships. They have a relatively high level of freedom when it comes to reporting lines and roles, and are positioned differently in each country depending on the status of cybersecurity initiatives there. The organization in Japan that corresponds to this role is the National Center of Incident Readiness and Strategy for Cybersecurity (NISC), which was established under the Cabinet Secretariat in 2015. In Singapore, national coordination body functions are handled by the Cyber Security Agency of Singapore (CSA), established under the Ministry of Communications and Information in 2015.

National CERTs, on the other hand, specialize in national and economic security as well as the protection of government and critical infrastructure. Typical roles include detecting and analyzing cyberthreats, sharing incident information with CERTs in other countries, and carrying out educational activities. In addition to national CERTs, there are also regional CERTs that focus on specific areas and private-sector CERTs for individual companies. Still, the priority should be setting up a national CERT designed to handle cybersecurity measures for the country as a whole. In Cambodia, CamCERT (under the jurisdiction of the MPTC), plays the role of national CERT. In Mongolia, MNCERT/CC handles some of functions associated with sharing incident information with other countries.

Finally, the purpose of information-sharing and analysis centers, or ISACs, is to shore up cybersecurity vulnerabilities in specific industrial sectors--so these organizations are set up to analyze cyberthreats and then share information and promote collaboration within those industries. ISACs are typically set up as independent arms of industrial groups during the process of establishing public-private partnerships. In some cases, government agencies will assist the formation of ISACs as part of national policy in industries defined as critical infrastructure, such as finance or energy.

3 types of organization typically required to deliver Cybersecurity

	1 National coordinating body	2 National/ Government CERT	3 ISAC
Mission	Often in charge of overall national Cybersecurity coordination, focal point in **coordinating legitimation, intra-government collaboration and promoting partnerships between industry, academia, and public and private sectors**	The main goal is **to protect national and economic security, the ongoing operations of a government, and the ability of critical infrastructures to continue to function**	The main mission is to **enhance the ability of the sector to prepare for and respond to cyber threats, vulnerabilities and incidents,** by providing a centralized organization to monitor, disseminate information, and help mitigate Cybersecurity risks and provide protection
Scope of work	**National coordination; national defense and response.** Typically, acts to coordinate various aspects of national Cybersecurity, cybercrime and cyberattack mitigation efforts, through cooperation with civilian agencies, national CERT, infrastructure operators, state and local governments, and international partners. It's also responsible for facilitation and execution **national Cybersecurity strategy and policy**	The mandatory/core activity includes **incident handling, analysis and reporting** (subsumed under Incident Management). Additionally, it is advisable that CERTs provide **security related information on alerts and warnings and announcements** in immediate cases of upcoming threats or other emergencies, and **good user practice to building awareness** for adding measurable value for the constituency	There are four major capabilities of an ISAC: **Vulnerability and Incident Information Sharing, Threat Analysis, Relationships and Possible Cross-Sector Partnerships, Cybersecurity Training.** As their primary function, all ISACs have a process in place for **gathering and disseminating information to mitigate risks to particular industry sectors.** Advanced ISACs may provide incident response through the use of "incident response teams"
Typical Name	**No typical name;** (i.e.) National Cybersecurity councils/ National Cybersecurity and Communications Integration Center	**CERT**- Computer Emergency Readiness Team **CSIRT**- Computer Security Incident Response Team	Mostly sector acronym followed by **"ISAC"**
Examples	NISC, CSA SINGAPORE	SingCERT, JPCERT/CC, US-CERT	FINANCIAL SERVICES, OT-ISAC

Figure 264. The three types of cybersecurity organizations

3.6.5 Overview of cybersecurity assistance from other donors

The survey team also looked at cybersecurity assistance measures being carried out by other donors. Assistance primarily targets human resource development, cybercrime countermeasures, and strengthening policy. The survey revealed that the most active were initiatives to combat cybercrime. Those led by the Korea International Cooperation Agency (KOICA) have been particularly notable in recent years. In 2015, for example, the Korean National Police University (KNPU) held discussions and conducted professional training for the governments of the Philippines, Vietnam, Indonesia, and Cambodia to help them improve their cyber investigation capabilities.

Number of "cyber" related projects by main donors since 2016

Category	① Capacity and Capability building	② Investigation, crime, police and terrorism	③ Policy and infrastructure	Total
KOICA	8	18	1	**27**
WBG	6	0	4	**11**
NATO	1	7	0	**9**
IDB	1	3	2	**6**
USAID	3	0	1	**4**
UNDP	1	1	0	**2**
ADB	0	1	0	**1**
IFC	0	0	1	**1**
UN	0	1	0	**1**
Total	**21**	**32**	**9**	**60**

Source: Website of each donor institute

Figure 265. Number of cyber-related projects by main donors since 2016

Summary

KOICA and KNPU organized a special training program at KNPU to strengthen the capacity of ASEAN countries' policy makers in the cyber-security sector on cyber-security related investigation and cyber policing

