ASEAN-JAPAN CENTRE

Assessing Digital Health Adoption in ASEAN

ASEAN-JAPAN CENTRE 2024

CONTENTS

ABOUT THIS REPORT 3

EXECUTIVE SUMMARY 4

1. The Digital Transformation of the Healthcare Sector 5

2. Is ASEAN Digital Health–Ready? 6

3. Digital Health Adoption in ASEAN 15

4. Challenges and Gaps in Digital Health Adoption among AMSs 23

5. Advancing Digital Health Adoption in ASEAN 25

TOWARDS DIGITAL-IN-HEALTH 28

REFERENCES 29

APPENDIX 30

ABOUT THIS REPORT

Assessing Digital Health Adoption in ASEAN is co-authored by Katrina Navallo, PhD, ASEAN-Japan Centre, and Keith Detros, Tech for Good Institute. The report is published by the ASEAN-Japan Centre Research and Policy Advocacy Cluster as part of its ASEAN-Japan Insights Series. The authors wish to thank the members of the ASEAN Coordinating Committee on Services, the ASEAN Healthcare Services Sectoral Working Group, and the Technical Working Group on eHealthcare Services for their invaluable insights and feedback, and Mr. Julius T. Gonzales for providing the data visualization in the report.

The research utilized the online databases Global Digital Health Monitor (GDHM 2023a) and Network Readiness Index (2023) and included interviews with six key persons involved in implementing the national ehealth strategies in the Lao People's Democratic Republic, Malaysia, and the Philippines, and from companies providing digital healthcare services in Singapore and Viet Nam. The interviewees have requested not to disclose their names in this publication for privacy purposes.

Some parts of this report were published in *ASEAN Focus* (2023), "Advancing the Digital Health Ecosystem in Southeast Asia", URL: https://fulcrum.sg/aseanfocus/advancing-the-digital-health-ecosystem-in-southeast-asia/

The opinions expressed in this report and any errors or omissions are those of the authors and should not be attributed to their organizations.

ISBN 978-4-910293-54-7 (print)

EXECUTIVE SUMMARY

The adoption of digital health technologies is a key tool in shaping the future of global health, and the World Health Organization recognizes the role of digital health technologies in improving medical treatment and service delivery. In ASEAN, the adoption of digital health has wide disparities in terms of legislation and policy, infrastructure, services and application, and workforce readiness.

The Global Digital Health Monitor (GDHM 2023a) indicates that most ASEAN countries score high particularly in the areas of leadership and governance, standards and interoperability, infrastructure, and services and applications. However, more work is needed in developing standards and interoperability, legislation, investment, and workforce development to support digital health adoption among ASEAN member states.

This report finds the following gaps and challenges to digital health adoption in ASEAN countries:

- Lack of trust in data protection and cybersecurity
- Fragmented digital health systems

To address the remaining gaps in digital health adoption of the ASEAN member states, this report recommends the following:

- Build trust through data protection and governance
- Develop standards for data interoperability
- Enable digital startups to drive innovation
- Promote healthcare professionals' digital health training support

1. THE DIGITAL TRANSFORMATION OF THE HEALTHCARE SECTOR

The COVID-19 pandemic significantly disrupted access to medical care, leading to an unparalleled surge in the use of telehealth and various forms of digital health technologies in Southeast Asia. The digital health ecosystem in ASEAN has grown significantly, especially with the accelerated rise of healthtech startups, such as Doctor Anywhere (Singapore), HaloDoc (Indonesia), Alodokter (Indonesia), Doctor A to Z (Thailand), docosan (Viet Nam), and Doctor 2u (Malaysia), some of which have expanded to other ASEAN member states (AMSs). As many ASEAN countries swiftly transitioned to telehealth, governments modified and updated their existing medical laws and policies to facilitate teleconsultations and support remote medical care.

The adoption of digital health technologies is a key tool in shaping the future of global health, and the World Health Organization (WHO 2021) recognizes the important role of digital health in improving medical treatment and service delivery. Digital health encompasses a wide range of medical technologies and services, from digital records, telecare, telehealth, and mobile health apps and wearables to more sophisticated health analytics such as genomics, precision medicine, and health data analytics. The digitalization of different segments of the healthcare process underscores the potential of digital health services to revolutionize the way societies access and efficiently utilize medical care, regardless of time and location constraints. Concurrently, it gives health service providers and digital startups the impetus to demonstrate their innovative solutions in medicine, health, and biotechnology.

The digital health ecosystem in the ASEAN region involves multiple players, generally including regulators (governments, medical associations), innovators (digital health startups, health service providers), enablers (governments, investors), and users (patients, healthcare providers, insurers). Other studies classified the players as innovation suppliers (startups, non-profits, academia, tech companies), enablers (investors and governments), and demand drivers (patients, healthcare consumers and providers, pharmaceuticals and insurance companies) (ACCESS Health International Southeast Asia 2019). Regulators are involved with legislation, policy, and compliance governing digital health investments, digital infrastructure, and data protection. Innovators are involved in developing standards and fostering interoperability, while enablers usually provide funding through investments, technical and business development acceleration, and legal or administrative support. Finally, users involve service providers and users and insurers.

To get to a digitally connected healthcare system requires transformation of the healthcare system into interoperable segments connected in a chain of digital services. World Bank (2023) describes three progressive stages towards the evolution of digital health demand and supply: digitalization, digital-for-health, and digital-in-health. The initial stage, “digitalization”, establishes the structural design and administrative procedures for health information systems, links health providers and facilities, and gathers standardized medical data. The subsequent stage, “digital-for-health”, integrates medical data and digital technology into routine business operations. Finally, the ultimate stage, “digital-in-health”, envisages the integration of digital technology and health data into a smooth process ingrained in developed and transformed health systems.

Despite significant advancements in digital health innovation in recent years, Southeast Asia still faces fundamental challenges in adopting digital health technologies. Countries in the region need to formulate specific digital transformation guidelines for the healthcare sector. Moreover, governments need to resolve policy implementation hurdles to fully leverage the digital revolution in healthcare. A preference for face-to-face healthcare delivery remains due to a lingering mistrust in digital services. Understanding these issues necessitates an assessment of ASEAN’s progress in fully integrating digital health.

This study used the Global Digital Health Monitor (GDHM 2023a) to assess the digital health readiness and maturity of ASEAN countries. It also relied on interviews with key informants in the digital health sector in five ASEAN countries (the Lao People’s

Democratic Republic [PDR], Malaysia, Philippines, Singapore, and Viet Nam) to further understand government and private sector perspectives on the establishment of digital infrastructures for health and pain points from their experience.

To establish how digital health adoption can unlock the possibilities for integrated and patient-centred healthcare delivery in the region, the following section looks at health systems and the digital network readiness of ASEAN countries.

2. IS ASEAN DIGITAL HEALTH-READY?

The WHO defines health systems as "the organizations, institutions, resources and people whose primary purpose is to improve health" (2010, vi). The WHO Health Systems Framework identifies six indicators that determine the strength of a country's health system:

1. Health service delivery
2. Health workforce
3. Health information
4. Access to essential medicines
5. Health financing
6. Leadership/governance

Figure 1 illustrates the strength of the AMSs' health workforce and financing relative to the regional (ASEAN) average. The radar graphs present the current state of the healthcare workforce among AMSs, ASEAN, and Japan (number of hospital beds and density of medical doctors, nurses and midwives, pharmacists, and dentists per 10,000 population). These indicators are not exhaustive but provide an overview of a country's performance in terms of the supply of health professionals and public financing for health, which are essential for the provision of basic health services in any country.

The bigger the coloured areas for all five indicators, the stronger the health capacities and the higher potential for that country to perform well in digital health. Figure 1 clearly shows huge gaps in the supply of healthcare professionals relative to the population sizes of ASEAN countries. The overall ASEAN score is plotted against individual AMSs' scores for comparison.

Singapore, Malaysia, and Brunei Darussalam have the highest ratios of medical doctors. The ratios of healthcare professionals for Indonesia, the Philippines, and Thailand are almost the same as the overall ASEAN score, while Cambodia, Lao PDR, Myanmar, and Viet Nam have relatively smaller ratios of healthcare professionals than the regional average. The shortage of healthcare professional supply in the region exists even though some AMSs are major healthcare professional exporters to other countries. For instance, the Philippines actively exports nurses overseas, and Indonesia and Vietnam also actively export healthcare professionals abroad.

