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Diagnostic Report

DIGITAL SKILLS LANDSCAPE IN INDONESIA

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DIGITAL SKILLS LANDSCAPE IN INDONESIA

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Diagnostic Report: Digital Skills Landscape in Indonesia

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List of abbreviation

4IR	:	Industrial Revolution 4.0
APBD	:	Local-government budget/ *Anggaran Pedapatan dan Belanja Daerah*
APBN	:	State budget/ *Anggaran Pendapatan dan Belanja Nasional*
APJII	:	Association of Indonesian Internet Service Providers/ *Asosiasi Penyedia Jasa Internet Indonesia*
BLK	:	Government-owned job training center/ *Balai Latihan Kerja*
BPS	:	Central Bureau of Statistics/ *Badan Pusat Statistik*
Bappeda	:	Regional Development Planning Agency/ *Badan Perencanaan Pembangunan Daerah*
CMoEA	:	Coordinating Ministry of Economic Affairs/ *Kementerian Koordinator Bidang Perekonomian*
GoI	:	The Government of Indonesia
MCI	:	Ministry of Communication and Informatics/ *Kementerian Komunikasi dan Informatika*
MoE	:	Ministry of Education/ *Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi*
MoI	:	Ministry of Industry/ *Kementerian Industri*
MoInv	:	Ministry of Investment/ *Kementerian Investasi*
MoM	:	Ministry of Manpower/ *Kemeterian Ketenagakerjaan*
MoRA	:	Ministry of Religious Affairs/ *Kementerian Agama*
MoSMEs	:	Ministry of Micro, Small, and Medium Enterprises/ *Kementerian Koperasi dan Usaha Mikro, Kecil, dan Menengah*
MoT	:	Ministry of Trade/ Kementerian Perdagangan
MRB	:	Ministry of State Apparatus Utilization and Bureaucratic Reform/ *Kementerian Pendayagunaan Aparatur Negara dan Reformasi Birokrasi*
NDPA		National Development Planning Agency/ *Badan Perencanaan Pembangunan Nasional (Bappenas)*
RPJMN	:	Indonesia's National Mid-Term Development Plan/ *Rencana Pembangunan Jangka Menengah*
Sakernas	:	National Labor Force Survey/ *Survei Angkatan Kerja Nasional*
Susenas	:	National Socioeconomic Survey/ *Survei Sosial Ekonomi Nasional*

1. Executive Summary

The increased adoption of digital technologies for public service delivery, income generation, and exchange has significantly altered economic landscapes and human capital requirements within the general citizenry and labor markets. A baseline familiarity with digital devices such as mobile phones and computers has increasingly become a requirement for education, accessing government services, and performing tasks at work. As technology advances and new tools and platforms are developed and adopted, individuals also face the requirement of having to constantly, and often, rapidly, update their skills to keep-up with the pace of advancements in technology. As a result of these changes, digital literacy, digital skills development, and continual skills upgrading are becoming an important priority for governments around the world. Of particular importance is the ability of nations to secure inclusive access within their labor force to opportunities that are crucial to adopt, in order to maximize and harness the development of technological skills within their economies. A culture of lifelong learning with regard to digitalization, thus, needs to be adopted to ensure the ability of countries and labor forces to adapt and respond to the swift advancements in technology we are all facing.

In Indonesia, the national strategic development plan emphasizes the role of digital transformation in increased productivity, effective service delivery, and job creation. The Ministry of Communication and Informatics (MCI/Kominfo) is preparing Indonesia's "Digital Nation Roadmap" to accelerate the country's digital readiness and competitiveness. This study was commissioned by the MCI to support the formation of this "Digital Roadmap" and to provide an assessment of the digital skills landscape in Indonesia, which will then guide the formulation of concrete actions and policies outlined within the Roadmap document.

The MCI has identified unequal opportunities in regard to access to digital technology as a crucial issue in Indonesia. Thus, ensuring that gains for wider technological adoption in governance and industry benefit a broad base of the Indonesian population is key. Investing in human capital is, therefore, of paramount importance. This recognition of the need to ensure equitable access to digital technology and skills in order to be able to harness the benefits of having a skilled labor force, also acted as part of the reason behind the commissioning of this study.

Based on the above outline, this study aims to assess the digital skills landscape in Indonesia and provide a discussion on the challenges and constraints facing digital skills development. To address these goals, the study employed a mixed-method approach, coupling the use of both quantitative and qualitative research tools. Firstly, a

descriptive examination of Indonesia's "Digital Landscape" was conducted, primarily using secondary survey data collected by Statistics Indonesia (BPS). These surveys cover information on digital access, technological literacy, and the key characteristics of Indonesia's labor market. Key findings within this quantitative exercise were then further explored and triangulated through in-depth qualitative interviews and FGDs with government and private sector stakeholders, all playing a central role in the future of digital governance in Indonesia.

The above two "assessment" steps were primarily employed to discover key trends within Indonesia's digital skills landscape. The first focused on an assessment of *digital literacy* in Indonesia. The second step then aimed to further explore digital skills by focusing on examining the uptake of job-specific/intermediate digital skills and *advanced skills* within Indonesia, including programming, data analytics, and so on. These two stages of analysis enabled the study not only to focus on the basic skills required for the utilization of digital platforms and technologies, but also on the training required to ensure increased productivity and innovation.

To further elaborate, within the two "steps" of analysis described above, the study assessed *both* the demand and the supply side of Indonesia's digital skills landscape. On the supply side, we looked at formal education and training opportunities provided by the government, as well as enterprise-initiated or privately instigated digital literacy initiatives. An analysis of the dynamics within the demand side was then conducted to examine the digital literacy requirements needed to be able to access government services, as well as the technological knowledge requirements within industry, both to ensure equal access to IT-related jobs and to ensure the achievement of general workplace skills.

Due to our explicit focus on inclusion, the diagnostic study also examines multiple dimensions of exclusion in the education and training ecosystem, ranging from the rural/urban divide, as well as differences in skill endowments across income levels, gender, geographic location, and disability.

In summary, this diagnostic study seeks to serve as a basis for broader discussion, alongside the discovery of joint solutions, with regard to education and training policy reforms in Indonesia. Furthermore, it aims to act as a guide for the government to support the design of initiatives, which ensure job-specific skills upgrading, lifelong learning, and broad digital literacy development. The following sections within the executive summary aim to first outline the key challenges that Indonesia faces with regard to digital skills and access before outlining our "Digital Skills Development" framework,

which provides an overview of the policy action points we found to be crucial for Indonesia in addressing these challenges.

Key Findings: Constraints to a healthy digital skills ecosystem in Indonesia

The findings summarized within this section resulted from an in-depth examination of secondary data on Indonesia's digital landscape collected by the Statistics Indonesia and an analysis of the trends within the qualitative FGD and interview results, which were conducted between June and December 2021. This section highlights the key challenges and constraints Indonesia faces with regard to the achievement of two main objectives: the creation of (1) digitally literate citizens and (2) digitally competent workforces.