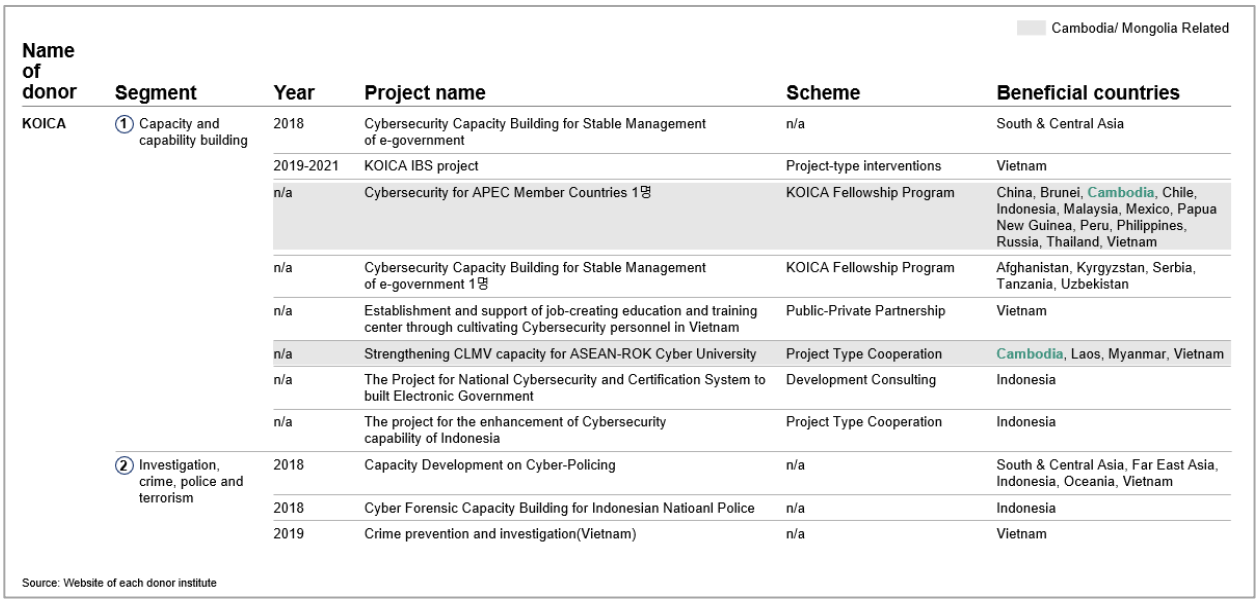
Key Initiative

The training program at KNPU to strengthen the capacity of ASEAN countries' **policy makers in the cyber-security sector on cyber-security related investigation and cyber policing.** The training was consisted of various subjects including **data protection and privacy, information security policy, comparative analysis on national Cybersecurity strategy, cyber incident response, understanding cybercrime and digital forensics.** Personnel from police agencies and government entities relevant to ICT(Cybersecurity) visited Korea Internet and Security Agency, Gangnam CCTV control center to grasp Cybersecurity management and local policing in Korea. They also had a chance to attend the Korea Police World Expo 2019

Details

Date	Oct. 2019
Fund	n/a
Countries	Philippines, Laos, and Cambodia
C/P	Police agencies, Government entities related to ICT(Cybersecurity)
Training institution	Korean National Police University (KNPU)

Figure 266. KOICA: Cyber-policing capacity-building (Asia)



Cambodia/ Mongolia Related

Name of donor	Segment	Year	Project name	Scheme	Beneficial countries
KOICA	① Capacity and capability building	2018	Cybersecurity Capacity Building for Stable Management of e-government	n/a	South & Central Asia
		2019-2021	KOICA IBS project	Project-type interventions	Vietnam
		n/a	Cybersecurity for APEC Member Countries 1명	KOICA Fellowship Program	China, Brunei, Cambodia, Chile, Indonesia, Malaysia, Mexico, Papua New Guinea, Peru, Philippines, Russia, Thailand, Vietnam
		n/a	Cybersecurity Capacity Building for Stable Management of e-government 1명	KOICA Fellowship Program	Afghanistan, Kyrgyzstan, Serbia, Tanzania, Uzbekistan
		n/a	Establishment and support of job-creating education and training center through cultivating Cybersecurity personnel in Vietnam	Public-Private Partnership	Vietnam
		n/a	Strengthening CLMV capacity for ASEAN-ROK Cyber University	Project Type Cooperation	Cambodia, Laos, Myanmar, Vietnam
		n/a	The Project for National Cybersecurity and Certification System to built Electronic Government	Development Consulting	Indonesia
		n/a	The project for the enhancement of Cybersecurity capability of Indonesia	Project Type Cooperation	Indonesia
	② Investigation, crime, police and terrorism	2018	Capacity Development on Cyber-Policing	n/a	South & Central Asia, Far East Asia, Indonesia, Oceania, Vietnam
		2018	Cyber Forensic Capacity Building for Indonesian Natioanl Police	n/a	Indonesia
		2019	Crime prevention and investigation(Vietnam)	n/a	Vietnam

Source: Website of each donor institute

Figure 267. Cybersecurity related assistance menu if international donor (1/7)

