ERIA Discussion Paper Series

No. 358

Gender Digital Equality Across ASEAN

Araba SEY

University of Washington Information School and Research ICT Africa[*]

February 2021

Abstract: *This paper provides an overview of the participation of women in the digital economy across ASEAN. By using available data sources, it compares and analyses levels of women participation in digital economy related occupations and activities across different ASEAN Member States. Overall, the analysis shows that the gap between women and men is bigger with respect to more advanced metrics of access to the digital economy (including skills; entrepreneurship opportunities; access to science, technology, engineering, mathematics, and tech occupations) than for more basic access metrics. Access to digital economy related occupations and activities is particularly important for ASEAN, which is amongst the fastest growing digital economies in the world. The shift towards digital technologies during the coronavirus disease (COVID-19) pandemic is accelerating pre-pandemic trends and making it even more relevant to gain a better understanding of women participation in the digital economy. The paper concludes by providing an overview of policy initiatives in ASEAN Member States and details possible policy options.*

Keywords: Women economic empowerment, digital gender divide, digital economy, women in STEM, women in leadership

[*] Senior Research Scientist at the University of Washington Information School and Principal Researcher with Research ICT Africa.

Acknowledgements

This paper has been prepared by Dr Araba Sey for ERIA's Strategy and Partnership Programme, led by Dr Giulia Ajmone Marsan who oversaw the production of this paper by providing comments and inputs and by drafting the section on policy and programme intervention in the region. Activities and analysis on women's economic empowerment, with a focus on the digital economy and entrepreneurship, are a growing priority for ERIA's Strategy and Partnership Programme. The financial support of the Australian Government to the Strategy and Partnership Programme and this stream of work is thankfully acknowledged.

Disclaimer

This paper was funded by the Australian Government through the Department of Foreign Affairs and Trade. The views expressed in this publication are the authors' alone and are not necessarily the views of the Australian Government.

1. Introduction: The Importance of Gender Equality in the Digital Economy

Following the 36th Association of Southeast Asian Nations (ASEAN) Summit on Women's Empowerment in the Digital Age, held in June 2020, ASEAN leaders reiterated their commitment to the 1995 Beijing Declaration and Platform for Action and the United Nations Security Council Resolution 1325 on Women, Peace and Security (ASEAN, 2020). Recognising the important role of women in the drive towards sustainable development, national security, and global peace, ASEAN leaders affirmed the need to promote gender equality and women's active participation in all spheres of life. This was reiterated at the August 2020 East Asia Summit Economic Ministers' Meeting (ASEAN Economic Ministers, 2020) and in a recent op-ed by the ASEAN Secretary General on the role of regional unity to build back better for the post-pandemic future, which also highlighted the need to narrow gender divides across ASEAN (Jock Hoi, 2020).

This emphasis on, and commitment to, gender equality are particularly important as women continue to disproportionately experience poverty; discrimination; social, economic, and political exclusion; and certain types of violence across both developed

and emerging countries. The coronavirus disease (COVID-19) pandemic and associated national lockdowns have further heightened the seriousness of these gender-related disadvantages, leading ASEAN leaders to stress the importance of consciously mainstreaming the needs of women and girls when developing pandemic responses, but also for post-pandemic recovery efforts. A key component of this goal is the improvement of women's participation in technological innovation and the digital economy by fostering digital literacy; science, technology, engineering, and mathematics (STEM); education; financial inclusion; entrepreneurial opportunities; and decent work; amongst other things.

Even before the COVID-19 pandemic, information and communication technologies (ICTs) were fast becoming the lifeblood of human connectivity and economic activity for governments; commercial, non-profit, and civil society organizations; and citizens. According to research by Facebook and Bain & Company (2020), the Southeast Asia region remains one of the fastest growing digital economies in the world and, according to some estimates, has already seen the equivalent of 'five years of digital transformation in a single year' (Facebook and Bain & Company, 2020: 5), with the number of online consumers expected to hit more than 300 million by the end of 2020. Over 70% of the adult population are considered digital consumers, and de Sartiges et al. (2020) have predicted a financial revolution in the region as almost 50% of urban consumers have adopted digital wallets and the number is projected to reach 84% by 2025. Even amongst the unbanked population, digital wallet adoption is expected to increase from 13% in 2020 to 58% by 2025 (de Sartiges et al., 2020). Furthermore, investment in technology continues to dominate other sectors, with 72% of private equity and venture capital funds going to the technology sector in the region during the first quarter of 2020 (Facebook and Bain & Company, 2020).

These dramatic shifts have been exacerbated by the transition to online activity necessitated by measures to deal with the COVID-19 pandemic. Restrictions on mobility have forced social, economic, and political activity to move online. But while many have adapted their lives to the lockdown – being able to work and study from home, access goods and services through online platforms, or shift their businesses to a virtual presence – a large segment of the world's population lacks the digital infrastructure and resources to shift online. This has created dire circumstances within

these communities, including job loss, food insecurity, and lack of access to critical health, education, and pandemic relief services (Painter, 2020). Other groups, such as essential workers and those whose jobs cannot be done remotely, have no choice but to risk their lives daily in order to save lives or make a living (Ruddy, 2020). The digital transition occurring during the pandemic threatens to deepen inequality and negative impacts even further for those who are already disadvantaged. Across the world, there are indications that women are amongst the most negatively impacted by the pandemic, due amongst other things to limited finances and savings, low access to digital technology, being a large proportion of frontline health workers and the informal workforce, lack of social protections, and carrying the burden of unpaid domestic and care work (UN Women, 2020). Women also tend to work in sectors that have been acutely impacted by the pandemic, such as the hospitality and textile industries (UNESCAP, 2020).

In the post-pandemic recovery, it is critical that these inequalities are eliminated or drastically reduced so that all can benefit from the digital economy. However, historical trends show that the benefits of digital technologies are persistently unequally distributed along several key demographics, including gender. Specifically, women tend to benefit less than men in all aspects, from access levels to skills to impacts (Sey and Hafkin, 2019). From a binary gender perspective, this means that about 50% of the world's population is systematically disadvantaged in systems that affect practically every aspect of existence, with the associated loss of potential productivity and human development. Thus, gender digital equality has become increasingly intertwined with gender equality in general. Policymakers and regulators need to be paying attention to guide the pace and direction of accelerating digital transformations to ensure equal opportunity for all (Brudvig et al., 2020; Chen, 2017: 2; de Sartiges et al., 2020; ERIA, 2019; UNESCAP, 2020). This is especially important in a region like ASEAN, where the digital economy is growing quickly and where many of the new jobs of the post-pandemic economy are likely to be digital-enabled and digital-related (Ajmone Marsan and Ruddy, 2020; Ajmone Marsan and Maulidina, 2020).

Advocates argue that shifting the balance requires more active participation of women in the digital economy as users, consumers, and producers. In recent years, this case is increasingly being presented from an economic perspective, as in addition to filling industry skills shortages, recent analysis shows that greater gender diversity also leads to increases in corporate productivity and financial performance (e.g. Gompers and Wang (2017); Hunt et al. (2018, 2020); ILO (2017)). Available estimates suggest that equal female labour force participation could contribute as much as $89 billion per year to the Asia-Pacific economy (UN Women, 2011) and $4.5 trillion by 2025 (Woetzel et al., 2018). It is now generally accepted that companies with 30% or more women on their executive teams outperform companies with a lower proportion of women – research by Hunt et al. (2020) calculated the performance differential between the most and the least gender-diverse companies to be 48%.

Although economic arguments are gaining more ground these days, it is important not to overlook the strong ethical reasons for advocating gender digital equality, in line with the United Nations Sustainable Development Goals on gender equality for example. Considering the pervasiveness of the digital economy and the immense power held by those who are able to harness it, issues of agency, fairness, the right to participate, and the potential for human development (e.g. Frehill, Abreu, and Zippel (2015); Sassler, Michelmore, and Smith (2017)) should be considered as equally valid rationales for seeking gender digital equality. Policies tend to assume that simply improving digital access will enable women to participate fully in the digital economy as well as in social and political life (Faith, 2017: 3), but often this is not the case. Furthermore, these technologies are usually presented as gender-neutral and leading to the prioritisation of market-driven solutions, often to the neglect of human rights and security issues (Randhawa, 2010). Therefore, ethical and social justice goals are critical elements of the gender equality agenda.

To ensure that both pandemic response and post-pandemic recovery strategies equally elevate and utilise the capabilities of all genders, policymakers will need information on the current levels of gender digital inequality in their jurisdictions, an appreciation of the complex dimensions of gender-based discrimination, and an understanding of the surface and underlying factors that contribute to gender digital inequality. This means policymakers must acquire and consult data and research on

gender equality in the digital economy (Buvinic, Noe, and Swanson, 2020; Data 2X, 2020). This paper therefore reviews and summarises existing data and research on gender digital equality in the 10 ASEAN Member States (Brunei Darussalam, Cambodia, Indonesia, the Lao People's Democratic Republic (Lao PDR), Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Viet Nam). It addresses the following questions:

- What is the state of gender digital equality in ASEAN countries?
- Are there differences amongst and within countries?
- What are the underlying reasons for the state of gender equality?
- What types of programmes or policies are being implemented to address barriers to gender equality in the digital economy?
- What are the recommended practices to improve gender digital equality in the region?

The rest of the paper discusses these issues, drawing from data on the ASEAN Member States (AMS) as well as other world regions. Section 2 describes various dimensions and issues of concern in the drive for greater gender digital inequality. Section 3 presents a high-level assessment of the availability of data on the topics discussed in Section 2. Section 4 discusses some policy and programme initiatives in the region. Section 5 concludes, with a summary of recommendations drawn from existing research on how to maximise women's participation in the digital economy.

2. Dimensions and Issues in Gender Digital Equality

Gender equality in the digital economy

[1] has many dimensions; it is not limited to levels of participation in economic production. The challenge starts in a vicious cycle from unequal access to and use of digital technologies, which can constrain women's ability to develop digital skills to fully utilise and innovate with technology. This contributes to an absence of women in

[1] This paper adopts a broad definition of digital economy, along the lines of the definition proposed by the Organisation for Economic Co-operation and Development (OECD) to the G20 Digital Economy Task Force: 'The Digital Economy incorporates all economic activity reliant on, or significantly enhanced by the use of digital inputs, including digital technologies, digital infrastructure, digital services and data. It refers to all producers and consumers, including government, that are utilising these digital inputs in their economic activities' (OECD, 2020: 5).

technology fields and the perpetuation of myths about the relevance of digital and other technological careers for women and girls. Branching out from this are a variety of discriminatory and harmful practices that further inhibit the flow of digital benefits to women. Broadly, therefore, replacing the vicious cycle with a virtuous cycle requires promoting equality in **basic digital access**, **meaningful digital access** (the ability to use technology in ways that bring benefits), **basic and advanced digital skills**, and **employment and entrepreneurship** opportunities. It also requires addressing unconducive environments created by gender-based **prejudice, discrimination,** and **harassment** that turn women away from engagement in the productive economy or that are used as reasons to inhibit women's engagement with technology. These goals must be pursued bearing in mind the different types of situations and the different types of identities that people might have, such as living in **rural or urban** areas. The emergence of new technologies such as artificial intelligence (AI) and machine learning bring unique **opportunities to erase gender inequalities**, but also carry **gender-related risks and harms,** including risks to female-dominated job sectors and **gender bias in automated decision-making**.

2.1. Definitional issues

Measuring participation in the digital economy presents definitional challenges due to the integration of digital technologies within and across all aspects of society. Whilst studies typically focus on the technology industry and the platform economy (employment facilitated by online platforms such as Uber, Airbnb, Grab, or Go-Jek), people working in other domains such as health, education, or agriculture could very well be in technology jobs depending on the extent to which their positions require the use of technology. As Calvino et al. (2018) have demonstrated, different sectors may be more or less digital-intensive, depending on the extent of their technological components, technical human capital required, and adoption of online activity. Participation in the digital economy could comprise working directly in industries that create and distribute technology products and services or could take the form of integrating digital technologies into activities in a non-technology industry.

In addition to the changing nature of jobs, new categories of work are constantly emerging that redefine the boundaries of what falls in or out of the digital economy (e.g. new jobs in digital health or the fashion industry). Current employment

categorisation schemes do not capture these changes and might therefore over- or under-estimate the true extent of participation. This paper depends on existing global repositories for data on labour force participation, most of which cover only a limited number of digital economy job categories.

2.2. Intersectional identities

Besides the binary male/female dimension of gender equality, intersectional identities are also relevant, since the disadvantages that come with gender can be further exacerbated by other identities such as geographic location (rural/urban), educational level, ethnicity, or immigration status. It is important to consider how these intersectional identities also have an impact on digital equality. Age and parenthood, for instance, have been found to contribute to gender pay gaps in Asia-Pacific Economic Cooperation (APEC) economies – older women and mothers receive lower pay than men at the same job and skill level; while men are not penalised for age, and fatherhood is actually associated with higher salaries (OECD, 2019).

2.3. Rural–urban divides

Geographic location, especially rural–urban divides, and associated infrastructural and lifestyle differences can have more significant consequences for women and girls than for men and boys. In many countries around the world, including ASEAN, the digital economy success story is often a story of men in hyperconnected metropolitan areas. In the United States (US), rural women entrepreneurs are less likely than other entrepreneurs to have internet access and the gender earnings gap is wider in rural areas (National Women's Business Council, 2019). As in other parts of the world (Perrin, 2019), AMS have hyperconnected (often urban) communities while other (often rural) areas face connectivity, affordability, education, and skills challenges. For example, a recent survey (Facebook and Bain & Company, 2020) found that although the levels of digital spending are increasing in both urban and rural areas of Southeast Asia, the proportion of high spenders in urban areas (44%) is greater than that of rural areas (32%). Urban migrants who had to return to their homes in rural areas during the pandemic lockdowns found themselves suddenly without adequate internet access for remote business and learning (UN News, 2020). In Malaysia, 71% of the urban population are internet users, compared with 51% of the rural population,

and in some rural areas less than 40% of businesses have an internet connection (Heng, 2020). Rural and ethnic women in Myanmar are reportedly more disadvantaged by lack of access to different types of ICTs, low access to skills training, higher illiteracy levels, gendered labour patterns, and constrained mobility in isolated and conflict-affected areas (Scott, Balasubramanian, and Ehrke, 2017). As plans proceed to further enhance economic corridors in ASEAN (Sheng, 2017), the creation of hyperconnected megacities could drive rural communities into greater exclusion and further marginalise the urban poor.

2.4. Impact of the Fourth Industrial Revolution on women's jobs

Emerging trends are demonstrating that Fourth Industrial Revolution (4IR) technologies present a double-edged sword – both threatening female-dominated occupations and offering opportunities for entrepreneurial activity and flexible working arrangements that could suit women's lives better than traditional employment. However, the already existing gender-related digital inequalities are at risk of worsening with the acceleration of the 4IR.

More flexible work opportunities for women

The platform or so-called gig economy offers the opportunity for women to fit work around their family and domestic roles. In this way, it can help to overcome time and mobility constraints that prevent women from seeking additional sources of income. An analysis of panel data for 156 countries from 1991 to 2014 concluded that digital technologies had contributed to narrowing the gender gap in labour market participation by women, although the impact was lower in developing countries (Valberg, 2020).

More women work in at-risk industries and jobs

Despite the potential advantages discussed above, women already in the workforce face high risks of job loss due to automation. This is because in AMS, the sectors that face high automation risk are heavily feminised sectors, e.g. the retail; business process outsourcing; and textile, clothing, and footwear industries (Chang, Rynhart, and Huynh, 2016a; Gavalyugova and Cunningham, 2020). An International Labour Organization (ILO) report (Chang, Rynhart, and Huynh, 2016b) on the workforce in five AMS (Cambodia, Indonesia, the Philippines, Thailand, and Viet

Nam) found that workers in the garment manufacturing industry are particularly susceptible to displacement by robots. In some Southeast Asian countries, more than 70% of workers in this industry are women (Chang, Rynhart, and Huynh, 2016a; Faith, 2017), although there are indications that as female education levels rise their desire to work in this industry is declining (Chang, Rynhart, and Huynh, 2016a). For example, 80% of workers in Cambodia's textile, clothing, and footwear industries are women, and an estimated 88% of waged workers in that industry are at risk of replacement by automated technologies (An, 2020). According to Chang, Rynhart, and Huynh (2016b), women in the Philippines and Viet Nam are most at risk (more than twice as much as their male counterparts). In Indonesia and Thailand, the risk is about 50% higher than for men, and in Cambodia the risk is about 20% higher than for men.

Compounding the situation, women not only tend to occupy the types of entry-level, low-skill jobs that are highly susceptible to automation, but also have limited representation in the advanced technology jobs that require higher skill levels and are better-paying (An, 2020; Aneja, 2019; Gavalyugova and Cunningham, 2020; Hilal, 2018). This is even before accounting for the impact of automation on informal and unpaid workers, of whom a large proportion are women. Even as the Sustainable Development Goal Target 5.4 calls for recognising and valuing currently unpaid care and domestic work, automation threatens to replace such workers with robots and automated personal companions (e.g. Faith (2017)). Frontier technologies are likely to perpetuate gender inequality due to 'unequal access of men and women to information and technical and vocational training' (An, 2020: 108) that leaves women perpetually disadvantaged in their ability to aspire to high-skill technical jobs.

Even the gains from automation are also unevenly distributed. According to Faith (2017: 1), 'men stand to gain one job for every three jobs lost to technological advances, while women are expected to gain one job for every five or more jobs lost'. Two related challenges are that as previously feminised jobs become more digitalised, women tend to be driven out of those jobs, and those women who do persevere have to cope with the dual responsibilities of professional and domestic work, and different types of gender discrimination (Aneja, 2019; Hunt and Samman, 2019). As Aneja (2019) observed, 'the growing platformisation of work… creates new forms of risk and vulnerability: from reinforcing cultural biases that relegate women to certain kinds

of occupational categories to reproducing the gendered division of labour. Further, increasing paid employment does not mean an improvement in the conditions of women workers, as it could lead to a double burden on women, who still need to fulfil household obligations' (Aneja, 2019: 11–12).

2.5. Prerequisites for gender equality in the digital economy across ASEAN

The level of gender digital equality is invariably linked to a broader set of factors that lay the foundation for equal participation. These prerequisites include equal digital access, equal ability to utilise technologies in beneficial ways, and equal ability to gain the requisite basic and advanced digital skills to be consumers and producers in the digital economy.

2.5.1. Gender equality in digital access

Overall, compared with other regions of Asia, ASEAN countries have relatively high levels of gender equality in digital inclusion. A 2018 McKinsey assessment (Woetzel et al., 2018) scored all AMS higher than the Asia-Pacific average on the measure of gender digital inclusion (however, there were no data for the Philippines, Myanmar, or Viet Nam). Similarly, for gender financial inclusion, only Myanmar (0.6) scores below the Asia-Pacific average (0.76). However, globally, there are troubling signs of slowing down of progress and in some cases worsening of gender digital gaps in recent years (International Telecommunication Union, 2019). The data below from the International Telecommunication Union (ITU) and the World Bank confirm these conclusions. This section presents data on computer use, access to and ownership of a mobile phone, and use of the internet.