FIGURE 1. HEALTH WORKFORCE IN ASEAN AND JAPAN

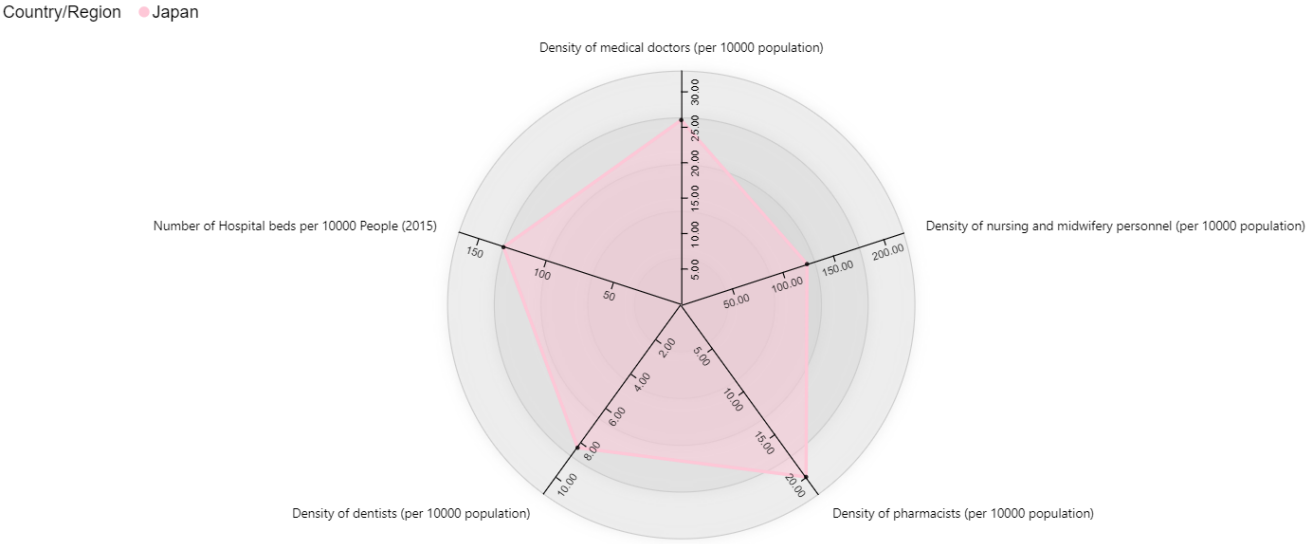
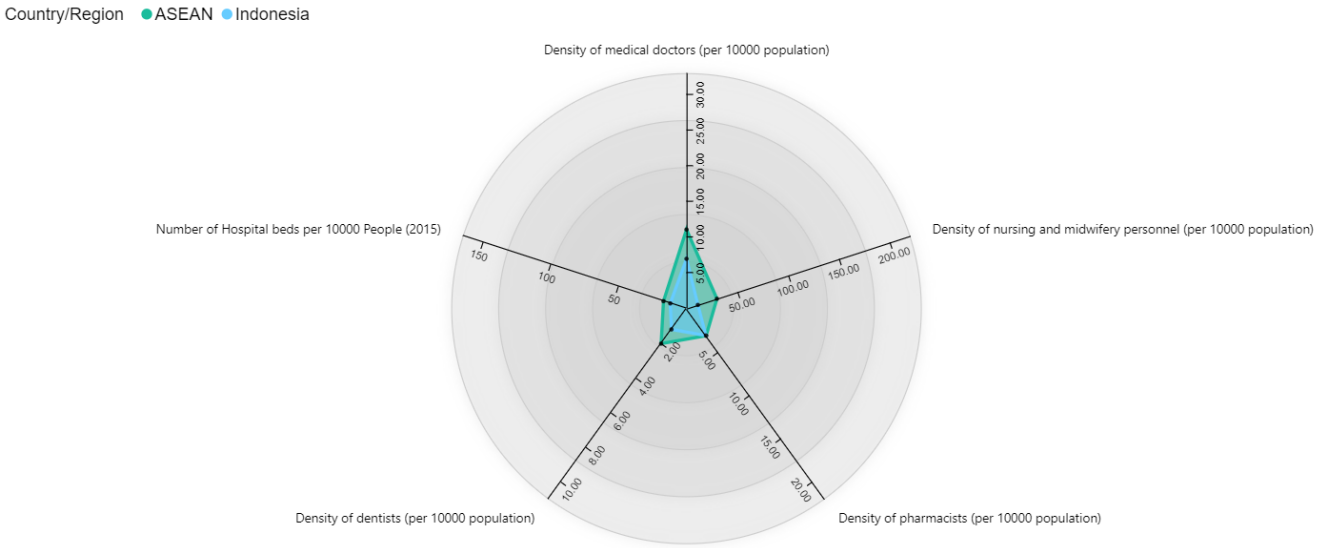
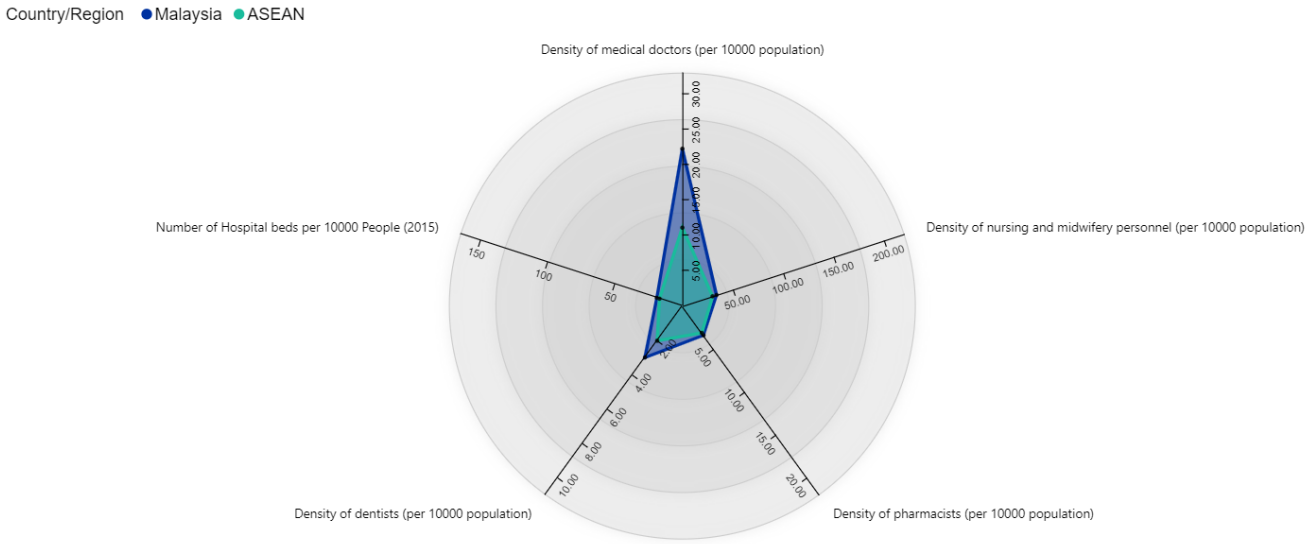
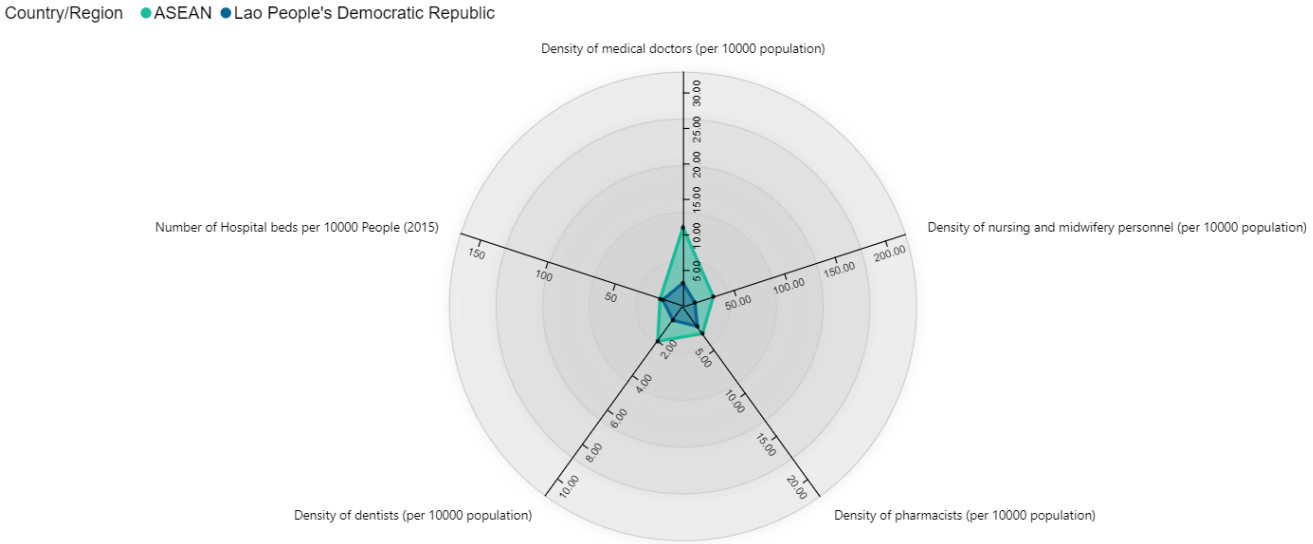


FIGURE 1. HEALTH WORKFORCE IN ASEAN AND JAPAN



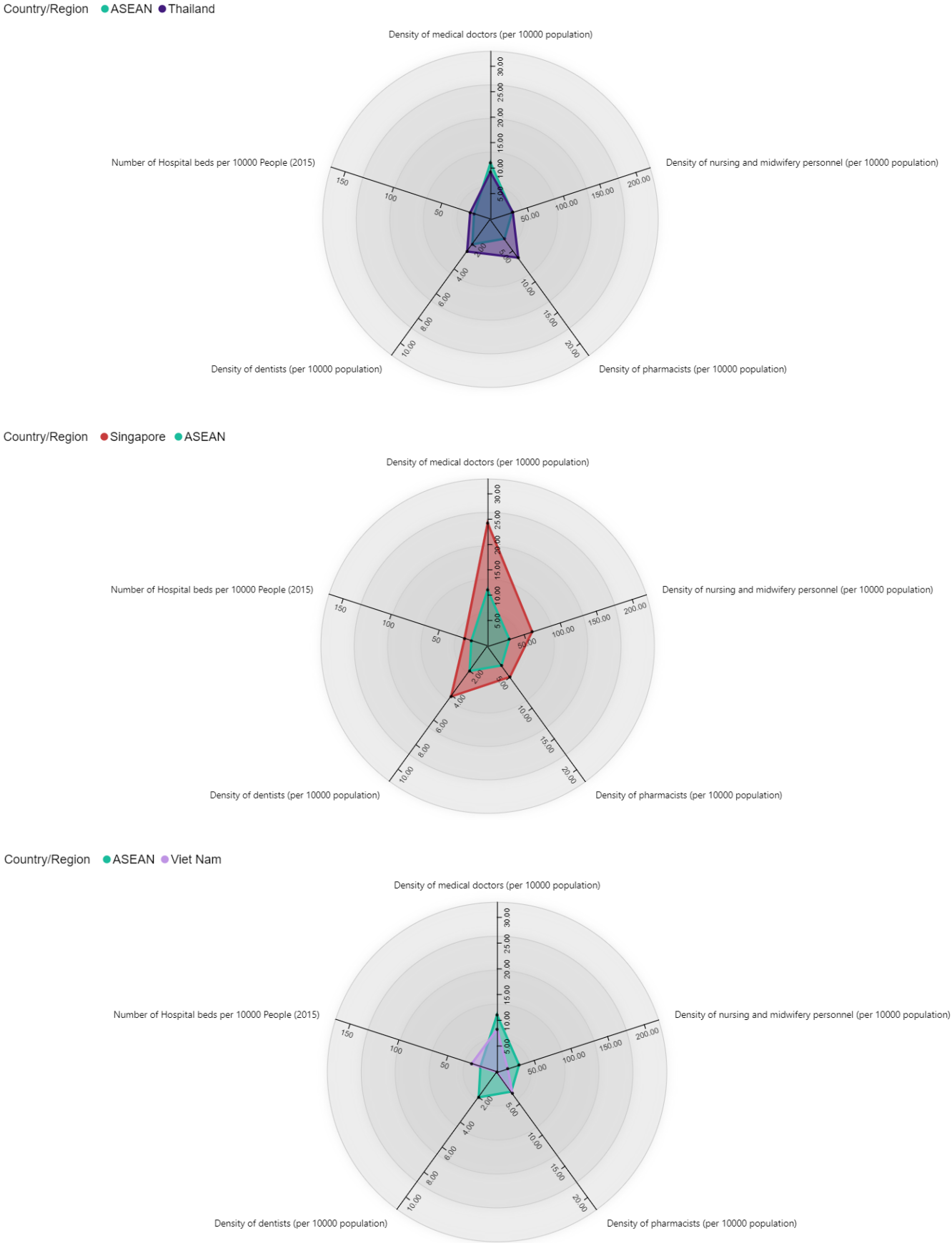



Country/Region
ASEAN
Lao People's Democratic Republic
Density of medical doctors (per 10000 population)
Density of nursing and midwifery personnel (per 10000 population)
Density of pharmacists (per 10000 population)
Density of dentists (per 10000 population)
Number of Hospital beds per 10000 People (2015)