Cambodia/ Mongolia Related

Name of donor	Segment	Year	Project name	Scheme	Beneficial countries
KOICA	② Investigation, crime, police and terrorism	n/a	Bangladesh Cybercrime Investigation 15명	KOICA Fellowship Program	Bangladesh
		n/a	Capacity Building of Investigation, crime, police and terrorism by IT (Indonesia)	KOICA Fellowship Program	Indonesia
		n/a	Capacity Development on Cyber-Policing 1명	KOICA Fellowship Program	Bhutan, Bangladesh, Fiji, India, Indonesia, Mongolia, Nepal, Pakistan, Philippines, Sri Lanka, Vietnam
		n/a	Cyber Crime 2명	Experts	Malaysia, Vietnam
		n/a	Investigation, crime, police and terrorism	KOICA Fellowship Program	Tanzania, Belarus, Belarus, Cambodia, Colombia, Cote d'Ivoire, Ecuador, Ecuador, Jordan, Kenya, Mongolia, Myanmar, Panama, Panama, Peru, Suriname, Trinidad and Tobago, Uganda, Ukraine, Ukraine, Vietnam, Yemen, Yemen
		n/a	Cyber Crime Prevention - Corruption Control (Tanzania) 15명	KOICA Fellowship Program	Tanzania
		n/a	Cyber Policing capacity Building(Asia)	KOICA Fellowship Program	Indonesia, Cambodia, Philippines, Vietnam
		n/a	Cybersecurity and Policing (Colombia)	KOICA Fellowship Program	Colombia
		n/a	Cyberspace and Terrorism-Common Response for Cybersecurity 1명	KOICA Fellowship Program	Cambodia, China, Indonesia, Laos, Malaysia, Mongolia, Pakistan, Papua New Guinea, Peru, Philippines, Thailand, Vietnam

Source: Website of each donor institute

Figure 268. Cybersecurity related assistance menu if international donor (2/7)

Cambodia/ Mongolia Related

Name of donor	Segment	Year	Project name	Scheme	Beneficial countries
KOICA	② Investigation, crime, police and terrorism	n/a	High tech crimes(scientific investigation including cyber etc.) investigation technique 1명	KOICA Fellowship Program	Nepal, Azerbaijan, Egypt, Fiji, India, Kenya, Kyrgyzstan, Serbia, Tanzania, Uzbekistan
		n/a	Improving Capacity of Investigators on the fight against cybercrime (Tunisia)	KOICA Fellowship Program	Tunisia
		n/a	Investigation of Cyber Crime	KOICA Fellowship Program	Indonesia, Bangladesh, Bolivia, Cambodia, Cameroon, Colombia, Congo, Cote d'Ivoire, Dominican Republic, Egypt, Egypt, El Salvador, Ethiopia, Indonesia, Jamaica, Jordan, Lebanon, Maldives, Mongolia, Nepal, Nigeria, Philippines, Rwanda, Sri Lanka, Thailand, Ukraine, Yemen, Zambia, Zimbabwe
		n/a	Prevention and Investigation of Cyber Crime (Morocco)	KOICA Fellowship Program	Morocco
		n/a	SAARC Special Training Program - Investigation, crime, police and terrorism	KOICA Fellowship Program	India, Afghanistan, Bangladesh, Bhutan, Maldives, Nepal, Pakistan, Sri Lanka
		n/a	The Project for Enhancing Investigation, crime, police and terrorism Capability of Bangladesh	Project Type Cooperation	Bangladesh
	③ Policy and infrastructure	n/a	Capacity Building on the Development of National Cyber-security Policy in the ASEAN Countries 1명	KOICA Fellowship Program	Indonesia, Laos, Malaysia, Myanmar, Philippines, Thailand, Vietnam, Cambodia

Source: Website of each donor institute

Figure 269. Cybersecurity related assistance menu if international donor (3/7)

Cambodia/ Mongolia Related

Name of donor	Segment	Year	Project name	Scheme	Beneficial countries
WBG	① Capacity and capability building	2020	Bangladesh: Enhancing Digital Government & Economy Project	n/a	Bangladesh
		2019-2025	Enhancing Digital Government & Economy Project	Project-type interventions	Bangladesh
		2021-2026	Caribbean Digital Transformation Project	Project-type interventions	Dominica, Grenada, Organisation of Eastern Caribbean States (OECS), Saint Lucia, Saint Vincent and the Grenadines
		n/a	Mongolia Digital Transformation Project	n/a	Mongolia
		n/a	Afghanistan Digital CASA 1 Project	n/a	Afghanistan
		n/a	Burkina-Faso eGovernment Project	n/a	Burkina Faso
	③ Policy and infrastructure	2020	MM: Digital Government Project	Project-type interventions	Myanmar
		2019-2024	Tonga Digital Government Support Project	Project-type interventions	Tonga
		n/a	Digital Malawi Program Phase I: Malawi Digital Foundations Project	n/a	Malawi
		n/a	Nigeria Digital Identification for Development Project	n/a	Nigeria

Source: Website of each donor institute

Figure 270. Cybersecurity related assistance menu if international donor (4/7)