Computer use

In the six countries for which data are available from the ITU, the level of computer use is fairly even between males and females (Annex 2, Figure 1). Computer use is generally low in Cambodia, Indonesia, and Thailand, where less than 30% of both the male and female populations are computer users. In Brunei, Malaysia, and Singapore, more than 50% of the population uses computers, and there is only 2–5 percentage points difference in the proportion of male and females.

Mobile phone use and ownership

Here also, the data indicate very small gender differences in mobile phone *use* (Annex 2, Figure 2) for five countries with data. The largest difference (6%) is in Indonesia, where 71% of women use a mobile phone compared with 77% of men. Brunei reports equal proportions of men and women (88% each) using mobile phones. There are larger disparities in mobile phone *ownership* (Annex 2, Figure 3). In Indonesia and Myanmar, there is an 11% difference in the proportions of the male and female populations that own a mobile phone.

According to Scott, Balasubramanian, and Ehrke (2017), women's access to and ownership of mobile phones has been steadily rising due to the rapid diffusion of mobile telephony in Myanmar. This is consistent with Zainudeed and Galpaya (2015), whose survey found that women were 29% less likely than men to own a mobile phone, although most women had mobile phone access through other members of their household. The gap was larger for women in low-income households. However, women appeared to have lower skill levels and were dependent on men to help them use data services. In terms of types of mobile phone use, the study found similar patterns between men and women. On average, women were spending less monthly on purchasing airtime or data (MK8,682 compared with MK9,254 for men) but the use of data services was in general similar.

Gender gaps in ownership generally tend to be larger than gaps in use (Sey & Hafkin, 2019). This is important because the gap between ownership and use can have implications for the ability to control a device. However, the ownership figures for AMS cannot be compared to mobile phone use because the data represent different years and might appear contradictory (e.g. making it appear that in some countries mobile phone ownership is higher than mobile phone use).

ITU data on smartphone use are only available for Thailand, and they show a very small gender difference – in 2018, 60% of males used a smartphone compared with 59% of females. A study by a mobile money operator in Myanmar found that women are 30% less likely than men to own a smartphone (Chang and Coppel, 2020). However, research by Zainudeed and Galpaya (2015) found that out of those who owned phones, similar proportions of men (65%) and women (64%) owned a

smartphone. Scott, Balasubramanian, and Ehrke (2017) reported that by 2016 this had increased to 78% for men and 77% for women.

Internet use

Gender differences in internet use (Annex 2, Figure 4) range from no difference (Cambodia) to 10% (Myanmar). Notably, in Brunei, although there is a gender gap, it is inverted from the typical – the proportion of women using the internet (100%) is higher than that of men (92%). A study by a mobile money operator in Myanmar found that women are 39% less likely than men to use the internet, due to affordability, low literacy, and safety concerns (Chang and Coppel, 2020). On the other hand, although reporting slightly lower mobile phone ownership and higher barriers to use for women in Myanmar, the founders of the Myanmar ICT for Development Organization also reported that women's use of the internet is high (Einzenberger, 2016). Statistical analysis showed that increasing female internet access in Indonesia would lead to an increase in economic development more so than an increase in male internet access (Lestariningsih et al., 2018).

There are some countries in which the data suggest that women have greater access than men. In these cases, it would be worth investigating the reasons for this as inequality for men should be taken as seriously as inequality for women. Brunei stands out in this regard, with data indicating a higher proportion of women (99%) than men (91%) owning mobile phones and using the internet (100% versus 92%). Age might also be a mediating factor, as in Thailand, for example, Angeningsih and Sirisunyaluck (2018) reported higher ICT access for female than for male students.

Digital technology usage patterns

There are no systematically collected data on gender differences in usage patterns, but a study in Thailand (Angeningsih and Sirisunyaluck, 2018) found differences in students' use of laptops and mobile phones. Male students mostly used their phones for texting and their laptops for internet browsing, while female students used their phones mostly for phone calls and laptops for writing. In Malaysia, data collected from 914 urban students (15–17 years old) showed no gender differences in computer use or internet access, but there were some differences in motivation, intensity of use, and place of access (Soh et al., 2013). For example, girls were more motivated by social interaction, shopping, and information, whilst boys were more

motivated by eroticism and more likely to be addicted to the internet; girls were more likely to use the internet at home and school, whilst boys were more likely to use at internet cafes; and boys used the internet more frequently and for longer amounts of time than girls (15.0 hours on average versus 9.4 hours for girls).

A 2016 study in Cambodia concluded that the gender gap in phone and internet use was closing naturally 'without recourse to any external intervention' due to market expansion (Phong, Srou, and Solá, 2016: 26). The study found that smartphone ownership was high, including ownership of a phone that could send and receive messages in Khmer script (71% of women and 82% of men had such phones), although only 42% of men and 32% of women made use of this capability (Phong, Srou, and Solá, 2016).

2.5.2. Gender equality in meaningful access

Meaningful use is discussed with reference to social media use and financial inclusion via mobile money accounts. There are numerous other possible facets of meaningful use. For example, a survey of nine low-income communities in urban areas (including Indonesia and the Philippines) showed that almost every woman had access to a mobile phone, but only 21% of them had used the phone to access important information on issues such as health and legal rights (Internet Society, 2017). These other areas (such as access to online health, education, and legal services) are not elaborated due to lack of information.

Social media use

An alternative view of digital access based on data from a social media platform management company, Hootsuite, covers all 10 ASEAN countries and shows the gender breakdown of the audiences reached by platform advertising (as reported by social media platforms). The data show that females dominate social media audiences, except on LinkedIn, the more formal profession-oriented platform (Annex 3, Table 1). It is also notable that females appear to be more active Facebook users, from both social (liking and sharing pagers) and economic (ad views) perspectives.

Mobile money

In financial inclusion, measured in terms of having a bank or mobile money account (Annex 3, Figure 1), overall levels are high in Singapore (100% of men and 96% of women), Malaysia (88% of men and 82% of women), and Thailand (84% of men and 80% of women). In other countries (Cambodia, Viet Nam, and Myanmar), financial inclusion is low overall (less than 35% for both men and women); and in three countries (Indonesia, the Lao PDR, and the Philippines), the proportion of the female population with a financial account is higher than that of the male population, although all are under 52%. Men are more likely to have mobile money accounts, at least in 2017 (Annex 3, Figure 2). Whether at a financial institution or via mobile money, the data indicate that gender differences are not very large. It is interesting to note that in almost all countries, women do more online spending than men, and ownership of a credit card is relatively equal (Annex 3, Table 2).

Despite these close numbers, researchers believe that gender gaps in financial inclusion are constraining economic development and see digital technologies as offering opportunities to improve financial inclusion for women (Ajani and Tjahjadi, n.d.; Wyman, 2017). Based on analysis of 2014 Findex data, Ajani and Tjahjadi (n.d.) concluded that women are 2% less likely to have a savings account; the Philippines is the only country with a proportionately higher level of financial inclusion for women; and Singapore, Malaysia, and Cambodia had made the most progress in providing adequate financial inclusion to women and other marginalised groups. In Viet Nam, Le et al. (2020) found that although there was no gender difference in satisfaction, perceived usefulness, ease of use, and task-technology fit, women tended to perceive higher risk than men did with mobile banking.

2.5.3. Gender equality in digital skills

Basic digital skills

Currently, there is no global standard for identifying digital skills (Sey and Hafkin, 2019). Additionally, apart from nine indicators collected by the ITU, there is no repository of globally comparable and gender-disaggregated indicators on specific digital skills. ITU's 2020 update does not appear to have disaggregated data for ASEAN countries.

With the rapidly changing technology landscape, measures of digital literacy quickly become outdated. ITU's data set on skills captures a relatively old set of self-reported measures (such as the ability to cut and paste from one document to another or to use a spreadsheet for calculations) – these may no longer be adequate indicators of digital skills. Global and regional agencies such as the Broadband Commission for Sustainable Development, European Commission, ILO, ITU, United Nations, and Organisation for Economic Co-operation and Development (OECD) have all generated different definitions of digital skills along with frameworks to measure them. More recently, new definitions are emerging to capture the anticipated skills needs of the Fourth Industrial Revolution (see Pedró et al. (2019)) for an overview of six frameworks). Interestingly, most of these definitions highlight the importance of both technical and non-technical skills. For example, one framework includes fundamentals of hardware and software as well as digital content creation, safety, and problem-solving (Pedró et al., 2019). However, global policy concerns still tend to emphasise technical skills.

Although some authors (e.g. Hoan, Chib, and Mahalingham, 2016; Loh-Ludher, 2007; Suwana and Lily, 2017) have mentioned low literacy as a barrier to digital inclusion for women in the Asian region, in their analysis of a data set from the Digital Kids Asia-Pacific project, Tran et al. (2020: 12) suggested that 'It is likely that there has been a vivid change within the gender gap in the new digital generation' based on their finding that girls scored higher than boys on digital literacy and digital resilience. This highlights the importance of distinguishing different groups and paying attention to how different identities such as age and location affect digital inclusion. General literacy rates in the ASEAN region are high for both men and women, at 72%–96% for women and 80%–99% for men. Further research would be needed to determine the extent to which general literacy is a barrier to the use of digital technologies and what types of general and digital literacy women might be lacking that constrains their use of technology.

Intermediate and advanced skills

Building high-level technical skills through formal or informal education prepares people for more technically oriented employment and entrepreneurship in the digital economy. As The Asia Foundation (2020: 22) noted, 'the lack of women in

STEM cuts off the pipeline of potential female workers with the skills needed to design and create digital technologies, as well as women in leadership and decision-making roles in the digital sector'. Consistent with trends seen in other parts of the world (Sey and Hafkin, 2019), women in the ASEAN region tend to dominate the non-science disciplines such as the social sciences, business, and law (Annex 4, Table 1). Women also dominate science programmes overall, but when technology-related programmes such as STEM, ICT, and engineering are separated out, it becomes clear that women in science are specialising more in the health sciences and much less in technology and math-oriented programmes (Chang, Rynhart, and Huynh, 2016a; Sey and Hafkin, 2019). The exceptions are Brunei and Myanmar, where the data suggest that female graduates exceed male graduates in almost all fields of study. However, as noted in the section on the state of women's participation in the digital economy, high female education in technical fields does not appear to translate into equally high female representation in related professions.

2.6. The state of women's participation in the digital economy in ASEAN

As already noted, definitional issues are particularly pertinent when examining the state of women's participation in the digital economy. The way occupations are classified results in variations in the measured levels of female participation. Furthermore, disaggregated data on this topic are mostly lacking. This section presents what can be gleaned from ILO statistics on the proportion of women in telecommunications, computer programming, and scientific research occupations. Considering the wide range of technology occupations and newly emerging digital-intensive professions, these three most likely do not represent the true picture of female participation in the sector. The section also briefly discusses other potential areas of participation – science and technology research, frontier technology jobs, management positions, entrepreneurship, and digital policymaking.

2.6.1. Female share of technology roles in general

Results from the World Economic Forum's Executive Opinion Survey (World Economic Forum, 2020) show that all ASEAN countries are perceived to be far from achieving gender parity in technology roles, with Singapore and Malaysia being the best performers (Annex 1, Table 1). Based on the level of internet access and

participation in the service industry, Nengsi (2019) concluded that the Philippines has the highest degree of female participation in the digital economy, followed by Malaysia, Singapore, and Thailand, with Cambodia and Myanmar at the bottom. Explaining Malaysia's relatively high proportion of women in computer science professions, Mellström (2009) suggested that, amongst other reasons, in the Malaysian context, there is a different notion of masculinity that does not associate computing with men, and that race and class are more relevant influences than gender.

Despite promising trends in top-performing countries such as the Philippines, indications are that even in countries where the data on STEM graduates (see section 2.5.3 on digital skills) show a high proportion of females, there appears to be a drop-off after graduation, with female graduates not continuing into related employment. According to Dahlquist (2018: 312), although females often do better than males in STEM subjects in Asia, the school-to-work transition is 'a critical juncture' at which women tend to be diverted away from technology jobs. In subsectors such as animation and game development, 25% of employees are women; however, in IT outsourcing, there is almost gender parity (Dahlquist, 2018).

2.6.2. Female share of telecommunications and computer programming-related occupations

ILO data indicate uneven development in the integration of women into technology-related jobs. In the case of telecommunications and computer programming-related occupations, some countries have almost equal proportions of men and women (Annex 1, Figures 1 and 2). For example, the female shares of telecommunication occupations in Thailand, Brunei, and the Lao PDR are 47%–50%; and in computer programming-related occupations, Myanmar reports a 46% female share. Other countries have relatively low levels of female representation (18%–36%.) However, while one does not expect a perfect 50:50 ratio in every single occupation, there are notable stark differences within a few countries, such as Myanmar, where there appears to be a high proportion of women in computer programming (46%) but low (only 29%) in telecommunications. On the other hand, Scott, Balasubramanian, and Ehrke (2017) reported that men in Myanmar were more likely to pursue technical computer training, while women were more likely to choose administrative, financial, and legal aspects of computing as career options.

2.6.3. Female share of scientific research and development occupations

In the three ASEAN countries for which ILO data are available, females make up 21%–45% of scientific research and development jobs (Annex 1, Figure 3). Thailand has the highest proportion (45%), followed by the Philippines (39%) and Indonesia (21%). Alternative data from the United Nations Educational, Scientific and Cultural Organization (UNESCO), breaking down researchers by field of research, show higher proportions of women in all fields of research in Malaysia, Myanmar, and the Philippines; and low proportions in Cambodia (Annex 1, Figures 4–7). However, women still tend to focus more on the medical, social, and natural sciences, but still comprise 43% of engineering and technology researchers in the Philippines, 47% in Malaysia, and 76% in Myanmar.

2.6.4. Female share of technical careers in frontier technologies

The 2020 Global Gender Gap report states that amongst LinkedIn users globally, women make up low proportions of technical careers in frontier technology sectors – 26% of data and AI roles, 15% of engineering roles, and 10% of cloud computing roles (World Economic Forum, 2020). Data for Singapore show that men comprise 81% of cloud computing roles, 73% of engineering roles, and 67% of data and AI roles, whilst women are more dominant in content production (63%), people and culture (59%), and marketing roles (55%). Of particular significance, they note that 'women continue to be under-represented amongst workers with disruptive technical skills…the capabilities associated with developing new technologies such as Artificial Intelligence, Robotics and Genetic Engineering' (World Economic Forum, 2020: 39). In the academic field, Best and Modi (2019), Element AI (2019), and Perrault et al. (2019) all found low proportions of women in AI scholarship globally. For example, women constituted only 18% of researchers publishing at the top AI conferences (Element AI, 2019) and 20% of new faculty hires (Perrault et al., 2019).

While data on these trends are not available for most ASEAN countries, they are concerning because the role of human beings in the jobs of the future is shifting towards functions such as mathematics and science, for which women, on average, seem ill-prepared compared with men (OECD, 2019). Although women appear to have

an advantage in other skills such as literacy and ICT-related tasks[2] (OECD, 2019), signs are that women are lagging in acquiring the types of technical skillsets that will be critical in the future of work.

2.6.5. Female share of management roles

Digital leadership refers to participation in the digital technology industry, especially in substantive roles such as technology creators and managers. It is not enough for women to have jobs in the digital economy; the types of jobs also matter. In particular, the ability of women to progress into top-management and policymaking roles determines the extent to which women can have an equal voice in the development of systems that affect their lives. Furthermore, there are economic benefits to including women in decision-making positions – EIU and IFC (2019) found that companies with more than 30% female board members performed better financially than companies with no female board members. Similar observations have been made by Gompers and Wang (2017); Hunt et al. (2018, 2020); and ILO (2017).

Unfortunately, there are no systematically collected data on female representation in management positions in technology-related industries (Sey and Hafkin, 2019). However, research in different contexts points to a lack of women in top-management and executive positions. For instance, the information technology and business process management (IT-BPM) sector is one of the largest employers of women in the Philippines and Thailand, and is credited with giving women better incomes, access to healthcare, and opportunities to develop news skills (Dahlquist, 2018). However, several researchers have observed that women in this and similar sectors tend to hold low-skill jobs whilst men have the positions requiring medium to high skills (An, 2020; Dahlquist, 2018).

Data on females in management positions across all industries support this view. In an analysis of over 1,000 companies in six countries (Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Viet Nam), the country with the most gender-diverse companies (Thailand) had women holding 20.4% of board seats (EIU and IFC, 2019). The Philippines had the highest proportion of women in senior management positions (32.8%), followed by Thailand with 29.7%. Regarding female board chairs,

[2] Defined by OECD (2019: 53) as 'the frequency with which some simple computer tasks are performed, such as, excel use, email use, simple internet use, computer use required for the job'.

Indonesia had the highest proportion (11.7%) followed by Viet Nam (7.8%) and Thailand (7.6%).

2.6.6. Female share of digital entrepreneurship

Southeast Asia has made more progress relative to the broader Asian region, with a high (over 60 million) and growing number of women entrepreneurs (Sothorn et al., 2019; UNESCAP, 2018). Most of these women-owned enterprises tend to be micro, small, and medium-sized enterprises (MSMEs) (Bosma et al., 2020; Guelich, 2018; UNESCAP, 2020). MSMEs are thus important policy targets, as they account for more than 90% of businesses in AMS and provide over 50% of total employment (ERIA, 2019). Women also start businesses for different reasons than men, which can have implications for their survival. The data for the Asia-Pacific region are mixed on this. In Viet Nam, although the rate of women-led start-ups is higher than the rate for men (25% versus 22%), women also create businesses more for necessity and survival (18% compared with 13% for men) rather than to take advantage of a business opportunity (Huan, 2018). However, in Indonesia and Malaysia the majority of women entrepreneurs are reported to be opportunity-motivated while males are more necessity-motivated (ADB, 2018) In Thailand, entrepreneurial activity amongst women is lower than for men, with barriers including having fewer entrepreneurial networks, low perception of their skills, and higher fear of failure (Guelich, 2020). It has also been noted that women entrepreneurs in Southeast Asia 'tend to be older than male entrepreneurs, have less access to ICTs and to business networks, less access to information, and run smaller businesses' (Sothorn et al., 2019: 14).

With the flexible options they offer, digital opportunities open avenues for women to overcome barriers to paid employment by becoming digital entrepreneurs (Chang, Rynhart, and Huynh, 2016a). In Indonesia, research has shown that through social media and online business activities, women's socio-economic status and self-actualisation was improved (Melissa et al., 2015). Eighty percent of the more than 41,000 Wave Money shops in Myanmar are managed by women who earn agent commissions (Chang and Coppel, 2020).

However, at present most ASEAN female entrepreneurs own and manage small businesses (UNESCAP, 2017), where digitalisation is low and generally refers to basic digital activities (ERIA, 2019). Considering the accelerated digitalisation prompted by

the COVID-19 pandemic, it is particularly important to institute measures to support women-owned MSMEs to make the digital transition (UNESCAP, 2020). This is particularly important, as MSMEs are more at risk of bankruptcy during the economic crisis induced by the COVID-19 pandemic (Ajmone Marsan and Maulidina, 2020).

