



ASEAN Socio-Cultural Community POLICY BRIEF

ASCC Research and Development Platform | Policy Brief #6 | 2023

EXECUTIVE SUMMARY

- Digital health transformation can address the soaring demand for high-quality health services and increasing healthcare costs in ASEAN.
- ASEAN Member States have taken a further step towards digital health transformation. Nevertheless, there is still room for advancement to narrow the gaps and optimize digital health transformation among ASEAN Member States.
- Currently there is no uniformity in the current landscape of digital health readiness among ASEAN Member States, where there are various legislative products, standards of digital products, infrastructure readiness, and digital literacy.
- Efforts to advance the region's digital health must be able to enforce the enabling factors of digital transformation and be tailored to address challenging aspects within the region.

POLICY RECOMMENDATIONS

- Standardize and strengthen the regulatory framework of digital health across the ASEAN region.
- Strengthen regional digital literacy, capacity, and infrastructure by creating more funding, knowledge transfer opportunities, and capacity building programmes.
- Standardize the quality and interoperability of digital applications.
- Enrich multi-sectoral and regional collaboration by establishing relevant collaborative platforms.

This policy brief was made possible with the support of:
The Government of Japan through the Japan-ASEAN Integration Fund (JAIF)



TRANSFORMING THE DIGITAL HEALTH LANDSCAPE IN ASEAN

Resilience Development Initiative and Aly Diana

Introduction

While rapid economic growth across ASEAN Member States (AMS) has ushered new levels of wealth, opportunities and quality of life, it has also brought about challenges such as the soaring demand for high-quality health services and rising healthcare costs (Mistry et al., 2019, pp. 7-11). Digital health transformation has the potential to address these issues, and it can be cost-effective in delivering healthcare services even to marginalized areas.

The COVID-19 pandemic has catalysed the sprint towards a technologically advanced health system (EU-ASEAN Business Council, 2022). Investment expansion in tech-enabled businesses is soaring, with telehealth and on-demand care (41%) and predictive analytics (43%) having the highest percentage of capital invested in Southeast Asia's health technology (GPCA, 2021, pp.10-11).

To create best practices on digital health transformation in ASEAN, it is crucial to consolidate its current landscape

The Resilience Development Initiative team comprises Bony Wiem Lestari, MD, MSc; Fadilah Fitri Arsy, BSc (PH); Annisaa Indrarini, BEng, MSc; Fachriey Mungkasa, BA; and Delaneira Humaira, BURP. Aly Diana, MD, PhD, is from the Department of Public Health, Faculty of Medicine, Universitas Padjadjaran, Bandung, Indonesia.

of digital health utilization, as well as the remaining challenges that need to be addressed. This policy brief aims to illustrate the current advances of digital health transformation in the ASEAN region and provide recommendations for improvements.

Use Cases of Digital Health in ASEAN

Digital health refers to the knowledge and practice associated with developing and using digital technologies to improve health (WHO, 2021, p. 9). Digital health transformation has revolutionized the region's health ecosystem through its various advantages. Telemedicine and other technology are cost-effective in extending the reach of high-quality healthcare into isolated communities, supporting the achievement of Universal Health Coverage. Digital systems, big data analytics, and artificial intelligence also play a critical role in ASEAN's response to public health issues.

Telemedicine and Digital Health Applications

Telemedicine is increasingly playing a critical role in AMS' health systems. Almost all AMS possess numerous hotlines, websites, and mobile applications available for telemedicine (Macariola et al., 2021). These services have spanned rural to urban areas, extending health coverage to the least unfortunate (Gajarawala and Pelkoswki, 2021). For instance, Indonesia's Halodoc application and Malaysia's teleconsultation programme enable remote and online consultations between doctors in rural clinics with more specialized healthcare providers (Mistry et al. 2019; Som et al. 2010). Digital health also improves the wellbeing of the aging population, e.g., Thailand's DoCare Protect, which uses room sensors to monitor elderly health, and Singapore's Dementia Friends application, which coordinates community support for dementia patients (Elgazzar et al. 2020, p.22).

Digital Systems and Big Data Analytics

Digital systems and big data analytics have a huge role in advancing various healthcare sectors. These technologies are known to help predict therapeutic outcomes and the potential of new treatment regimens, including in the event of emergencies (Abidi 2019, p.1). In Brunei Darussalam, a system called BRU-HIMS includes patients' data from all public hospitals into a single electronic medical record (Brunei Ministry of Health n.d.). In ASEAN, a digital data analytics and visualization system called the ASEAN BioDiaspora Virtual Center is used to address public health emergencies (PHE).

Artificial Intelligence

The role of Artificial Intelligence (AI) in improving care quality include monitoring and diagnostic systems, robotic services, and treatment through advanced technology. In the ASEAN region, AI adoption is still in the nascent stages, meaning that many companies are piloting AI initiatives, while only a few are in the advanced stages of AI implementation, typically those in more service-oriented sectors (Chua and Dobberstein, 2020, p.4).