Cambodia/ Mongolia Related

Name of donor	Segment	Year	Project name	Scheme	Beneficial countries
NATO	① Capacity and capability building	2012-Present	Individual Partnership and Cooperation Programme	Project-type interventions	Republic of Korea, Japan
	③ Investigation, crime, police and terrorism	2012	Bolster the cyber defence capacity of Mongolia	n/a	Mongolia
		1993-Present	NATO Science for Peace and Security (SPS) Programme	Project-type interventions	Kyrgyz Republic, The Republic of Moldova
		1995-Present	NATO Science for Peace and Security (SPS) Programme	Project-type interventions	Azerbaijan
		2008-Present	NATO Science for Peace and Security (SPS) Programme	Project-type interventions	Malta
		2014-Present	Trust Fund on Cyber Defence for Ukraine	Contributions to specific-purpose programmes and funds managed by implementing partners	Ukraine
		2017-Present	NATO Cooperative Cyber Defence Centre of Excellence	Project-type interventions	Finland
		2017-2020	Cybersecurity Centre to improve the Cybersecurity posture of the Mongolian Ministry of Defence (MoD) and the General Staff of the Mongolian Armed Forces (GSMAF)	Project-type interventions	Mongolia

Source: Website of each donor institute

Figure 271. Cybersecurity related assistance menu if international donor (5/7)

Cambodia/ Mongolia Related

Name of donor	Segment	Year	Project name	Scheme	Beneficial countries
IDB	① Capacity and capability building	n/a	Strengthening Cybersecurity in Uruguay	Reform / Modernization Of The State	Uruguay
	③ Investigation, crime, police and terrorism	n/a	Support the Chilean Police Reform	Reform / Modernization Of The State	Chile
		n/a	Program to Strengthen the Strategic Management of Public Security in Chile	Social Investment	Chile
		n/a	Strengthening the Strategic Management of Public Security in Chile	Reform / Modernization Of The State	Chile
	③ Policy and infrastructure	n/a	Support to the Digital Transformation and Social Inclusion in Mexico	Reform / Modernization Of The State	Mexico
		n/a	Diagnosis and development of broadband and cyber-security plans	Science And Technology	Paraguay
USAID	① Capacity and capability building	2018	Department of Energy, Development of Technical Assistance Programs - Grid Cybersecurity	n/a	Georgia
		2019	U.S. Department of State: Bureau of European and Eurasian Affairs (EUR) - Multi-sector - Unspecified: CRDF Ukraine Cybersecurity	n/a	Ukraine
		2020	Cybersecurity Strengthening Activity	n/a	Ukraine
	③ Policy and infrastructure	2020	USAID Information Assurance (IA) Cybersecurity	n/a	Egypt

Source: Website of each donor institute

Figure 272. Cybersecurity related assistance menu if international donor (6/7)

Cambodia/ Mongolia Related

Name of donor	Segment	Year	Project name	Scheme	Beneficial countries
UNDP	① Capacity and capability building	n/a	Kyrgyzstan Electoral Support Programme	n/a	Kyrgyzstan
	② Investigation, crime, police and terrorism	n/a	Kyrgyz Election Support Project II	n/a	Kyrgyzstan, Kosovo
ADB	② Investigation, crime, police and terrorism	2017	Pacific Information and Communication Technology Investment Planning and Capacity Development Facility- Phase 2	Other technical assistance	Cook Islands, Marshall Islands, Palau, Tonga, Vanuatu
IFC	③ Policy and infrastructure	2017-Present	pi Ventures Investment Trust	Contributions to specific-purpose programmes and funds managed by implementing partners	India
UN	② Investigation, crime, police and terrorism	2017-2021	Kosovo Safety And Security Programme	Project-type interventions	Norway

Source: Website of each donor institute

Figure 273. Cybersecurity related assistance menu if international donor (7/7)

3.6.6 Identifying cybersecurity startups (Cambodia/Mongolia)

One of the ways to measure cybersecurity maturity in a country is to look at the maturity if its cybersecurity industry, so the team studied cybersecurity startups in each country as potential local resources to implement cybersecurity assistance measures. After analyzing company databases in the target countries and reviewing the websites of the potential candidates to determine the cybersecurity services provided by each one, the team identified eight cybersecurity startups in Cambodia and nine in Mongolia. Given the number of cybersecurity startups in Thailand and the Philippines, these results confirmed the lack

of maturity in the cybersecurity industry in the target countries. It is hoped that the companies can be used as local resources in downstream processes, including cyber protection and other cyber measures.

