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

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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

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

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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 new 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,
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 gaps3 – 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.

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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;  

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\(^4\) This discussion uses a narrow definition of ‘gender-disaggregated’ in this case to refer to data disaggregated into binary male/female categories.

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


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

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

<table>
<thead>
<tr>
<th>Country</th>
<th>Ranking</th>
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<tbody>
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<td>Singapore</td>
<td>5.39</td>
</tr>
<tr>
<td>Malaysia</td>
<td>5.17</td>
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<tr>
<td>Indonesia</td>
<td>4.79</td>
</tr>
<tr>
<td>Philippines</td>
<td>4.73</td>
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<td>Lao PDR</td>
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</tr>
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<td>Thailand</td>
<td>3.96</td>
</tr>
<tr>
<td>Brunei Darussalam</td>
<td>3.66</td>
</tr>
<tr>
<td>Viet Nam</td>
<td>3.64</td>
</tr>
<tr>
<td>Cambodia</td>
<td>3.32</td>
</tr>
<tr>
<td>Myanmar</td>
<td>n/a</td>
</tr>
</tbody>
</table>

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.

Figure 1: Female Share of Employment in Telecommunications
(% of total)

Note: Data for Cambodia and the Lao People’s Democratic Republic are unreliable.
Figure 2: Female Share of Employment in Computer Programming, Consultancy, and Related Activities
(% of total)

Brunei = Brunei Darussalam.

Figure 3: Female Share of Employment in Scientific Research and Development
(% of total)

Note: Myanmar and Viet Nam data are marked unreliable.
Figure 4: Female Researchers as a Percentage of Total Researchers (FTE), Cambodia, Last Known Year (2015)

FTE = full-time equivalent.

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

FTE = full-time equivalent.
Figure 6: Female Researchers as a Percentage of Total Researchers (FTE), Myanmar, Last Known Year (2017)

FTE = full-time equivalent.

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

FTE = full-time equivalent.
Table 2: Gender of Heads of ICT Ministries and Telecom Regulators
(June 2018)

<table>
<thead>
<tr>
<th>Country</th>
<th>ICT ministry name</th>
<th>Gender</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brunei</td>
<td>Ministry of Communications</td>
<td>Male</td>
<td>Minister</td>
</tr>
<tr>
<td>Cambodia</td>
<td>Ministry of Posts &amp; Telecommunications</td>
<td>Male</td>
<td>Minister</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Ministry of Communication and Information Technology</td>
<td>Male</td>
<td>Minister</td>
</tr>
<tr>
<td>Lao PDR</td>
<td>Ministry of Post and Telecommunications</td>
<td>Male</td>
<td>Minister</td>
</tr>
<tr>
<td>Malaysia</td>
<td>Ministry of Communications &amp; Multimedia</td>
<td>Male</td>
<td>Minister</td>
</tr>
<tr>
<td>Myanmar</td>
<td>Ministry of Transport and Communications</td>
<td>Male</td>
<td>Minister</td>
</tr>
<tr>
<td>Philippines</td>
<td>Department of Information &amp; Communications Technology (Acting)</td>
<td>Male</td>
<td>Secretary</td>
</tr>
<tr>
<td>Singapore</td>
<td>Ministry of Communication &amp; Information</td>
<td>Male</td>
<td>Minister</td>
</tr>
<tr>
<td>Thailand</td>
<td>Ministry of Digital Economy &amp; Society</td>
<td>Male</td>
<td>Minister</td>
</tr>
<tr>
<td>Viet Nam</td>
<td>Ministry of Information &amp; Communications</td>
<td>Male</td>
<td>Minister</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Country</th>
<th>Telecommunication regulator name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brunei</td>
<td>Authority for Info-communications Technology Industry (AITI)</td>
</tr>
<tr>
<td>Cambodia</td>
<td>Telecommunication Regulator of Cambodia</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Indonesian Telecommunication Regulatory Authority</td>
</tr>
<tr>
<td>Lao PDR</td>
<td>Ministry of Communication Transport Post and Construction</td>
</tr>
<tr>
<td>Malaysia</td>
<td>Malaysian Communications and Multimedia Commission</td>
</tr>
<tr>
<td>Myanmar</td>
<td>Ministry of Transport and Communications</td>
</tr>
<tr>
<td>Philippines</td>
<td>National Telecommunications Commission</td>
</tr>
<tr>
<td>Singapore</td>
<td>Info-comm Media Development Authority</td>
</tr>
<tr>
<td>Thailand</td>
<td>National Broadcasting and Telecommunications Commission</td>
</tr>
<tr>
<td>Viet Nam</td>
<td>Vietnam Internet Network Information Center</td>
</tr>
</tbody>
</table>