Country/Region
ASEAN
Myanmar
Density of medical doctors (per 10000 population)
Density of nursing and midwifery personnel (per 10000 population)
Density of pharmacists (per 10000 population)
Density of dentists (per 10000 population)
Number of Hospital beds per 10000 People (2015)


Country/Region
ASEAN
Philippines
Density of medical doctors (per 10000 population)
Density of nursing and midwifery personnel (per 10000 population)
Density of pharmacists (per 10000 population)
Density of dentists (per 10000 population)
Number of Hospital beds per 10000 People (2015)

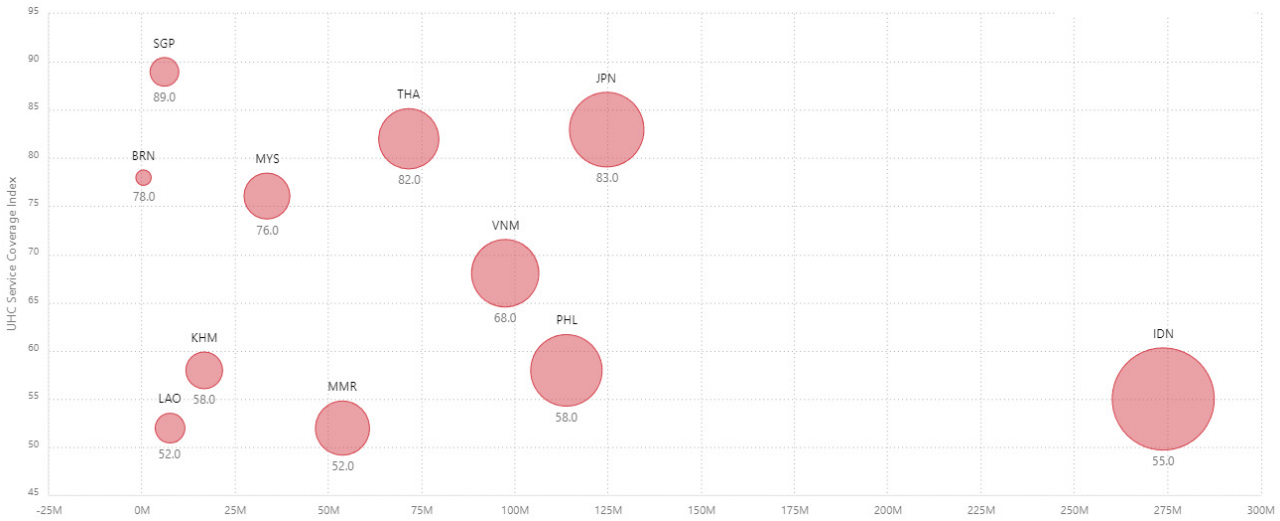
FIGURE 1. HEALTH WORKFORCE IN ASEAN AND JAPAN



Source: Collated by the authors from WHO Health Statistics 2023: Annex 2

Notwithstanding the increasing cost of healthcare in ASEAN, these huge gaps in the supply of healthcare professionals have contributed to an increase in general government health expenditures (GGHE) among ASEAN member states. Demographic issues, such as the ageing population, contribute to public health spending as medical and welfare costs for the elderly population compound with age-related illnesses and demand for care. Figure 2 shows this: Japan's GGHE of 24.2% is thrice that of ASEAN overall. Meanwhile, ageing ASEAN countries including Singapore, Thailand, and Malaysia score more than 10%.

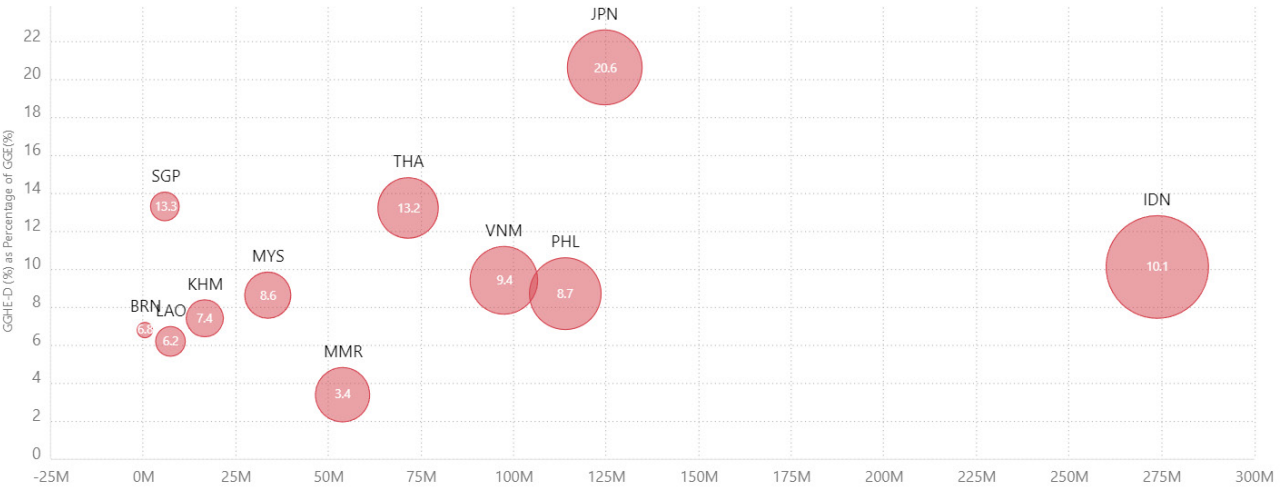
FIGURE 2. GOVERNMENT HEALTH EXPENDITURE OF ASEAN MEMBER STATES



Source: General government health expenditure (domestic), WHO Health Statistics 2023: Annex 2

In terms of health financing among the AMSs, the trend in the GGHE as a proportion of government expenditure shows that Singapore has the highest ratio at 14.5% of total government expenditure followed by Thailand at 13.9% and Malaysia at 10.1%. Singapore and Malaysia both have universal health coverage of more than 85% of the population. Indonesia, with a population of roughly 300 million, mirrors the regional average of government expenditure at 8.7%. Other countries have government health expenditure ratios below 7%, which corresponds to less than 60% in their universal healthcare (UHC) coverage indices (Figure 3). The ASEAN member states show great disparities in the three indicators that reflect gaps in health workforce and financing.

FIGURE 3. UNIVERSAL HEALTHCARE COVERAGE INDEX OF ASEAN MEMBER STATES

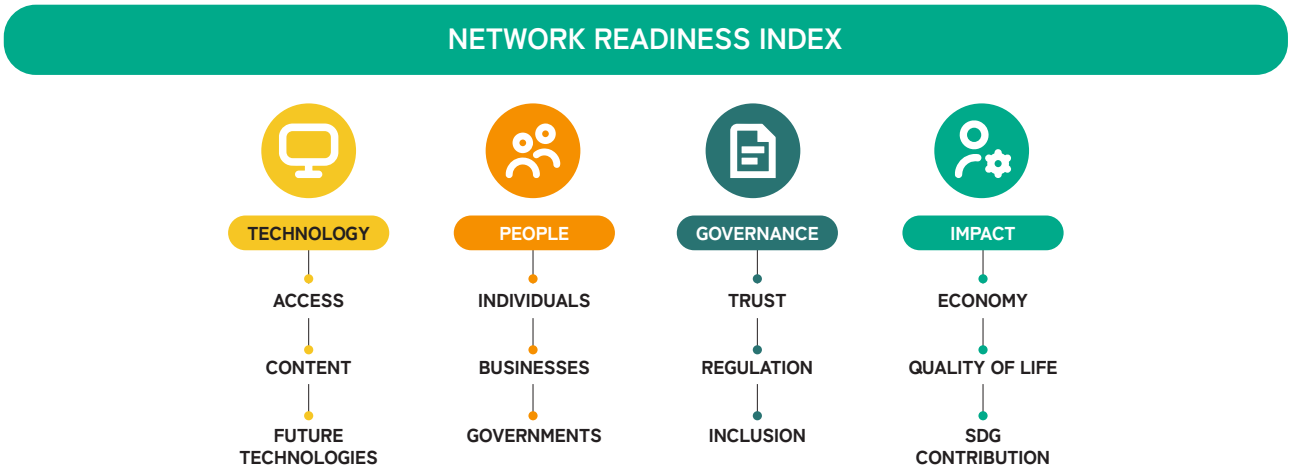


Source: Universal health coverage, WHO Health Statistics 2023: Annex 2

ACCESS Health International Southeast Asia (2019) found that ASEAN as a region stands to benefit from digital health by laying the infrastructure to achieve UHC. The UHC index for the ASEAN region shows that seven out of the 10 AMSs have attained more than 60% coverage for their population. However, the remaining tasks to achieve full coverage will be further augmented by the establishment of national medical records systems and digitalization of medical records as part of the digitalization of healthcare services. The recent experience with the COVID-19 pandemic also shows the promise of digital health, especially in the use of telehealth medicine to deliver healthcare services despite physical and geographical distances. As digital health relies on the connectivity and digital capacities of AMSs, the following section discusses the current state of digital connectedness in the region.

Digital readiness in ASEAN varies widely by country. The Network Readiness Index (NRI), which evaluates the digital readiness of countries based on technology, people, governance, and impact, shows the state of ASEAN economies in their digital transformation journeys (Figure 4). To gauge the readiness of countries to take advantage of digital societies, the report uses the 2023 NRI.

FIGURE 4. NETWORK READINESS INDEX PILLARS AND INDICATORS



Source: Network Readiness Index (2023)

The NRI provides a robust framework for assessing the impact of information communication and technology (ICT) on society and the development of nations. The NRI recognizes the pervasiveness of digital technologies in today's networked world, resting on 58 indicators across four fundamental dimensions: technology, people, governance, and impact. It covers 134 economies, including eight of the ASEAN member countries.