In Singapore, the utilization of AI has supported several services, e.g., pathology and medicine delivery. Consumer-focused applications have also been developed, including OneNUHS App and OneNUHS Health Chatbox, which use AI-powered diagnostic and predictive systems to diagnose patients through chat (Lee, 2022).

AI utilization also helps rapid diagnosis and early detection of high-risk patients (Wang et al. 2021, p.11). In Indonesia, AI is used by a start-up named CekMata for the early detection of cataracts (mClinica, 2020). In Thailand, IBM Watson

supercomputer analytics has been integrated into the oncology department at Bumrungrad International Hospital to advise doctors on the best treatment plans for cancer patients (ibid.).

Case Example: Digital Health for COVID-19 Management

Many digital health interventions have been used in ASEAN to address public health emergencies, with the most recent being the COVID-19 pandemic. For instance, Malaysia’s MySejahtera and Indonesia’s PeduliLindungi serve as a mobile-based digital hub for COVID-19-related information, such as individual vaccination status, test results, and national COVID-19 statistics. Furthermore, in Singapore, a new AI tool was developed to predict if an admitted patient will develop mild or severe pneumonia within 30 days.

Moreover, Khan (2022) stated that big data analytics can support global epidemic intelligence platforms. ASEAN and AMS have harnessed the potential of digital systems and big data analytics to address these needs, in which ASEAN has established the PHE Portal and the BioDiaspora tools, including the ASEAN BioDiaspora Virtual Center (ABVC) initiatives. ABVC aims to build regional capacity in big data analytics and visualization, strengthening ASEAN’s epidemic and pandemic preparedness and response capabilities. The programme links multiple datasets and empowers its member states’ public health through real-time web-based risk assessment tools (the explorer and the insight tool). It provides updated reports on national risk assessments, readiness, and response planning efforts.

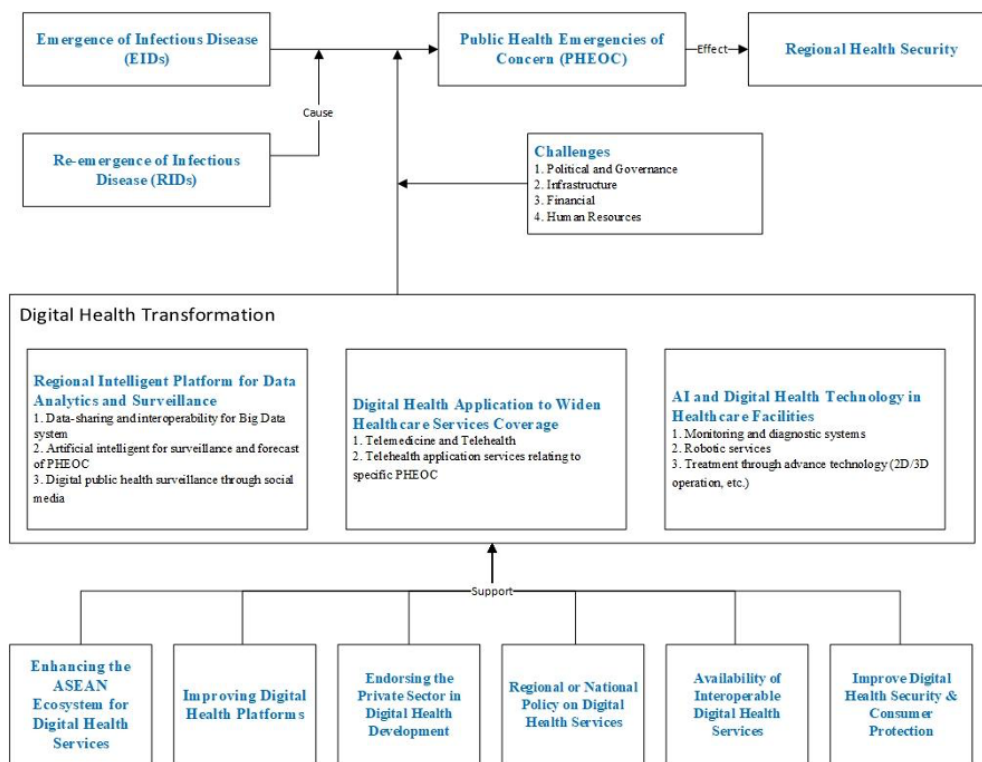


Figure 1. The Framework of Digital Health Transformation to Support Regional Health Security

Current Landscape of ICT Preparedness in ASEAN: Barriers and Enablers to Digital Health Transformation

Generally, the penetration of technology in ASEAN has been rapid, albeit at different rates. Nevertheless, there is still room for further advancement to narrow the gaps in digital health transformation among AMS, and to achieve digital health system adoption as envisioned in the ASEAN Socio-Cultural Community Blueprint 2025 and the

ASEAN Digital Masterplan 2025. In this section, we divide the barriers and enablers to digital health transformation in the ASEAN in accordance with WHO eHealth components: leadership and governance, strategy and investment, legislation, policy, and compliance, infrastructure, workforce, standards and interoperability, and services and applications (Figure 2). Table 1 summarizes ASEAN’s current digital health landscape.