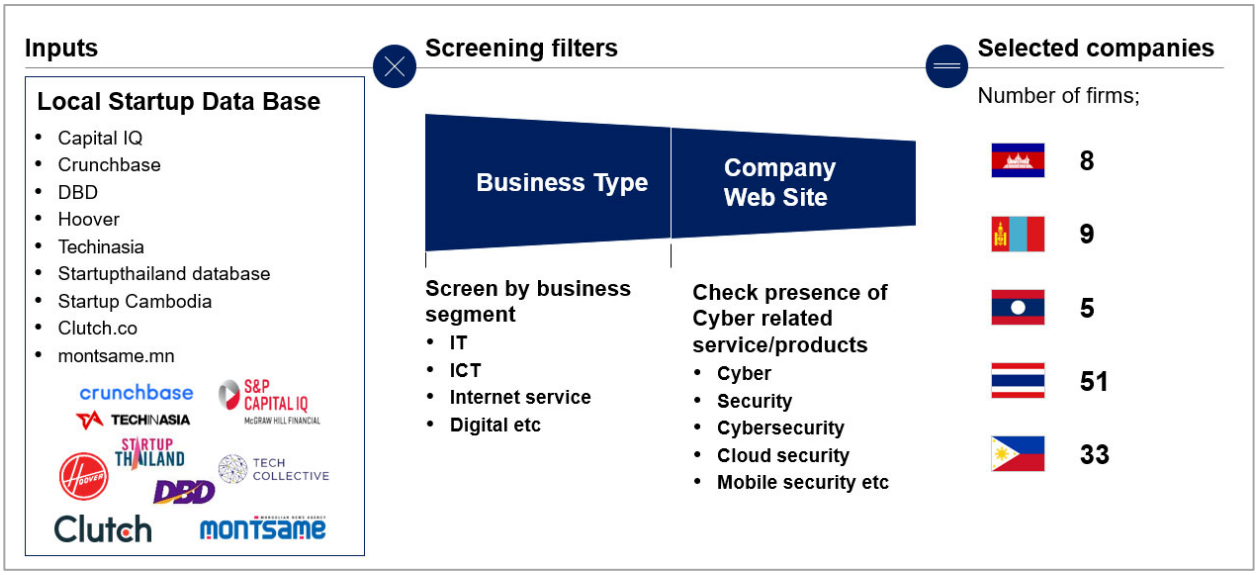


Figure 274. How cybersecurity startups were identified

3.6.7 Local resource candidates in the cybersecurity sector (Cambodia/Mongolia)

In addition to the local startups that could potentially implement cybersecurity assistance measures on the ground, the team also studied additional local resources that might assist Cambodia and Mongolia, including companies with their headquarters located overseas. These companies could be candidates for getting involved in the strategic aspects of assistance farther upstream, including national cybersecurity policy. The team reached out directly to ICT companies listed as having a presence in the target countries and then met with the ones that provided cybersecurity services. They then listed as candidates only those who had an interest in providing those services in Cambodia and/or Mongolia.