To meet the objective of supporting the formation of digitally literate citizens, two components were found to be required in order to ensure that Indonesia makes the most of opportunities offered by the development of a digital economy: 1) digital inclusion and 2) digital literacy. As for the second objective, i.e., shaping digitally competent work forces, our analysis uncovered the importance of two main areas of analysis. Firstly, the need for a thorough understanding of the workforce's skills profile, and secondly, in order to delve deeper into this profile, greater awareness is required, particularly within the government, around the levels of advanced digital skills that the labor force possesses.

The sections below briefly discuss the results and analysis of the above aspects of both of the objectives listed in the first paragraph of this section. We begin with the first objective and aspect: the need for digital inclusion in the creation of digitally literate citizens.

(1) Digitally literate citizens: digital inclusion

Narrowing the internet gap across regional and socioeconomic factors requires the Government of Indonesia, hereafter referred to as GoI, to provide universal access to the internet and digital devices. The GoI set out a target stipulating that "82% of the population will have access to the internet by 2024".[1] Currently, 132 million people (54% of the population) are internet users.[2] Without universal access to the internet and digital devices, it is difficult for the GoI to achieve the 2024 target and for the nation overall to be able to integrate with the digital world. This will later also affect citizen's opportunities to develop their digital skills and to participate in the digital economy.

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[1] Government of Indonesia (2020) 'Rencana Pembangunan Jangka Menengah Nasional (RPJMN) Tahun 2020–2024' [2020–2024 National Medium-Term Development Plan (RPJMN)]. Jakarta: Government of Indonesia [online] <https://jdih.bappenas.go.id/peraturan/detailperaturan/1037> [24 November 2021].
[2] SUSENAS (2020).

In order to discover solutions to the challenge of achieving equal access to digital technology and the internet, an in-depth overview of the digital access landscape in Indonesia is required. The following six points summarize the existing conditions of internet user profiles in Indonesia and key constraints Indonesia faces, which are inhibiting the achievement of the above 2024 target:

a. Internet users are concentrated in the urban centers of Java Island. 40% of the rural population are internet users, compared to 64% of the urban population.[3] 30% of villages in a number of provinces in the outermost and least developed regions (3T regions), including Maluku, Maluku Utara, Papua, and Papua Barat, are covered by 3G/4G. However, more than 70% of villages in these regions report weak signals. While accessible to the Palapa Ring, in some areas, especially in rural parts of the 3T regions, providers have not made use of land and sea cables to provide connections due to profitability concerns.

b. Different age groups face different challenges. Internet users are generally young: 77% of individuals aged 10-29 years old use the internet, while the figure is only 21% for those over 50 years of age.[4] Furthermore, younger cohorts are able to adapt more effectively to changes and advancements in digital development compared to older cohorts. The main motivation to use the internet for elderly citizens was to ensure that they are connected to their families and to the communities which they are a part of. Particularly in the midst of the pandemic, which has made social interactions increasingly challenging, it is important to ensure that all ages have equal access and the skills necessary to utilize digital technology in order to maintain social connections.

c. Persons with disabilities (PwDs), in some case also related to age, are also less likely to use the internet. In Indonesia, only 18% of PwDs have access to the internet, compared to 50% of the non-disabled community.[5] During the FGDs and interviews, we found that the low rates of mobile phone ownership among PwDs is largely due to the unavailability of user-friendly mobile interfaces that are accessible to PwDs.

d. Gender differences also influence access to digital tools. Women and girls use the internet 11% *less* than men and boys.[6] In rural areas, where levels of connectivity are low, social norms around phone ownership further restrict

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[3] SUSENAS (2020).
[4] SUSENAS (2020).
[5] SUSENAS (2020).
[6] See ITU (2019).

women from accessing digital devices, undermining their ability to improve their levels of utilization and literacy.

e. Individuals with higher levels of education are more likely to access the internet. 78% of individuals with a senior high school education have used the internet.[7] Meanwhile, 94% of those with a college/university education use the internet. Furthermore, there are significant concerns that the COVID-19 pandemic will worsen this gap, particularly as all learning activities are conducted online.

f. Income levels determine people's opportunities to access the internet. The internet remains largely unaffordable to individuals at the lower end of the income spectrum. 77% of individuals within the top income quintile have access to the internet, while only 32% of those within the bottom quintile have internet access. [8] Individuals with higher incomes are more likely to own tablets/computers/laptops and multiple devices that enable them to go online. Many also have access to home broadband services.

(2) Digitally literate citizens: digital literacy

The target of narrowing the gap in Indonesia's digital literacy requires special attention to the quality of basic education and basic literacy outcomes in Indonesia. The GoI set a target of "36% of students in Indonesia having PISA reading scores that are above the minimum standard by 2024".[9] Currently, only 30% of students in Indonesia have achieved the minimum level of proficiency (Level 2 or higher) in reading.[10] This significantly hinders the development of students' IT skills as digital literacy outcomes highly depend on the quality of the input and output of ICT learning and teaching activities. These activities go hand-in-hand and interact comprehensively with programs implemented to improve basic literacy skills.

The following points summarize the existing digital literacy landscape in Indonesia and a number of the main constraints that Indonesia faces in achieving the above PISA achievement target:

a. Indonesia scored significantly lower than the OECD average on a number of key aspects of the basic literacy competencies required for digital development, including: the ability to "distinguish facts from opinion" when accessing social media and online reports, and the ability to "assess the credibility of sources".

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[7] SUSENAS (2020).
[8] SUSENAS (2020).
[9] RPJMN 2020-2024 (Bappenas).
[10] 2018 PISA Report (OECD).

Reading strategies, which support these skills, were found to be lacking. To elaborate this point, only 30% of Indonesian students aged 15 years old have a higher than Level 2 proficiency in reading compared to the OECD average of 77%. Furthermore, 70% of Indonesian adults in Jakarta performed at a lower than Level 1 proficiency in literacy compared to the OECD average of 15%.[11]

b. Educational outcomes vary between regions, with those in rural and 3T regions exhibiting the lowest levels of school completion. These regions are also among those with the lowest levels of access to IT course options at the primary, secondary, and post-secondary education levels. This disparity in digital access, and the apparent exclusion of rural areas, tends to follow similar trends across many other developing countries.

c. The implementation of High Order Thinking Skills (HOTS), which the Ministry of Education aims to integrate across all school subjects, has led to a number of challenges in terms of its application, particularly with regard to the removal of a selection of stand-alone IT-related subjects. One of the results of this policy is that "ICT" will no longer be considered an independent compulsory subject, but should be integrated across all subject areas. Fundamental challenges are present in the implementation of this policy, meaning that students are unable to learn ICT skills during their lessons. The challenges include the pedagogical skills of teachers to deliver ICT lessons in subjects not specifically related to ICT, for example, the ability of teachers to relate aspects of biology as a subject to ICT-related issues.

(3) Digitally competent workforces

Narrowing the gap in producing digitally competent workers requires governments to place significant attention on workers' access to ICT education and relevant training to improve their digital skills. Adopted from the RPJMN, the Indonesian Short to Medium Term Development Plan, the GoI set a target of "50% of workers having intermediate and advanced digital skills by 2024". Currently, 50% of the labor force in Indonesia has basic to intermediate digital skills, while advanced digital skills represent less than 1%.[12] Without the advancement of IT skills up-take within the nation, it will be difficult for the GoI to achieve its 2024 target.