2.6.7. Female share of digital policymaking positions

Participation in policymaking is important because of the power of policy and regulation to shape the behaviour of institutions and societies. Diversity of representation at policymaking levels is necessary to ensure that the perspectives and realities of different populations are factored into policymaking. In the digital sector, this includes national policymaking bodies responsible for ICT, science, and education policy and regulation, for example. A review of ICT ministries and telecommunications regulatory agencies in AMS shows that the highest ranks were occupied by males in every country in 2018 (Annex 1, Table 2). To the extent that representation in national politics has an influence on the general gender equality landscape, it is also useful to note the participation of women at the parliamentary level. The share of women in Parliaments in ASEAN, which as legislative bodies also have regulatory powers on digital policymaking matters, is also low (IPU, 2020) – less than one-third in all 10 ASEAN countries, with the highest shares in Singapore (29%), the Philippines (28%), the Lao PDR and Viet Nam (27% in both countries), and the lowest in Myanmar (11%) and Brunei (9%).

2.7. The dark side of the digital economy – Implications for gender equality

This section discusses two potential risks and harms that can make it difficult for women to thrive in the digital economy – gender-based cyberviolence and gender discrimination in the workplace. AMS have ratified the Convention on the Elimination of all Forms of Discrimination Against Women (CEDAW) and even published a set of good practices in this area (Ministry of Women, Family and Community Development, Malaysia, 2013), but in practice they fall short of actually eliminating gender-based discrimination (Fulu et al., 2013; Randhawa, 2010; Soto, 2010; The Online Citizen, 2020). For example, according to a recent study, Cambodia has a high rate of physical or sexual violence against women and even though the nation has a Domestic Violence Law, women rarely resort to it (Sothorn et al., 2019). From 6%

(Singapore) to 44% (Thailand) of women have experienced violence from an intimate partner (Sothorn et al., 2019). Deeply entrenched cultural attitudes and beliefs about gender, masculinity, and femininity perpetuate gender-based violence (ADB, 2014; Safitri and Angeline, 2019; Sothorn et al., 2019). Rural women in particular are often unable to get access to justice (Randhawa, 2010).

2.7.1. Gender-based cyberviolence

Cyberviolence refers to 'the use of computer systems to cause, facilitate, or threaten violence against individuals that results in, or is likely to result in, physical, sexual, psychological or economic harm or suffering and may include the exploitation of the individual's circumstances, characteristics or vulnerabilities' (Cybercrime Convention Committee, 2018: 5). Gender-based cyberviolence then means cyberviolence that is targeted at a person because of their gender. It can take numerous forms (e.g. threats with physical or sexual harm, sexist content, stalking, bullying, revealing personal information or private images without consent, or posting abusive comments) and can negatively impact women's experience of digital access. However, this should not be used as a justification for restricting their access to the digital economy.

Both the Declaration on the Elimination of Violence against Women and Elimination of Violence against Children in ASEAN and the ASEAN Regional Plan of Action on the Elimination of Violence against Children recognise online violence against women as an area of concern, and propose a review of laws to reflect this new threat (ASEAN, 2013, 2016). However, in Southeast Asia, online harassment is not well-documented (Ojanen et al., 2014; Soto, 2010) and the region has not responded substantively to the problem (Swe, 2019). At the country level, few AMS have provisions against cyberviolence. Singapore passed a Protection from Harassment Act in 2014 that covers cyberbullying (ASEAN, 2016) On the other hand, in Indonesia, Nawangpalupi et al. (2016) recommended that the government develop a new law to address cyber-harassment since the current legislation only covers harassment in the physical world. Part of the reason for the lack of a gender perspective in digital policymaking is that activists lack resources and do not have confidence in their ability to engage with the ICT discourse (Randhawa, 2010).

Much of the relevant research on Southeast Asia seems to focus on cyberbullying (in general and amongst youth), especially in high school or college. Studies have found significant levels of cyberbullying experienced, observed, or perpetuated by teenagers and youth, commonly affecting people from as young as 6 up to 30 years old (Khine et al., 2020; Ruiz, 2019; Sittichai and Smith, 2018). A media article reported that 80% of Filipino teenagers have experienced cyberbullying (Swe, 2019). However, a study of laws in six ASEAN countries found that only the Philippines has a cyberbullying law that expressly addresses students (Ruiz, 2019).

Most research agrees that females are more likely to be cyber victims, although some (e.g. Nazriani and Zahreni, 2016) have shown they are also equally likely to be cyberbullies. In Thailand, a study of school students found both boys and girls had equally been cyber victims, but boys were slightly more likely to have committed cyberbullying acts. In Myanmar, a study of university students concluded that 41% of males and 51% of females had been victims of cyberbullying in the past 12 months and that this was associated with academic difficulties (Khine et al., 2020). Furthermore, 65% of females and 78% of males had experienced some sort of cyberbullying by the age of 20 years. In Thailand, researchers found gender differences in coping strategies adopted to deal with cyberbullying – girls were more likely than boys to recommend reporting it or blocking messages, whilst boys were more likely to recommend fighting back (Sittichai and Smith, 2018). The authors suggest that this may be due to the different types of bullying faced by girls (relational) and boys (physical).

The relevance of these types of findings is that cyberviolence can cause high barriers for women and girls to access and use digital technologies for maximum benefit, by discouraging them from using online tools. Additionally, cyberviolence against women can causes them to become further marginalised from productive society, thereby worsening gender equality.

2.7.2. Gender bias in artificial intelligence

Artificial intelligence and machine learning systems depend on data to train the algorithms that run their processes. The quality and representativeness of the training data therefore shape the type of ‘knowledge’ the systems acquire – this can have serious consequences when the systems are used for automated decision-making.

Already, evidence is emerging that algorithms tend to have embedded racial and gender biases (Borgesius, 2018; Collett and Dillon, 2019; Dastin, 2018; Leavy et al., 2020; West, Whittaker, and Crawford, 2019) that lead to discrimination. Examples include an Amazon recruiting tool that was trained with data on previous (mostly male) applicants and therefore tended to select male candidates (Dastin, 2018); the discovery that facial recognition systems are particularly weak at correctly classifying the faces of dark-skinned females (Buolamwini and Gebru, 2018); evidence that natural language processing trained on Google News articles ends up exhibiting gender stereotypes (Bolukbasi et al., 2016); crime risk assessment systems that overestimate the probability of recidivism by women (Hamilton, 2019); and the possibility that AI-based health tools could misdiagnose medical conditions typically associated with a particular gender (Cirillo et al., 2020; Niethammer, 2020). The way AI is embodied can also reinforce gender stereotypes, as for example, in the tendency for virtual personal assistants to be given female identities (Bergen, 2016; Gustavsson, 2005; Sey and Fesalbon, 2019; UNESCO and Equals Skills Coalition, 2019).

2.8. Barriers to gender equality in the digital economy

There are multiple and intersecting barriers to gender equality in the digital economy. This section focuses on barriers to employment and entrepreneurship specifically, touching briefly on some of the prerequisite factors such as access and skills, and then discussing key obstacles to women's participation in the digital economy.

Access and skills

As already noted, gender inequality in the digital economy can be partly attributed to a history of disadvantage in digital access, meaningful access, digital skills, and unpleasant online experiences. A variety of access barriers, such as affordability and skills, continue to be obstacles to gender digital equality in Southeast Asia (Freedom House, 2019). Online security and safety concerns also inhibit digital inclusion – for example, there is a significant amount of cyberbullying directed at high-profile women activists, young women, religious minorities, and the LGBT+ community (Freedom House, 2019). Oftentimes, the gender digital divide in this region is normalised as a natural outcome of the cultural context, however this does

not have to be the case. Even when basic access barriers are overcome, additional factors can still constrain digital inclusion. For example, in Viet Nam, Scott, Balasubramanian, and Ehrke (2017) concluded that the most significant contributors to the gender digital divide were not related to access (age and geographic location are stronger determinants of digital access) but rather lack of control over devices, skills gaps, and perceived or actual lack of benefits from ICT use.

Social and cultural norms

In an analysis of gender parity (Woetzel et al., 2018), although AMS score above the Asia-Pacific average on digital inclusion indicators, they also score the lowest (and below the Asia-Pacific average) in political representation, legal protection, and violence against women. This is some indication that high levels of digital inclusion do not translate to genuine broad-based gender equality, without attention to fundamental human rights and representation in decision-making at the highest levels. Access to digital technologies does not automatically confer an empowered status to women, but rather a 'restricted agency' (Hoan, Chib, and Mahalingham, 2016) that while offering some social and economic opportunities, also tends to reproduce gender inequalities. Based on a qualitative study of eight female entrepreneurs in ICT-related businesses in Asia (including entrepreneurs from Brunei, the Philippines, Singapore, and Viet Nam), Kim et al. (2020) found that success factors included general and gender-specific government ICT policy, growth of the digital economy, support from mentors and families, active use of ICTs for business promotion, and customer-oriented entrepreneurship philosophy. Challenges included gendered social structures and norms, lack of mentors, limited access to finance, and lack of business skills amongst other factors.

The expectations for women to maintain traditional gender roles, even after they enter the workforce, places undue pressures on women to continue managing domestic chores as normal, whilst trying to obtain a science education or hold a demanding job in the digital economy. In Thailand, for instance, ILO data show that women spent three times as much time as men on unpaid domestic and care work (about 12% of the day compared with about 4% for men). In Myanmar, a study found that women and men spend similar amounts of time on productive (paid) work (6.4 and 8.0 hours respectively), but vastly different amounts of time (6 and 1 hour respectively) on

reproductive (unpaid) tasks. Cultural norms about power, control over resources and decision-making, hierarchy, and tradition, blind people to the discriminatory impacts of such outcomes as these '**differences are perceived as normal and right**, therefore requiring no special measures to achieve equity or equality' (Scott, Balasubramanian, and Ehrke, 2017: 29 (emphasis in original)). An interesting observation by Fulu et al. (2013) was that both men and women in selected Asian countries agreed with gender equality in the abstract but not in practice. The outcome is 'time poverty' (USAID, 2018: 14) and an unhealthy overload for women workers who must balance the expectations of both family-devotion and work-devotion, whilst men can prioritise work-devotion.

Domestic (and unpaid) responsibility constitutes one of the biggest restraints to women's income-generating capacity, as it drains their time and energy and blocks their ability to take advantage of certain opportunities such as building professional networks (ADB, 2018; Hoan, Chib, and Mahalingham, 2016; Internet Society, 2017; Kim et al., 2020; Madan, 2020; Roberts and Hernandez, 2019; Suwana and Lily, 2017). Having to take the main responsibility for unpaid domestic work and care means women have less time to upgrade their skills or to succeed in highly demanding technology positions, including at the executive level (The Asia Foundation, 2020). A study of barriers to digital inclusion in the Philippines found that lack of time was mentioned more frequently by women (and more so by poorer women) than men as a barrier to using the internet (Roberts and Hernandez, 2019). In Malaysia, researchers identified tensions between domestic obligations and employment opportunities even when women had access to mobile phones for social and economic purposes (Hoan, Chib, and Mahalingham, 2016). In fact, focusing on Africa, Hunt and Samman (2019) noted that the supposed flexibility of jobs in the digital economy is proving unachievable for women, as they still have to fit work around their household schedules.

Many women in the ASEAN region leave their jobs mid-career, usually for family reasons such as helping kids prepare for examinations or caring for elderly relatives. Indeed, research by Gavalyugova and Cunningham (2020) concluded that motherhood increases a woman's likelihood of working in a non-wage occupation by 10% more than fatherhood does for men. In Viet Nam, despite a long history of women

in leadership (political and economic), there are 'traditional gender scripts' that perceive women's primary role to be that of homemaker and family caretaker (Vu et al., 2019: 87). Even though women are considered to have leadership abilities, they are expected to prioritise family.

Stereotypes also affect participation, as women tend to be seen as lacking leadership skills generally or the aggressive management styles expected of leaders in industry (EIU and IFC, 2019; Madan, 2020). Similar gender stereotypes include the 'misconception that women are less suitable for entrepreneurship than men, women have less ability to work under pressure on in teams, women lack financial management skills, and women have other priorities such as children and family' (Kim et al., 2020: 59). A striking comment by a research participant highlights this mentality: 'Communities are uncomfortable with girls entering the tech field because these jobs demand more time and require girls to work at night. These fields are also male-dominated, which makes the family feel uncomfortable. Girls internalise and accept this perception.*'* (Scott, Balasubramanian, and Ehrke, 2017: 32). Such social and cultural attitudes can impact females' livelihood choices from an early age, as through limited education opportunities and restrictions on their mobility (Madan, 2020).

Gender pay gaps and unequal professional development

Unequal pay for the same work is a longstanding problem globally. The Global Wage Report shows that globally, women earn 20% less than men (ILO, 2018a, 2018c). Of the four ASEAN countries represented in the report (ILO, 2018a), two have positive gender pay gaps[3] – Indonesia with 7.8% and Viet Nam with 7.7%. Conversely, the report found negative gender pay gaps in the Philippines (–10%, meaning that women earn 10% more than men) and in Thailand (–2.7%). In addition, wages are lower in highly feminised enterprises and there is a 'motherhood pay gap' ranging from 1% in South Africa to 30% in Turkey (ILO, 2018a). According to the report, a large part of the observed gaps cannot be explained by differences in the attributes of men and women.

[3] Gender gaps are defined as positives (+) when men earn more than women. Gender gaps are considered negative (–) when women earn more than men.

This applies to all industries, although there are contrasting arguments about whether the pay gap is larger in the digital economy than in other sectors. The United States Department of Commerce (2017), for example, found that science and technology occupations had smaller gender pay gaps than other occupations. Other studies have shown larger gender pay gaps for technology workers than for other workers – for instance Zarya (2016) found that female programmers were earning almost 30% less than male programmers, and BCS, The Chartered Institute for IT (2017) reported that female IT professionals were making 11% less than male IT professionals. Unfortunately, the data needed to compare gender pay gaps in the digital and non-digital economy are unavailable for most countries.

The new industries emerging in the digital economy are showing similar trends, even in the absence of overt discrimination. Analyses of Uber rideshare data in the US have shown unequivocally that male drivers earn more than female drivers (Cook et al., 2018; Staley, 2018). Cook et al. (2018) demonstrated that the gender earnings gap amongst drivers is about 7%, and attributed this to three factors – experience, choices on where and when to work, and driving speed.

In addition to pay gaps, women also tend to have less access to professional development opportunities such as mentoring by senior partners and entrepreneurship or executive training programmes (ADB, 2018; Davis-Ali, 2017). This could be because they are passed over in favour of male candidates or because domestic pressures make it challenging for them to take up opportunities that may occur after hours or require long-distance travel. This can affect staff evaluations and promotions and discourage women from aspiring to higher positions.

Access to business finance

According to Wyman (2017), based on a study of MSMEs in Cambodia, Indonesia, Malaysia, and the Philippines, increasing financial inclusion for women and MSMEs could increase gross domestic product (GDP) by 9%–14%. However, lack of formal income, identification documents, and/or collateral, as well as gender gaps in digital access, are key barriers to financial inclusion for women in the region (Ajani and Tjahjadi, n.d.; ADB, 2018; USAID, 2018; Wyman, 2017). Madan (2020) found that 42% of women-owned MSMEs in five Asian countries (including Cambodia and the Lao PDR) felt they were full constrained in their ability to access finance,

compared with 33% of men-owned enterprises. Globally as well, access to business finance is a challenge for most women-owned or -led enterprises. Although investment in women's enterprises has increased over the years, it remains a miniscule proportion (around 3%–5%) of total venture capital for instance (Bradley et al., 2013; Brush et al., 2014; Quirós et al., 2018; Scott et al., 2018). Venture capital firms with women partners are more likely to invest in women's business, however the venture capital industry itself lacks gender diversity (Brush et al., 2014; Diversity VC, 2017; Scott et al., 2018; Lerner and Nanda, 2020).

Sexual harassment

Although this has not been scientifically established, there is a general belief that gender-based harassment is higher in the technology sector than in other sectors. Work-related sexual harassment against women has come to the top of the global human rights agenda with the emergence of the #MeToo movement. Regarding ASEAN, USAID (2018: 12) observed that 'although harassment of women in the workplace occurs, this issue is not yet recognized in the region'. Anecdotal evidence suggests that this is a serious problem (Mayhew, 2015) that is even acknowledged in the UN Gender Guidance (Götzmann, 2019). Sexual harassment discourages women from pursuing certain careers, can make it difficult for them to advance professionally, and contributes to a stressful work environment.

3. Availability of Gender-disaggregated Data

All discussions of gender digital equality eventually have to contend with a data deficit. Gender-disaggregated[4] data as well as qualitative research on gender issues are essential for governments and other actors to adequately tackle gender digital inequalities. Apart from helping to establish the true extent, nature, and reasons for digital divides in context, such data also enable tracking of the outcomes of policies and programmes to determine their effectiveness. There is a severe lack of gender-disaggregated and reliable data on the digital economy, its prerequisites, and related needs (ILO, 2018b; Randhawa, 2010; Scott, Balasubramanian, and Ehrke, 2017;

[4] This discussion uses a narrow definition of 'gender-disaggregated' in this case to refer to data disaggregated into binary male/female categories.

Sothorn et al., 2019; Soto, 2010; UNDP and United Nations Working Group on Business and Human Rights, 2019; USAID, 2018). According to Nengsi (2019: 520) only Singapore, Thailand, and Indonesia consistently gather gender-disaggregated ICT statistics.

On basic and meaningful digital access, the full set of seven indicators examined is available only for Thailand (Annex 5, Table 1). Singapore, Indonesia, and Malaysia have six of the seven indicators; Brunei and Cambodia have five; Myanmar and the Philippines have three indicators; and the Lao PDR and Viet Nam have data for just two indicators. The last year of availability ranges from 2016 to 2020.

Data on basic and advanced digital skills are particularly lacking (Annex 5, Table 2). The latest ITU data set does not include information on basic digital skills for any ASEAN countries. Data on advanced skills obtained through tertiary education are slightly dated, with the latest known year being 2018 (Brunei, Indonesia, Lao PDR, Malaysia), and as far back as 2015 for Cambodia.

Only two countries (Myanmar and the Philippines) have data on all four occupational categories examined under digital work (Annex 5, Table 3). Four other countries have three indicators, and the remaining countries have either one or two. Data on digital entrepreneurship are not systematically collected by any country.

There appears to be no publicly available data on the negative aspects of the digital economy for women. AMS are not covered in global data sets on gender pay gaps, and only Thailand is currently represented in the ILO's database on the amount of time spent on unpaid domestic and care work, with data available for 2015. Similarly, there are no comprehensive data on gender-based cyberviolence or gender-based discrimination and harassment in public spaces, schools, or the workplace.

The capabilities of big data have presented opportunities to fill gender data gaps through the digital trails (e.g. SIM card registrations and internet traffic) captured when people acquire and use digital technologies. Alternative information sources such as Facebook or LinkedIn data are increasingly being used to approximate gender disparities (Fatehkia, Kashyap, and Weber, 2018; Verkroost et al., 2020; World Economic Forum, 2020). However, the use of these approaches is still in its infancy (ADB and UN Women, 2018). There is also a need for more granular data collection

frameworks to avoid binary reductionisms that mask the diversity of people's experiences (Roberts and Hernandez, 2019).