Brunei = Brunei Darussalam, ICT = information and communication technology, Lao PDR = Lao People’s Democratic Republic.
Figure 1: Individuals Using a Computer (from any Location), by Gender


Figure 2: Mobile Phone Use by Gender

Figure 3: Mobile Phone Ownership by Gender

(%)  

<table>
<thead>
<tr>
<th>Country</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thailand (2017)</td>
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<td>88</td>
</tr>
<tr>
<td>Singapore (2019)</td>
<td>88</td>
<td>89</td>
</tr>
<tr>
<td>Myanmar (2017)</td>
<td>57</td>
<td>68</td>
</tr>
<tr>
<td>Malaysia (2019)</td>
<td>95</td>
<td>97</td>
</tr>
<tr>
<td>Indonesia (2019)</td>
<td>58</td>
<td>69</td>
</tr>
<tr>
<td>Cambodia (2018)</td>
<td>33</td>
<td>32</td>
</tr>
<tr>
<td>Brunei Darussalam (19)</td>
<td>91</td>
<td>99</td>
</tr>
</tbody>
</table>


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

(%)  

<table>
<thead>
<tr>
<th>Country</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thailand (2019)</td>
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<td>68</td>
</tr>
<tr>
<td>Singapore (2019)</td>
<td>88</td>
<td>90</td>
</tr>
<tr>
<td>Myanmar (2017)</td>
<td>19</td>
<td>29</td>
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<tr>
<td>Malaysia (2019)</td>
<td>82</td>
<td>86</td>
</tr>
<tr>
<td>Indonesia (2019)</td>
<td>45</td>
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<td>Cambodia (2018)</td>
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<td>41</td>
</tr>
<tr>
<td>Brunei Darussalam (19)</td>
<td>92</td>
<td>100</td>
</tr>
</tbody>
</table>

### Annex 3 – Meaningful Access

#### Table 1: Social Media Use

<table>
<thead>
<tr>
<th>Country</th>
<th>Ad audience (% female)</th>
<th>Facebook activity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Facebook</td>
<td>Instagram</td>
</tr>
<tr>
<td>Brunei</td>
<td>43</td>
<td>53</td>
</tr>
<tr>
<td>Cambodia</td>
<td>43</td>
<td>57</td>
</tr>
<tr>
<td>Lao PDR</td>
<td>46</td>
<td>64</td>
</tr>
<tr>
<td>Indonesia</td>
<td>44</td>
<td>51</td>
</tr>
<tr>
<td>Malaysia</td>
<td>45</td>
<td>53</td>
</tr>
<tr>
<td>Myanmar</td>
<td>42</td>
<td>52</td>
</tr>
<tr>
<td>Philippines</td>
<td>53</td>
<td>64</td>
</tr>
<tr>
<td>Singapore</td>
<td>49</td>
<td>55</td>
</tr>
<tr>
<td>Thailand</td>
<td>50</td>
<td>64</td>
</tr>
<tr>
<td>Viet Nam</td>
<td>49</td>
<td>61</td>
</tr>
</tbody>
</table>

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).

#### Table 2: Online Transactions

<table>
<thead>
<tr>
<th>Country</th>
<th>Make online transactions</th>
<th>Have a credit card</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% women</td>
<td>% men</td>
</tr>
<tr>
<td>Singapore</td>
<td>57.0</td>
<td>56.0</td>
</tr>
<tr>
<td>Malaysia</td>
<td>39.0</td>
<td>38.0</td>
</tr>
<tr>
<td>Viet Nam</td>
<td>21.0</td>
<td>20.0</td>
</tr>
<tr>
<td>Thailand</td>
<td>19.0</td>
<td>19.0</td>
</tr>
<tr>
<td>Indonesia</td>
<td>13.0</td>
<td>9.4</td>
</tr>
<tr>
<td>Philippines</td>
<td>12.0</td>
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</tr>
<tr>
<td>Cambodia</td>
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<td>3.2</td>
</tr>
<tr>
<td>Myanmar</td>
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<td>4.5</td>
</tr>
<tr>
<td>Brunei</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Lao PDR</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Brunei = Brunei Darussalam, Lao PDR = Lao People’s Democratic Republic, n/a = not applicable.
Figure 1: Individuals with a Financial Institution or Mobile Money Account, 2017
(% of population ages 15+)

Lao PDR = Lao People’s Democratic Republic.