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[11] Based on the results of the 2015 Programme for the International Assessment of Adult Competencies (PIAAC): https://www.oecd.org/skills/piaac/Skills-Matter-Jakarta-Indonesia.pdf.
[12] Roughly calculated using Sakernas (BPS).

The following points summarize the existing digital skills profile of Indonesian workers, a number of key statistics on the uptake of advanced digital skills, and the main constraints Indonesia faces in achieving the nation's RPJM target by 2024:

a. More than half of the current workforce is made up of workers with a low level of education, who are not exposed to the internet in their main job. Individuals without digital connections are less likely to initiate upskilling or to join digital literacy programs as they do not see or have not experienced any of the benefits that internet connectivity has to offer.

b. Low sectoral digitization levels indicate sparse R&D activities aimed at mobilizing and upgrading business models. Our analysis of interview and FGD results, which were conducted between October-November 2021, found that the reasons behind this trend were that business owners felt that these developments were either still irrelevant, or that they were unwilling to risk the uncertain benefits linked to digital transformation. Promoting digitalization requires supporting the ecosystem to attract investment, for example regulations to ease the processing of business permits, achieve cyber security, and create an integrated digital talent pool.

c. The quality of the curriculum at the secondary and post-secondary education level does not adequately reflect industry requirements, particularly in terms of advanced digital skills, leading to the need for digital businesses or startups to outsource talent.[13] The curriculum applied within mainstream education often overlooks the importance of also equipping students with soft skills, including communication, collaboration, and creative problem solving, which are increasingly required to keep up with the challenges and competition faced in today's business environment. The absence of incentives for the adoption of a culture of skills-upgrading and lifelong learning in the education system in Indonesia has led to a slow rate of adaptation to the ever-changing digital technology landscape.

d. Accessible training programs are only available to individuals with higher educational attainment levels. Based on 2020 National Labor Force Survey (Sakernas) data, less than 2% of workers with a secondary, junior-secondary, or lower level of education, have received ICT skills training. Meanwhile, 32% of

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[13] Indonesia is home to a growing number of startups. According to Startup Ranking, the number of startups in Indonesia increased from 1,400 in 2017 to 2,200 in 2019, placing Indonesia as the country with the fifth highest growth in startups after the USA, India, the UK, and Canada. Two prominent unicorns include Gojek (a ride-hailing and service supplying startup) and Tokopedia (an online marketplace) with a valuation of more than USD 18 billion (DS/Innovate, 2021).

workers with a diploma or university degree have received training.[14] The exclusive focus on technical skills in training programs leads to an absence of the complementary soft skills required to support productivity, including project and product management skills. Furthermore, the cost of accessing certified training programs is relatively high, especially for unskilled workers from low-income groups. In addition to transportation and the cost of equipment and supplies, unskilled workers must often leave their jobs to attend training, depriving them of their income for the duration of the of training course.

e. Several government-owned training centers (BLKs) were reoriented by the government, leading to the elimination of IT-related courses. The government currently remains focused on courses that are in high overall industry demand. Therefore, although IT skilled workers are sought after by digitally oriented businesses and startups, as noted in point (l), IT skills have not been identified as a general priority. As more and more businesses digitalize, however, this lack of a need for IT skills is rapidly changing. If the government does not act to pre-empt the increasing importance of digital literacy, Indonesia will not be able to catch-up. The quality gap between the curriculums delivered by training centers affects the ability of the centers to adapt and respond to industry demands. BLK instructors/trainers receive limited opportunities to advance their skills and encounter challenges in upgrading both their technical and pedagogical knowledge, thus preventing them from being agile and responsive to changes in tech-industry needs, which should be reflected in the curriculum that they teach.

f. Training certifications are not necessarily recognized as mainstream industry often prefers to hire talent with a formal higher education certificate. Only a few industries equip their workforces with systematic upskilling programs, for example implementing three-month induction training sessions for new employees, setting up buddy and mentoring programs, and providing regular internal knowledge sharing platforms.

Key Policy Recommendations: Digital Skills Development Framework

This section outlines the key output of this project: the "Digital Skills Development Framework". This framework seeks to act as a guideline to support the MCI in addressing

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[14] The variable in the Sakernas survey that provides this information indicates whether an individual has "ever received" ICT related training.

the challenges listed in the previous section. The figure below summarizes the main components of the framework.

The "Framework for Digital Skills Development in Indonesia" identifies two key objectives, which the government should work towards in order to harness the potential of digital development and to maximize its contribution to GDP growth and job creation in Indonesia. The two objectives are achieving: (1) digitally competent workforces, and (2) digitally literate citizens. The objectives should be used as the basis for strategic planning around digital skills.

Framework for Digital Skills Development in Indonesia
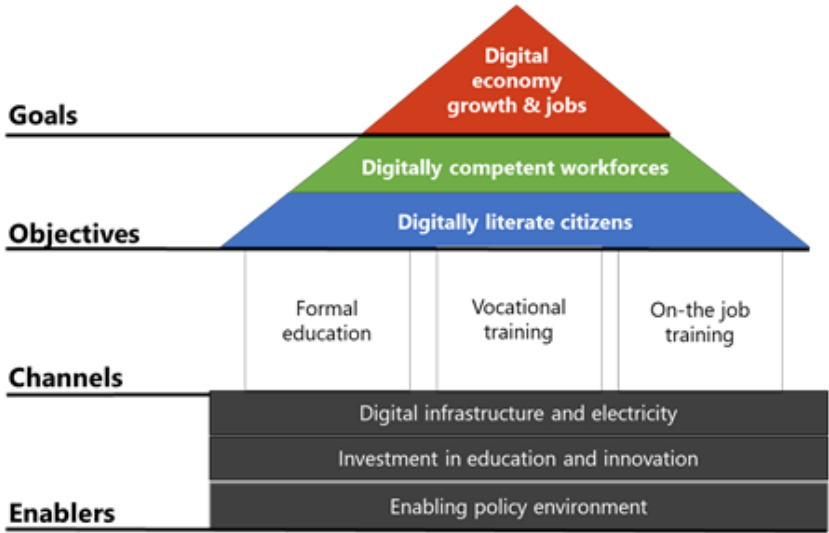
The importance of achieving these goals is further highlighted as Indonesia's economic growth becomes more and more reliant on a citizenry that is digitally literate and able to effectively make use of digital economic platforms and tools. These tools are in turn key to accelerating economic growth. The benefits of technology, which include the gains of implementing digital market platforms, productivity advancements resulting from information sharing, and technological methods of streamlining business processes, cannot be achieved without a skilled workforce and citizen base. A digitally competent workforce that is engaged in the use of technology to increase business process efficiency and is able to adapt their skills to respond to real-time challenges is key for Indonesia.

With the above explanation in mind, we propose that in order to achieve the two objectives outlined above, three channels must be established through which digital

skills may be developed: formal education, vocational training, and on-the-job training. Referring to Diagram 1, these channels act as pillars that aim to support the achievement of digital literacy and equal access to digital skills training. The implementation of key actions within these three channels is then dependent on the sound bedrock offered by the "enablers" listed in Diagram 1.