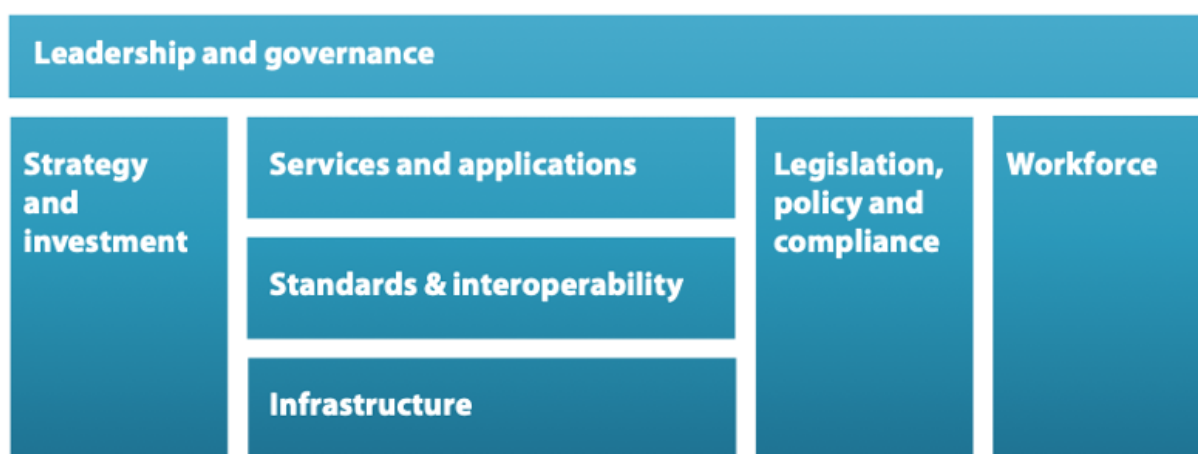


Figure 2. WHO eHealth Components
Source: WHO 2012

1. Leadership and Governance

Adequate governance is important to encourage the growth of the digital health industry. Leadership and governance entail direction and coordination mechanisms of digital health at the national level, as well as multi-sector engagement and specification of roles (WHO, 2012).

Digital health initiatives in AMS are more often private sector-driven. ASEAN governments have

frequently collaborated with the private sector in developing digital health services, as exemplified in the collaboration between Halodoc and the Indonesian Ministry of Information and Technology to strengthen the COVID-19 management ecosystem. Within ASEAN, public-private partnership is also evident, as exemplified by the ‘Go Digital ASEAN’ programme that focuses on digital skills training.

AMS	Leadership & Governance	Strategy & Investment	Legislation, Policy and Compliance			Infrastructure		Workforce
	Evidence of multisectoral coordination, e.g., public-private partnerships (ASEAN, 2022 and HKTDC, 2021)	Importance of ICTs to government vision, range 0-10 (Wiley, 2021 based on WEF, 2016)	The presence of digital health legislation (HKTDC, 2021, WHO, 2015, and various countries policies)	Law on data privacy (HKTDC, 2021 and Deloitte, 2018)	Cybersecurity performance, range 0-10 (Wiley, 2021)	LTE coverage in population (avg 2017-19), in % (ASEAN, 2021)	Smartphone penetration, in % (Statista, 2020)	Digital Skills Gap Index, range 0-10 (Wiley, 2021)
Brunei Darussalam	Yes	7.2	Yes	Yes*	6.2	93%	88%	6.1
Cambodia	Yes	3.3	Yes	Yes*	1.6	73%	47%	2.8
Indonesia	Yes	5.5	Yes	Yes	7.8	95%	67%	5.2
Lao PDR	Yes	N/A	Yes	Yes*	N/A	26%	40%	N/A
Malaysia	Yes	8.7	Yes	Yes*	8.9	93%	88%	7.2
Myanmar	Yes	1.6	Yes	Yes*	1.7	76%	54%	3.0
The Philippines	Yes	4.4	Yes	Yes	6.4	87%	72%	5.1
Singapore	Yes	9.6	Yes	Yes	9.0	100%	88%	7.8
Thailand	Yes	4.2	Yes	Yes*	8.0	98%	77%	4.5
Viet Nam	Yes	3.8	Yes	Yes*	6.9	95%	71%	5.0

*Yes, but not specific for digital health

Table 1. Current ASEAN Digital Health Landscape based on WHO eHealth Components

Notes: i.e., standards and interoperability and services and applications components are not included as these components cannot be used for comparison.

To regulate this public-private synergy, some AMS (e.g., Indonesia) have enacted several coordination programmes (Indonesian Ministry of Health, 2021). However, in AI development, ASEAN is still facing limited private sector underinvestment and government sectors' slow adjustment to fast-growing AI technology and the expanding pool of potential AI users (Upalat et al. 2022).

At the regional level, AMS have collaborated with other countries to establish the Asia eHealth Information Network (AeHIN), a network of digital health advocates. AeHIN has assisted the

Asian Ministries of Health (MoH) in implementing national digital health strategies and multi-sectoral coordination systems. It is important to note that the difference in national laws prevents ASEAN from implementing a transnational telemedicine scheme.