4. Policy and Programme Interventions in the Region

Individual AMS have developed various policies and initiatives to support women's economic empowerment over the last decades. For example, in Brunei Darussalam universal access to education has enabled girls and women to access better skills and opportunities. The Cambodian Ministry of Women's Affairs, under its new mandate, focuses on skills development for women to achieve leadership positions in the political, social, and economic sphere. Indonesia enacted its National Gender Mainstreaming Policy in 2000, which guides the country's National Long-Term Development Plan, 2005–2025; and leading digital business sector champions like Go-Jek are developing partnerships with the public sector to advance women's economic empowerment.

In the Lao PDR, women are increasingly seen as a key group to support the green transition, detailed by the National Green Growth Strategy. Malaysia has developed a national action plan to empower women, especially in rural and disadvantaged areas, and there is a clear recognition of the role women can play towards the achievement of high-income status. Myanmar adopted the National Strategic Plan for the Advancement of Women, 2013–2022, which contains practical ways to address women's issues in the country. The Philippines adopted a Magna Carta for Women in 2009 to fight discrimination. Since 2015, in Thailand, the Committee to Promote Gender Equality and the Women Development Strategy, 2017–2021 have set targets and objectives towards greater gender equality. The Singaporean Ministry of Social and Family Development, with the support of the Ministry of Culture, Community and Youth and the Ministry of Home Affairs, is coordinating a review of gender-related issues and initiatives to develop a white paper for Parliament in 2021. Viet Nam is working with UN Women to review the current national strategy on gender equality and develop a new one for 2021–2030. However, most of these national strategies do not address gender digital equality specifically.

At the regional level, AMS have already initiated several programmes on women's empowerment and gender equality such as through the ASEAN Ministerial Meeting on Women, the ASEAN Commission on the Promotion and Protection of the Rights of Women and Children, the ASEAN Committee on Women, the ASEAN Women Entrepreneurs Network, and the ASEAN Women for Peace Registry.

However, also at the regional level, the emphasis on the gender digital divide is very recent. Positive developments took place during 2020, when Viet Nam was chair of ASEAN, as the ASEAN Intergovernmental Commission on Human Rights inaugurated a Special Session on Women's Empowerment in the Digital Age, to focus specifically on digital gender equality for the first time. The recently adopted ASEAN Comprehensive Recovery Framework aims at putting women at the core of recovery efforts, and the first ever ASEAN Women Leader's Summit was held during the 37th ASEAN Summit. As these initiatives are very recent, gaining a better understanding of gender digital equality and narrowing the gender digital divide across ASEAN, including through data and indicators, is key for an inclusive post-pandemic economic recovery. More work is needed to focus attention specifically on gender equality in the digital sector and the digital economy in the region.

5. Conclusion

The low proportions of women in the digital economy (especially as entrepreneurs and in leadership positions) is most likely connected to societal trends that (i) limit women's access to and use of technology, (ii) limit the types of digital skills women acquire and use, or (iii) constrain women's ability to work productively in ICT-related industries. Measures to correct the situation are diverse due to the varied underlying causes. They can be categorised into six main groups that align with the main barriers to digital equality: (i) improve the availability of digital infrastructure, (ii) address affordability and financial constraints, (iii) address skills gaps, (iv) improve the interest in and relevance of digital technologies, (v) address safety and security risks, and (vi) combat socio-cultural and institutional barriers (Sey and Hafkin, 2019). A similar set of recommendations was made by Woetzel et al. (2018), noting that gender equality in society and at work as well as contextual factors such as

the level of economic development, government policy, and market forces, all play a role in fostering or inhibiting gender digital equality. With the vast diversity of cultural contexts and business practices, it may be useful for institutions to turn to international standards such as the extensive guidelines of the UNDP and United Nations Working Group on Business and Human Rights (2019) for gender-responsive implementation of the UN Guiding Principles on Business and Human Rights by states and business enterprises. Such frameworks provide blueprints for comprehensively addressing gender digital inequality, but individual countries must determine which actions are most critical, based on evidence about the situation in their contexts.

Since 'gender is an intimate and deeply structural form of social inequality that rarely changes due to a single initiative or short-term project' (George et al., 2018: 9), holistic measures that target structural inequalities and gendered norms are critical (Faith, 2017). To this end, government commitment to gender-responsive policymaking is critical (Internet Society, 2017). As noted by Chang and Coppel (2020: 7), 'it is not sufficient to argue that the technology is gender neutral and women and girls are targeted no differently from men in technical campaign materials'. However, Scott, Balasubramanian, and Ehrke (2017) suggested that there is more political will directed towards integrating ICTs into the economy than to the issue of gender equality specifically; and noted the lack of a focal point at both government and nongovernmental levels driving the digital inclusion agenda. Likewise, Freedom House (2019) stated that 'gender-based disparities in access are generally ignored by the government' whilst Choi (2014) identified large differences in policymakers' willingness to address gender inequalities, due to different perceptions of the problem and different cultural values. Such policy deficits and inconsistencies lead to inconsistent standards, behaviours, and outcomes (ADB et al., 2016).

A key recommendation to lay the foundation for women's participation in the digital economy is to ensure the prerequisites discussed in section 2 are put in place. This means improving access to the digital economy, digital literacy, and skills development, using universal basic funds for example (USAID, 2018), and training STEM teachers to break gender stereotypes (Dahlquist, 2018). This is even more critical given the fast acceleration towards digital economies across ASEAN, an acceleration that has become even faster during the COVID-19 pandemic. Women

have suffered more severe job losses during the pandemic and many of the jobs of the post-pandemic future will be linked to the digital economy: this makes digital gender divides a key issue that policymakers need to consider and address for building back better more inclusive societies and economies.

To boost female labour force participation and entrepreneurship, innovative income security schemes such as the universal basic income could be used to provide income security (Faith, 2017) and reduce the need for the types of professional sacrifices women have to make in order to meet work and family role expectations. Access to financial services and products should be improved, including designing services tailored to female entrepreneurs (Kim et al., 2020; Loo, 2019).

On the employment front, effort should be put into improving conditions of employment, work environments, and advancement opportunities, including addressing 'the undervaluing of women's work in highly feminized occupations and industries…More equitable sharing of family duties between women and men,…adequate childcare and eldercare services,…Adequate company policies on flexible working-time arrangements … programmes supporting women's return to work after childbirth' (ILO, 2018a: xix; also Dahlquist (2018); USAID (2018)).

It is also important to pay attention to the unintended consequences of the new platform (gig) economy. The flexibility that digital technologies provide to work from any location and at any time is often touted as an advantage for women. However, introducing digital technologies as a work solution without addressing gender power dynamics and roles in the home can lead to negative outcomes. Consequently, Thas (2006) argued that the number of women teleworking may not be as good an indicator of gender equality as the number of house-husbands, for example. Furthermore, measures are needed to safeguard worker protections (Loh-Ludher, 2007) and remove the inherent biases against women in the gig economy, which contribute to gender inequality.

Finally, addressing gender inequalities, especially to successfully shifting social and institutional biases, requires working with both men and women. More and more programmes are emerging that either broaden messaging to reach both male and female groups or target men specifically (George et al., 2018: 10; Birchall, 2018).

References

ADB (2014), 'Gender-Based Violence in Asia and the Pacific'. Manila: Asian Development Bank. https://www.adb.org/news/infographics/gender-based-violence-asia-and-pacific (accessed 30 August 2020).

ADB (2018), *Emerging Lessons on Women's Entrepreneurship in Asia and the Pacific: Case Studies from the Asian Development Bank and The Asia Foundation*. Manila: Asian Development Bank. https://doi.org/10.22617/TCS189585-2 (accessed 30 August 2020).

ADB and UN Women (2018), *Gender Equality and the Sustainable Development Goals in Asia and the Pacific: Baseline and Pathways for Transformative Change by 2030*. Manila: Asian Development Bank. https://www.adb.org/publications/gender-equality-sdgs-asia-pacific (accessed 30 August 2020).

Ajmone Marsan, G. and L. Maulidina (2020), 'ASEAN MSMEs in a COVID-19 World: Lessons from ERIA MSMEs Talks 1–5'. Jakarta: Economic Research Institute for ASEAN and East Asia, https://www.eria.org/uploads/media/Event-Reports/2020-November-ERIA-Event-Report-ASEAN-MSMEs-In-A-COVID-19-World-Revised.pdf (accessed 21 December 2020).

Ajmone Marsan, G. and L. Ruddy (2020), 'Post-Pandemic ASEAN Must Bridge the Digital Gender Divide', Op-ed, 13 May. https://www.eria.org/database-and-programmes/op-ed-post-pandemic-asean-must-bridge-the-digital-gender-divide/ (accessed 21 December 2020).

Ajani, J. and A.M. Tjahjadi (n.d.), 'Assessing Financial Inclusion in ASEAN Countries: Are We Done Yet? http://www.academia.edu/download/57271507/SUPER_FINAL_1.pdf (accessed 18 August 2020).

An, I.Y. (2020), 'The Fourth Industrial Revolution: The Potential Impacts of Artificial Intelligence and Automation Technologies on Gender Equality', *Pitt Policy Journal*, 11, pp.108–23.

Aneja, U. (2019), 'Feminist Visions of the Future of Work in Asia'. *Perspective FES Berlin*.

Bonn: Friedrich-Ebert-Stiftung. https://www.fes-asia.org/news/feminist-visions-of-the-future-of-work-in-asia/ (accessed 30 August 2020).

Angeningsih, L.R. and B. Sirisunyaluck (2018), 'Gender and ICT Usage: Self-Assessment of Critical Issues Facing Indonesia-Thai Gen Y Students' Future by 2030'. *SALASIKA: Indonesian Journal of Gender, Women, Child, and Social Inclusion's Studies*, 1(2), pp.75–92.

ASEAN, ed. (2013), 'The Declaration on the Elimination of Violence Against Women and Elimination of Violence Against Children in ASEAN'. https://asean.org/?static_post=declaration-on-the-elimination-of-violence-against-women-in-the-asean-region-4 (accessed 25 October 2020).

ASEAN (2016), *ASEAN Regional Plan of Action on the Elimination of Violence Against Women*. Jakarta: ASEAN Secretariat.

ASEAN (2020), 'Chairman's Press Statement of ASEAN Leaders' Special Session at the 36th ASEAN Summit on Women's Empowerment in the Digital Age', 26 June, Viet Nam.

ASEAN Economic Ministers (2020), 'The Eighth EAS Economic Ministers' Meeting 28 August 2020 Video Conference Meeting', Joint Media Statement, https://asean.org/storage/2020/08/JMS-of-the-8th-EAS-EMM.pdf (accessed 27 September 2020).

BCS, The Chartered Institute for IT (2017), *Diversity in IT 2017: Shaping Our Future Together*. London: BCS, The Chartered Institute for IT. http://www.bcs.org/category/19217?src=hs4 (accessed 30 August 2020).

Bergen, H. (2016), ''I'd Blush if I Could': Digital Assistants, Disembodied Cyborgs and the Problem of Gender', *Word and Text: A Journal of Literary Studies and Linguistics*, VI(01), pp.95–113.

Best, M. and D. Modi (2019), 'Where Are the Women? Gender Disparities in AI Research and Development', in A. Sey and N. Hafkin (eds.) *Taking Stock: Data and Evidence on Gender Equality in Digital Access, Skills, and Leadership*. Tokyo: United Nations University Institute on Computing and Society and the International Telecommunication Union, p.96. http://collections.unu.edu/view/UNU:7350 (accessed 25 October 2020).

Birchall, J. (2018), 'Gender Sensitive Strategic Communications Interventions', K4D Helpdesk Report. Brighton, UK: Institute of Development Studies. https://opendocs.ids.ac.uk/opendocs/handle/20.500.12413/14265 (accessed 3 August 2020).

Bolukbasi, T., K.-W. Chang, J.Y. Zou, V. Saligrama, and A.T. Kalai (2016), 'Man is to Computer Programmer as Woman is to Homemaker? Debiasing Word Embeddings', Paper prepared for the 30th Conference on Neural Information Processing Systems (NIPS 2016), Barcelona, Spain. https://papers.nips.cc/paper/2016/file/a486cd07e4ac3d270571622f4f316ec5-Paper.pdf (accessed 30 August 2020).

Borgesius, F.Z. (2018), *Discrimination, Artificial Intelligence, and Algorithmic Decision-Making*. Strasbourg: Council of Europe. https://rm.coe.int/discrimination-artificial-intelligence-and-algorithmic-decision-making/1680925d73 (accessed 9 September 2020).

Bosma, N., S. Hill, A. Ionescu-Somers, D. Kelley, J. Levie, and A. Tarnawa (2020), *Global*

Entrepreneurship Monitor 2019/2020 Global Report. London: Global Entrepreneurship Research Association. https://www.gemconsortium.org/report/gem-2019-2020-global-report (accessed 30 August 2020).

Bradley, S.R., D. Gicheva, L. Hassell, and A.N. Link (2013), 'Gender Differences in Access to Private Investment Funding to Support the Development of New Technologies', *UNCG Economics Working Papers,* No. 13–9. Greensboro, NC: University of North Carolina at Greensboro, Department of Economics. https://ideas.repec.org/p/ris/uncgec/2013_009.html (accessed 30 August 2020).

Brudvig, I., N. Sambuli, and D. Thakur (2020), '#eSkills4Policymakers: From Policy Recommendations to Policy Action – Training Policy-Makers on Gender Equality in ICT Policy Formulation', in ITU, *Digital Skills Insights 2020*. Geneva: International Telecommunication Union, pp.71–80. https://academy.itu.int/sites/default/files/media2/file/Digital Skills Insights 2020.pdf (accessed 25 October 2020).

Brush, C.G., P.G. Greene, L. Balachandra, and A. Davis (2014), *Diana Report – Women Entrepreneurs 2014: Bridging the Gender Gap in Venture Capital*. Babson Park, MA: Babson College, The Center for Women's Entrepreneurial Leadership. http://www.babson.edu/Academics/centers/blank-center/global-research/diana/Documents/diana-project-executive-summary-2014.pdf (accessed 30 August 2020).

Buolamwini, J. and T. Gebru (2018), 'Gender Shades: Intersectional Accuracy Disparities in Commercial Gender Classification', Conference on Fairness, Accountability, and Transparency, *Proceedings of Machine Learning Research*, 81, pp.77–91. http://proceedings.mlr.press/v81/buolamwini18a.html (accessed 30 August 2020).

Buvinic, M., L. Noe, and E. Swanson (2020), 'Tracking the Gender Impact of COVID-19: An Indicator Framework'. Washington, DC: Data 2X. https://data2x.org/resource-center/tracking-the-gender-impact-of-covid-19-an-indicator-framework/ (accessed 30 August 2020).

Calvino, F., C. Criscuolo, L. Marcolin, and M. Squicciarini (2018), 'A Taxonomy of Digital Intensive Sectors', *OECD Science, Technology and Industry Working Papers*, No. 2018/14. Paris: Organisation for Economic Co-operation and Development. https://doi.org/10.1787/f404736a-en (accessed 24 October 2020).

Chang, J.-H., G. Rynhart, and P. Huynh (2016a), 'ASEAN in Transformation: How Technology Is Changing Jobs and Enterprises', *Working Paper*, No. 10. Geneva: International Labour Organization (ILO), Bureau for Employers' Activities. http://www.ilo.org/actemp/publications/WCMS_579553/lang--en/index.htm (accessed 30 August 2020).

Chang, J.-H., G. Rynhart, and P. Huynh (2016b), 'ASEAN in Transformation: The Future of Jobs at Risk of Automation'. *Working Paper*, No. 9. Geneva: International Labour Organization (ILO), Bureau for Employers' Activities. http://www.ilo.org/actemp/publications/WCMS_579554/lang--en/index.htm (accessed 30 August 2020).

Chang, L.Y.C. and N. Coppel (2020), 'Building Cyber Security Awareness in a Developing Country: Lessons from Myanmar', *Computers & Security*, 97, 101959. https://doi.org/10.1016/j.cose.2020.101959 (accessed 3 August 2020).

Chen, L. (2017), 'Developing Asia in the Era of Cross-Border E-Commerce', *ERIA Discussion Paper Series*, No. DP-2017-11. Jakarta: Economic Research Institute for ASEAN and East Asia (ERIA).

Choi, D. ju. (2014), 'Comparative Analysis of Gender Equality and E-Government: Philippines, Malaysia, Indonesia, Vietnam', *Southeast Asia Journal*, 23(3), pp.411–49.

Cirillo, D. et al. (2020), 'Sex and Gender Differences and Biases in Artificial Intelligence for Biomedicine and Healthcare', *npj Digital Medicine*, 3(81), pp.1–11. https://doi.org/10.1038/s41746-020-0288-5 (accessed 9 September 2020).

Collett, C. and S. Dillon (2019), *AI and Gender: Four Proposals for Future Research*. Cambridge, UK: The Leverhulme Centre for the Future of Intelligence. http://lcfi.ac.uk/media/uploads/files/AI_and_Gender___4_Proposals_for_Future_Research.pdf (accessed 14 October 2020).

Cook, C., R. Diamond, J. Hall, J.A. List, and P. Oyer (2018), 'The Gender Earnings Gap in the Gig Economy: Evidence from over a Million Rideshare Drivers', *Working Paper*, No. 3637. Stanford, CA: Stanford Graduate School of Business. https://web.stanford.edu/~diamondr/UberPayGap.pdf (accessed 30 August 2020).

Cybercrime Convention Committee (2018), *Mapping Study on Cyberviolence*. Strasbourg: Council of Europe, Cybercrime Convention Committee. https://rm.coe.int/t-cy-2017-10-cbg-study-provisional/16808c4914 (accessed 30 August 2020).

Dahlquist, M. (2018), 'Achieving Gender Equality, Job Quality and Diversity in the Science, Technology, Engineering and Mathematics Fields', in A. Sakamoto and J. Sung (eds.) *Skills and the Future of Work: Strategies for Inclusive Growth in Asia and the Pacific*. Bangkok: ILO Regional Office for Asia and the Pacific, pp.308–36.

http://www.ilo.org/asia/publications/WCMS_650239/lang--en/index.htm (accessed 30 August 2020).

Dastin, J. (2018), 'Amazon Scraps Secret AI Recruiting Tool That Showed Bias Against Women', *Reuters*, 10 October. https://www.reuters.com/article/us-amazon-com-jobs-automation-insight-idUSKCN1MK08G (accessed 25 October 2020).

Data 2X (2020), COVID-19 Resources: Gender Data, Gender, and Data. https://data2x.org/resource-center/gender-and-data-resources-related-to-covid-19/ (accessed 30 August 2020).

Davis-Ali, S. (2017), *Advancing Women Technologists into Positions of Leadership: Strategies for Cultivating Confident Women Leaders*. Belmont, CA: AnitaB.org. https://anitab.org/wp-content/uploads/2020/08/advancing-women-technologists-leaders.pdf (accessed 28 March 2018).