These enablers include the availability of digital infrastructure, financing and investment in digital education and innovation, and finally, policy commitments towards concrete government-supported actions, laws, and regulations that promote equal access to digital skills training. Without stable connections and affordable access to the internet and to energy which enables this access; significant investment in education and innovation, which helps to increase levels of digital literacy and job-related digital competencies; and, importantly, an enabling policy environment, universal access to digital technology cannot be achieved.

Therefore, all three levels of the proposed "Framework for Digital Skills Development in Indonesia" are interconnected and crucial to fulfilling Indonesia's goal of achieving economic growth by harnessing the benefits of technology and of equipping its citizens and work force with the necessary skills to keep-up with the rapid developments we face with regard to digitization.

2. Introduction

Technological advancements through digitalization brings with them tremendous opportunities for the enhancement of economic growth and social equity. **As the fourth most populous country in the world, Indonesia possesses the tools to significantly harness the benefits that digital technology may bring to ensure inclusive growth within its economy.** With a working-age population of 191 million, which accounts for 70.7% of the population, Indonesia is and will continue to experience a significant *demographic dividend* across the upcoming decade.[15]

To maximize the productive benefits of this abundance of labor, whilst also responding to rapid developments in digitalization and technology, Indonesia desperately needs to review its digital access landscape and address the key requirements for digital skills advancement within its labor force. The current report aims to do just this by providing an in-depth descriptive analysis of Indonesia's current digital landscape, with a particular focus on digital skills. In doing so, the report acts as a *portrait* that captures Indonesia's digital skills landscape in detail, as well as the steps that the Government of Indonesia has taken to unlock the country's digital potential, before highlighting policy recommendations, which seek to support the government in mitigating the challenges it currently faces.

Mapping out these obstacles and discovering ways to address them comes at a pivotal moment, as the role of digital transformation for inclusive economic growth and job creation is emphasized within key national planning documents. Indonesia's 2020-2024 National Mid-Term Development Plan (RPJMN) recognizes the importance of digital skills in boosting economic productivity and efficiency.[16] In addition, Indonesia's Ministry of Communication and Informatics, hereafter referred to as the MCI, is drafting a "Digital Nation Roadmap", which aims to accelerate the country's digital readiness and competitiveness. Within this document, the development of digital skills is also seen as a "foundational pillar" to support Indonesia's digital citizens, which in turn is key to accelerating the nation's strategy to be included in the top 5 global economies in 2045[17].

Before realizing the above opportunities, a higher awareness of how fundamental challenges, including poverty, unemployment, and inequality, may impact the

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[15] UNFPA (2015).
[16] Government of Indonesia (2020).
[17] This aspiration is contained in the document outlining Indonesia's 2045 Vision. See, https://perpustakaan.bappenas.go.id/e-library/file_upload/koleksi/migrasi-data-publikasi/file/Policy_Paper/Ringkasan%20Eksekutif%20Visi%20Indonesia%202045_Final.pdf

adoption of digital skills in Indonesia should be established. This is increasingly important considering that COVID-19 has severely impacted these indicators, leading to the formation of the "newly poor" and exacerbating inequality.[18] Based on 2020 data collected by Statistics Indonesia, hereafter referred to as BPS, 10.19% of the population live in poverty. Indonesia's unemployment rate increased from 5.3% in 2018 to 7.77% in 2020. With a Gini coefficient of 0.385 (as per September 2020), inequality is also a major problem in Indonesia. These measures highlight significant challenges in improving living standards across the nation. Importantly, however, they also underline the crucial role technology and skills training may play in breaking cycles of poverty, improving equal access to job markets, and achieving equitable growth in Indonesia.

In order to harness digital advancements, recognition of Indonesia's decentralized political system and where policies are formed must also be considered. Indonesia's government system is complex, particularly since decentralization of power, from the national to district level government was established as an aftermath of the 1998 Asian financial crisis.[19] Currently, Indonesia has 34 provinces, 514 cities/districts, and more than 83 thousand villages[20] spread over more than 17,000 islands across the nation. Each administrative unit has a particular role and authority in ensuring that national strategies are translated into actionable plans and financeable projects[21]. Navigating the role of each government level and district administrative unit is key in identifying how policies are formulated and the agents of change within Indonesia's provinces and districts.

Therefore, the goal of the current report is to provide an analysis of the opportunities and challenges faced in the creation of (1) digitally literate citizens and (2) digitally competent workforces in Indonesia.[22,23] Supporting equitable knowledge sharing and access for the formation of digitally literate *citizens* in Indonesia is the basis for the development of a digitally competent workforce. As is the need to take

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[18] World Bank (2020). See, https://www.worldbank.org/en/news/press-release/2020/10/07/covid-19-to-add-as-many-as-150-million-extreme-poor-by-2021

[19] Brodjonegoro (2003).

[20] Law No.6/2014 on Village Administration states that "each Village is equipped with an average of IDR 1 billion in the form of a Village Fund. This fund may be used for infrastructural and empowerment programs, i.e., village information system or "digital literacy" (article 86).

[21] Law No. 23/2014 on Local Governments states that each administrative level has its respective authorities. For example, the development of primary education is mainly the authority of the city/district government.

[22] The research framework is adopted from the World Bank's digital skills framework, as in Bashir and Miyamoto (2020). The World Bank emphasizes the importance of 'digitally literate citizens' in measuring digital skills in developing countries.

[23] By "digitally literate", we refer to society's capacity to access and use digital technology in their daily lives (see Bashir and Miyamoto, 2020).

into account the key socio-economic challenges outlined above, including poverty dynamics, fluctuations in unemployment, and Indonesia's political structure, when examining the ways that policies regarding the enhancement of digital skills may contribute to the development of a productive workforce. Taking this point into consideration, the section below summarizes the methodological steps we took to address the report's goal.

Research Methodology

This report employs a mixed method approach, coupling rich literature reviews with secondary data analysis, the results of which were then triangulated through the use of in-depth qualitative interviews and focus group discussions (FGD). The methodological framework consisted of three research steps: 1) policy mapping, 2) quantitative analysis of statistical data available in Indonesia, and 3) a series of focus group discussions and group interviews.

The first step within our methodological framework consisted of reviewing the literature on digital skills and their role in the overall economy worldwide. Furthermore, grey literature, encompassing national official development planning documents, including Indonesia's 2020-2024 National Medium-Term Development Plan (RPJMN) document and policy papers detailing strategic plans from the MCI, Ministry of Education (MoE), Ministry of Industry (MoI), Ministry of Manpower (MoM), and Ministry of SMEs (MoSMEs). Within these sources, we focused on summarizing the current digital skills-related issues faced by Indonesia and the ways that the GoI is proposing to address them. Existing policies were then mapped to summarize the government's efforts to improve digital skills.

The second step included a descriptive analysis of secondary data, which aimed to provide a general portrait of digital skills in Indonesia. For this analysis, official data collected by Indonesia's BPS were employed. These datasets included the National Labor Force Survey (Sakernas) and National Socioeconomic Survey (Susenas).