Recommendations: (i) AMS should create a shared digital health transformation blueprint and coordination mechanism understood by all stakeholders; (ii) The Ministry of Health within each AMS should strengthen its national digital health project managers' capacity through training

programmes and workshops; and (iii) AMS should collaborate and provide technical assistance for digital health transformation.

2. Strategy and Investment

This component entails responsive strategy, planning, and financing for the digital health environment. These include identifying financing needs and sources, e.g., from the government, private sector, and donors (WHO, 2012).

Generally, digital transformation is included as a priority of AMS. However, the perceived importance varies between countries (Table 1). Several AMS, such as Singapore, Malaysia, Indonesia, and Cambodia, have created a national roadmap for digital health transformation. (WHO, 2021, Indonesian MoH, 2022, and Cambodian Government, 2022).

Differing financial capacities amongst the AMS presents a challenge to furthering digital health transformation. After the COVID-19 pandemic, the lack of funding entangles expansive digital health transformation (e.g., investing in a state-of-the-art surveillance tool), especially when countries are still trying to recover from the adverse impacts of the pandemic (Kotenko and Bohnhardt 2021, p.1). The inability of AMS to provide the utmost focus on digitalization may undermine the progress of digital health transformation and perpetuate gaps between countries altogether.

Recommendations: (i) AMS should prioritize digital health transformation by creating national digital health roadmaps; (ii) AMS should prioritize funding for digital health through collaboration with the private sector and donors; and (iii) to help with financing digital health transformation, ASEAN can create digital health sandbox/incubation programmes, supported financially by the private

sector and donors. An example is the Digital Sandbox programme supported by the European Institute of Innovation and Technology (EIT Health, 2020).

3. Legislation, Policy, and Compliance

This component is described as the development and adoption of national policies and legislation aiming to establish trust and protection for digital health consumers and the industry (WHO, 2012). These include ensuring adequate services quality, data privacy, and reimbursement. Compliance to these regulations should be prioritized through periodic accreditation of digital health products and services (WHO, 2021).

In the ASEAN region, although regulatory barriers removal is already underway, the lack of policy in ASEAN remains one of the main barriers to digital health transformation (Macariola et al., 2021, pp. 3-4; EU-ASEAN Business Council, 2022). Furthermore, the development of data protection regulation has been uneven (ZICO law, 2020). Most countries have not addressed the clinical, ethical, legal, and operational aspects of digital health (Macariola et al., 2021; Sabrina and Defi, 2021). The Global Digital Health Index found that several AMS lag behind in telemedicine rules and privacy laws, particularly in terms of consistent legal enforcement (Global Digital Health Index 2019).

Reimbursement scheme for digital health is a relatively emerging issue. Singapore, Taiwan, and Thailand have provided telemedicine reimbursement for COVID-19 patients (APACMed, 2021).

Recommendations: (i) ASEAN should continue its plan of fostering cybersecurity improvements by building regional trust and security frameworks, as mentioned in the ASEAN Digital Masterplan

2025 (pp.21-22); (ii) ASEAN should promote the development of best practices and aim for a single certification approach to ensure digital health security with participation from regional stakeholders, including the private sectors; (iii) AMS and ASEAN should use the European Union's General Data Protection Regulation (EU GDRD) as a benchmark of ASEAN-specific regulations to help accelerate privacy protection; and (iv) AMS should develop reimbursement schemes for digital health utilization.

4. Infrastructure

ICT infrastructure and internet usage represent another challenge in implementing telemedicine due to digital divides across country lines (Ramsetty and Adams, 2020; Saeed and Masters, 2021). The absence of competition correlates with costly internet connections. Therefore, it is essential to promote competition to ensure quality and in keeping low prices (Salac and Kim, 2016, pp. 87).

AMS, while improving, are subject to relatively inequitable and sparse provision of ICT infrastructure. Table 1 shows that apart from Singapore, the remaining AMS struggle to keep pace with the needed internet speed and infrastructure for digital health (Ookla, 2022; GSM Association, 2021; ASEAN, 2021; and Statista, 2021). In addition, ICT infrastructure and equipment (e.g., mobile tariffs, handset prices) in AMS, apart from Singapore, are not affordable if compared to the rest of the world (NRI, 2021).

Recommendation: AMS should prioritize equitable access to affordable, high-quality internet by providing incentives to the private sector and utilizing government assets to fill the network gaps via targeted wireless services (Tomer et al., 2020).

5. Workforce

This component entails the improvement of digital skills and literacy through education, technical cooperation, establishing relevant networks, and collaborations with the private sector (WHO, 2012). Additionally, this section also focuses on the digital literacy of the general public.