This measure indicates the ASEAN and Japanese averages on various dimensions of ICT's impact on society and development. Before considering specific countries, a key takeaway is that levels of digital readiness vary across ASEAN (Figure 5). Furthermore, areas of improvement exist that can help enable digital health in the region.

Singapore, for example, ranks second out of the 134 economies included in the 2023 NRI. The country's main strength relates to governance, where trust, regulation, and inclusion indicators are faring well. Its people component, which is relatively lower than the other three pillars, is around the same as Japan. Note that Singapore scores higher than Japan across all pillars of the NRI.

Malaysia is also trending in the right direction, with all pillars scoring higher than the ASEAN average. Its core strength is also in governance, although areas for improvement exist across all pillars.

Thailand rates slightly higher than the ASEAN average in the pillars of governance, technology, and people,

but areas for improvement exist on the impact component of ICT. To improve the impact pillar, areas related to the digital economy, quality of life, and contributions to the United Nations Sustainable Development Goals should be addressed. Thailand's strongest pillar is also governance.

Viet Nam rates slightly higher than the ASEAN average on people and impact but slightly lower than the ASEAN average on technology and governance. The country is not far behind its neighbors across all pillars. Viet Nam is strongest in the impact component.

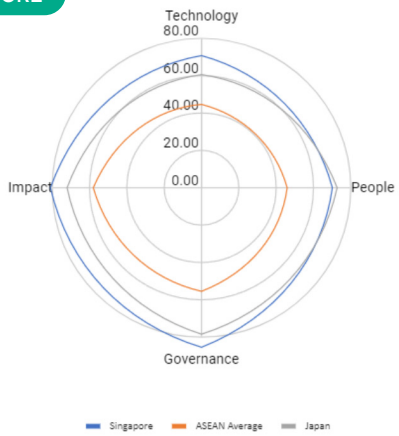
Indonesia, however, is above par on technology and governance, but people and impact components need improvement. Indonesia is relatively strong in governance, while the people pillar has most room for growth.

The Philippines is slightly below the ASEAN average in all pillars of technology, governance, people, and impact. Most room for growth is around the technology pillar, while impact is the Philippines' strongest component.

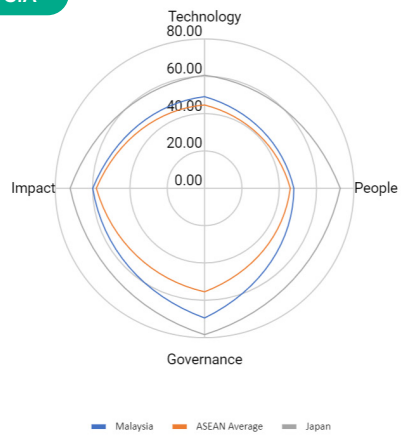
Finally, Cambodia and Lao PDR are just starting in their digital development journeys. Both countries' strongest pillars are in impact. Cambodia has the most room for improvement in the people aspect, and Lao PDR has most room for improvement in governance.

FIGURE 5. NETWORK READINESS OF EIGHT ASEAN MEMBER STATES (2023)

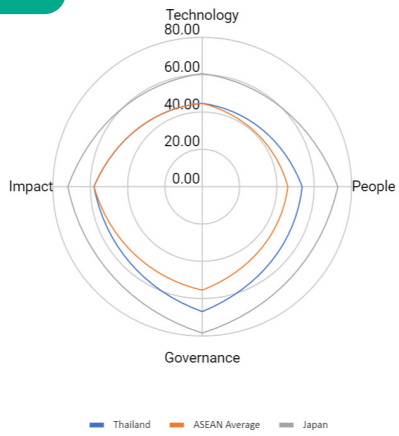
SINGAPORE



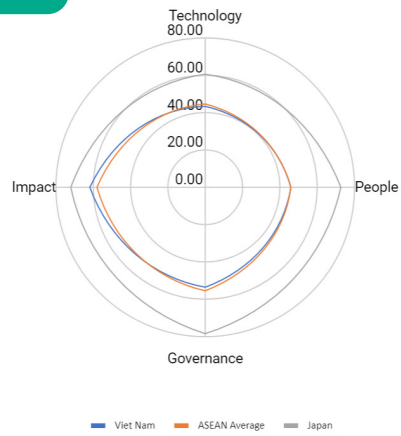
MALAYSIA



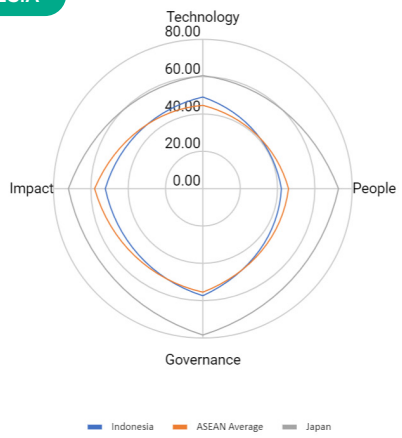
THAILAND



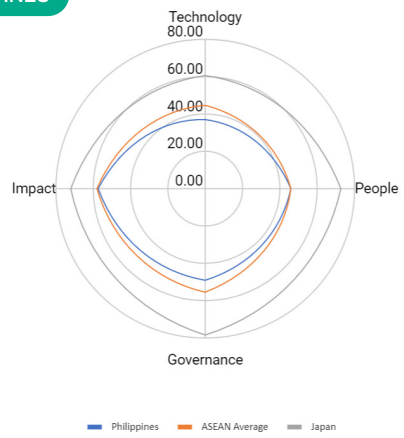
VIET NAM



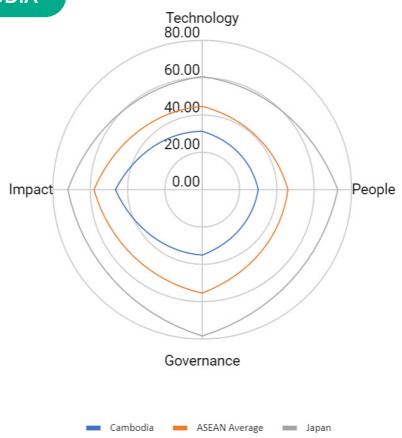
INDONESIA



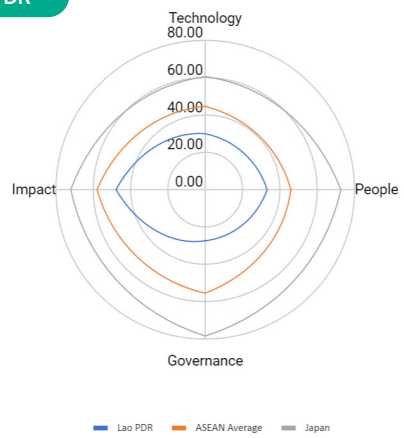
PHILIPPINES



CAMBODIA



LAO PDR

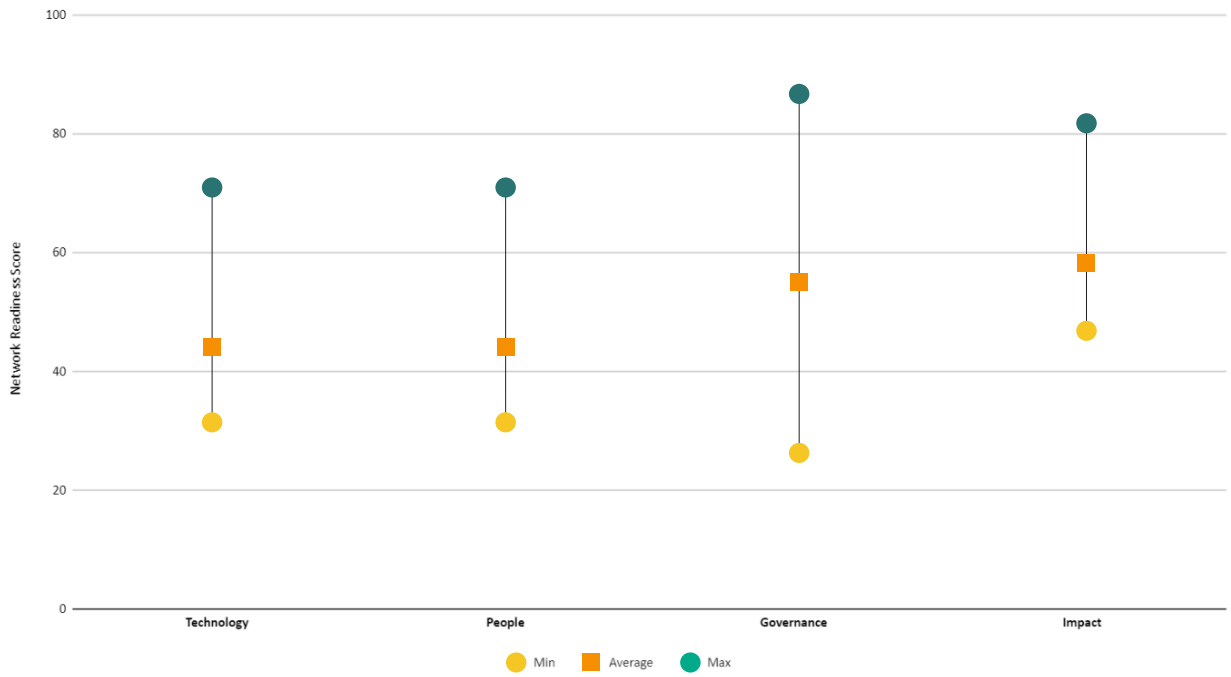


Source: Network Readiness Index 2023. Visualization by the authors.

The information and scores of different countries reveal some trends with respect to digital readiness in ASEAN. As mentioned earlier, wide disparities in readiness exist, but certain pillars are more developed in ASEAN countries than others.

On average, ASEAN is relatively strong in terms of impact, or the cascading effects of technology on the economy, society, and the Sustainable Development Goals. In addition, ASEAN has made strides in developing appropriate governance mechanisms. It is the pillar that some of the more digitally mature economies fare stronger in as well (Figure 6).

FIGURE 6. GAPS IN THE DIGITAL READINESS OF ASEAN MEMBER STATES



The range of scores is also revealing. Governance, while strong, also has one of the largest ranges between the highest and the lowest scores. Opportunity exists here for knowledge sharing and for establishing enough channels for cross-border collaborations and policy alignments. The ASEAN Digital Economy Framework Agreement is one initiative that should help in this cause.

Most room for growth lies in the people and technology components. The AMSs have pressing challenges in digital skilling, for example, which this report discusses later.