To probe deeper into the results found during the above two steps, input was then sought from government and non-government institutions, including research institutes, universities, think tanks, training institutions, and community organizations, on policy issues and discourse to improve digital skills in Indonesia in our third qualitative research step. This was achieved using a series of FGDs and interviews.

To delve deeper into the various policy steps summarized in our literature review, we conducted policy dialogues and thematic multistakeholder workshops with key national and sub-national stakeholders. Table 1 & 2 below list the stakeholders in more detail.

Table 1. List of policy dialogues

No	Main topic	Key resources	Number of participants
National level			
1	Indonesia's digital skills development	MCI	27
2	Demand for and prospects of digital skills	MoI and the Coordinating Ministry of Economic Affairs (CMoEA)	30
3	Preparing digitally competent workforces	MoM and MoE	30
4	Inclusive digital skills development	MoSMEs and the National Development Planning Agency (NDPA)	32
Sub-national level			
5	Digital skills development in North Sumatera	Bappeda of North Sumatera and University of North Sumatera (USU)	29
6	Digital skills development in South Sulawesi	Bappeda of South Sulawesi and University of Hasanuddin (UNHAS)	40
7	Digital skills development in DKI Jakarta	Bappeda of Jakarta	34

Source: Authors

Table 2. List of thematic workshops

No	Workshop theme	Number of workshops	Participants in attendance
1	Higher education	3	15
2	Basic education	2	13
3	Non-formal upskilling opportunities	1	11
4	Digital access and infrastructure	2	18
5	Electricity	1	7
6	Investment in digitalization	2	13

Source: Authors

Focus Group Discussions (FGDs) and in-depth interviews were also conducted to explore the central challenges in the formation of digital skills found within the literature review and secondary data analysis. Table 3 provides a summary of the FGD topics and goals, and an overview of the participants included in each discussion.

Table 3. List of qualitative informants

No	Main purpose	Informant category	Number of Informants
1	IT education dynamics in equipping workforces with digital skills	Heads of academic staff and lecturers from IT universities and vocational schools	12
2	Training institution experience in providing programs to improve digital skills	Managers and instructors from government and non-government training institutions	10
3	Industry demand for digital skills and experience in meeting labor market demand	Human resource officers and talent managers in tech and non-tech companies	5
4	Required digital and complimentary skills that are relevant to working	Fresh IT graduates and IT graduates with 5-years of work experience	4
5	Strategies to assess and improve digital skills in Indonesia	Experts from research institutions and development partners	4

Source: Authors

Using this mixed-method approach, our research examined the prospects, situation, and digital landscape, as well as factors influencing digital skills development in Indonesia. The study discovered that digital skills are essential to accelerate Indonesia's development objectives. Section 2 of the report explores this claim further and outlines findings that strengthen the key role of digital skills as an instrument for Indonesia to implement digital transformation, which is essential to enable the nation to reap optimum benefits from the growth of a digitalized economy.

After outlining the pivotal role of digital skills, Section 3 of the report summarizes the key challenges Indonesia faces with regard to developing these skills. Challenges include inequality in digital access, digital literacy, and disparity in digital skills within the work force. Both Sections 2 and 3 provide an in-depth background for Section 4 of the report, which analyzes the root causes of the challenges described in Section 3. In particular,

Section 4 finds that the main causes hindering progress within Indonesia's digital skills foundation are related to various channels and enabling actors and/or factors within Indonesia's economy that influence the level of inclusivity in access to digital skills development in the nation.

Given the results and descriptive analysis contained in sections 1, 2, 3 and 4, the final Section of the report, Section 5, concludes by summarizing the steps that Indonesia can take in order to maximize the gains from a digitized economy, and to ensure that these benefits are enjoyed by *all* individuals within the nation and that *no one if left behind* as Indonesia further embraces the dawn of technology and digital development.

3. The Availability of Digital Skills to Accelerate Indonesia's Development Objectives

This section tackles the pivotal question of *why digital skills matter*? **The development of digital skills can accelerate the achievement of national development goals.** Digital skills improve the quality of human resources, enhancing productivity, promoting positive structural transformations, and generating added value from the digitalized economy. These elements are essential for inclusive economic growth and job creation. Furthermore, they can support Indonesia's 2020-2024 RPJMN target to increase annual economic growth to between 5.4-6.0% and to reduce poverty to 6.5% by 2024.

Indonesia has tremendous opportunities to gain maximum dividends by increasing citizens' participation in the digital economy ecosystem and by undergoing a digital transformation of its labor force by promoting access to digital skills formation. Although highest in total Gross Merchandise Volume (GMV) among ASEAN countries, Indonesia's per capita GMV is one of the lowest in the world.[24] Between 2016-2020, the total GMV of the internet economy in Indonesia increased (**Figure 1**). Despite contractions in travel, transport, and food businesses caused by the pandemic, the GMV continued to increase from USD 40 billion in 2019 to USD 44 billion in 2020, and is projected to rise to USD 124 billion in 2025.[25] Thus, despite remaining low, these increases suggest significant potential for further digital transformation within Indonesia's economy.

Figure 1. Total and per capita GMV among ASEAN countries

total GMV	2016	2019	2020	2025
Indonesia	8	40	44	124
Malaysia	5	11	11	30
Singapore	7	12	9	22
Thailand	6	16	18	53
Vietnam	3	12	14	52
Philippines	8	40	44	124

GMV per capita	2016	2019	2020	2025
Indonesia	31	150	162	439
Malaysia	158	329	346	857
Singapore	1,248	2,105	1,560	3,595
Thailand	87	230	258	754
Vietnam	32	124	144	511
Philippines	78	373	405	1,057
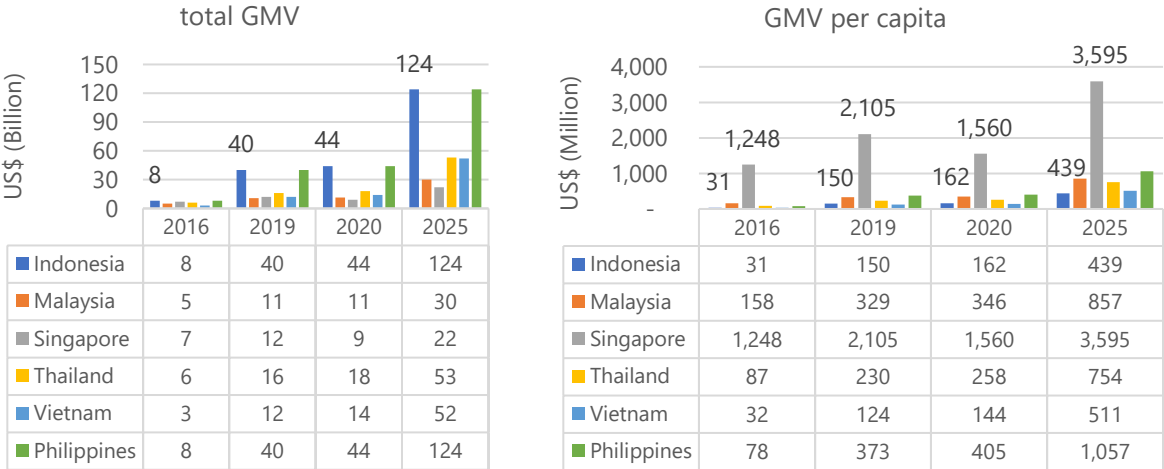
Source: Google, Temasek, Bain & Company (2020) and Statista, 2020

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[24] GMV is the total sales value of products in a customer-to-customer (C2C) marketplace over a given period.
[25] See Google, Temasek, Bain & Company, 2020.