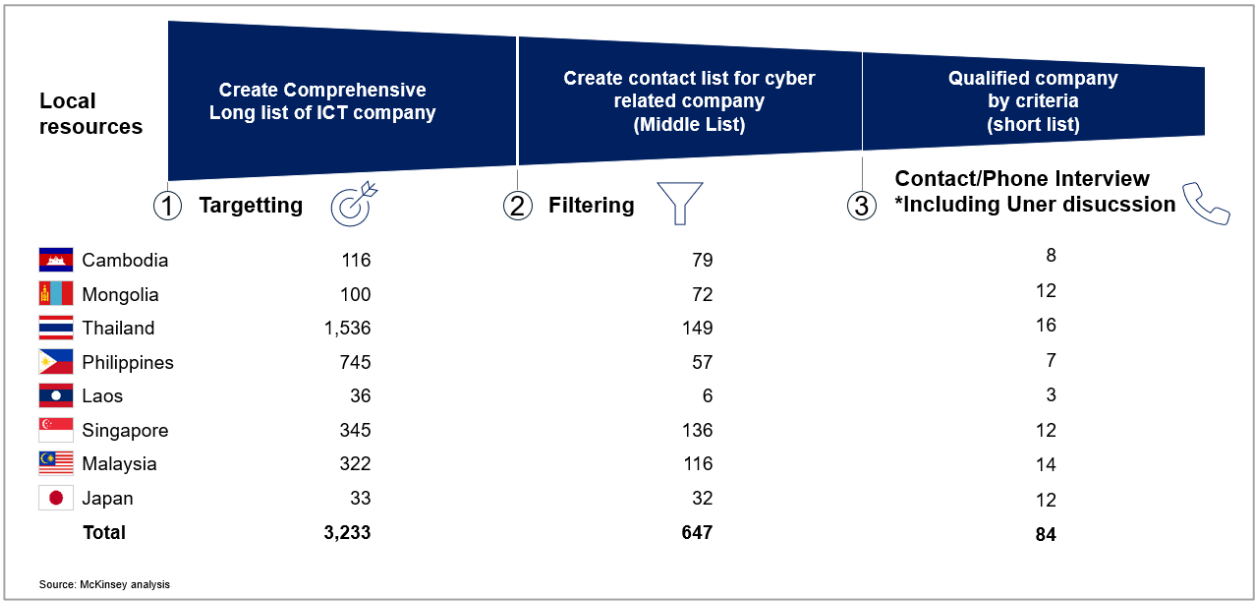


Figure 275. How local cybersecurity resources were identified

Japan	Singapore	Malaysia	Thailand
Accenture	Accenture	Accenture	Accenture
Boston Consulting Group (BCG)	Bain & Co.	Boston Consulting Group (BCG)	Atos
Deloitte	Boston Consulting Group (BCG)	Capgemini	Bain & Co.
DXC Technology	Capgemini	Chinasoft International	BDO
EY	Cognizant	Cognizant	Boston Consulting Group (BCG)
FPT	Deloitte	Deloitte	Deloitte
Fujitsu	DXC Technology	DXC Technology	DXC Technology
Hitachi	EY	EY	EY
IBM	FPT	FPT	**Fujitsu**
ISID	HCL Technologies	**Fuji Xerox**	HCL Technologies
Itochu Techno-Solutions	**Hitachi**	Grant Thornton	**Hitachi**
KPMG	IBM	HCL Technologies	HPE
McKinsey	Kearney	IBM	IBM
NEC	KPMG	Indra	**ISID**
Nomura Research Institute	McKinsey	KPMG	KPMG
NS Solutions	**NTT DATA**	McKinsey	McKinsey
NTT Communications	**NTT Ltd**	Microsoft	Microsoft
NTT DATA	Oliver Wyman	**NEC**	**NS Solutions**
PwC	PwC	**NTT DATA**	**NTT DATA**
SCSK	Samsung SDS	**NTT Ltd**	**NTT Ltd**
Tata Consultancy Services	Singtel	PSI AG	RSM
TIS Inc.	ST Engineering	PwC	Samsung SDS
	Tata Consultancy Services	Samsung SDS	**TIS Inc.**
	Tech Mahindra	Tata Consultancy Services	Wipro
	Wipro		

X Japanese HQ

Source: Desktop research

Figure 276. Professional service company for more upstream strategic work (1/2)

Cambodia	Laos	Mongolia	Philippines X Japanese HQ
Asian Vision institute	CIT Co., Ltd	BDO Mongolia LLC	Accenture Philippines
BDO (Cambodia) Limited	Cognizant Technology Solutions	Boston International Strategies LLC	CIT Co., Ltd
Cognizant Technology Solutions	Deloitte	CIT Co., Ltd	Cognizant Technology Solutions
Correspondent firm: Fii & Associates Co.	EY	Cognizant Technology Solutions	Deloitte
Deloitte Cambodia	**Hitachi Group Global Network**	Cover Mongolia	Development Centre
Emerging Markets Consulting	HPE WW	Crowe Mongolia	DTSI Group
EY	KPMG Laos	Deloitte Mongolia	DXC Technology Philippines
FPT Telecom Cambodia	Microsoft Laos	EY	EY
Grant Thornton (Cambodia)	**NTT Communications**	**Hitachi Group Global Network**	FPT Software Philippines Corp
Hitachi Group Global Network	**NTT DATA Laos**	HPE WW	**FUJITSU PHILIPPINES INC.**
HPE WW	PFU ASIA PACIFIC PTE LTD.	IBM Mongolia	HCL Technologies Philippines, Inc.
IBM Cambodia	PSI LAOS	KPMG Mongolia	**Hitachi Group Global Network**
KPMG	PwC	Mongolia - Kantar	HPE WW
MRTS Consulting LTD	TCS Global	**NTT DATA Mongolia**	IBM Philippines
Nexia International	Thales Partners	PwC Mongolia	Indra Philippines
NTT Communications		Tashkent Liaison Office	KPMG
NTT DATA Cambodia		TCS Global	McKinsey
POCARI SWEAT		Thales Partners	Navarro Amper & Co.
PSI Cambodia		**TOSHIBA Mongolia**	**NTT DATA Philippines**
PwC Cambodia			Oliver Wyman INC.
TCS Global			PwC
Tech Mahindra Ltd			TCS Global
Thales Partners			Thales Partners
Tokyo Consulting Firm			WSI (Wordtext Systems, Inc)

Source: Desktop research

Figure 277. Professional service company for more upstream strategic work (2/2)

Country	Name	URL
Cambodia	CambodiaSoft	http://www.cambodiasoft.com/
	Softline Cambodia Co Ltd	https://softline.com.kh/
	FIRST CAMBODIA CO LTD	https://www.first-cambodia.com/
	VSTECS (Cambodia) Co., Ltd	https://www.vstecs.co.th/kh
Mongolia	ARVIS SYSTEMS LLC	http://www.arvisys.com/
	Bodi Electronics Co Ltd	http://bodi-electronics.mn/
	Computer Business Solutions, LLC	http://www.cbs.mn/
	GrapeCity Mongolia LLC	http://www.grapecity.mn/
	Infinite Solutions	https://infinite.mn/#/
	ITForce LLC	https://www.itforce.mn/
	UNIT LLC	http://www.online-solution.mn/
	Tridum e-Security LLC	https://www.devex.com/organizations/tridum-e-security-llc-55874
Malaysia	Firmus Sdn Bhd	https://firmussec.com/
	Nexagate Sdn Bhd	https://www.nexagate.com/
	NETASSIST (M) SDN BHD	https://www.mynetassist.com/
Thailand	SAS SOFTWARE (THAILAND) CO.,LTD.	https://www.sas.com/th_th/home.html
	COMP TRADING CO., LTD.	https://www.ctc.co.th/
	SAMART CORPORATION PCL	https://www.samartcorp.com/11/index_th.php
Philippines	AIM Corporate Solutions	http://www.aim.ph/

Source: Desktop research

Figure 278. Qualified and potential company

3.6.8 Plan for pilot activities

Pilot program activities were planned and implemented during a period of approximately three months between May and August of 2021. In addition to a proof of concept (PoC) discussion of expert cybersecurity details with MPTC and CamCERT (the project counterparts in Cambodia), the pilot activities also put together local educational seminars on cybersecurity aimed at a broad range of participants from all government agencies in Cambodia, Laos, and Mongolia.