3. DIGITAL HEALTH ADOPTION IN ASEAN

Combining the current strength of health systems and the digital network readiness of the AMSs, this section assesses the overall digital health readiness of the region. This report does not offer a new framework or methodology for assessing digital health readiness but adopts the Global Digital Health Monitor as a measure.

The Global Digital Health Monitor measures digital maturity according to seven ehealth components based on the WHO National eHealth Strategy Toolkit (2012; Table 1):

- Leadership and governance
- Strategy and investment
- Legislation, policy, and compliance
- Workforce
- Standards and interoperability
- Infrastructure
- Services and applications

TABLE 1. DIGITAL HEALTH INDICATORS AND MEASUREMENT

DIGITAL HEALTH INDICATOR	DEFINITION AND MEASUREMENT
LEADERSHIP AND GOVERNANCE	Measures the coordination of digital health at the national level to ensure alignment with national health goals and priorities Indicator 1: Digital health is prioritized at the national level through dedicated bodies/mechanisms for governance Indicator 2: Digital health prioritized at the national level through planning Indicator 2a: Health is prioritized in national digital transformation and data governance policies Indicator 3: Readiness for emerging technologies adoption and governance Indicator 4: Diversity, equity, and human rights analysis, planning, and monitoring included in national digital health strategies and plans Indicator 4a: Gender considerations accounted for in digital health strategies and digital health governance
STRATEGY AND INVESTMENT	Ensures a responsive strategy and plan for systematically financing and implementing national digital health plans Indicator 5: National ehealth/digital health strategy or framework Indicator 5a: National digital strategy alignment with UHC core components Indicator 6: Public funding for digital health Indicator 6a: Private sector participation and investments in digital health

LEGISLATION, POLICY, AND COMPLIANCE	Creation of legal and regulatory environments to establish trust and protection for users and consumers of digital health interventions through privacy, security, and safety Indicator 7: Legal framework for data protection (security/cybersecurity) Indicator 8: Laws or regulations for privacy, consent, confidentiality, and access to health information (privacy) Indicator 9: Protocol for regulating or certifying devices and/or health services, including provisions for artificial intelligence and algorithms (at higher stages of maturity) Indicator 9a: Protocol for regulating and certifying artificial intelligence within health services Indicator 10: Cross-border data security and sharing
WORKFORCE	Need for human resources with the skills to develop, support, and use digital health services and applications Indicator 11: Digital health integrated in health and related professional pre-service training (prior to deployment) Indicator 12: Digital health integrated in health and related professional in-service training (after deployment) Indicator 13: Training of digital health workforce Indicator 14: Maturity of public sector digital health professional careers

STANDARDS AND INTEROPERABILITY	Facilitate the ability for individuals and data to move through the continuum of care to enable data to be seamlessly shared, stored, and used when, where, and how they are needed Indicator 15: National digital health architecture and/or health information exchange Indicator 16: Health information standards
INFRASTRUCTURE	Includes computing equipment and connectivity and electricity required to run digital health services and applications Indicator 17: Network readiness Indicator 18: Planning and support for ongoing digital health infrastructure maintenance
SERVICES AND APPLICATIONS	Reflects the digital health interventions deployed for service delivery and/or tracking health system performance Indicator 19: Nationally scaled digital health systems Indicator 20: Digital identity management of service providers, administrators, and facilities for digital health, including location data for Geographic Information Systems mapping Indicator 21: Digital identity management of individuals for health (master patient index representative of the population) Indicator 21a: Digital identity management of individuals for health (master patient index accessible and ready for use) Indicator 21b: Digital identity management of individuals for health (secure birth registry) Indicator 21c: Digital identity management of individuals for health (secure death registry) Indicator 23: Population health management contribution of digital health

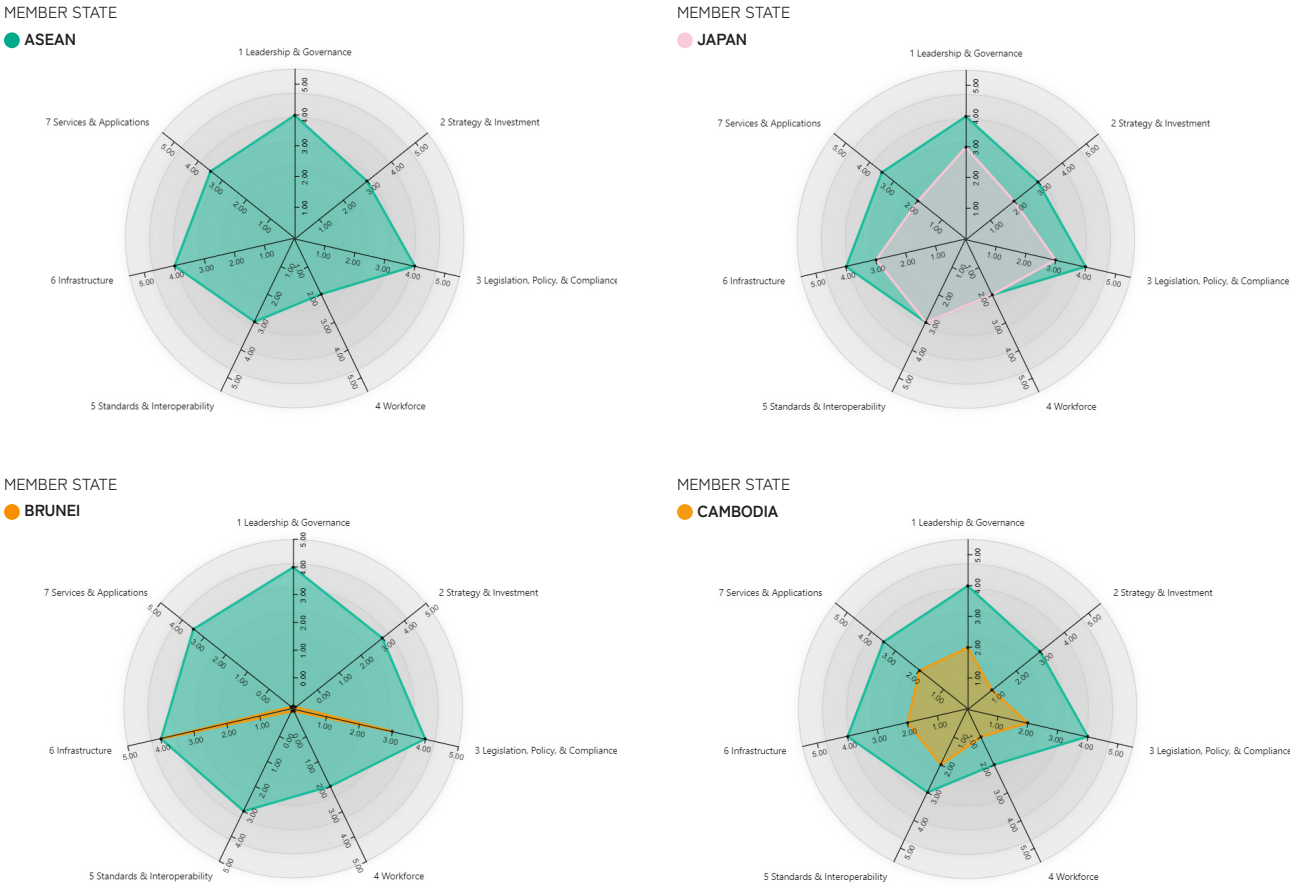
Source: GDHM (2023a)

These seven ehealth components were measured based on the 23 standardized indicators developed by the Global Digital Health Monitor team together with representatives from ministries of health of the 67 participating countries. Where data are unavailable, proxy data from publicly available databases were used especially for countries that could not provide data (e.g., Brunei Darussalam and Singapore). For a comprehensive discussion of the methodology used, please refer to the Methodology section of GDHM (2023a).

Figure 7 illustrates the performance of the ASEAN countries and Japan on each indicator measuring digital health readiness and maturity according to the Global Digital Health Monitor (GDHM 2023a) using a radar graph.

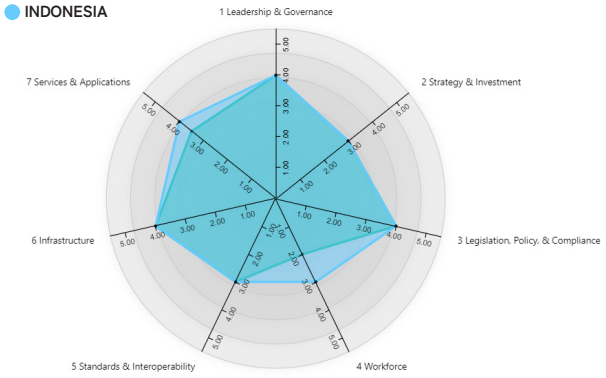
FIGURE 7. DIGITAL HEALTH READINESS AMONG ASEAN COUNTRIES

Note: Adjusted scale for extreme values (0 and -1), in Singapore and Brunei Darussalam due to lack of available data.