Diversity VC (2017), 'Women in U.K. Venture Capital 2017'. http://www.diversity.vc/women-in-uk-vc/ (accessed 12 June 2018).

Einzenberger, R. (2016), ''If It's on the Internet It Must Be Right': An Interview with Myanmar ICT for Development Organisation on the Use of the Internet and Social Media in Myanmar', *Austrian Journal of South-East Asian Studies*, 9(2), pp.301–10. https://doi.org/10.14764/10.ASEAS-2016.2-9 (accessed 3 August 2020).

EIU and IFC (2019), *Board Gender Diversity in ASEAN*. Washington, DC: International Finance Corporation. https://www.ifc.org/wps/wcm/connect/21f19cfe-9cce-4089-bfc1-e4c38767394e/Board_Gender_Diversity_in_ASEAN.pdf?MOD=AJPERES (accessed 30 August 2020).

Element AI (2019), 'Global AI Talent Report 2019'. Montreal: Element AI. https://jfgagne.ai/talent-2019/ (accessed 14 October 2020).

ERIA (2019), *Study on MSMEs Participation in the Digital Economy in ASEAN: Nurturing ASEAN MSMEs to Embrace Digital Adoption*. Jakarta: Economic Research Institute for ASEAN and East Asia. https://www.eria.org/uploads/media/Books/2019-October-ERIA-ASEAN-Study-On-MSMEs-Participation.pdf (accessed 23 October 2020).

Facebook and Bain & Company (2020), 'Digital Consumers of Tomorrow, Here Today'. https://www.bain.com/insights/digital-consumers-of-tomorrow-here-today/ (accessed 23 October 2020).

Faith, B. (2017), 'Automation, Women, and the Future of Work', *Rapid Response Briefing*, No. 1. Brighton: University of Sussex, Institute of Development Studies. https://doi.org/10.35648/20.500.12413/11781/ii287 (accessed 17 August 2020).

Fatehkia, M., R. Kashyap, and I. Weber (2018), 'Using Facebook Ad Data to Track the Global Digital Gender Gap', *World Development*, 107, pp.189–209. https://doi.org/10.1016/j.worlddev.2018.03.007 (accessed 30 August 2020).

Freedom House (2019), Freedom on the Net 2019. Myanmar. https://freedomhouse.org/country/myanmar/freedom-net/2019 (accessed 19 August 2020).

Frehill, L., A. Abreu, and K. Zippel (2015), 'Gender, Science, and Occupational Sex Segregation', in W. Pearson, L. Frehill, and C. McNeely (eds.) *Advancing Women in Science: An International Perspective*. Cham, Switzerland: Springer, pp. 51–92. http://www.springer.com/br/book/9783319086286 (accessed 30 August 2020).

Fulu, E., X. Warner, S. Miedema, R. Jewkes, T. Roselli, and J. Lang (2013), *Why Do Some Men Use Violence Against Women and How Can We Prevent It? Quantitative Findings from the UN Multi-Country Study on Men and Violence in Asia and the Pacific*. Bangkok: UNDP, UNFPA, UN Women, and UNV. http://www.partners4prevention.org/resource/why-do-some-men-use-violence-against-women-and-how-can-we-prevent-it-quantitative-findings (accessed 30 August 2020).

Gavalyugova, D. and W. Cunningham (2020), *Gender Analysis of the Cambodian Labor Market*. Washington, DC: World Bank. https://openknowledge.worldbank.org/handle/10986/34201 (accessed 3 August 2020).

George, A.S., R. Morgan, E. Larson, and A. LeFevre (2018), 'Gender Dynamics in Digital Health: Overcoming Blind Spots and Biases to Seize Opportunities and Responsibilities for Transformative Health Systems', *Journal of Public Health*,

40(suppl_2), pp.ii6–ii11. https://doi.org/10.1093/pubmed/fdy180 (accessed 17 August 2020).

Gompers, P.A. and S.Q. Wang (2017), 'Diversity in Innovation', *NBER Working Paper Series*, No. 23082. Cambridge, MA: National Bureau of Economic Research. https://doi.org/10.3386/w23082 (accessed 30 August 2020).

Götzmann, N. (2019), 'New UN Gender Guidance is a Reminder that Real Equality Requires Tackling Discrimination', Business & Human Rights Resource Centre, 25 June. https://www.business-humanrights.org/en/blog/new-un-gender-guidance-is-a-reminder-that-real-equality-requires-tackling-discrimination/ (accessed 7 September 2020).

Guelich, U. (2018), *Global Entrepreneurship Monitor Thailand Report, 2017/18*. Bangkok: ILO Regional Office for Asia and the Pacific. https://www.gemconsortium.org/economy-profiles/thailand-2 (accessed 30 August 2020).

Guelich, U. (2020), *Global Entrepreneurship Monitor Thailand Report, 2019/20*. Bangkok: ILO Regional Office for Asia and the Pacific. https://www.gemconsortium.org/report/gem-thailand-report-201920 (accessed 30 August 2020).

Gustavsson, E. (2005), 'Virtual Servants: Stereotyping Female Front-Office Employees on the Internet', *Gender, Work & Organization*, 12(5), pp.400–19. https://doi.org/10.1111/j.1468-0432.2005.00281.x (accessed 30 August 2020).

Hamilton, M. (2019), 'The Sexist Algorithm', *Behavioral Sciences & the Law*, 37(2), pp.145–57. https://doi.org/10.1002/bsl.2406 (accessed 24 October 2020).

Heng, D. (2020), 'Malaysia Sees the Digital Economy as Key to Unlocking Rural Economic Growth', *ASEAN Today*, 25 January. https://www.aseantoday.com/2020/01/malaysia-sees-the-digital-economy-as-key-to-unlocking-rural-economic-growth/ (accessed 24 October 2020).

Hilal, S.E.A. (2018), 'Creative Destruction? Technological Progress, Employment Growth, and Skills for the Future in Indonesia, the Philippines, Thailand and Viet Nam', in A. Sakamoto and J. Sung (eds.) *Skills and the Future of Work: Strategies for Inclusive Growth in Asia and the Pacific*, Bangkok: ILO Regional Office for Asia and the Pacific, pp.182–255.

http://www.ilo.org/asia/publications/WCMS_650239/lang--en/index.htm (accessed 30 August 2020).

Hoan, N.T., A. Chib, and R. Mahalingham (2016), 'Mobile Phones and Gender Empowerment: Enactment of ''Restricted Agency'', Proceedings of the Eighth International Conference on Information and Communication Technologies and Development, pp.1–10. https://dl.acm.org/doi/10.1145/2909609.2909671 (accessed 17 August 2020).

Huan, L.M. (2018), *Global Entrepreneurship Monitor Vietnam 2017/2018*. Hanoi: Thanh Nien Publishing House. https://www.gemconsortium.org/report/gem-vietnam-20172018-report-executive-summary (accessed 23 October 2020).

Hunt, V., S. Prince, S. Dixon-Fyle, and K. Dolan (2020), *Diversity Wins: How Inclusion Matters*. McKinsey & Company. https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Diversity%20and%20Inclusion/Diversity%20wins%20How%20inclusion%20matters/Diversity-wins-How-inclusion-matters-vF.ashx (accessed 23 October 2020).

Hunt, A. and E. Samman (2019), 'The 'Flexible' Gig Economy Is Not Such a Great Option for Women After All', *OpenDemocracy*, 19 November. https://www.opendemocracy.net/en/oureconomy/the-flexible-gig-economy-is-not-such-a-great-option-for-women-after-all/ (accessed 17 September 2020).

Hunt, V., L. Yee, S. Prince, and S. Dixon-Fyle (2018), *Delivering Growth Through Diversity in the Workplace*. McKinsey & Company. https://www.mckinsey.com/business-functions/organization/our-insights/delivering-through-diversity (accessed 30 August 2020).

ILO (2017), 'Economic Impacts of Reducing the Gender Gap', *Research Brief*, No. 10. Geneva: International Labour Organization. http://www.ilo.org/global/research/publications/what-works/WCMS_577685/lang--en/index.htm (accessed 30 August 2020).

ILO (2018a), *Global Wage Report 2018/19: What Lies Behind Gender Pay Gaps*. Geneva: International Labour Organization. http://www.ilo.org/global/publications/books/WCMS_650553/lang--en/index.htm (accessed 30 August 2020).

ILO (2018b), *Game Changers: Women and the Future of Work in Asia and the Pacific*. Bangkok: ILO Regional Office for Asia and the Pacific. http://www.ilo.org/asia/publications/WCMS_645601/lang--en/index.htm (accessed 30 August 2020).

ILO (2018c), 'Global Wage Growth Lowest Since 2008, While Women Still Earning 20 Per Cent Less Than Men', News, 26 November. http://www.ilo.org/global/about-the-ilo/newsroom/features/WCMS_650551/lang--en/index.htm (accessed 30 August 2020).

International Telecommunication Union (2019), *Measuring Digital Development: Facts and Figures 2019*. Geneva: International Telecommunication Union. https://www.itu.int/en/ITU-D/Statistics/Documents/facts/FactsFigures2019.pdf (accessed 25 October 2020).

Internet Society (2017), 'Issue Paper: Asia-Pacific Bureau—Gender'. Reston, VA: Internet Society. https://www.internetsociety.org/wp-content/uploads/2017/08/APAC-Issue-Papers-Gender_0.pdf (accessed 30 August 2020).

IPU (2020), Monthly ranking of women in national parliaments. Geneva: Inter-Parliamentary Union. https://data.ipu.org/women-ranking?month=10&year=2020 (accessed 22 October 2020).

Jock Hoi, L. (2020), 'Recovering and Building Back Better as a Region', Op-ed, *The Jakarta Post*, 2 October. https://www.thejakartapost.com/academia/2020/10/02/recovering-and-building-back-better-as-a-region.html (accessed 2 October 2020).

Khine, A.T. et al. (2020), 'Assessing Risk Factors and Impact of Cyberbullying Victimization Among University Students in Myanmar: A Cross-Sectional Study', *PLOS ONE*, 15(1), e0227051. https://doi.org/10.1371/journal.pone.0227051 (accessed 3 August 2020).

Kim, M., S.C. Abdullah, N.T.B. Thuy, and I. Boey (2020), 'Female Entrepreneurship in the ICT Sector: Success Factors and Challenges, *Asian Women*, 36(2), pp.43–72. https://doi.org/10.14431/aw.2020.6.36.2.43 (accessed 30 August 2020).

Le, T.T., H.M. Pham, N.H. Chu, D.K. Nguyen, and H.M. Ngo (2020), 'Factors Affecting Users' Continuance Intention Towards Mobile Banking in Vietnam', *American Journal of Multidisciplinary Research & Development*, 2(4), pp.42–51.

Leavy, S., G. Meaney, K. Wade, and D. Greene (2020), 'Mitigating Gender Bias in Machine Learning Data Sets'. ArXiv:2005.06898 [Cs]. http://arxiv.org/abs/2005.06898 (accessed 12 August 2020).

Lerner, J and R. Nanda (2020), 'Venture Capital's Role in Financing Innovation: What We Know and How Much We Still Need to Learn', *Journal of Economic Perspectives*, 34(3), pp.237–61.

Lestariningsih, E., S.H. Rachmad, A.N. Hasyyati, and K. Maharani (2018), 'Digital Economy and Gender Well-Being Measurement: Evidence from Indonesia', International Association for Research in Income and Wealth (IARIW) 35th General Conference, Copenhagen, 20–25 August 2018. http://www.iariw.org/copenhagen/eni.pdf (accessed 3 August 2020).

Loh-Ludher, L.L. (2007), 'Homeworkers Online: Utilization of ICT for Home-Based Work in Malaysia', *The Electronic Journal of Information Systems in Developing Countries*, 32(1), pp.1–14. https://onlinelibrary.wiley.com/doi/abs/10.1002/j.1681-4835.2007.tb00224.x (accessed 6 September 2020).

Loo, M.K.L. (2019), 'Enhancing Financial Inclusion in ASEAN: Identifying the Best Growth Markets for Fintech', *Journal of Risk and Financial Management*, 12(4), 181.

Madan, N. (2020), 'A Review of Access to Finance by Micro, Small and Medium Enterprises and Digital Financial Services in Selected Asia-Pacific Least Developed Countries', *MPFD Working Paper Series*, No. WP/20/03. Bangkok: United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP). https://www.unescap.org/publications/mpfd-working-paper-review-access-finance-micro-small-and-medium-enterprises-and-digital (accessed 3 August 2020).

Mayhew, J. (2015), 'Using Technology to Counter Gender-Based Violence in Cambodia', *DW*, 19 August. https://www.dw.com/en/using-technology-to-

counter-gender-based-violence-in-cambodia/a-18657639 (accessed 28 August 2020).

Melissa, E., A. Hamidati, M.S. Saraswati, and A. Flor (2015), 'The Internet and Indonesian Women Entrepreneurs: Examining the Impact of Social Media on Women Empowerment', in A. Chib, J. May, and R. Barrantes (eds.) *Impact of Information Society Research in the Global South*. Singapore: Springer, pp.203–22.

Mellström, U. (2009), 'The Intersection of Gender, Race and Cultural Boundaries, or Why Is Computer Science in Malaysia Dominated by Women?', *Social Studies of Science*, 39(6), pp.885–907. http://journals.sagepub.com/doi/10.1177/0306312709334636 (accessed 24 October 2020).

Ministry of Women, Family and Community Development, Malaysia (2013), *Good Practices: Eliminating Violence Against Women and Children (EVAWC): Documentation of Good Practises in ASEAN Member States on the Elimination of Violence Against Women and Children (EVAWC)*. Kuala Lumpur: Ministry of Women, Family and Community Development, Malaysia. https://acwc.asean.org/wp-content/uploads/2016/04/Good-Practices-EVAWC-Publication.pdf (accessed 30 August 2020).

National Women's Business Council (2019), *Rural Women Entrepreneurs: Challenges and Opportunities*. Report prepared for the US National Women's Business Council. https://cdn.www.nwbc.gov/wp-content/uploads/2019/05/08180133/Rural-Women-Entrepreneurs-Report-508-Compliant-Final2.pdf (accessed 26 October 2020).

Nawangpalupi, C.B., G. Pawitan, M. Widyarini, A. Gunawan, F.E. Putri, and T. Iskandarsjah (2016), *Entrepreneurship in Indonesia: Conditions and Opportunities for Growth and Sustainability*. Bandung: UNPAR Press. https://www.gemconsortium.org/report/entrepreneurship-in-indonesia-conditions-and-opportunities-for-growth-and-sustainability-20152016-indonesia-report (accessed 30 August 2020).

Nazriani, D. and S. Zahreni (2016), 'Adolescent Cyberbullying in Indonesia: Differentiation between Bullies and Victim', *Advances in Social Science,*

Education and Humanities Research (ASSEHR), 81, Proceedings of the 1st International Conference on Social and Political Development (ICOSOP 2016), pp.505–508. https://doi.org/10.2991/icosop-16.2017.68 (accessed 29 August 2020).

Nengsi, F. (2019), 'The Women's Participation in Digital Economy in ASEAN', *Journal of Islamic World and Politics*, 3(1), pp.516–36. https://doi.org/10.18196/jiwp.3128 (accessed 17 August 2020).

Niethammer, C. (2020), 'AI Bias Could Put Women's Lives at Risk: A Challenge for Regulators', *Forbes*, 2 March. https://www.forbes.com/sites/carmenniethammer/2020/03/02/ai-bias-could-put-womens-lives-at-riska-challenge-for-regulators/ (accessed 9 September 2020).

OECD (2019), *The Role of Education and Skills in Bridging the Digital Gender Divide: Evidence from APEC Economies*. Paris: Organisation for Economic Co-operation and Development. https://www.oecd.org/sti/education-and-skills-in-bridging-the-digital-gender-divide-evidence-from-apec.pdf (accessed 23 October 2020).

OECD (2020), *A Roadmap Toward a Common Framework for Measuring the Digital Economy*, Report for the G20 Digital Economy Task Force, Saudi Arabia, 2020. Paris: Organisation for Economic Co-operation and Development. https://www.oecd.org/digital/ieconomy/roadmap-toward-a-common-framework-for-measuring-the-digital-economy.pdf (accessed 23 October 2020).

Ojanen, T.T. et al. (2014), 'Investigating Online Harassment and Offline Violence Among Young People in Thailand: Methodological Approaches, Lessons Learned', *Culture, Health & Sexuality*, 16(9), pp.1097–1112. https://doi.org/10.1080/13691058.2014.931464 (accessed 29 August 2020).

Painter, A. (2020), 'Coronavirus: Respond at Scale, Build Bridges to the Future, RSA, Blog, 21 March. https://www.thersa.org/discover/publications-and-articles/rsa-blogs/2020/03/coronavirus-respond-at-scale-build-bridges-to-the-future (accessed 7 May 2020).

Pedró, F., M. Subosa, A. Rivas, and P. Valverde (2019), 'Artificial Intelligence in Education: Challenges and Opportunities for Sustainable Development', *Working Papers on Education Policy*, No. 07. Paris: United Nations Educational, Scientific and Cultural Organization (UNESCO). http://www.nied.edu.na/assets/documents/05Policies/NationalCurriculumGuide/Artificial_Intelligence_(AI)-challenges_and_opportunities_for_sustainable_development.pdf (accessed 17 August 2020).

Perrault, R. et al. (2019), *The AI Index 2019 Annual Report*. Stanford, CA: Stanford University AI Index Steering Committee, Human-Centered AI Institute. https://hai.stanford.edu/research/ai-index-2019 (accessed 14 October 2020).

Perrin, A. (2019), 'Digital Gap Between Rural and Nonrural America Persists', Pew Research Center FactTank News, 31 May. https://www.pewresearch.org/fact-tank/2019/05/31/digital-gap-between-rural-and-nonrural-america-persists/ (accessed 24 October 2020).

Phong, K., L. Srou, and J. Solá (2016), *Mobile Phones and Internet Use in Cambodia 2016*. USAID, Development Innovations, the Asia Foundation, and Open Institute. https://asiafoundation.org/publication/mobile-phones-internet-use-cambodia-2016/ (accessed 9 September 2020).

Quirós, C.T., E.G. Morales, R.R. Pastor, A.F. Carmona, M.S. Ibáñez, U.M. Herrera (2018), *Women in the Digital Age*, Study prepared for the European Commission DG Communications Networks, Content & Technology by Iclaves. Brussels: European Commission. https://ec.europa.eu/digital-single-market/en/news/increase-gender-gap-digital-sector-study-women-digital-age (accessed 30 August 2020).

Randhawa, S. (2010), 'Cambodia, Malaysia, Pakistan and the Philippines: Cross-Country Study on Violence Against Women and Information Communication Technologies', genderIT.org. https://www.genderit.org/resources/cambodia-malaysia-pakistan-and-philippines-cross-country-study-violence-against-women-and (accessed 30 August 2020).

Roberts, T. and K. Hernandez (2019), 'Digital Access Is Not Binary: The 5'A's of Technology Access in the Philippines', *The Electronic Journal of Information Systems in Developing Countries*, 85(4), e12084.