Figure 279. Plan for pilot activities

Pilot name	Target country	Participants	Objectives
First PoC	Cambodia	MPTC(CamCERT) · Universities and educational institutions	Discuss a strategy for cybersecurity professionals
Second PoC	Cambodia	MPTC(CamCERT) · Cambodian government agencies	Discuss cybersecurity strategy
Local seminars	Cambodia, Mongolia, Laos	ICT government agencies, JICA regional departments	Educate/raise awareness about cybersecurity

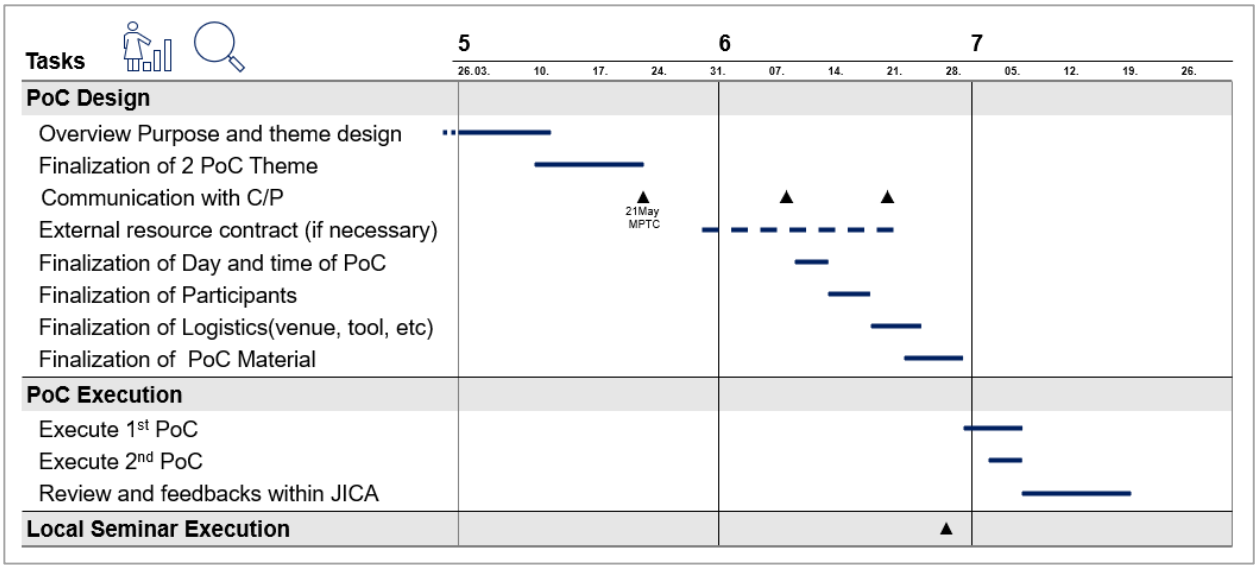


Figure 280. PoC and local seminar preparation timeline

Pilot activity report

The first PoC was a workshop on professional development in cybersecurity held June 28–29, 2021 for more than 30 participants from fourteen organizations in Cambodia, including government agencies, academic institutions, and private companies. The PoC discussion addressed measures to train cybersecurity professionals in Cambodia in all three sectors--public, academic, and private. As the image below shows, the agenda started with a presentation on a six-item framework for formulating measures to train cybersecurity professionals (why, what, who, where, how, and when). Participants were then split into groups of ten or so to give them an opportunity to discuss with the instructors the professional development strategies Cambodia needed. Given that the discussions were held remotely and that participants had limited English ability and uneven knowledge of professional development in cybersecurity, the main purpose of the discussions was not to generate output, but to give attendees as much input as possible.

Figure 281. Key questions for designing a national strategy for developing cybersecurity professionals

Figure 282. Workshop on professional development in cybersecurity

Date	Time (JST)	Topic
June 28	10:00-12:00/ 14:00-16:00	National strategy for developing cybersecurity professionals
June 29	10:00-12:00/ 14:00-16:00	

The second PoC was a workshop on formulating national cybersecurity strategy for key government players, particularly those in the MPTC. Presentations were given on pivotal discussion items for national cybersecurity strategy. The presentations included case examples from cybersecurity leaders like the US and Singapore so that participants could see for themselves the lack of cybersecurity maturity in Cambodia and be more motivated to prioritize stronger cybersecurity measures in their respective departments and agencies. The participants were also evaluated on their cybersecurity maturity before and after the workshop using CREST and similar frameworks in order to measure their cybersecurity knowledge and capabilities. The workshop also brought in outside instructors from the Kirirom Institute of Technology (a private university in Cambodia with a cybersecurity department) and from FPT Software, Vietnam's largest software outsourcing and offshore development company with operations in Cambodia as well as in Singapore, Malaysia, Myanmar, the Philippines, Indonesia, Korea, China, Taiwan, and elsewhere--primarily in Asia. These instructors provided more expert-level content on education, public-private partnerships, and other cybersecurity content to help educate and raise awareness among participants.