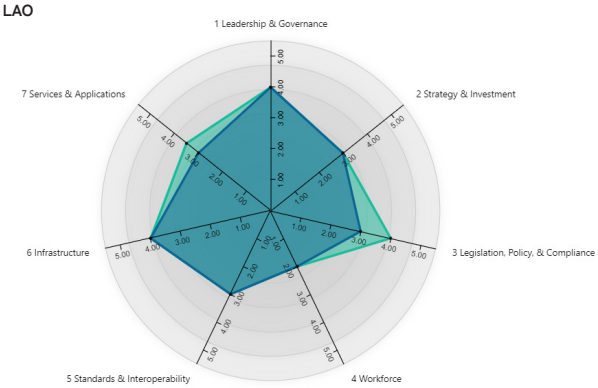
MEMBER STATE

INDONESIA



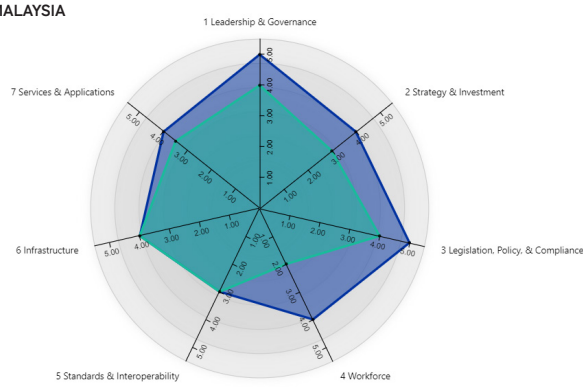
MEMBER STATE

LAO



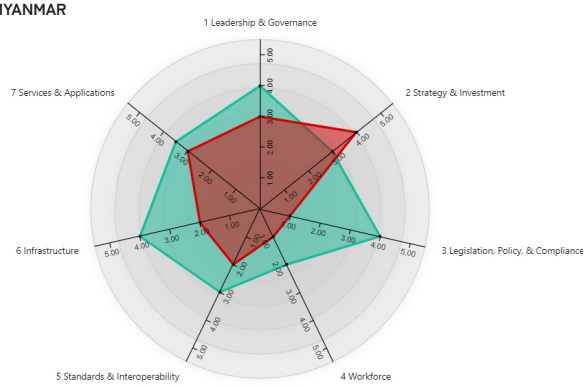
MEMBER STATE

MALAYSIA



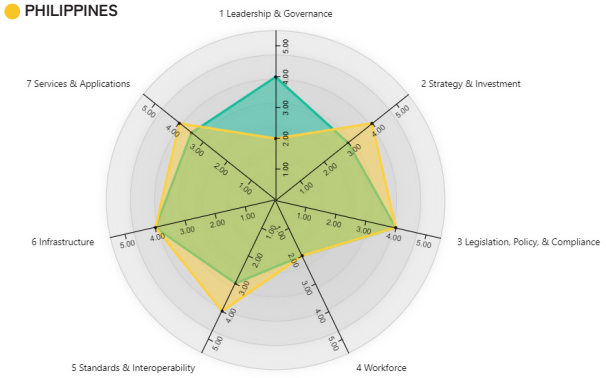
MEMBER STATE

MYANMAR



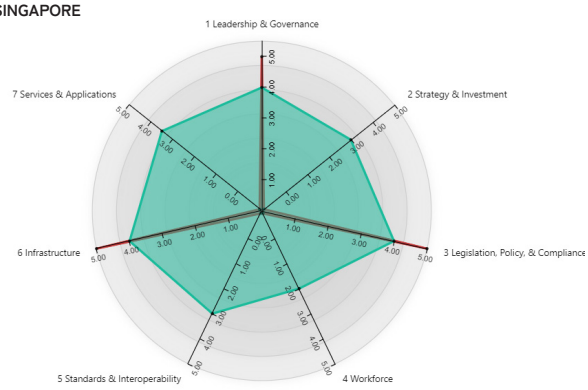
MEMBER STATE

PHILIPPINES



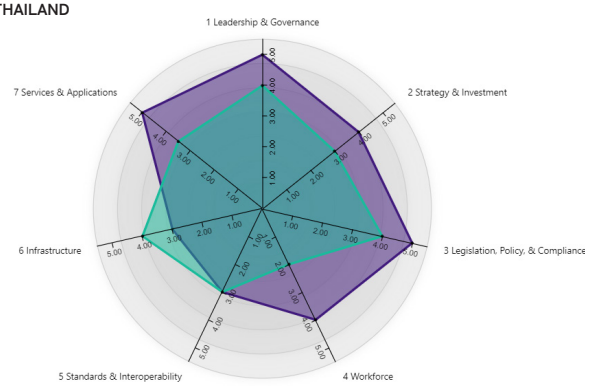
MEMBER STATE

SINGAPORE



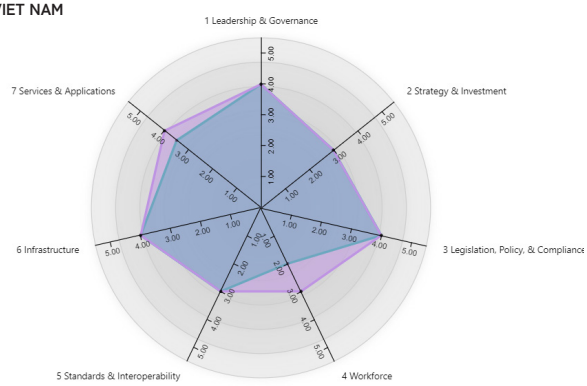
MEMBER STATE

THAILAND



MEMBER STATE

VIET NAM



Source: GDHM (2023a)

Figure 7 shows that in terms of leadership and governance, Malaysia, Singapore, Thailand, Indonesia, Lao PDR, and Viet Nam have strong coordination of digital health at the national level.

Malaysia, Myanmar, Philippines, and Thailand have established responsive financing and implementing strategies to support digital health initiatives and startups.

Malaysia, Singapore, Thailand, Viet Nam, Indonesia, Philippines, and Brunei Darussalam have established national legal and regulatory policies for the governance and protection of digital health data against possible threats.

In terms of workforce readiness, the Philippines has been integrating telehealth and ehealth programs into the mandatory continuing professional development programs for healthcare professionals including nurses, doctors, and allied medical health professionals. [1]

Singapore, Brunei Darussalam, Indonesia, Malaysia, Philippines, Viet Nam, and Thailand all have existing infrastructure that allows for some level of digital health connectivity.

Thailand, Indonesia, Malaysia, Philippines, and Viet Nam have established basic digital health management systems that can track unique digital identities of registered patients and users in the system.

Table 2 highlights concrete achievements made by selected AMSs on the seven indicators.

TABLE 2. ACCOMPLISHMENTS OF ASEAN COUNTRIES IN DIGITAL HEALTH

DIGITAL HEALTH INDICATOR	AMS ACCOMPLISHMENTS
LEADERSHIP AND GOVERNANCE	The Malaysian government is one of the first AMSs to enact legislation with the Telemedicine Act in 1997. The Philippines enacted the Telehealth Act of 2012 and the subsequent Data Privacy Act of 2012. Singapore implemented its National Telemedicine Guidelines in 2015.
STRATEGY AND INVESTMENT	The Malaysian government provides grants, acceleration, and regulatory support for digital health startups through the Malaysian Research Accelerator for Technology & Innovation. Singapore's Startup SG provides funding and investment, infrastructure, and workforce support to startups including digital health companies.

[1] Continuing professional development in the Philippines is mandated by the Republic Act No. 10912: Continuing Professional Development Act of 2016.

LEGISLATION, POLICY, AND COMPLIANCE	Indonesia, Malaysia, Philippines, Singapore, and Viet Nam have existing laws and regulations specific to medical data protection and data privacy (refer to the Appendix). Brunei Darussalam, Lao PDR, and Thailand have regulations governing data protection for digital health use. Cambodia and Myanmar are still in the review stages of their data protection policies.
WORKFORCE	The University of the Philippines Manila–National Telehealth Center provides accredited continuing professional development programs for licensed nurses on ehealth training for health professionals, open source medical record systems, community health information tracking system, and HIV telehealth training program, among others. [2]
STANDARDS AND INTEROPERABILITY	Brunei Darussalam established the Brunei Darussalam Healthcare Information and Management System in 2012, which integrates the management of all patients' health data through the country's electronic patient record system or One Health One Record System.
INFRASTRUCTURE	Singapore is integrating the connectivity of healthcare services and processes by establishing the following systems: HealthHub, National Electronic Health Record, Next Generation Electronic Medical Record, National Harmonised Integrated Pharmacy System, and the National Billing System. Upon completion, these systems will allow the seamless integration of all patient data in the healthcare journey across various care settings and providers.
SERVICES AND APPLICATIONS	Singapore established its National Electronic Health Record System in 2012. Brunei Darussalam established the One Health One Record System in 2013.

Overall, gaps (scores equal to or less than 3) needing further strengthening are in the areas of strategy and investment, workforce, and standards and interoperability. In addition to these, key experts and individuals in Lao PDR, Malaysia, Philippines, Singapore, and Viet Nam contributed their insights on the contextual challenges and opportunities of implementing digital health initiatives in their respective countries. The following section unravels the various layers of digital health implementation in selected ASEAN countries.

[2]For a list of the accredited continuing professional development programs for Filipino nurses, see NURSING PROGRAM12092020.pdf (prc.gov.ph).

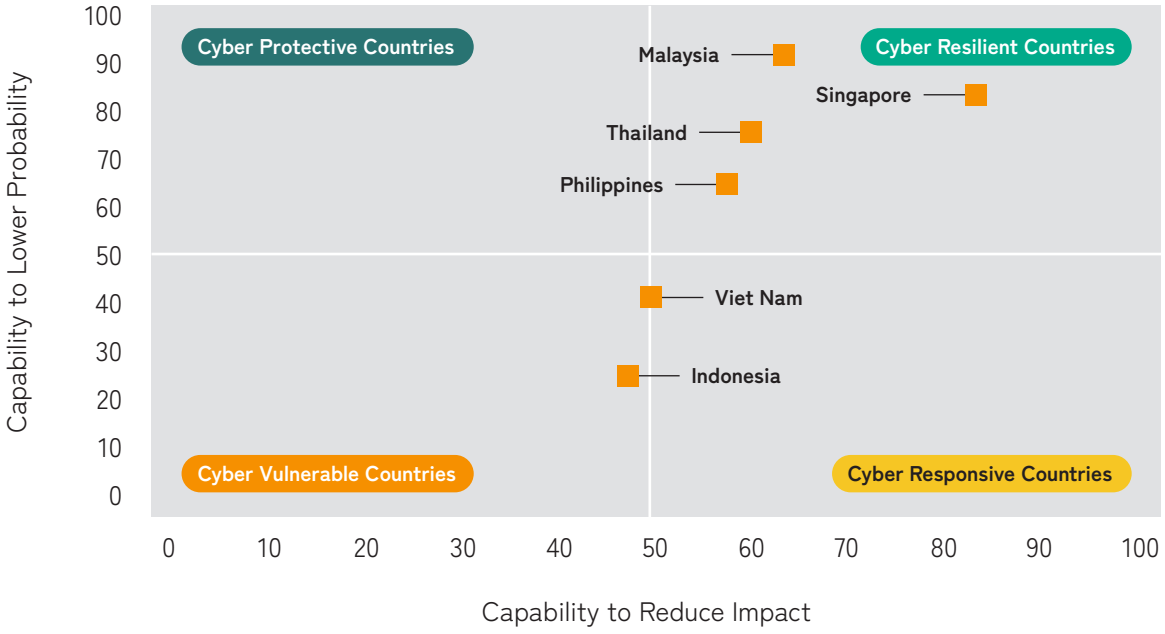
4. CHALLENGES AND GAPS IN DIGITAL HEALTH ADOPTION AMONG AMSS

Despite significant achievements for some ASEAN countries in establishing frameworks and infrastructures for digital health, the challenge for the public and private sector in adopting digital health technologies is mainly user trust.