Ruddy L. (2020), 'ASEAN's Frontline Heroes: Women and the Cost of Informal Ageing Care During and After a Pandemic', Opinions, Economic Research Institute for ASEAN and East Asia (ERIA), 10 July. https://www.eria.org/news-and-views/aseans-frontline-heroes-women-and-the-cost-of-informal-ageing-care-during-and-after-a-pandemic/ (accessed 30 August 2020).

Ruiz, R.M.N.M. (2019), 'Curbing Cyberbullying Among Students: A Comparative Analysis of Existing Laws Among Selected ASEAN Countries', *PEOPLE: International Journal of Social Sciences*, 4(3), pp.1285–1305. https://doi.org/10.20319/pijss.2019.43.12851305 (accessed 28 August 2020).

Safitri, Y. and M. Angeline (2019), 'Social Marketing Aspect in Anti-Violence Against Women Campaign in Indonesia', *INJECT (Interdisciplinary Journal of Communication*), 4(1), pp.93–114. https://doi.org/10.18326/inject.v4i1.93-114 (accessed 29 August 2020).

de Sartiges, D., A. Bharadwaj, I. Khan, J. Tasiaux, and P. Witschi (2020), 'Southeast Asian Consumers Are Driving a Digital Payment Revolution', 20 May. Boston, MA: Boston Consulting Group.

Sassler, S., K. Michelmore, and K. Smith (2017), 'A Tale of Two Majors: Explaining the Gender Gap in STEM Employment Among Computer Science and Engineering Degree Holders', *Social Sciences*, 6(3), 69. https://doi.org/10.3390/socsci6030069 (accessed 30 August 2020).

Scott, A., F. Kapor Klein, F. McAlear, A. Martin, and S. Koshy (2018), *The Leaky Tech Pipeline: A Comprehensive Framework for Understanding and Addressing the Lack of Diversity Across the Tech Ecosystem*. Oakland, CA: Kapor Center for Social Impact. https://www.kaporcenter.org/the-leaky-tech-pipeline-a-comprehensive-framework-for-understanding-and-addressing-the-lack-of-diversity-across-the-tech-ecosystem/ (accessed 30 August 2020).

Scott, S., S. Balasubramanian, and A. Ehrke (2017), *Ending the Gender Digital Divide in Myanmar: A Problem-Driven Political Economy Assessment*.

Washington, DC: IREX. http://www.irex.org/resource/ending-gender-digital-divide-myanmar-problem-driven-political-economy-assessment (accessed 3 August 2020).

Sey, A. and L. Fesalbon (2019), 'Ok Google: Is AI gendered?', in A. Sey and N. Hafkin (eds.) *Taking Stock: Data and Evidence on the State of Gender Equality in Digital Access, Skills, and Leadership*. United Nations University Institute on Computing and Society and the International Telecommunication Union, pp.144–45. http://collections.unu.edu/view/UNU:7350 (accessed 30 August 2020).

Sey, A. and N. Hafkin, eds. (2019), *Taking Stock: Data and Evidence on the State of Gender Equality in Digital Access, Skills, and Leadership*. United Nations University Institute on Computing and Society and the International Telecommunication Union. http://collections.unu.edu/view/UNU:7350 (accessed 30 August 2020).

Sheng, Y.K. (2017), 'Urbanisation Wave and ASEAN Regional Agenda', in S.S.C. Tay and J.P. Tijaja (eds.) *Global Megatrends: Implications for the ASEAN Economic Community*. Jakarta: ASEAN Secretariat and Singapore Institute of International Affairs, pp.123–41. https://asean.org/global-megatrends/ (accessed 30 August 2020).

Sittichai, R. and P.K. Smith (2018), 'Bullying and Cyberbullying in Thailand: Coping Strategies and Relation to Age, Gender, Religion and Victim Status', *Journal of New Approaches in Educational Research*, 7(1), pp.24–30. https://doi.org/10.7821/naer.2018.1.254 (accessed 28 August 2020).

Soh, P.C.-H., B.H. Teh, Y.H. Hong, T.S. Ong, and J.P. Charlton (2013), 'Exploring Gender Differences in Malaysian Urban Adolescent Internet Usage', *First Monday*, 18(9). https://doi.org/10.5210/fm.v18i9.4334 (accessed 18 August 2020).

Sothorn, K., R. Bandeth, F.P.B. Zwiers, and K. Keothyda (2019), 'The Empowerment of Women in Cambodia', Background paper. Phnom Penh: Parliamentary Institute of Cambodia. http://ticambodia.org/library/wp-content/files_mf/159644023820191227_EmpowermentofWomeninCambodiaEn.pdf (accessed 30 August 2020).

Soto, J.U. (2010), *Violence Against Women and Information Communication Technologies: Philippines Country Report*. Manila: Association for Progressive Communications Women's Networking Support Programme. https://genderit.org/sites/default/files/philippines_APC_WNSP_MDG3_VAW_ICT_ctryrpt_1.pdf (accessed 6 September 2020).

Staley, O. (2018), 'Why Male Uber Drivers Earn More Than Women', *Quartz at Work*, 6 February. https://work.qz.com/1198825/why-male-uber-drivers-earn-more-than-women/ (accessed 25 October 2020).

Suwana, F. and Lily (2017), 'Empowering Indonesian Women Through Building Digital Media Literacy', *Kasetsart Journal of Social Sciences*, 38(3), pp.212–17. https://doi.org/10.1016/j.kjss.2016.10.004 (accessed 18 August 2020).

Swe, H.T. (2019), 'Combating Cyberbullying in Southeast Asia: How ASEAN Can Adopt a Regional Approach', ASEAN–Australia Strategic Youth Partnership, 26 August. https://aasyp.org/2019/08/26/combating-cyberbullying-in-southeast-asia-how-asean-can-adopt-a-regional-approach/ (accessed 28 August 2020).

Thas, A.M.K. (2006), 'An Empowerment Approach to Gender Equality in the Information Society: Perspectives from East Asia', in A. Gurumurthy, P.J. Singh, and A. Kovacs (eds.) *An Empowerment Approach to Gender Equality in the Information Society: Regional Analyses from Asia*. Bangalore: IT for Change, pp.11–50. https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/41796/129459.pdf?sequence=1 (accessed 30 August 2020).

The Asia Foundation (2020), *The Future of Work Across ASEAN: Policy Prerequisites for the Fourth Industrial Revolution*. San Francisco, CA: The Asia Foundation. https://asiafoundation.org/wp-content/uploads/2020/02/The-Future-of-Work-Across-ASEAN_summary.pdf (accessed 7 September 2020).

The Online Citizen (2020), 'ASEAN: End Systemic Violence Against Women in Southeast Asia', 11 March. https://www.theonlinecitizen.com/2020/03/11/asean-end-systemic-violence-against-women-in-southeast-asia/ (accessed 25 October 2020).

Tran, T. et al. (2020), 'How Digital Natives Learn and Thrive in the Digital Age: Evidence from an Emerging Economy', *Sustainability*, 12(9), 3819.

UN News (2020), 'Bridging Asia-Pacific 'Digital Divide' Vital to Realize Tech Benefits', 18 August. https://news.un.org/en/story/2020/08/1070502 (accessed 24 October 2020).

UN Women (2011), *Progress of the World's Women 2011–2012: In Pursuit of Justice*. New York: UN Women. https://asiapacific.unwomen.org/en/digital-library/publications/2011/1/progress-of-the-worlds-women-in-pursuit-of-justice (accessed 22 October 2020).

UN Women (2020), 'Surveys Show That COVID-19 Has Gendered Effects in Asia and the Pacific', 29 April. https://data.unwomen.org/resources/surveys-show-covid-19-has-gendered-effects-asia-and-pacific (accessed 24 October 2020).

UNDP and United Nations Working Group on Business and Human Rights (2019), *Gender Dimensions of the Guiding Principles on Business and Human Rights*. United Nations Development Programme (UNDP) and the United Nations Working Group on Business and Human Rights. https://www.ohchr.org/EN/Issues/Business/Pages/GenderLens.aspx (accessed 24 September 2020).

UNESCAP (2017), *Fostering Women's Entrepreneurship in ASEAN: Transforming Prospects, Transforming Societies – Overview*. Bangkok: United Nations Economic Social and Commission for Asia and the Pacific. https://www.unescap.org/sites/default/files/ESCAP-Fostering-Womens-Entrepreneurship-Overview.pdf (accessed 21 December 2020).

UNESCAP (2018), *Fostering Women's Entrepreneurship in ASEAN: Transforming Prospects, Transforming Societies*. Bangkok: United Nations Economic and Social Commission for Asia and the Pacific. https://www.unescap.org/sites/default/files/publications/SSD-Gender-FWE-report_0.pdf (accessed 26 October 2020).

UNESCAP (2020), 'Policy Guidelines for Supporting Women-Owned Micro, Small and Medium Enterprises (WMSMEs) Affected by the COVID-19 Pandemic in the Kingdom of Cambodia'. Bangkok: United Nations Economic and Social Commission for Asia and the Pacific.

https://www.unescap.org/sites/default/files/Policy_WMSMEs_COVID-19_20200603.pdf (accessed 23 October 2020).

UNESCO and Equals Skills Coalition (2019), *I'd Blush If I Could: Closing Gender Divides in Digital Skills Through Education*. Paris: United Nations Educational, Scientific and Cultural Organization. https://en.unesco.org/Id-blush-if-I-could (accessed 9 September 2020).

United States Department of Commerce (2017), 'Women in STEM: 2017 Update', *ESA Issue Brief*, No. 06-17. Washington, DC: United States Department of Commerce Economics & Statistics Administration. https://files.eric.ed.gov/fulltext/ED590906.pdf (accessed 30 August 2020).

USAID (2018), *Women's Economic Empowerment in the Digital Economy*. Washington, DC: United States Agency for International Development. https://www.nathaninc.com/wp-content/uploads/2019/03/WEE-in-the-Digital-Economy-White-Paper.pdf (accessed 13 September 2020).

Valberg, S. (2020), 'ICT, Gender, and the Labor Market: A Cross-Country Analysis', in D. Maiti, F. Castellacci, and A. Melchior (eds.) *Digitalisation and Development: Issues for India and Beyond*. Singapore: Springer, pp.375–405. https://doi.org/10.1007/978-981-13-9996-1_15 (accessed 30 August 2020).

Verkroost, F.C.J., R. Kashyap, K. Garimella, I. Weber, and E. Zag (2020), 'Tracking Global Gender Gaps in Information Technology Using Online Data', in ITU, *Digital Skills Insights 2020*. Geneva: International Telecommunication Union, pp.81–93. https://academy.itu.int/sites/default/files/media2/file/Digital Skills Insights 2020.pdf (accessed 23 October 2020).

Vu, H.T., B. Barnett, H.T. Duong, and T.T. Lee (2019), ''Delicate and Durable': An Analysis of Women's Leadership and Media Practices in Vietnam', *International Journal of Media & Cultural Politics*, 15(1), pp.87–108. https://doi.org/10.1386/macp.15.1.87_1 (accessed 17 August 2020).

West, S.M., M. Whittaker, and K. Crawford (2019), *Discriminating Systems: Gender, Race and Power in AI*. New York: New York University AI Now Institute. https://ainowinstitute.org/discriminatingsystems.html (accessed 9 September 2020).

Woetzel, J. et al. (2018), *The Power of Parity: Advancing Women's Equality in Asia Pacific, Executive Summary*. McKinsey Global Institute. https://www.mckinsey.com/featured-insights/gender-equality/the-power-of-parity-advancing-womens-equality-in-asia-pacific (accessed 25 September 2020).

World Economic Forum (2020), *Global Gender Gap Report 2020*. Geneva: World Economic Forum. https://www.weforum.org/reports/global-gender-gap-report-2020/ (accessed 1 September 2020).

Wyman, O. (2017), *Accelerating Financial Inclusion in South-East Asia with Digital Finance*. Manila: Asian Development Bank. https://think-asia.org/handle/11540/7500 (accessed 3 August 2020).

Zainudeed, A. and H. Galpaya (2015), *Mobile Phones, Internet and Gender in Myanmar*. GSMA Connected Women and LIRNE*asia*. https://www.gsma.com/mobilefordevelopment/resources/mobile-phones-internet-and-gender-in-myanmar/ (accessed 30 August 2020)

Zarya, V. (2016), 'Female Programmers Make Nearly 30% Less Than Their Male Counterparts', *Fortune*, 16 November. http://fortune.com/2016/11/16/gender-pay-gap-programmers/ (accessed 30 August 2020).

Annex 1 – Digital Leadership: Employment, Entrepreneurship, and Policymaking

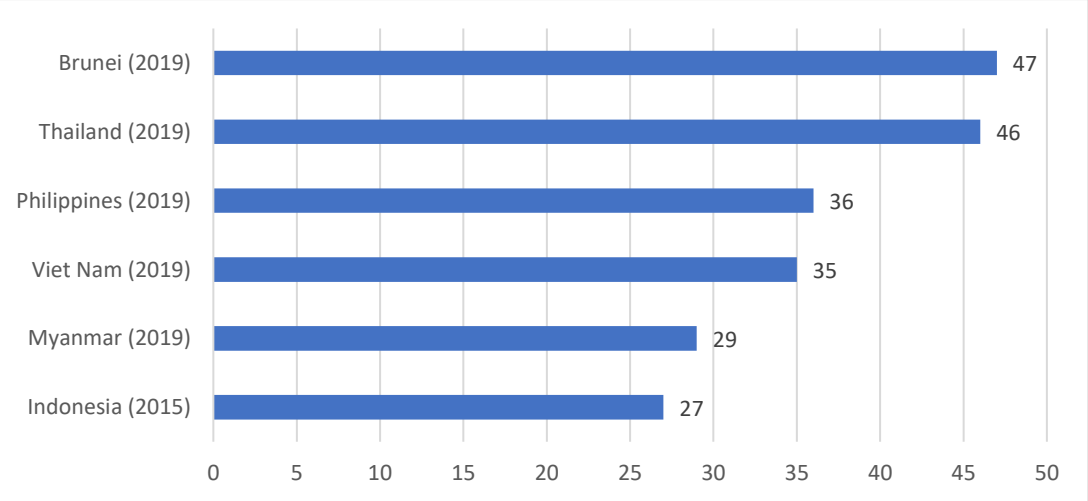
Table 1: Gender Parity in Technology Roles, 2018–2019

Country	Ranking
Singapore	5.39
Malaysia	5.17
Indonesia	4.79
Philippines	4.73
Lao PDR	4.11
Thailand	3.96
Brunei Darussalam	3.66
Viet Nam	3.64
Cambodia	3.32
Myanmar	n/a

Lao PDR = Lao People's Democratic Republic.
Note: Response to the survey question: 'In your country, to what extent are women entering information technology roles (across all sectors)?'
1 = not at all; 7 = to a great extent, the rate is equal to that of men.
Source: World Economic Forum (2020).

Figure 1: Female Share of Employment in Telecommunications

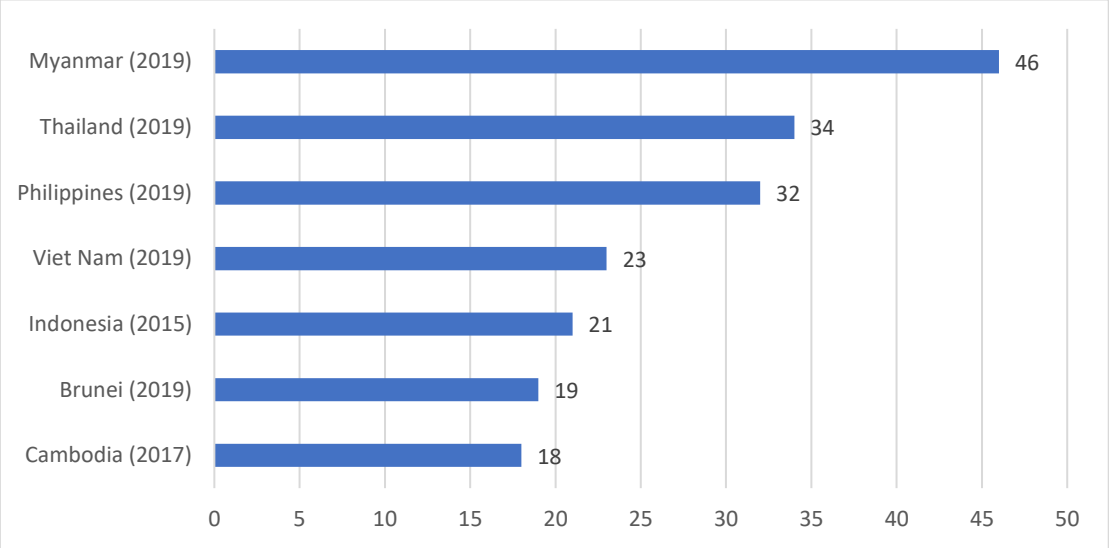
(% of total)



Brunei = Brunei Darussalam.
Note: Data for Cambodia and the Lao People's Democratic Republic are unreliable.
Source: International Labour Organisation (2020), ILOSTATS (Employment by sex and economic activity - ISIC level, 2), 2020. Geneva: ILO. https://ilostat.ilo.org/data/ (accessed 31 August 2020).

Figure 2: Female Share of Employment in Computer Programming, Consultancy, and Related Activities

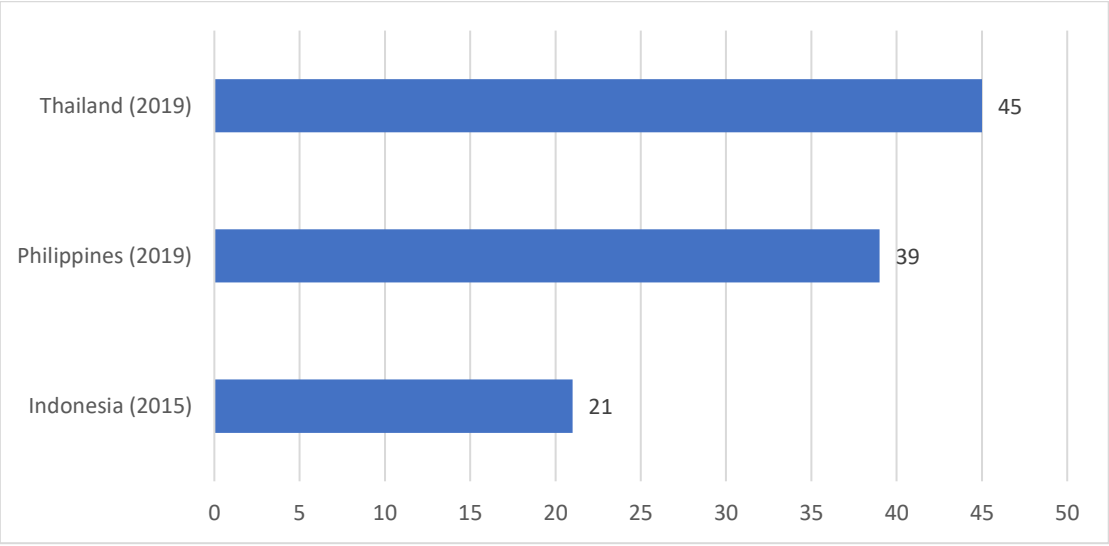
(% of total)



Brunei = Brunei Darussalam.
Source: International Labour Organisation (2020), ILOSTATS (Employment by sex and economic activity - ISIC level, 2), 2020. Geneva: ILO. https://ilostat.ilo.org/data/ (accessed 31 August 2020).