Digital skills and literacy are the bedrock of digital health technology. However, the Digital Skills Gap Index (DGSI) by Wiley showed huge differences in digital skills and literacy among AMS (Table 1, from Wiley, 2021). These findings are supported by Voelker (2021, p.6) who showed that a significant percentage of respondents from least developed countries (LDCs) self-assessed their digital literacy as relatively poor compared to their peers from non-LDCs. Furthermore, rural respondents, ethnic minority respondents, and those between 15-24 years old lag behind their urban, non-minority and younger peers in terms of digital literacy (ibid.).

Among the health workforce, although no ASEAN-wide study was found, a study in an urban setting in Indonesia showed that 7.5% of primary healthcare workers have never used the internet and 15.7% of them have never operated computers (Rachmani, 2019).

Recommendations: (i) The AMS' MoH should conduct proper digital health literacy training and education, in collaboration with the Ministry of Education, the private sector, and other relevant stakeholders; (ii) AMS should create information campaigns on digital health; and (iii) ASEAN should conduct knowledge transfer opportunities regarding digital literacy.

6. Standards and Interoperability

To effectively transform the digital health landscape, it is crucial to introduce standards that allow for accurate and consistent collection and

exchange of information across systems (WHO, 2012). Additionally, a digital health product needs to be user friendly with good UI-UX to bridge the digital divide (Klier et al., 2020).

In the ASEAN region, challenges in implementing data analytics include an unstandardized reporting system, user-centric interpretation, lack of suitable talent, data collection from different platforms, and fragmentation of data (Setiaji, 2022). At the ASEAN level, information on the ABVC is severely scarce and delimits the examination of digital transformation to merely data governance.

Recommendations: AMS should increase the standards and interoperability of public digital health services across AMS by: (i) identifying the most promising product candidates as the benchmark of interoperable health services throughout ASEAN. This has a huge potential as similar digital health services are implemented across all AMS (ASEAN, 2018, pp. 3-4); (ii) creating open access knowledge hubs and technical assistance catering to international health standards for standards and interoperability. ASEAN can create similar programmes as AeHIN or work closely with the network; (iii) conducting capacity building and knowledge transfer opportunities about UI/UX and ease of use of digital health applications; and (iv) integrating digital surveillance through social media platforms to be user-friendly. An example is the epidemic intelligence system in the WHO Regional Office for Africa that utilizes Facebook and Twitter.

7. Services and Applications

These components involve brainstorming and working sessions to develop digital health products that can solve health issues (WHO, 2012).

Recommendation: AMS should periodically conduct surveys on health issues that can be addressed with digital health.

Conclusion

The current digital health landscape in ASEAN is promising, however further efforts are needed to further the transformation, as follows:

1. Standardize and strengthen the regulatory framework of digital health that protect both the consumers and digital health industry

ASEAN and AMS should facilitate knowledge transfer between AMS and periodically hold capacity building programmes for policymakers and stakeholders.

2. Strengthen digital literacy, capacity and infrastructure

ASEAN and AMS should prioritize more funding, knowledge transfer opportunities, and capacity building programmes on digital health transformation.

3. Standardize the quality and interoperability of digital applications

To maximize digital health transformation and public engagement, the products should be interoperable and user friendly. This can be done through capacity building programmes, creating knowledge hubs, and creating innovative solutions to engage the public (e.g., through social media reporting).

4. Enrich regional and global multi-sectoral collaborations programme

Endorsing collaborative multi-sectoral actions is imperative to develop enabling conditions in the region. ASEAN can push for more collaborative actions by establishing relevant platforms (e.g., interoperability lab, capacity building) and digital health sandbox programme.