4.1. LACK OF TRUST IN DATA PROTECTION AND CYBERSECURITY

In a study on the state of cybersecurity and resilience in six Southeast Asian countries, Singapore, Malaysia, Thailand, and the Philippines exhibited strong cyber resilience capabilities, while Viet Nam and Indonesia were found to be cyber vulnerable countries (TFGI 2023; Figure 8). Borrowing from the Organisation for Economic Co-operation and Development's concept of resilience as used in disaster management, the study defines cyber resilience as the "ability of individuals, communities, and states and their institutions to absorb and recover from shocks, whilst positively adapting and transforming their structures and means for living in the face of long-term changes and uncertainty" (TFGI 2023, 17). Regulations on data protection must be able to flexibly adapt given the fast and iterative nature of software and digital health technology.

FIGURE 8. STATE OF CYBER RESILIENCE IN SIX ASEAN MEMBER STATES



Source: Cyber Resilience Framework in TFGI (2023, 25)

Note: Cyber protective countries have high capability to reduce probability but have low capability to reduce impact. Cyber resilient countries have high capability to reduce probability and have high capability to reduce impact. Cyber vulnerable countries have low capability to reduce probability and have low capability to reduce impact. Cyber responsive countries have low capability to reduce probability but have high capability to reduce impact.

The government's role in shaping trust in technology is high if public trust in the government's transparency is relatively high:

"I will definitely feel secured because it is a government application. By government application, that means it has gone through a whole lot of data protection, [and] government security check audit". – Digital health startup accelerator from Singapore

This trust is concurrently tied with the strength of governance on data-related policies and regulations, which creates an atmosphere of security. Public trust in the government tends to be derailed by persisting threats such as cybersecurity issues, which remains a challenge for most ASEAN countries:

"During the pandemic, when we were doing our main app for the pandemic management...because it was

led by the government, so the trust was very high. We had almost 30 million users on it... Cybersecurity issues not only in Malaysia but also in neighbouring countries... that shakes out the trust". – State medical director in Malaysia

Among ASEAN countries, Cambodia and Myanmar have not implemented laws or policies that protect medical and health data, while other AMSs have some regulations that protect data in general.

Lack of trust also relates to the social norms and health-seeking behaviours concerning technology. The COVID-19 pandemic created an incentive for the use of telehealth and other forms of remote medical platforms amid community quarantines that made traveling to medical facilities a challenge. However, some key experts noted that in the wake of post-COVID rehabilitation, patients have defaulted back to the traditional in-person consultation even if the option of telehealth is made available to them.

"It is about trust and the habits; people still are very accustomed to going to a hospital. Despite all the pain points of a patient journey, some people will take two hours, go to a rural provincial [hospital] to the city, wait for two hours again to see a doctor for only two minutes, and then go back home".
– Manager in a multinational digital health company in Viet Nam

As telehealth requires digital connectivity, access to such services may be limited to urban communities that have a more stable network connection, and mobile phone ownership and utilization may be demographic-specific and pose a challenge for older patient populations.

"In terms of public acceptance, people are generally ready to embrace technology; [however] the degree of usage may vary. However, connectivity remains an issue in rural areas... cashless transactions are prevalent, driving smartphone usage, and the majority of people own smartphones with improved connectivity. These supportive factors are essential for the advancement of digital health". – State medical director of Malaysia

Ensuring digital connectivity and network readiness remains an essential component of digital health integration and adoption, as noted previously.

4.2 FRAGMENTED DIGITAL HEALTH SYSTEMS

Among the key challenges facing ASEAN countries is the establishment of a secure medical data identification system.

"We face challenges in maintaining a consistent health identification system. Different hospitals use different health IDs, making it difficult to exchange health information". – Former head of health informatic division in Lao PDR

Related to medical data identification is data ownership, which ideally should be owned by the patient. However, without a clear regulation on data ownership, protection, and privacy, security remains an issue.

"While we promote data interoperability, data ownership is not well-defined in Malaysia. Currently, patient data belongs to hospitals. We are working on enabling patients to own their data. We are also pushing for more collaboration with cloud service provider to ensure compliance and security, though challenges exist in government regulations".
– Government startup accelerator in Malaysia

The government plays an important role in ensuring that these regulatory policies are in place to protect patient data and ensure that whoever owns medical data has the adequate means to keep it secure.

"Seamless transition of patient data through a circled platform that allows registered and certified healthcare entities. It can be startups, small businesses, publics hospitals to assess information upon request by the specific user". – Digital health startup accelerator from Singapore

Patients must be sure that their data are responsibly managed when they utilize digital health services. Equally, hospitals and medical institutions must comply with established legal standards and guidelines to guarantee the safety and security of patient data records.

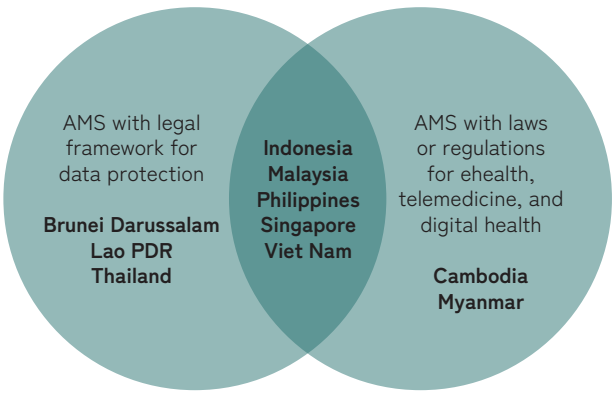
5. ADVANCING DIGITAL HEALTH ADOPTION IN ASEAN

Given the relative differences in the digital health capacities and uptake of ASEAN countries, this report offers four strategies for governments to advance the adoption of digital health in the region. These are (1) build trust through data protection and governance, (2) develop standards for an interoperable digital health infrastructure, (3) enable digital startups to foster innovation, and (4) promote healthcare professionals' digital training support.

5.1. BUILD TRUST THROUGH DATA PROTECTION AND GOVERNANCE

In addition to enhancing the interoperability of the healthcare data ecosystem, fostering user trust is also vital for the adoption of digital health in the region. Experts in digital health underscore the importance of robust regulatory structures and mechanisms that balance innovation and data security. Achieving this balance is essential as it would foster confidence in the ecosystem. Figure 9 shows that out of the 10 AMSs, five have existing laws and regulations specific to digital health and data protection and three have legal frameworks for data protection, while two are still developing both. The Appendix presents a comprehensive list of existing laws and regulations on telemedicine and telehealth and data protection for medical data.

FIGURE 9. DATA PROTECTION AND DIGITAL HEALTH LAWS AND REGULATION AMONG ASEAN COUNTRIES



Source: Authors

Trust is a key element in the adoption of digital health technologies, especially for users who are encountering and using digital health services for the first time. A recommended approach to fostering trust and ensuring the implementation of appropriate guidelines is the adoption of sandbox practices. Digital health sandboxes provide a controlled environment for the preliminary testing of new technological solutions prior to their public release. This also presents a timely opportunity for regulators to ascertain that clear data governance, stringent cybersecurity guidelines, and data protection policies are in effect. At present, countries like Singapore, Malaysia, and Indonesia have implemented sandbox programs specifically for digital health technologies.

5.2. DEVELOP STANDARDS FOR AN INTEROPERABLE DIGITAL HEALTH INFRASTRUCTURE

Within ASEAN countries, the absence of a comprehensive and unified digital health data system is a significant hurdle. Notably, the Philippines and Malaysia have created comprehensive national digital health frameworks and blueprints and industry standards for health information exchange. Singapore, Malaysia, and Brunei Darussalam have established nationwide electronic medical records systems. Despite these efforts, the integration and use of medical data across diverse platforms continues to be inconsistent. This issue prevents the seamless connectivity of health data and complicates the user experience in digital health.

In terms of data encoding, the absence of uniform data standards and taxonomy are major obstacles in allowing interoperability of electronic health records. For instance, when documenting a patient's medical history, public and private hospitals employ various platforms to encode medical data, which could be in different formats. Without well-defined data standards, the task of synchronizing digital systems and enhancing interoperability remains challenging.

To enhance interoperability, unifying data encoding is key to harmonizing data and creating a data system for the healthcare sector. A certain degree of digital proficiency is also required for healthcare workers to shift from paper records to digital data and to understand and use the same taxonomy of medical data.

CASE STUDY 1: ESTABLISHING SINGAPORE'S NATIONAL ELECTRONIC HEALTH RECORD

In 2011, Singapore's Ministry of Health initiated its first national electronic health record (NEHR), which became the foundation for the integration of all patients' medical records and can be accessed by various public and private healthcare providers who are onboarded into the system. This development was motivated by the continuity of care envisioned in the "One Patient One Record" goal of the Ministry of Health. Health data stored in the NEHR includes patient demographics; hospital visit, admission, and discharge history; radiology and laboratory test results; medication history and allergies and drug reactions; and surgical procedure history (Synapxe n.d.).

Singapore's healthcare system combines public and private health servicing, where primary care is 80% private (general practitioner clinics) and 20% public, secondary and tertiary care is 80% public and 20% private (hospitals), and intermediate and long-term care is 70% public and 30% private. Initial implementation challenges included the unevenness of data encoding from various sources, including codification, structure, availability, and taxonomy.

To overcome these initial challenges, the implementation was staged in two phases. The first phase beginning in 2012 involved one-way sharing of health data, limiting viewing of health information to the NEHR portal. The second phase, which was accomplished in 2015, included increased integration and two-way health data flows, more information and data sources, and increased portal access and reconciliation services (Stephanie 2018, 1129).

An important aspect and challenge of setting up the NEHR is the onboarding of both public and private healthcare providers, especially the latter, which may regard being part of the network as unnecessary and costly. At present, some private clinics and health providers (including general practitioners and outpatient specialists) are accessing the NEHR. See (2020) revealed that among private healthcare service providers that do not access it, low levels of technical aptitude and perceived inadequate level of support contribute to less likelihood to use the system.

5.3. ENABLE DIGITAL STARTUPS TO FOSTER INNOVATION

In addition to the adoption of digital technologies by conventional healthcare entities like hospitals and clinics, digital health specialists emphasize the crucial role of startups in propelling the digital health ecosystem forward. These startups are instrumental in creating technology-driven solutions that not only encourage users to embrace digital health but also introduce pioneering business models.

To stimulate innovation in the healthcare sector, nations like Singapore and Malaysia have set up specialized agencies to aid digital health startups. For instance, Startup SG offers financial assistance, education, and infrastructure support for startups, accelerators, and investors. Similarly, the Malaysian Research Accelerator for Technology & Innovation serves as an accelerator, providing research incubation assistance from the conceptual stage to market entry and expansion.