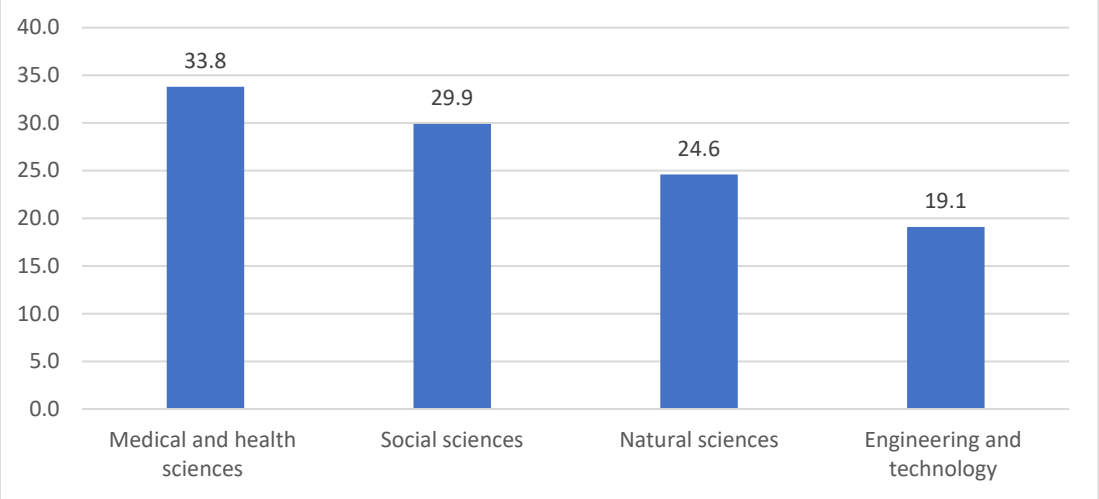
Figure 3: Female Share of Employment in Scientific Research and Development

(% of total)



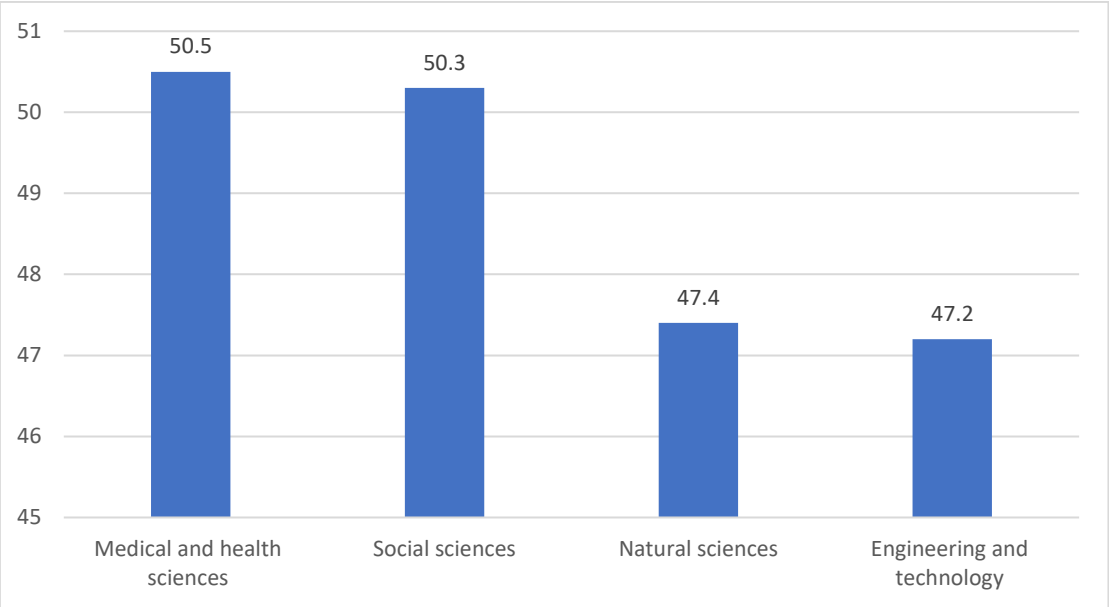
Note: Myanmar and Viet Nam data are marked unreliable.
Source: International Labour Organisation (2020), ILOSTATS (Employment by sex and economic activity - ISIC level, 2), 2020. Geneva: ILO. https://ilostat.ilo.org/data/ (accessed 31 August 2020).

Figure 4: Female Researchers as a Percentage of Total Researchers (FTE), Cambodia, Last Known Year (2015)



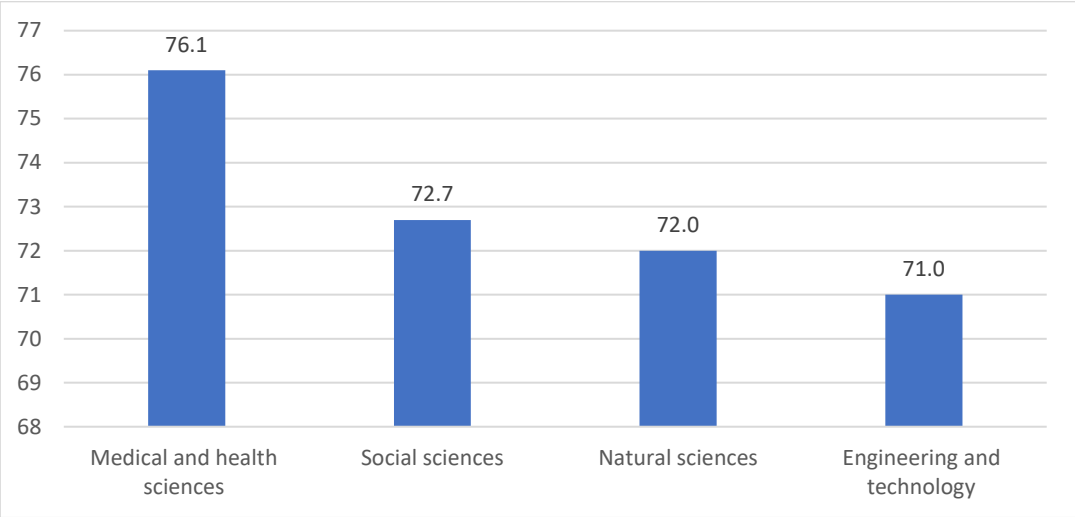
FTE = full-time equivalent.
Source: UNESCO (2020), UNESCO Institute for Statistics, Researchers by field of R&D and sex, 2020. Paris: UNESCO. http://data.uis.unesco.org/ (accessed 23 August 2020).

Figure 5: Female Researchers as a Percentage of Total Researchers (FTE), Malaysia, Last Known Year (2015)



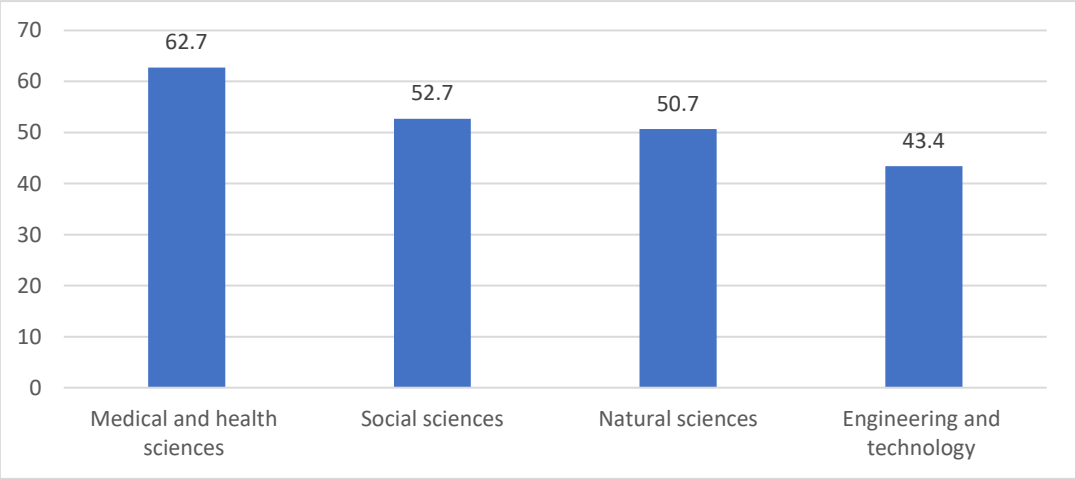
FTE = full-time equivalent.
Source: UNESCO (2020), UNESCO Institute for Statistics, Researchers by field of R&D and sex, 2020. Paris: UNESCO. http://data.uis.unesco.org/ (accessed 23 August 2020).

Figure 6: Female Researchers as a Percentage of Total Researchers (FTE), Myanmar, Last Known Year (2017)



FTE = full-time equivalent.
Source: UNESCO (2020), UNESCO Institute for Statistics, Researchers by field of R&D and sex, 2020. Paris: UNESCO. http://data.uis.unesco.org/ (accessed 23 August 2020).

Figure 7: Female Researchers as a Percentage of Total Researchers (FTE), Philippines, Last Known Year (2015)



FTE = full-time equivalent.
Source: UNESCO (2020), UNESCO Institute for Statistics, Researchers by field of R&D and sex, 2020. Paris: UNESCO. http://data.uis.unesco.org/ (accessed 23 August 2020).

Table 2: Gender of Heads of ICT Ministries and Telecom Regulators (June 2018)

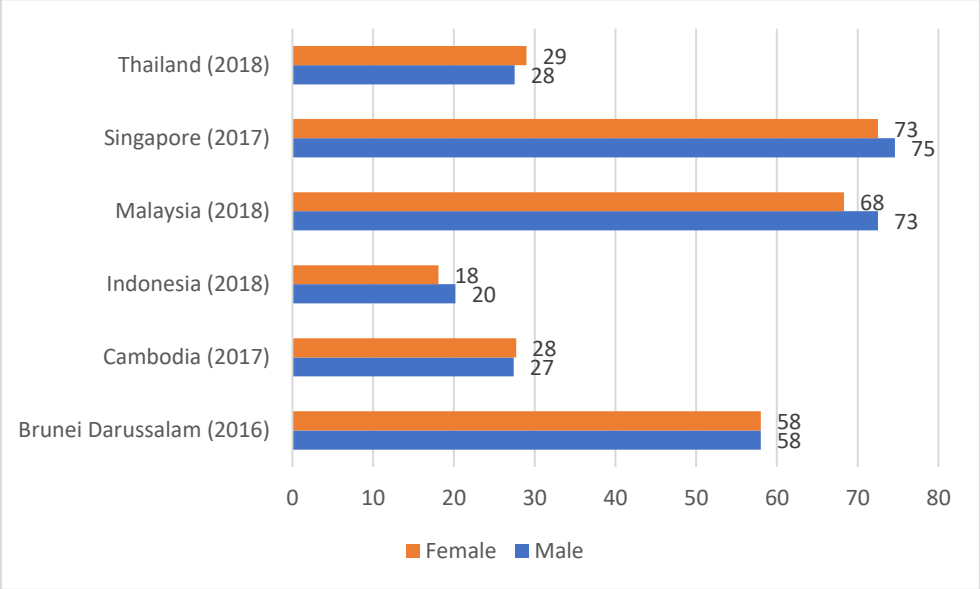
Country	ICT ministry name	Gender	Title
Brunei	Ministry of Communications	Male	Minister
Cambodia	Ministry of Posts & Telecommunications	Male	Minister
Indonesia	Ministry of Communication and Information Technology	Male	Minister
Lao PDR	Ministry of Post and Telecommunications	Male	Minister
Malaysia	Ministry of Communications & Multimedia	Male	Minister
Myanmar	Ministry of Transport and Communications	Male	Minister
Philippines	Department of Information & Communications Technology (Acting)	Male	Secretary
Singapore	Ministry of Communication & Information	Male	Minister
Thailand	Ministry of Digital Economy & Society	Male	Minister
Viet Nam	Ministry of Information & Communications	Male	Minister
	Telecommunication regulator name		
Brunei	Authority for Info-communications Technology Industry (AITI)	Male	Chair
Cambodia	Telecommunication Regulator of Cambodia	Male	Chair
Indonesia	Indonesian Telecommunication Regulatory Authority	Male	Chair
Lao PDR	Ministry of Communication Transport Post and Construction	Male	Minister
Malaysia	Malaysian Communications and Multimedia Commission	Male	Chair
Myanmar	Ministry of Transport and Communications	Male	Minister
Philippines	National Telecommunications Commission	Male	Commissioner
Singapore	Info-comm Media Development Authority	Male	Chair
Thailand	National Broadcasting and Telecommunications Commission	Male	Chair
Viet Nam	Vietnam Internet Network Information Center	Male	Director General

Brunei = Brunei Darussalam, ICT = information and communication technology, Lao PDR = Lao People's Democratic Republic.
Source: United Nations University Institute in Macau, 2019.

Annex 2 – Access

Figure 1: Individuals Using a Computer (from any Location), by Gender

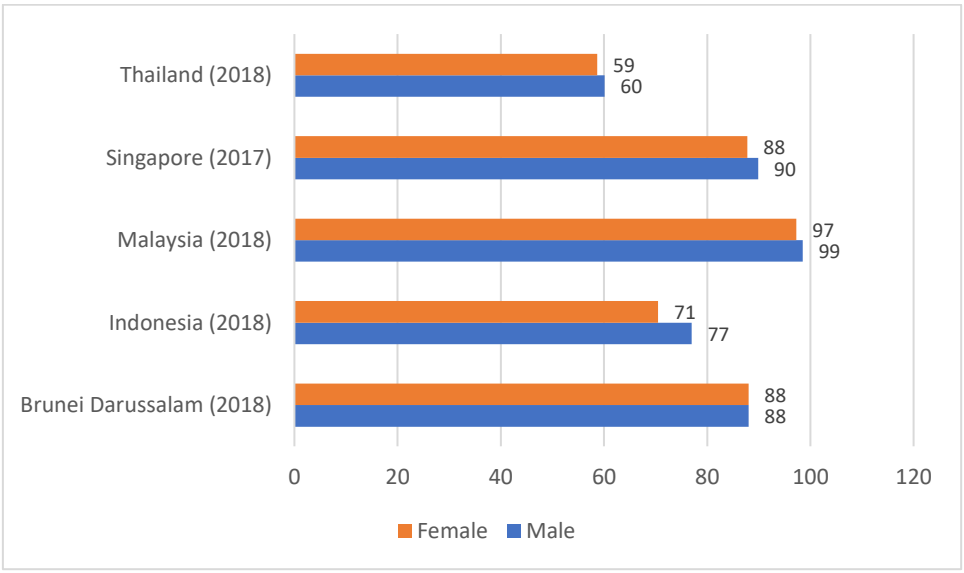
(%)



Source: International Communication Union (2020), ITU World Telecommunication/ICT Indicators database, 2020. Geneva: ITU. https://www.itu.int/en/ITU-D/Statistics/Pages/publications/wtid.aspx (accessed 1 September 2020).

Figure 2: Mobile Phone Use by Gender

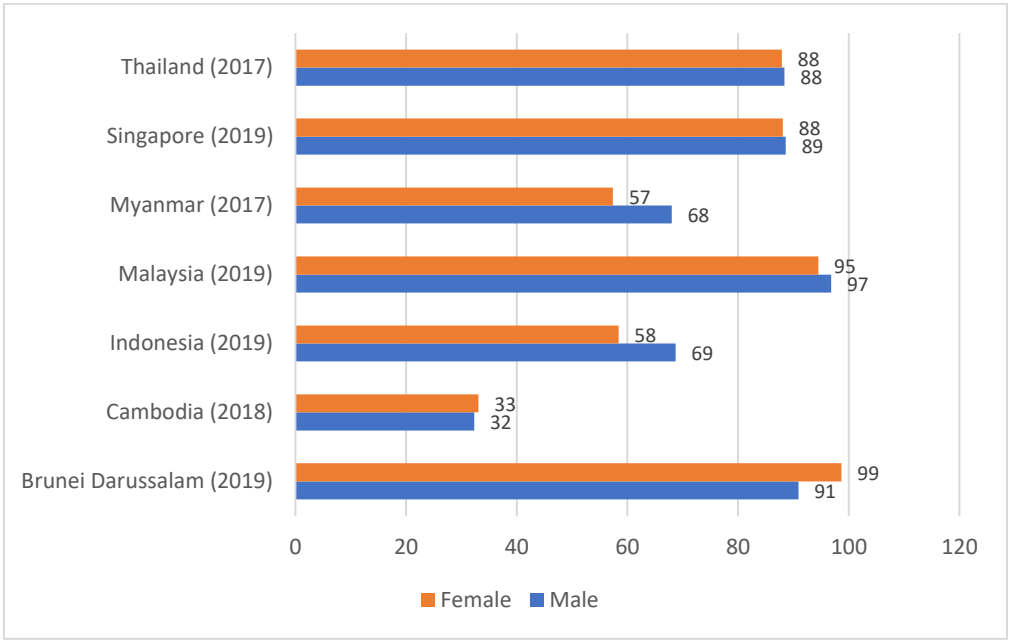
(%)



Source: International Communication Union (2020), ITU World Telecommunication/ICT Indicators database, 2020. Geneva: ITU. https://www.itu.int/en/ITU-D/Statistics/Pages/publications/wtid.aspx (accessed 1 September 2020).

Figure 3: Mobile Phone Ownership by Gender

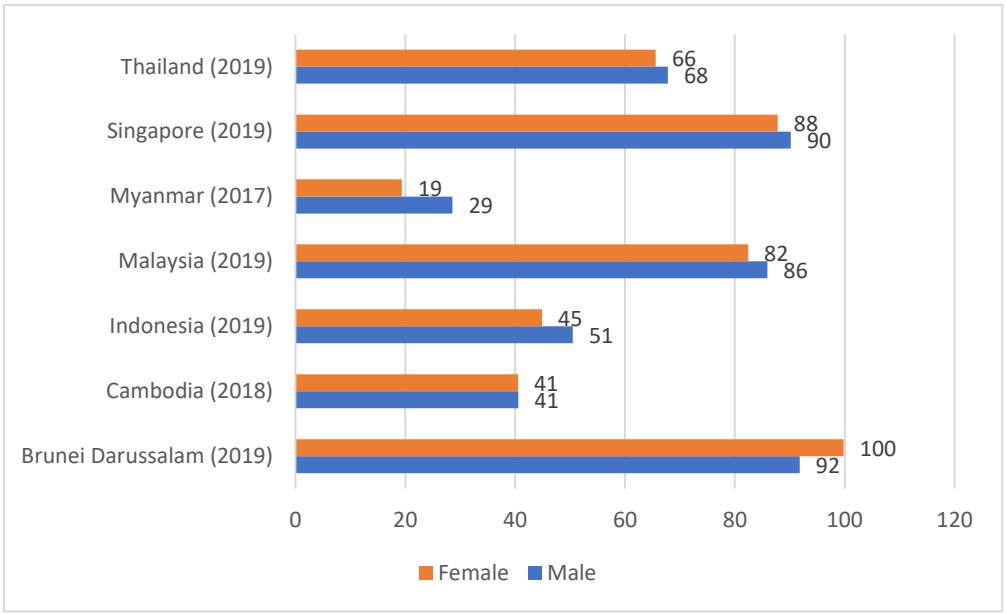
(%)



Source: International Communication Union (2020), ITU World Telecommunication/ICT Indicators database, 2020. Geneva: ITU. https://www.itu.int/en/ITU-D/Statistics/Pages/publications/wtid.aspx (accessed 1 September 2020).