References

- Abidi Syed Sibte Raza and Samina Raza Abidi.** “Intelligent health data analytics: A convergence of artificial intelligence and big data.” *Healthcare Management Forum*, 32(4) (2021): 178-182.
- Almathami, Hassan Khader, Khin Than Win, and Elene Vlahu-Gjorgievska.** “Barriers and facilitators that influence telemedicine-based, real-time, online consultation at patients’ homes: Systematic literature review”. *Journal of Medical Internet Research*, 22(2) (2020).
- Amit, Arianna Maever, Veincent Christian F. Pepito, Lourdes Sumpaico-Tanchanco, and Manuel Millar Dayrit.** “COVID-19 Vaccine Brand Hesitancy and Other Challenges to Vaccination in The Philippines”. *PLOS Global Public Health* 2(1), no. 0000165 (2022).
- ASEAN.** “Council for ASEAN Chief Justices (CACJ) Working Group on Case Management and Court Technology”. 2018 <<https://cacj-ajp.org/web/wp-content/uploads/2021/06/Summary-on-the-Use-of-Tech-CM-in-ASEAN-Courts.pdf>> (accessed 27 June 2022).
- . *ASEAN Digital Masterplan 2025*. Jakarta: ASEAN Secretariat, 2021.
- . ““Go Digital ASEAN” Impact Summary Report: MSMEs, Job Seekers Benefit from Digital Skills Training”. 27 June 2022 <<https://asean.org/go-digital-asean-impact-summary-report-msmes-job-seekers-benefit-from-digital-skills-training/>> (accessed 7 November 2022).
- Asian Development Bank.** *Basic 2019 Statistics*. Philippines: Asian Development Bank, 2019.
- Asia Pacific Medical Technology Association (APACMed).** “Landscape of Digital Health Reimbursement Policies in APAC”. 2021. <<https://apacmed.org/content/uploads/2021/05/APACMed-Digital-Health-Reimbursement-Policy-Database-APAC.pptx>> (accessed 7 November 2021).
- Brunei Darussalam Ministry of Health.** “BRU-HIMS”. n.d. <<https://www.moh.gov.bn/SitePages/Bru-HIMS.aspx>> (accessed 7 November 2022).
- Burtch, Gordon, and Jason Chan.** “Investigating the relationship between medical crowdfunding and personal bankruptcy in the United States: Evidence of a digital divide”. *MIS Quarterly*, 43(1) (2019), 237–262.
- Chang Anthony.** “The Role of Artificial Intelligence in Digital Health”. *Digital Health Entrepreneurship*, (2019): 71–81.
- Chua Soon Ghee and Nikolai Dobberstein.** “Racing Towards the Future: Artificial Intelligence in Southeast Asia”. *Kearney*, 2020 <<https://www.kearney.com/digital/article/-/insights/racing-toward-the-future-artificial-intelligence-in-southeast-asia>> (accessed 24 June 2022).
- Deloitte.** “Data and Privacy Protection in ASEAN: What Does It Mean for Businesses in the Region?” 2018. <<https://www2.deloitte.com/content/dam/Deloitte/sg/Documents/risk/sea-risk-data-privacy-in-asean.pdf>> (accessed 7 November 2022).
- EIT Health.** “Digital Sandbox Helps Six Start-Ups Access Key Data”. September 2020 <<https://eithealth.eu/news-article/digital-sandbox-helps-6-start-ups-access-key-data/>> (accessed 27 June 2022).
- Elgazzar, Sarah, Joanne Yoong, and Eric Finkelstein.** “Digital Health as an Enabler of Healthy Aging in Southeast Asia”. 28 September 2021 <https://www.duke-nus.edu.sg/docs/librariesprovider5/publications/2020_p003_core_-_digital-health-as-an-enabler-of-healthy-aging-in-southeast-asia.pdf?sfvrsn=ba1206c1_0> (accessed 27 June 2022).
- EU-ASEAN Business Council.** “Webinar - Fit-For-Purpose Regulatory Frameworks for Digital Health Post Covid-19: Opportunities for ASEAN”. 3 May 2022 <<https://www.eu-asean.eu/fit-for-purpose-regulatory-frameworks-for-digital-health-post-covid-19-opportunities-for-asean/>> (accessed 4 June 2022).
- European Center for Disease Prevention and Control (ECDC).** “ECDC Activities on Epidemic Intelligence and Outbreak Response”. 21 June 2021 <<https://www.ecdc.europa.eu/en/about-us/what-we-do/ecdc-activities-epidemic-intelligence-and-outbreak-response>> (accessed 27 June 2022).
- Gajarawala, Shilpa, and Jessica N Pelkowski.** “Telehealth benefits and barriers”. *The Journal for Nurse Practitioners*, 17(2) (2021): 218–221.