"The sandbox process involves technology assessment teams evaluating start-ups' readiness for clinical validation. We advise start-ups on whether they need sandbox validation or can proceed to market access". – Government startup accelerator in Malaysia

"The main challenge for local innovations is the cost of certification. Medical devices, especially high-risk ones, require costly tests. The application process itself can be time-consuming sometimes taking six months to a year. This is a major financial burden for start-ups, potentially leading to bankruptcy".
– Government startup accelerator in Malaysia

While pinpointing a viable business model and a proof of concept with real market value and demand is a key step in fostering innovation, it is just the beginning. Equally important is for governments to facilitate the entry of digital startups into the market by ensuring fair competition. Enabling these startups to expand and flourish is vital for them to make a significant contribution to the healthcare industry.

CASE STUDY 2. INDONESIA'S TELEHEALTH SANDBOX

In 2023, Indonesia's Ministry of Health launched a regulatory sandbox with the aim of testing new innovations in digital health, specifically in telemedicine. This initiative was formalized through Decree No. HK.01.07/Menkes/1280/2023. Initially, the sandbox program was started to find innovative solutions to malaria treatment. Eventually, it expanded to include telemedicine applications (Antara 2023a).

The telemedicine sandbox aimed to foster innovative digital solutions, while ensuring regulatory compliance. One of the criteria specified by the decree is for the digital solution to have the potential to benefit the public through inclusivity and equal accessibility. The initiative gathered interest from 15 developers, including Riliv, Medic+, Klinik Simas Sehat, Good Doctor, Naluri, MyCLNQ Sehat, Lifepack, Alodokter, Halodoc, Sehati TeleCTG, Getwell, FitHappy, Cexup, SIRKA, and SehatQ (Antara 2023b). The sandbox closed in December 2023 with the government currently assessing the next steps in terms of potential policies for the telehealth sector.

Regulatory sandboxes in Indonesia's digital health industry are expected to include other sectors of the digital health ecosystem, including the protection of personal data, the pharmaceutical industry, and data-based health technologies (Antara 2023a).

5.4. PROMOTE HEALTHCARE PROFESSIONALS' DIGITAL TRAINING SUPPORT

One of the main challenges of several AMSs' digital health capacities involve limited availability of digital-ready healthcare professionals and tech supporters. Interviews with several health officials echoed this assessment, who noted that because the priority has largely been on infrastructure development, limited public resources have hampered streamlined training of health professionals.

Many opportunities exist to include digital health subjects in health education curricula, in continuing professional education courses, and in post-graduate studies.

The ASEAN Mutual Recognition Arrangements aim to harmonize education and professional qualifications of selected professionals, including of doctors, nurses, and dentists, and could be a good platform for onboarding digital health capacity building among ASEAN professionals, or as part of certification requirements.

The private sector and non-governmental organizations also play an important role in building the capacities of health professionals, especially in aligning with industry standards.

TOWARDS DIGITAL-IN-HEALTH

The role of digital health in expanding medical services to a wider consumer base in Southeast Asia will continue given current developments in medical and health technology. The implications of this will be varied and wide-ranging and adjust rapidly to the needs of changing societies. ASEAN countries are gradually evolving towards an older population, and the WHO projects that by 2030, 13.7% of Southeast Asians will be over 60 years old, a figure anticipated to rise to 20.3% by 2050. Moreover, new illnesses and diseases needing new therapeutic interventions are emerging. The use of digital health technologies will aid in enhancing accessibility and elevating the quality of care as Southeast Asia confronts new health issues resulting from an ageing population.

This report underscores the importance of establishing standards to allow for data interoperability among health service providers, building trust through strong governance in data protection, supporting innovation through digital startups, and promoting the digital training of healthcare professionals.

While the pandemic has significantly accelerated the adoption of digital health, it is vital to underscore the responsibility of ASEAN governments in maintaining this progress. Incorporating digital transformation strategies into broader national health plans could direct the attention of digital health ecosystem participants towards infrastructure, trust, and innovation, all of which are essential for advancing the digital health agenda.

REFERENCES

ACCESS Health International Southeast Asia (2019). *Reaching 650 million: Digital technology is key to achieving universal health coverage in ASEAN.* Singapore. https://accessh.org/reports/reaching-650-million-how-digital-technology-is-key-to-achieving-universal-health-coverage-in-asean/

Antara (2023a). Health Ministry launches regulatory sandbox to secure telemedicine. Accessed 4 June 2024. https://en.antaranews.com/news/278697/health-ministry-launches-regulatory-sandbox-to-secure-telemedicine

Antara (2023b). Minister announces 15 health innovators chosen for regulatory sandbox. Accessed 4 June 2024. https://en.antaranews.com/news/283449/minister-announces-15-health-innovators-chosen-for-regulatory-sandbox

GDHM (Global Digital Health Monitor) (2023a). Database. Accessed 21 March 2024. https://monitor.digitalhealthmonitor.org/map

GDHM (Global Digital Health Monitor) (2023b). The state of digital health 2023. https://digitalhealthmonitor.org/stateofdigitalhealth23

Network Readiness Index (2023). Accessed 21 March 2024. https://networkreadinessindex.org/countries/

See, Q. Y. (2020). Attitudes and perceptions of general practitioners towards the National Electronic Health Record (NEHR) in Singapore. *European Medical Journal* 5(1): 86–93. https://doi.org/10.33590/emj/19-00184

Stephanie, F. L. (2018). Singapore's NEHR: Challenges on the path to connected health. 2017 IEEE International Conference on Industrial Engineering and Engineering Management, December 2017, 1128–1132. https://dx.doi.org/10.1109/IEEM.2017.8290068

Synapxe (n.d.). National health electronic record. Accessed 4 June 2024. https://www.synapxe.sg/healthtech/national-programmes/national-electronic-health-record-nehr/

TFGI (Tech for Good Institute) (2023). *Towards a resilient cyberspace in Southeast Asia.* https://techforgoodinstitute.org/wp-content/uploads/2023/07/TFGI_Towards_a_Resilient_Cyberspace_in_Southeast_Asia_Executive_Summary.pdf

World Bank (2023). *Digital-in-health: Unlocking the value for everyone.* Washington DC: The World Bank. https://openknowledge.worldbank.org/entities/publication/06ffb4d1-a7c0-4563-9feb-f14fa8395e32

WHO (World Health Organization) (2010). *Monitoring the building blocks of health systems: A handbook of indicators and their measurement strategies.* Geneva: WHO.

WHO (World Health Organization) (2012). *National ehealth strategy toolkit.* Geneva: WHO. https://www.who.int/publications-detail-redirect/national-ehealth-strategy-toolkit

WHO (World Health Organization) (2021). *Global strategy on digital health 2020–2025.* Geneva: WHO.
https://www.who.int/publications/i/item/9789240020924

WHO (World Health Organization) (2023). Health statistics 2023: Annex 2. Geneva: WHO. https://www.who.int/data/gho/publications/world-health-statistics

APPENDIX

TABLE 3. LAWS AND POLICIES ON TELEHEALTH AND DATA PROTECTION OF MEDICAL DATA IN 10 ASEAN MEMBER STATES

	LAWS OR REGULATIONS ON TELEMEDICINE OR TELEHEALTH	LAWS OR REGULATIONS ON DATA PRIVACY AND DATA PROTECTION
BRUNEI DARUSSALAM	None	Personal Data Protection Order (under development by the Authority for Info-communications Technology Industry of Brunei Darussalam)
CAMBODIA	None	E-Commerce Law (2019)
INDONESIA	Minister of Health Regulation No. 9 of 2020 on Guidelines for the Implementation of Telemedicine Services Konsil Kedoktoran Indonesia (KKI) Regulation No. 74 of 2020 on Clinical Authorities and Medical Treatment Through Telemedicine During the COVID-19 Pandemic Regulation of Minister of Health of the Republic Indonesia No. 20 of 2019: Organisation of Telemedicine Services through Health Service Facilities Law No. 36 of 2009 on Health	Electronic Information and Transactions Law, supplemented by two regulations: Government Regulation No. 71 of 2019 regarding Provisions of Electronic Systems and Transactions and Minister of Communications & Informatics Regulation No. 20 regarding Protection of Personal Data in Electronic System (" PDP Regulation "). Law of the Republic of Indonesia No. 11 of 2008 Concerning Electronic Information and Transactions
LAO PDR	None	Law on Electronic Data Protection No. 25/NA (2017) Law on Resistance and Prevention of Cybercrime No. 61/NA (2015)
MALAYSIA	Telemedicine Act 1997 (Ministry of Health) Malaysian Medical Council Advisory on Virtual Consultation 2020 (during the COVID-19 pandemic) Medical Device Authority Act (2012) (Act 737)	Personal Data Protection Act 2010 and subsidiary regulations
MYANMAR	None	None

PHILIPPINES	Telehealth Act of 2012 Telehealth Act of 2014 Senate Bill No. 1618 (The Philippine eHealth Systems and Services Act) *(Not yet enacted) Guidelines of the Use of Telemedicine in COVID-19 Response Privacy Guidelines on the Processing and Disclosure of COVID-19 Related Data for Disease Surveillance and Response Guidelines on the Monitoring and Evaluation (M&E) of the Use of Telemedicine in COVID-19 Response Department of Health-University of the Philippines Manila (DOH-UPM) Joint Memorandum Circular No. 2020-0001 "Telemedicine Practice Guidelines"	Republic Act 10173: Data Privacy Act of 2012
SINGAPORE	Health Services Act 2021–2022 (Singapore Ministry of Health) 2015 National Telemedicine Guidelines (Ministry of Health) Ethical Code and Ethical Guidelines 2016 - A6. Telemedicine (Singapore Medical Council) Regulatory Guidelines for Telehealth Products and Devices (2018)	Personal Data Protection Act 2012 (No. 26 of 2012) and other subsidiary legislations and regulations
THAILAND	Notification No. 54/2563 (2020) Guideline on Telemedicine and Online Clinics (The Medical Council of Thailand) eHealth Strategy, Ministry of Public Health (2017–2026)	Personal Data Protection Act 2019 - section 26
VIET NAM	Regulating the Management of Distance Medicine Circular 49/2017 (Viet Nam Ministry of Health) Decision No. 4888 of 2019: Application of Smart Health Information Technology in the Period of 2019-2025 (Ministry of Health) Law No. 15/2023/QH15 – article 80: Law on Medical Examination and Treatment 2023.	Decree No. 13/2023/ND-CP on Personal Data Protection Law on Network Information Security 2016 Directive No. 16 of 2017

Source: Collected by authors from various sources (links to the original source are included where available)

ASEAN-JAPAN
CENTRE