Figure 4: Internet Use (from any Location), by Gender

(%)



Source: International Communication Union (2020), ITU World Telecommunication/ICT Indicators database, 2020. ITU: Geneva. https://www.itu.int/en/ITU-D/Statistics/Pages/publications/wtid.aspx (accessed 1 September 2020).

Annex 3 – Meaningful Access

Table 1: Social Media Use

Country	**Ad audience** (% female)					**Facebook activity**
	Facebook	**Instagram**	**Twitter**	**Snapchat**	**LinkedIn**	
Brunei	43	53	60	n/a	40	Females slightly more active
Cambodia	43	57	54	n/a	46	Females slightly more active
Lao PDR	46	64	64	n/a	44	Females more active
Indonesia	44	51	68	88	41	Females slightly more active
Malaysia	45	53	67	74	41	Females more active
Myanmar	42	52	n/a	n/a	61	Females slightly more active
Philippines	53	64	86	79	53	Female slightly more active
Singapore	49	55	50	62	46	Females slightly more active
Thailand	50	64	78	65	42	Females more active
Viet Nam	49	61	46	n/a	56	Females more active

Brunei = Brunei Darussalam, Lao PDR = Lao People's Democratic Republic, n/a = not applicable.
Notes: Facebook activity (number of pages liked, comments, sharing posts, clicking ads).
Source: Kepios (2020), We Are Social, Hootsuite, Digital 2020 reports. https://datareportal.com/ (accessed 9 September 2020).

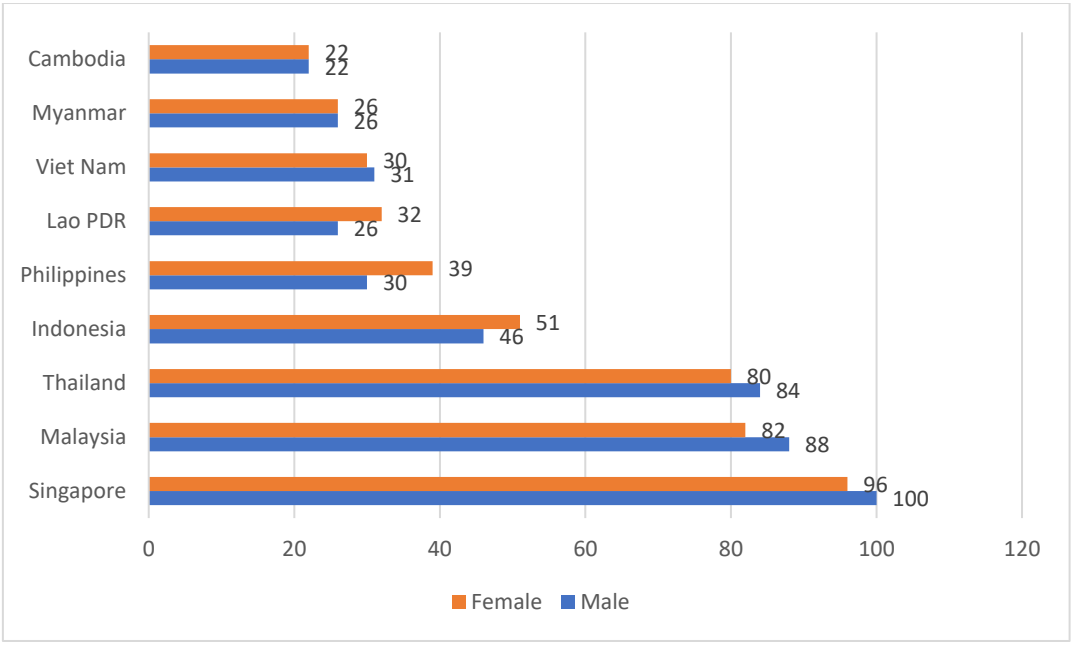
Table 2: Online Transactions

Country	**Make online transactions**		**Have a credit card**	
	% women	**% men**	**% women**	**% men**
Singapore	57.0	56.0	49.0	49.0
Malaysia	39.0	38.0	16.0	26.0
Viet Nam	21.0	20.0	3.7	4.6
Thailand	19.0	19.0	9.5	10.0
Indonesia	13.0	9.4	1.9	3.1
Philippines	12.0	8.2	1.4	2.5
Cambodia	4.3	3.2	0.8	0.2
Myanmar	2.9	4.5	0.0	0.1
Brunei	n/a	n/a	n/a	n/a
Lao PDR	n/a	n/a	n/a	n/a

Brunei = Brunei Darussalam, Lao PDR = Lao People's Democratic Republic, n/a = not applicable.
Source: Kepios (2020), We Are Social, Hootsuite, Digital 2020 reports. https://datareportal.com/ (accessed 9 September 2020).

Figure 1: Individuals with a Financial Institution or Mobile Money Account, 2017

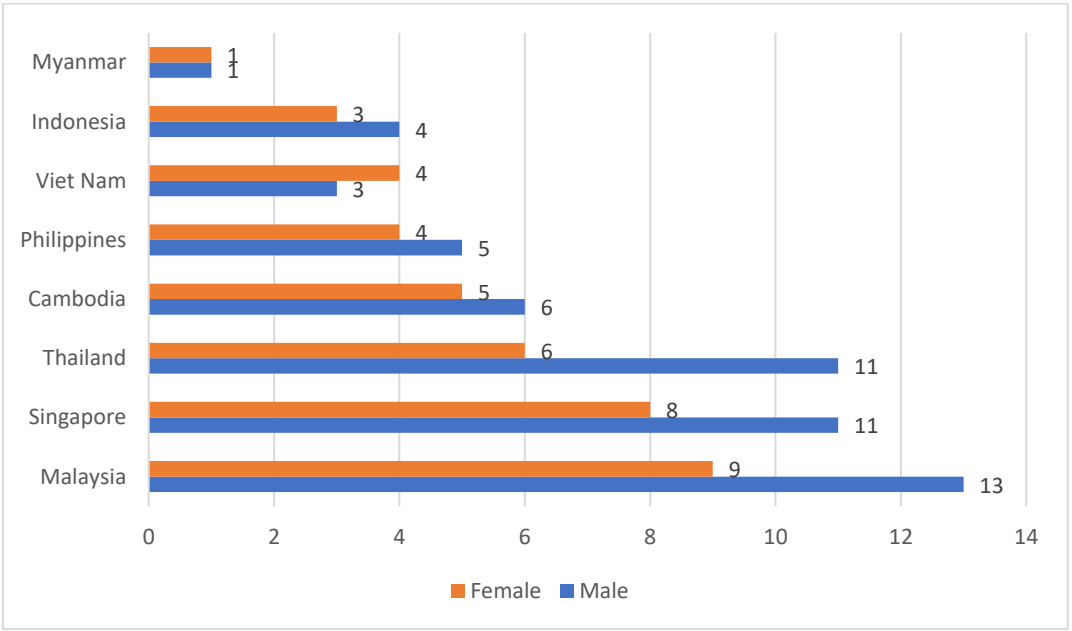
(% of population ages 15+)



Lao PDR = Lao People's Democratic Republic.
Source: World Bank (2020), World Bank Data Bank, Gender Statistics, 2020. Washington, DC: World Bank. http://databank.worldbank.org/data/home.aspx (accessed 7 August 2020).

Figure 2: Individuals with a Mobile Money Account, 2017

(% age 15+)



Source: World Bank (2020), World Bank Data Bank, Gender Statistics, 2020. Washington, DC: World Bank. http://databank.worldbank.org/data/home.aspx (accessed 7 August 2020).

Annex 4 – Digital Skills and STEM Education

Table 1: Female Share, Graduate Programmes

(%)

Country	STEM programmes	ICT programmes	Engineering, manufacturing, & construction programmes	Health & welfare programmes	Business, administration, & law programmes	Social science, journalism, & information programmes
Myanmar 2018	61	67	42	57	71	51
Brunei 2018	54	42	52	76	68	74
Indonesia 2018	37	35	25	78	58	51
Viet Nam 2016	37	26	37	59	60	57
Philippines 2017	36	48	24	72	67	70
Malaysia 2018	34	46	27	72	67	69
Singapore 2017	34	32	28	71	58	66
Thailand 2016	30	48	17	76	69	62
Lao PDR 2018	29	41	18	67	57	48
Cambodia 2015	17	8	15	56	49	23

Brunei = Brunei Darussalam; ICT = information and communication technology; Lao PDR = Lao People's Democratic Republic; STEM = science, technology, engineering, and mathematics.
Source: UNESCO (2020), UNESCO Institute for Statistics, Researchers by field of R&D and sex, 2020. Paris: UNESCO. http://data.uis.unesco.org/ (accessed 23 August 2020).

Annex 5: Availability of Sex-Disaggregated Data

Table 1: Availability of Sex-Disaggregated Data on Digital Access (Last Known Year)

Country	Computer use	Mobile phone use	Mobile phone ownership	Smartphone use	Internet use	Social media use	Mobile money
Thailand	2018	2018	2017	2018	2018	2020	2017
Singapore	2017	2017	2019	No data	2017	2020	2017
Indonesia	2018	2018	2019	No data	2018	2020	2017
Malaysia	2018	2018	2019	No data	2018	2020	2017
Brunei	2016	2018	2019	No data	2016	2020	No data
Cambodia	2017	No data	2018	No data	2017	2020	2017
Myanmar	No data	No data	2017	No data	No data	2020	2017
Philippines	No data	No data	2019	No data	No data	2020	2017
Lao PDR	No data	No data	No data	No data	No data	2020	2017
Viet Nam	No data	No data	No data	No data	No data	2020	2017

Brunei = Brunei Darussalam, Lao PDR = Lao People's Democratic Republic.
Source: Kepios (2020), We Are Social, Hootsuite, Digital 2020 reports. https://datareportal.com/ (accessed 9 September 2020); World Bank (2020), World Bank Data Bank, Gender Statistics, 2020. Washington, DC: World Bank. http://databank.worldbank.org/data/home.aspx (accessed 7 August 2020); ITU World Telecommunication/ICT Indicators database, 2020. ITU: Geneva. https://www.itu.int/en/ITU-D/Statistics/Pages/publications/wtid.aspx (accessed 1 September 2020).

Table 2: Availability of Sex-Disaggregated Data on Digital Skills (Last Known Year)

Country	Digital skills	STEM & ICT tertiary graduates
Brunei	No data	2018
Indonesia	No data	2018
Lao PDR	No data	2018
Malaysia	No data	2018
Myanmar	No data	2018
Philippines	No data	2017
Singapore	No data	2017
Thailand	No data	2016
Viet Nam	No data	2016
Cambodia	No data	2015

Brunei = Brunei Darussalam, ICT = information and communication technology; ITU = International Telecommunication Union; Lao PDR = Lao People's Democratic Republic; STEM = science, technology, engineering, and mathematics; UNESCO = United Nations Educational, Scientific and Cultural Organization.
Source: ITU World Telecommunication/ICT Indicators database, 2020. Geneva: ITU. https://www.itu.int/en/ITU-D/Statistics/Pages/publications/wtid.aspx (accessed 1 September 2020); UNESCO (2020), UNESCO Institute for Statistics, Researchers by field of R&D and sex, 2020. Paris: UNESCO. http://data.uis.unesco.org/ (accessed 23 August 2020).

Table 3: Availability of Sex-Disaggregated Data on Digital Leadership (Last Known Year)

Country	Telecom occupation	Computer programming, consulting, & related occupation	Scientific research & development	Engineering & technology and ICT researchers	Digital entrepreneurship
Myanmar	2019	2019	2015	2017	No data
Philippines	2019	2019	2019	2015	No data
Thailand	2019	2019	2019	No data	No data
Viet Nam	2019	2019	2019	No data	No data
Indonesia	2015	2015	2015	No data	No data
Cambodia	2016	2017	No data	2015	No data
Brunei	2019	2019	No data	No data	No data
Lao PDR	2017	No data	No data	No data	No data
Malaysia	No data	No data	No data	2015	No data
Singapore	No data	No data	No data	No data	No data

Brunei = Brunei Darussalam, ICT = information and communication technology; ILO = International Labour Organization; Lao PDR = Lao People's Democratic Republic; UNESCO = United Nations Educational, Scientific and Cultural Organization.

Source: International Labour Organisation (2020), ILOSTATS (Employment by sex and economic activity – ISIC level, 2), 2020. Geneva: ILO. https://ilostat.ilo.org/data/ (accessed 31 August 2020); UNESCO (2020), UNESCO Institute for Statistics, Researchers by field of R&D and sex, 2020. Paris: UNESCO. http://data.uis.unesco.org/ (accessed 23 August 2020).

ERIA Discussion Paper Series

No.	Author(s)	Title	Year
2020-30 (no. 357)	Kimty SENG	Child Education: Rethinking Microcredit in Cambodia	December 2020
2020-29 (no. 356)	Dyah PRITADRAJATI	Determinants of School Enrolment: Relationship between Minimum Wage and Human Capital Investment	December 2020
2020-28 (no. 355)	Duc Anh DANG and Vuong Anh DANG	The Role of Innovation in Skill Development: Evidence from Small and Medium-Sized Enterprises in Viet Nam	December 2020
2020-27 (no. 354)	Sasiwimon Warunsiri PAWEENAWAT	Intergenerational Transmission of Human Capital: The Case of Thailand	December 2020
2020-26 (no. 353)	Nobuaki YAMASHITA and Trong-Anh TRINH	The Effects of Prenatal Exposure to Plentiful Rainfall on Cognitive Development in Viet Nam	December 2020
2020-25 (no. 352)	Han PHOUMIN, Fukunari KIMURA, and Jun ARIMA	Potential Renewable Hydrogen from Curtailed Electricity for ASEAN's Clean Energy: Policy Implications	November 2020
2020-24 (no.351)	Takahiro AKITA and Sachiko MIYATA	Measuring the Pro-Poorness of Urban and Rural Economic Growth in Indonesia, 2004-2014	November 2020
2020-23 (no.350)	Takahiro ONO and Venkatachalam ANBUMOZHI	Effects of Business Continuity Planning on Reducing Economic Loss due to Natural Disasters	November 2020
2020-22 (no.349)	HAN Phoumin, Fukunari KIMURA and Jun ARIMA	Energy Reality and Emission in ASEAN: Energy Modelling Scenarios and Policy Implications	November 2020
2020-21 (no.348)	Bin NI and Ayako OBASHI	Robotics Technology and Firm-level Employment Adjustment in Japan	November 2020
2020-20 (no.347)	Pavel CHAKRABORTHY and Prachi GUPTA	Does Change in Intellectual Property Rights Induce Demand for Skilled Workers? Evidence from India	November 2020
2020-19 (no.346)	Makoto IKEDA and Thawatchai PALAKHAMARN	Economic Damage from Natural Hazards and Local Disaster Management Plans in Japan and Thailand	October 2020

2020-18 (no. 345)	Tony CAVOLI and Ilke ONUR	Financial Inclusion, Active Bank Accounts and Poverty Reduction in India	October 2020
2020-17 (no. 344)	Rashesh SHRESTHA, Samuel NURSAMSU	Financial Inclusion and Savings in Indonesia	September 2020
2020-16 (no.343)	Kimty SENG	The Poverty-Reducing Effects of Financial Inclusion: Evidence from Cambodia	September 2020
2020-15 (no. 342)	Rajabrata BANERJEE, Ronald DONATO, Admasu Afsaw MARUTA	The Effects of Financial Inclusion on Development Outcomes: New Insights from ASEAN and East Asian Countries	September 2020
2020-14 (no. 341)	Rajabrata BANERJEE and Ronald DONATO	The Composition of Financial Inclusion in ASEAN and East Asia: A New Hybrid Index and Some Stylised Facts	September 2020
2020-13 (no. 340)	Tony CAVOLI and Rashesh SHRESTHA	The Nature and Landscape of Financial Inclusion in Asia	September 2020
2020-12 (no. 339)	Han PHOUMIN, TO Minh Tu, THIM Ly	Sustainable Water Resource Development Scenarios and Water Diplomacy in the Lower Mekong Basin: Policy Implications	September 2020
2020-11 (no. 338)	Kiki VERICO and Mari Elka PANGESTU	The Economic Impact of Globalisation in Indonesia	August 2020
2020-10 (no. 337)	Yuziang YANG and Hongyong ZHANG	The Value-Added Tax Reform and Labour Market Outcomes: Firm-Level Evidence from China	August 2020
2020-09 (no. 336)	Juthathip JONGWANICH, Archanun KOHPAIBOON, Ayako OBASHI	Technological Advancement, Import Penetration, and Labour Markets: Evidence from Thai Manufacturing	August 2020
2020-08 (no. 335)	Duc Anh DANG and Thu Thu VU	Technology Imports and Employment in Developing Countries: Evidence from Viet Nam	August 2020
2020-07 (no. 334)	Hiroaki ISHIWATA, Hiroyuki WADA, Koji SUZUKI, Makoto IKEDA, Naoto TADA	A Quantitative Analysis of Disaster Risk Reduction Investment Effects for Sustainable Development: Indonesia Case Study	June 2020
2020-06 (no. 333)	Dao Ngoc TIEN, Nguyen Quynh HUONG	Assessment of Industrial Cluster Policies in Viet Nam: The Role of Special Economic Zones in Attracting Foreign Direct Investment	June 2020

2020-05 (no. 332)	Ayako OBASHI and Fukunari KIMURA	New Developments in International Production Networks: Impact of Digital Technologies	June 2020
2020-04 (no. 331)	Upalat KORWATANASAKUL, Youngmin BAEK, Adam MAJOE	Analysis of Global Value Chain Participation and the Labour Market in Thailand: A Micro-level Analysis	May 2020
2020-03 (no. 330)	Ha Thi Thanh DOAN and Huong Quynh NGUYEN	Trade Reform and the Evolution of Agglomeration in Vietnamese Manufacturing	April 2020
2020-02 (no. 329)	Kazunobu HAYAKAWA, Tadashi ITO, Shujiro URATA	Labour Market Impacts of Import Penetration from China and Regional Trade Agreement Partners: The Case of Japan	April 2020
2020-01 (no. 328)	Fukunari KIMURA, Shandre Mugan THANGAVELU, Dionisius A. NARJOKO, Christopher FINDLAY	Pandemic (COVID-19) Policy, Regional Cooperation, and the Emerging Global Production Network	April 2020

ERIA discussion papers from the previous years can be found at:

http://www.eria.org/publications/category/discussion-papers