Benefits of digital skills

The development of digital skills is necessary to realize the potential of a digital economy. Indonesia's potential for a digitalized economy derives not only from digital sector activities, including a digital services and platform economy, but also from the non-digital sector's adoption and utilization of ICT, for example, in the application of e-government, e-commerce, and industry 4.0 solutions. Digital skills are required to enable the society, government, and business sector to utilize, apply, and develop digital technologies (**Figure 2**). Digitalization has the potential to improve the quality of life for all people and to contribute to the economy. The need for digital skills will continue to grow along with digital technological advancements and their utilization.

Figure 2. Digital Skills Pathways to Improve Quality of Life
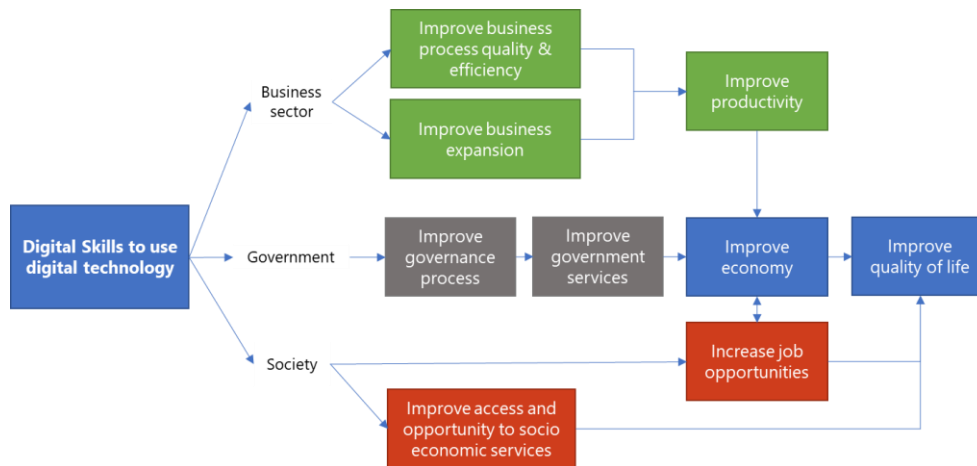
Source: Author

In the business sector, digital skills will increase productivity by improving (i) business process quality and efficiency and (ii) business expansion. Digital skills reduce the amount of time required to conduct routine tasks, as well as analytical and non-routine tasks. As predicted by the ADB (2021), the increase in efficiency due to the automation of routine tasks could lead to a 9.5 to 12.5 percent reduction in working hours. By triangulating this finding and probing deeper into the context of Indonesia, the study found that this was certainly the case. For example, one interview participant from a non-tech company with whom this issue was discussed shared their experience of increased efficiency after implementing an online database system to track their business activities. The system allowed them to reduce the time taken to distribute and integrate data across their work divisions from eight hours to thirty minutes.

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The development of tech companies in Indonesia further reveals the importance of digital skills in business expansion. Digital skills help industries to increase their business volume and userbase, as well as enable them to diversify the products and services they offer. Gojek and Grab, for example, demonstrate how digital talents applied to ride-hailing platforms have successfully increased the number of users by expanding their business model from originally only a human transportation service to encompass shopping and food delivery services. Significant e-commerce players in Indonesia, including Bukalapak and Shopee, have also enlarged their trading platforms to include multi-payment services, for example, internet subscriptions, electricity bills, and tax payments.

The improvement in business productivity due to advancements in digital transformation will enhance the overall economy and increase job opportunities. Indonesia is ranked 5th globally in startup growth, which indicates Indonesia's openness to the development of new and innovative business ideas that aim to harness the benefits of digital technology. This also indicates Indonesia's—and its consumer base's— willingness to embrace new digital solutions to increase efficiency in daily transactions and activities, highlighting the significant potential that digital technology could offer Indonesia's economy. [26] To illustrate this point, Indonesia has one of the highest numbers of "unicorn" digital businesses, i.e., privately-owned startups with a valuation of over USD 1 billion. Table 4 summarizes the market valuations of Indonesia's five unicorns.

Table 4. List of Indonesia's unicorns

No	Company	Category	Valuation (est.)
1	Gojek	Ride hailing platform	USD 10.5 billion
2	Tokopedia	E-commerce	USD 7.5 billion
3	Traveloka	Travel experience services	USD 5 billion
4	Bukalapak	E-commerce	USD 3.5 billion
5	OVO	Digital payment services	USD 3 billion

Source: DS/Innovate (2021)

Digital skills will also benefit the government as they can enhance governance processes, improve government service delivery, and boost the quality of interactions between the state and its citizens. Harnessing digital technology will support the implementation of Presidential Regulation No. 95/2018 on e-Governance and Presidential Regulation No. 39/2019 on One Data. The "One Data" initiative, in particular, aims to develop an online integrated data and information system to support a platform-based public service delivery tool, which aims to assist the business sector and civil society

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[26] See https://www.startupranking.com/countries.

in accessing government services. Also seeking to harness efficiency gains through digitization, the Ministry of Investment (MoInv) has developed an Online Single Submission (OSS) platform to overcome investor uncertainty caused by red tape and bureaucratic paperwork, which was previously scattered across different ministries. Digital innovation in governance is also evident at the district level of government in Indonesia. For example, "Tangerang Live", a public service application developed by the Tangerang municipal government, utilizes digital technology to provide a complaint handling system, COVID-19 vaccine registration portal, and civil administration platform, which aims to streamline and increase the efficiency of public service delivery. To illustrate how this system supports citizenship activities, by using this application, citizens of Tangerang City can obtain birth certificates for newborn infants without queuing. Furthermore, the system eliminates the practice of imposing illegal fees to access government services. The uptake of birth registration remains a challenge in Indonesia, particularly in rural areas. Automating this service is thus crucial to mitigate this issue, as without having an official birth certificate, children may face barriers to accessing educational facilities and receiving social protection packages with regard to education and health.[27]

The success of the public and business sectors in improving the quality-of-service delivery through investment in digital skills will promote broader public participation in the digitalized economy ecosystem. For example, the emergence of digital platforms that offer easy access to financial, educational, healthcare, and transportation services is triggering an increasing number of individuals to learn and take advantage of these platforms by improving their digital skills. Having more individuals involved in the ecosystem will increase the digital market share, which will incentivize more industries to undergo digital transformation. In other words, the development of digital skills has a cyclical effect on digital participation and transformation.