Figure 283. National cybersecurity strategy formulation workshop

Date	Time (JST)	Topic
July 19	11:00-13:00	• Overview of cybersecurity trends
July 19	15:00-17:00	• Definition of cyber threats and national incident response framework
July 20	11:00-13:00	• Cybersecurity regulation frameworks
July 20	15:00-17:00	• Partnerships (public, private, academic, international)
July 21	11:00-13:00	• Professional training and certification
July 21	15:00-17:00	• Public awareness and alerts
July 26	11:00-13:00	• Cybersecurity for small and medium enterprises
July 26	15:00-17:00	• Critical infrastructure industry protection
July 28	11:00-13:00	• CERTs/resilience
July 28	15:00-17:00	• Wrap up (MPTC and CamCERT assessment results)

Lastly, local seminars were held on June 23, June 25, and July 7 of 2021 for counterparts in Laos, Cambodia, and Mongolia, respectively. The sessions targeted all government players with an interest in cybersecurity. Participants included eight staff members from LaoCERT, around 70 Mongolian government officials, and more than 330 members of various Cambodian government agencies, resulting in an incredibly lively discussion and Q&A session. The seminar touched on cybersecurity trends in other countries, cybersecurity maturity survey results, best cases, and other topics designed to develop participants' basic knowledge.

Defining counterpart capabilities

The team used two diagnostic frameworks to define cybersecurity capabilities in the MPTC and CamCERT (operating under the MPTC), as these organizations are the potential counterparts for cybersecurity assistance in Cambodia. The first item measured the maturity of cybersecurity vulnerability assessments, and involved interviewing CamCERT on 22 items across three stages of the vulnerability assessment process--preparation, testing, and follow-up--in order to determine the organization's ability to diagnose vulnerabilities. CamCERT came in with a maturity level below average in all three areas, further underlining the need to assist Cambodia through technical cooperation.

Figure 284. Results of counterpart capability evaluations (1/2)

Stage	Step	Score (five-point scale)
Prepare	Maintain a technical security assurance framework	1.2
Prepare	Establish a governance structure for penetration testing	0.8
Prepare	Evaluate drivers for conducting penetration tests	0.9
Prepare	Identify target environments	1.2
Prepare	Define the purpose of the penetration tests	2.2
Prepare	Produce requirement specifications	1.9
Test	Select suitable suppliers	0.3
Test	Agree on testing style and type	1.6
Test	Identify testing constraints	1.2
Test	Produce scope statements	1.1
Test	Establish a management assurance framework	0.7

Stage	Step	Score (five-point scale)
Test	Implement management control processes	0.7
Test	Use an effective testing methodology	0.6
Test	Conduct sufficient research and planning	1.0
Test	Identify and exploit vulnerabilities	1.2
Test	Report key findings	1.5
Follow up	Remediate weaknesses	1.8
Follow up	Address root causes of weaknesses	1.5
Follow up	Initiate improvement program	0.8
Follow up	Evaluate penetration testing effectiveness	0.9
Follow up	Build on lessons learned	0.9
Follow up	Create and monitor action plans	0.2

The CSIRT Maturity Assessment for national CERTs designed by the European Union Agency for Cybersecurity was also used to assess CamCERT's current level of maturity across four areas: organization, human, tool, and processes. Although CamCERT demonstrated a high level of maturity on several of the items (among them incident classification (O-7), incident resolution toolset (T-10), and incident prevention process (P-4)), the survey still revealed numerous areas with room for technical cooperation.

Figure 285. Results of counterpart capability evaluations (2/2)

Stage	Step	Score (five-point scale)
Staff	Mandate	2.2
Staff	Constituency	2.4
Staff	Authority	2.0
Staff	Responsibilities	2.2
Staff	Service content	2.2
Staff	Service level description	1.8
Staff	Incident classification	3.2
Staff	Participation in existing CSIRT frameworks	2.0
Staff	Organizational framework	1.2
Staff	Security policy	1.6
Staff	Codes of conduct/practices/ethics	1.6
Staff	Personal resilience	1.8
Staff	Skillset description	2.4
Staff	Internal training	2.6
Staff	Technical training (external)	2.4
Staff	Communications training (external)	2.0
Staff	External networking	2.2
Tools	IT resources list	1.6
Tools	Information sources list	2.4
Tools	Consolidated email system	3.0
Tools	Incident tracking system	3.0
Tools	Resilient phone system	1.4
Tools	Resilient email system	1.8
Tools	Resilient internet access	1.6
Tools	Incident prevention toolset	2.7

Stage	Step	Score (five-point scale)
Tools	Incident detection toolset	3.7
Tools	Incident resolution toolset	3.6
Process	Escalation to governance level	2.8
Process	Escalation to press function	2.4
Process	Escalation to legal function	2.6
Process	Incident prevention process	3.6
Process	Incident detection process	2.8
Process	Incident resolution process	2.8
Process	Specific incident processes	2.2
Process	Audit/feedback process	1.4
Process	Emergency reachability process	1.6
Process	Best practice internet presence	1.2
Process	Secure information handling process question	3.2
Process	Information sources process	2.0
Process	Outreach process	3.2
Process	Reporting process	3.2
Process	Statistics process	1.6
Process	Meeting process	2.2
Process	Peer-to-peer process	1.6