- Global Digital Health Index (GDHI).** “Global Digital Health Index 2019”. 2019 <<https://www.digitalhealthindex.org/>> (accessed 24 June 2022).
- Global Private Capital Association (GPCA).** “Emerging Tech Trends in Southeast Asia: Foodtech, Fintech, Healthtech, and Edtech”. June 2021 <<https://www.globalprivatecapital.org/app/uploads/2021/11/GPCA-SE-Asia-Tech-Report-Final.pdf>> (accessed 27 June 2022).
- GSMA.** “2022 – GSMA Mobile Connectivity Index”. GSMA <<https://www.mobileconnectivityindex.com/>> (accessed 24 June 2022).
- Hong Kong Trade Development Council.** “ASEAN Digital Health Landscape: An Overview”. 17 September 2021. <<https://research.hktcdc.com/en/article/ODU1NDkyNDU0>> (accessed 7 November 2022).
- Hollander, Judd E., and Brendan G. Carr.** “Virtually perfect? Telemedicine for Covid-19”. *New England Journal of Medicine*, 382(18) (2020): 1679–1681.
- Mohamad, Intan Sabrina, and Irma Ruslina Defi.** “Telemedicine Guidelines in South East Asia—a Scoping Review”. *Frontiers in Neurology*, no.11 (2021).
- Indonesian Ministry of Communication and Information Technology.** “Bersama Kemenkominfo, Halodoc Integrasikan Layanan Telemedicine” [Indonesian]. 30 June 2022. <https://www.kominfo.go.id/content/detail/27518/bersama-kemenkominfo-halodoc-integrasikan-layanan-telemedicine/0/sorotan_media> (accessed 4 November 2022)
- Indonesian Ministry of Health.** *Blueprint of Digital Health Transformation Strategy 2024*. Jakarta; 2021.
- Iyamu, Ihoghosa, Oralía Gómez-Ramírez, Alice XT Xu, Hsiu-Ju Chang, Sarah Watt, Geof Mckee, and Mark Gilbert.** “Challenges in the Development of Digital Public Health Interventions and Mapped Solutions: Findings from a Scoping Review”. *Digital Health* 8 (2022): 205520762211022.
- Kichloo, Asim, Michael Albosta, Kirk Dettloff, Farah Wani, Zain El-Amir, Jagmeet Singh, Michael Aljadah, Raja Chakinala, Ashok Kanugula, Shantanu Solanki, and Savneek Chugh.** “Telemedicine, the Current COVID-19 Pandemic and the Future: A Narrative Review and Perspectives Moving Forward in the USA”. *Family Medicine and Community Health*, 8(3), no. e000530 (2020).
- Klier, Julia, Mathias Klier, Karharina Schäfer-Siebert, and Irina Sigler.** “#Jobless #Older #Digital – Digital Media User Types of The Older Unemployed”. In *Proceedings of the 28th European Conference on Information Systems (ECIS)* (15–17 June 2020).
- Korwatanasakul Upalat, Dang-Dao Nguyen, and Suonvisal Seth.** “Artificial Intelligence to Unlock Sustainable Development Potential in Southeast Asia”. *Asian Pathways*, 25 February 2022. <<https://www.asiapathways-adbi.org/2022/02/artificial-intelligence-to-unlock-sustainable-development-potential-in-southeast-asia/>> (accessed 23 June 2022).
- Kotenko, Nataliia and Viktoriya Bohnhardt.** “Digital Health Projects Financing: Challenges and Opportunities”. *Health Economics and Management Review* 2(1) (2021): 100–7.
- Lee James.** *A Glimpse into the future of AI Driven Healthcare*, 2022. [Oral Presentation].
- Ma Xiao, Zie Wang, Sheng Zhou, Haoyu Wen, and Yin Zhang.** “Intelligent Healthcare Systems Assisted by Data Analytics and Mobile Computing”. *14th International Wireless Communications & Mobile Computing Conference (IWCMC)* (2018): 1317-22.
- Macariola, Aitana D. Theara Santarin, Ferianne Villafior, Leofe Villaluna, Rea Yonzo, Jamie Fermin, and Myles Tan.** “Breaking Barriers Amid the Pandemic: The Status of Telehealth in Southeast Asia and Its Potential as a Mode of Healthcare Delivery in the Philippines”. *Frontiers in Pharmacology* 12, no. 754011 (2021).
- mClinica.** “AI Adoption in Southeast Asia’s Healthcare Systems”. 1 October 2020 <<https://www.mclinica.com/ai-adoption-in-southeast-asias-healthcare-systems/>> (accessed 23 June 2022).
- Mistry, Sejal, Adrienne Mendenhall, and Raunak Rajore.** *Reaching 650 Million: How Digital Technology is Key to Achieving Universal Health Coverage in ASEAN*. Singapore: ACCESS Health International, 2019.