Societies with better digital skills have wider opportunities to generate greater value from goods, services, and job opportunities in the digitalized economy. In the present climate, people can shop for lower-cost quality goods and services using digital marketplaces or platforms. Moreover, the emergence of on-demand service platforms, e-commerce, and financial technology platforms will enable members of the lower socioeconomic classes, who are currently only partly or not at all participating in the job market, to connect with better-paid jobs (Table 5). In other words, promoting digital skills

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[27] UNICEF (2020).

has the potential to reduce unemployment. Digital skills will also be strategic in addressing the demand for occupations that do not yet currently exist.

Table 5. How digital platforms have unlocked inclusive economic opportunities in Indonesia

No	Category	Case
1	On-Demand Services	Gojek, a ride-hailing platform: 80% of the company's driver-partners have a high school level of education or lower, whose average income increased by 44% after joining the platform.
		Golife, Gojek's lifestyle service: 50% of service partners were female heads of households, 1 in 20 of whom were people with disabilities.
2	E-commerce	Tokopedia: the platform has reached up to 11 million sellers, 86.5% of whom were newcomers. During the COVID-19 pandemic, Eastern Indonesia demonstrated the highest rate of growth in online transactions.
3	Financial Technology	Amartha: the platform has empowered female micro-entrepreneurs from lower educational backgrounds and socioeconomic statuses, and living in remote villages. 53% of the 350 thousand borrowers had only graduated from elementary school, with less than 20% having a bank account.

Source: Compiled from LDUI (2019), Gojek (2019), LPEM UI (2021), and Amartha (2019)

Ensuring digital skills development in Indonesia

A digital skills development framework is needed to maximize the digital economy dividend in order to accelerate the achievement of development goals. In a developing country such as Indonesia, the development of digital skills must be aimed at the creation of (1) digitally literate citizens and (2) digitally competent workforces.[28]

Individuals with high levels of digital literacy are required to increase population participation in productive activities, as well as to maximize the value gained from a digitized economic ecosystem. Digital literacy is also the basis for building a digitally competent workforce. A workforce with digital competencies will help the government and business sector to create more productive and efficient business processes, which will significantly impact business expansion, economic growth, and job creation.

Digital skills need to be part of the human development agenda, requiring the government's commitment to improving digital inclusion, literacy, and

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[28] See Bashir and Miyamoto (2020).

competency. Digital upskilling opportunities must be strengthened through formal education, vocational training, and on-the-job training channels. The smooth functioning of these channels is determined by the policy, financial, and infrastructural frameworks in place, which will enable the formation of a conducive digital skills ecosystem in Indonesia (**Figure 3**).

Figure 3. Digital Skills Development Framework
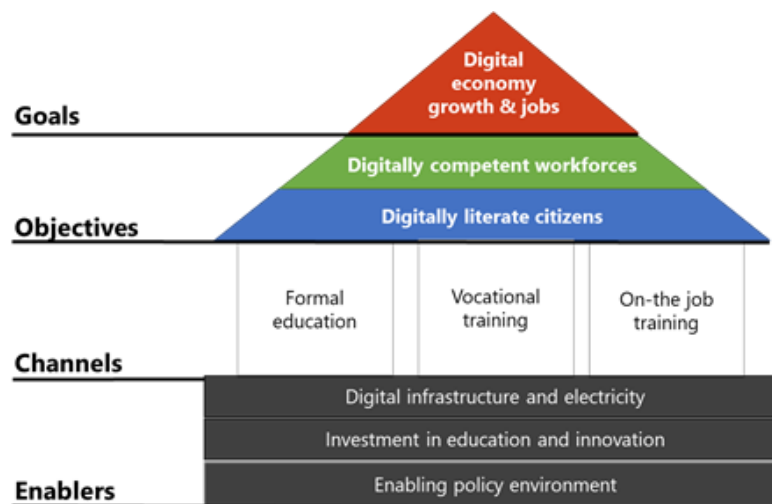
Source: Author

To enable digital skills to be developed across the nation, inequalities within the channel and enabler dimensions need to be addressed. Inclusive digital skills development is essential to ensuring that no one is left behind in terms of the benefits that the digitalized economy produces. Regional disparities, for example between urban and rural regions, and between Java and areas outside of Java, affect access to digital skills development. Our policy dialogues concluded that socioeconomic factors, including gender, age, disability, and income, also influence digital competencies and their unequal distribution.

A deeper understanding of the digital skills landscape in Indonesia will help the government to develop a strategy primer to address the challenges faced. A greater understanding of the issue will help to improve the 2021-2024 Digital Nation Roadmap to develop digitally literate citizens and a digitally competent workforce. Inclusive digital skills development is essential to ensure that no one is left behind in benefiting from the digitalized economy. In many parts of the country, affirmative policies are required to respond to digital skills gaps in Indonesia, as geographical, social, and income inequality have prevented people from accessing and benefiting from the use of digital technology.

To conclude this chapter, *all* pillars within Figure 3, i.e., enablers, which include conducive policies, effective financing, and equal access to digital infrastructure; alongside the three enabling channels, i.e., formal education, vocational training, and on-the-job training, *must be firmly in place* in order for Indonesia to fully harness the positive growth potentials that digital transformation may produce.

4. Indonesia's Digital Skills Profile: Citizens and Workforce

The previous section drew upon results from our three steps of analysis: (1) a review of literature and government documents, (2) a descriptive study of secondary data, and (3) a trend analysis of the FGD and interview results, in order to unpack how digital skills can accelerate Indonesia's development. Two critical objectives were found, the prioritization of which is crucial in order for Indonesia to harness its demographic dividend and the growth potential that digitalization may create. The two objectives are to develop (1) digitally literate citizens and (2) digitally competent workforces.

Within this chapter, Indonesia's current and targeted positions with regard to the two objectives will be examined before important elements that may hinder or promote success in the achievement of these targets are identified. Finally, we highlight how the development of digital skills by meeting the two objectives listed above may address the challenges that Indonesia's workforce faces, increase productivity, and promote inclusive growth within the nation's economy. The analysis contained in this chapter is also based on the three research steps outlined above, through which development targets found within grey literature reports were triangulated with the secondary data analysis, before a deeper exploration of results was conducted through the use of in-depth interviews and FGDs.

4.1. Digitally Literate Citizens

For a country to participate in the complexity of a digital economy, a digitally capable society is essential. Two components are required to enable societies to take full advantage of opportunities offered by the digital economy: 1) digital inclusion and 2) digital literacy. Ensuring digital inclusion and greater access to digital devices and infrastructure for individuals from *all* backgrounds will provide the public with the tools required to be able to unlock the benefits of digitalization and create "digitally smart" citizens, who are able to recognize the advantages that technology may bring, whilst also equipping them with the knowledge to navigate the possible risks that digital solutions may possess. Equal access to digital tools promotes growth by enabling individuals to practice and develop their digital literacy skills, which will later support the formation of a competitive labor force and increase the capacity for the adoption and use of digital products and services for the general public.

This interaction between digital inclusion and digital literacy creates societies that are able to generate more value from the digital economy, particularly as skills up-take increases, through the provision of better-paid jobs and increased access to entrepreneurial opportunities. Digital solutions and widespread knowledge on how to utilize them also leads to better access to essential goods and services, broader information sharing, and greater community engagement.