Figure 2: Individuals with a Mobile Money Account, 2017
(% age 15+)

## Annex 4 – Digital Skills and STEM Education

**Table 1: Female Share, Graduate Programmes (\%)**

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

Brunei = Brunei Darussalam; ICT = information and communication technology; Lao PDR = Lao People’s Democratic Republic; STEM = science, technology, engineering, and mathematics.

Annex 5: Availability of Sex-Disaggregated Data

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

<table>
<thead>
<tr>
<th>Country</th>
<th>Computer use</th>
<th>Mobile phone use</th>
<th>Mobile phone ownership</th>
<th>Smartphone use</th>
<th>Internet use</th>
<th>Social media use</th>
<th>Mobile money</th>
</tr>
</thead>
<tbody>
<tr>
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<td>2020</td>
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<td>2020</td>
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<td>2020</td>
<td>2017</td>
</tr>
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<td>2019</td>
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<td>2016</td>
<td>2020</td>
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<td>2017</td>
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<td>No data</td>
<td>No data</td>
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<td>Viet Nam</td>
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<td>No data</td>
<td>No data</td>
<td>No data</td>
<td>No data</td>
<td>2020</td>
<td>2017</td>
</tr>
</tbody>
</table>

Brunei = Brunei Darussalam, Lao PDR = Lao People’s Democratic Republic.

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

<table>
<thead>
<tr>
<th>Country</th>
<th>Digital skills</th>
<th>STEM &amp; ICT tertiary graduates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brunei</td>
<td>No data</td>
<td>2018</td>
</tr>
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<td>Indonesia</td>
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</tr>
<tr>
<td>Lao PDR</td>
<td>No data</td>
<td>2018</td>
</tr>
<tr>
<td>Malaysia</td>
<td>No data</td>
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</tr>
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<td>Myanmar</td>
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<td>Philippines</td>
<td>No data</td>
<td>2017</td>
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<td>Singapore</td>
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</tr>
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<td>Thailand</td>
<td>No data</td>
<td>2016</td>
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<tr>
<td>Viet Nam</td>
<td>No data</td>
<td>2016</td>
</tr>
<tr>
<td>Cambodia</td>
<td>No data</td>
<td>2015</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Country</th>
<th>Telecom occupation</th>
<th>Computer programming, consulting, &amp; related occupation</th>
<th>Scientific research &amp; development</th>
<th>Engineering &amp; technology and ICT researchers</th>
<th>Digital entrepreneurship</th>
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</thead>
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<td>2015</td>
<td>2017</td>
<td>No data</td>
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<td>2019</td>
<td>2015</td>
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<td>Thailand</td>
<td>2019</td>
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<td>2019</td>
<td>No data</td>
<td>No data</td>
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<tr>
<td>Viet Nam</td>
<td>2019</td>
<td>2019</td>
<td>2019</td>
<td>No data</td>
<td>No data</td>
</tr>
<tr>
<td>Indonesia</td>
<td>2015</td>
<td>2015</td>
<td>2015</td>
<td>No data</td>
<td>No data</td>
</tr>
<tr>
<td>Cambodia</td>
<td>2016</td>
<td>2017</td>
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<td>2015</td>
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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.

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<td>December 2020</td>
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<td>Intergenerational Transmission of Human Capital: The Case of Thailand</td>
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<td>Nobuaki YAMASHITA and Trong-Anh TRINH</td>
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<td>Takahiro AKITA and Sachiko MIYATA</td>
<td>Measuring the Pro-Poorness of Urban and Rural Economic Growth in Indonesia, 2004-2014</td>
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<td>Robotics Technology and Firm-level Employment Adjustment in Japan</td>
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<td>Pavel CHAKRABORTHY and Prachi GUPTA</td>
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<td>Makoto IKEDA and Thawatchai PALAKHAMARN</td>
<td>Economic Damage from Natural Hazards and Local Disaster Management Plans in Japan and Thailand</td>
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<td>Tony CAVOLI and Ilke ONUR</td>
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<td>Rajabrata BANERJEE, Ronald DONATO, Admasu Afsaw MARUTA</td>
<td>The Effects of Financial Inclusion on Development Outcomes: New Insights from ASEAN and East Asian Countries</td>
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<td>2020</td>
<td>341</td>
<td>Rajabrata BANERJEE and Ronald DONATO</td>
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<td>The Economic Impact of Globalisation in Indonesia</td>
</tr>
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<tr>
<td>2020</td>
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<td>Duc Anh DANG and Thu Thu VU</td>
<td>Technology Imports and Employment in Developing Countries: Evidence from Viet Nam</td>
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<tr>
<td>2020</td>
<td>334</td>
<td>Hiroaki ISHIWATA, Hiroyuki WADA, Koji SUZUKI, Makoto IKEDA, Naoto TADA</td>
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