- Ministry of Industry, Science, Technology, & Innovation of Cambodia.** *HealthTech Roadmap*. Phnom Penh, 2022.
- Network Readiness Index (NRI).** “Network Readiness Index 2021”. 2021 <<https://networkreadinessindex.org/>> (accessed 24 June 2022).
- OECD.** *Economic Outlook for Southeast Asia, China, and India: Reallocating Resources for Digitalisation*. Paris: OECD Publishing, 2021.
- Ookla.** “Internet speed around the world”. Speedtest Global Index, June 2022 <<https://www.speedtest.net/global-index>> (accessed 24 June 2022).
- Rachmani, Enny.** “Digital Health Literacy and Internet Behavior of Primary Health Care Staff in Indonesia, Are They Ready Adopting eHealth?” 12 December 2019. <<https://ahla-indonesia.dinus.ac.id/2019/12/12/digital-health-literacy-and-internet-behavior-of-primary-health-care-staff-in-indonesia-are-they-ready-adopting-ehealth/>> (accessed 7 November 2022).
- Ramsetty, Anita and Cristin Adams.** “Impact of The Digital Divide in the Age of COVID-19”. *Journal of the American Medical Informatics Association*, 27(7) (2020):1147–48.
- Saeed, Sy Atezaz and Ross MacRae Masters.** “Disparities in Health Care and The Digital Divide”. *Current Psychiatry Reports* 23, no. 61 (2021).
- Salac, Romeo Agan, and Kim Yun Seon.** “A Study on The Internet Connectivity in The Philippines”. *Asia Pacific Journal of Business Review*, 1(1) (2016):67–88.
- Setiaji.** *Implementation of Data Analysis in Health’s Digital Transformation*, 2022. [Oral Presentation].
- SIL-Asia.** “What is an Interoperability Lab?”. 30 March 2020 <<http://sil-asia.org/what-is-an-interoperability-lab/#:~:text=A%20health%20interoperability%20laboratory%20is.connect%20digital%20health%20information%20systems>> (accessed 27 June 2022).
- Sit, David.** “The ASEAN Digital Health Landscape: An Overview”. HKTDC Research, 17 September 2021 <<https://research.hktdc.com/en/article/ODUINDkyNDU0>> (accessed 27 June 2022).
- Smith, Anthony, Emma Thomas, Centaine Snoswell, Helen Haydon, Ateev Mehrotra, Jane Clemensen, and Liam Caffery.** “Telehealth for Global Emergencies: Implications for Coronavirus Disease 2019 (COVID-19)”. *Journal of Telemedicine and Telecare*, 26(5) (2020): 309–13.
- Som, M. H. Mat, A. N. Norali, and M. Megat Ali.** “Telehealth in Malaysia – An Overview”. *IEEE Symposium on Industrial Electronics and Applications* (2010):660-64
- Statista.** “Ranking of Smartphone Penetration in Asia by Country 2020.” 2022. <<https://www.statista.com/forecasts/1169108/smartphone-penetration-in-asia-by-country>> (accessed 4 November 2022).
- Sunarti, Sri, Ferry Rahman, Muhammad Naufal, Muhammad Risky, Kresna Febriyanto, and Rusni Masnina.** “Artificial Intelligence in Healthcare: Opportunities and Risk for Future”. *Gac Sanit*, 35(Suppl 1) (2021): S67-S70.
- Tomer, Adie, Lara Fishbane, Angela Siefer, and Bill Callahan.** “Digital Prosperity: How Broadband Can Deliver Health and Equity to All Communities”. The Brookings Institution, February 2020 <https://www.brookings.edu/wp-content/uploads/2020/02/20200227_BrookingsMetro_Digital-Prosperity-Report-final.pdf> (accessed 24 June 2022).
- Van Dijk, Jan A.** “Digital Divide: Impact of Access”. *The International Encyclopaedia of Media Effects*, (2017): 1–11.
- Vassilakopoulou, Polyxeni and Eli Hustad.** “Bridging Digital Divides: A Literature Review and Research Agenda for Information Systems Research”. *Information Systems Frontiers*, 2021.
- Voelker, Marc.** “Digital Literacy in Education Systems Across ASEAN”. UNICEF East Asia and Pacific, February 2021 <<https://www.unicef.org/eap/reports/digital-literacy-education-systems-across-asean>> (accessed 28 June 2022).
- Wang Lian, Yonggang Zhang, Dongguang Wang, Xiang Tong, Tao Liu, Shijie Zhang, Jizhen Huang, Li Zhang, Lingmin Chen, Hong Fan and Mike Clarke.** (2021). “Artificial Intelligence for COVID-19: A Systematic Review”. *Frontiers in Medicine* 8, no. 704256 (2021).

- WHO & ITU.** *National eHealth Strategy Toolkit*. Geneva: World Health Organization and International Telecommunication Union, 2012.
- WHO.** *Atlas of eHealth Country Profiles*. Geneva: WHO, 2015.
- . *Global Strategy on Digital Health 2020-2025*. Geneva: WHO, 2021
- Wiley.** “The Digital Skills Gap Index”. 2021. <<https://dsgi.wiley.com/global-rankings/>> (accessed 4 November 2022)
- World Economic Forum.** “Global Information Technology Report”. 2016. <https://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf> (accessed 7 November 2022).
- ZICO Law.** “ASEAN Insiders Series: Personal Data Protection in ASEAN”. September 2020 <https://www.zicolaw.com/wp-content/uploads/2020/09/ASEAN-INSIDERS_PDPA-in-ASEAN-3.pdf> (accessed 4 June 2022).

Editorial Committee

Advisor	: Dr. Kao Kim Hourn, Secretary-General of ASEAN
Chairperson	: Ekkaphab Phanthavong, Deputy Secretary-General of ASEAN for ASEAN Socio-Cultural Community
Members	: Rodora T. Babaran, Director of Human Development Directorate Ky-Anh Nguyen, Director of Sustainable Development Directorate Roger Yap Chao Jr., Head of Education, Youth and Sports Division Ferdinal Fernando, Head of Health Division Mega Irena, Head of Labour and Civil Service Division Miguel Musngi, Head of Poverty Eradication and Gender Division Jonathan Tan, Head of Culture and Information Division Riyanti Djalante, Head of Disaster Management and Humanitarian Vong Sok, Head of Environment Division
Managing Editor	: Benjamin Loh, Head of ASCC Monitoring Division
Associate Editor	: Dinita Setyawati, Senior Officer, ASCC Analysis Division
Production Editors	: Erie Febriyanto, Officer, ASCC Monitoring Division Pricilia Putri Nirmala Sari, Officer, ASCC Analysis Division Olivia Anday Sope, Project Officer, ASCC Monitoring Division Merina Cahya Anggraeni, Project Officer, ASCC Monitoring Division

This Policy Brief is a publication of the ASEAN Socio-Cultural Community Department of the ASEAN Secretariat. The views expressed in this publication are those of the author(s), and do not necessarily reflect the views of ASEAN and ASEAN Member States, the ASEAN Secretariat, and ASEAN Dialogue Partners. For more information about the ASCC Research and Development Platforms contact the ASCC Monitoring Division at ASCCMONITORING@asean.org