This section employs different sources of nationally representative data to assess gaps in the achievement of the two main objectives stated in the introduction of this chapter: the formation of digitally literate citizens and digitally competent workforces. To assess current *digital inclusion* trends in Indonesia, we predominantly draw upon results found in Indonesia's National Socioeconomic Survey (SUSENAS), which covers household and individual level socio-economic data, including the ability to own and access digital devices and the internet. In terms of *digital literacy*, results from PISA studies and Reports for Indonesia were referred to.

4.1.1.   Digital Inclusion

To fully benefit from the development of digital skills, no one should be left behind. ITU (2013) defines digital inclusion as the means necessary to ensure that all individuals and communities, including disadvantaged and vulnerable groups, have access to and can use ICT. Individuals who are potentially vulnerable to digital exclusion are those who live in areas without network availability, those from low-income groups—particularly women in rural areas—persons with disabilities (PwDs), and the elderly population.

The incorporation of digital inclusion as one of the components of social inclusion policies has become increasingly relevant during the COVID-19 pandemic. The rapid spread of the virus significantly restricted human mobility, particularly as, due to lockdowns, people were required to stay within their homes. Interactions at work, school, and business could only take place using an internet connection and through supporting devices such as mobile phones and tablets, laptops or computers. The sudden need for the government to be able to deliver social services and assistance through digital means in order to protect jobs and livelihoods was extremely apparent.[29] If vulnerable groups are denied access to these digital tools, they will be left even further behind.

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[29] For example, in the Pre-Employment Card Program/Program Kartu Prakerja, a social assistance program especially tailored to informal workers and small business owners affected by COVID-19, the government provides training fees in the form of digital money to be used by the beneficiaries to participate in online training programs. The beneficiaries also are required to fill out an evaluation form on the program. The incentive fee for completing the survey is presented in the form of digital money.

GoI projections estimate that internet users in Indonesia will reach up to 82% of the population by 2024. According to the Central Bureau of Statistics, the number of internet users increased from 48% of the population aged five and above in March 2019 to 54% in March 2020. This is equivalent to approximately 132 million internet users in 2020. Given Indonesia's total population of around 270 million people, this number is low compared to other ASEAN countries, including Singapore (89%), Malaysia (84%), Vietnam (69%), and Thailand (67).[30] Nevertheless, the expansion of mobile broadband services in Indonesia has outweighed a slowdown in the nation's fixed broadband market (Figure 4), offering strong growth potential for the country's telecommunications operators.

Figure 4. Trends in the expansion of fixed and mobile broadband services
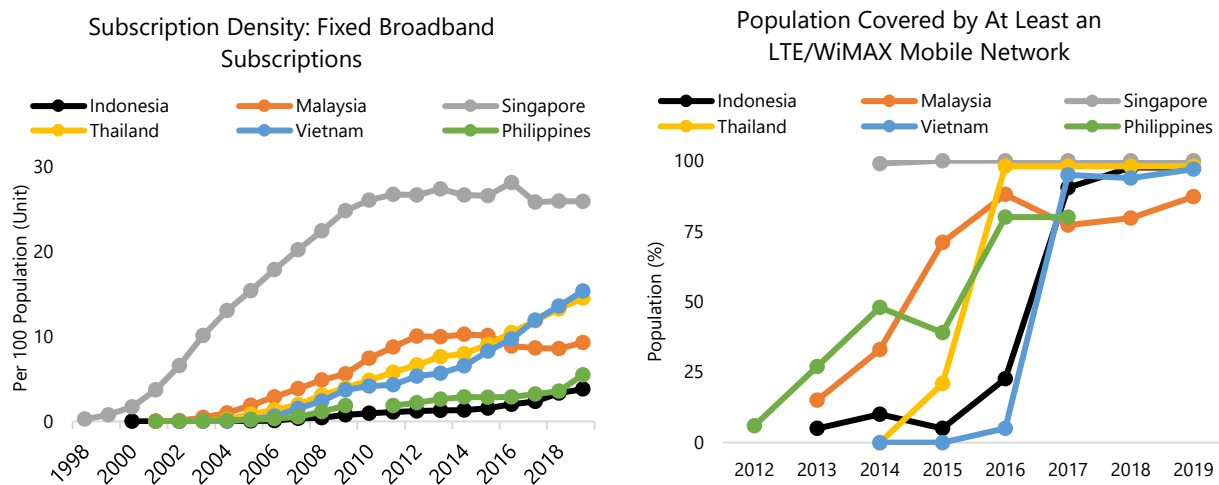
Source: CEIC (2020).

Regional disparities and demographic factors

Internet users are concentrated in the urban centers of Java Island. Across Indonesia, rural areas have the lowest levels of internet users due to underdeveloped digital infrastructure (**Figure 5**). 40% of the rural population are internet users, compared to 64% of the urban population. In several provinces in the outermost and least developed regions, including in Maluku, North Maluku, Papua, and West Papua, 30% of villages have access to 3G and 4G networks. However, 70% of these villages reported weak signal coverage. Although the GoI completed the Palapa Ring project to close the digital divide, providers have not made use of the land and sea cables to provide high quality internet connections due to profitability concerns.

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[30] Analysis from 2020 CEIC data.

Different age groups face different challenges. These differences have implications for the approach used to address digital skills gaps across different age groups. Internet users are generally young: 77% of individuals aged 10-29 years old use the internet. This figure is reduced to 60% of individuals aged 30-49, and 21% of those over 50. There is, however, an encouraging trend in that the number of internet users over 50 increased from 2% in 2011 to 21% in 2020. This figure is reassuring for Indonesia when compared to figures from the Philippines where only 8% of the population aged 55 years old and older use the internet (Labucay, 2014). However, in Vietnam, 52% of the population aged 55 years and older uses the internet (Ecomobi, 2017) and in Singapore 80% of population aged 50 years and older uses the internet (IMDA, 2019).

The FGDs and interviews found that the main motivation for the elderly to use the internet was to ensure that they are connected to their families and to the communities which they are a part of. The challenge is to educate the elderly on *other* uses and benefits of digitalization. This step is necessary as more and more everyday services are moving online. Without access to the internet and to the "user-knowledge" that is needed to be able to support the use of digitalized solutions, there is a danger that the elderly may be further excluded in an era that embraces fast-changing innovations in digital technology. Moreover, accelerated digitalization during the COVID-19 pandemic has emphasized existing age-driven inequalities. Many older individuals struggled to access essential goods and services during lockdowns (i.e., online registration for vaccination, food, and medication), if they were unable to access these services online (UNSDG, 2020).

People with disabilities, in some cases related to age, are also less likely to use the internet. Only 18% of PwDs have access to the internet, compared to 50% of the non-disabled population. The number of PwDs in their 60s and above who have access to the internet is even lower, with only 1% of those within this age group being internet users. Analysis of the in-depth interviews conducted in October-November 2021 found that the digital engagement of PwDs, to an extent, depends on the possession of digital devices widely used to access the internet, for example, mobile phones. Although trends in mobile phone ownership over past decade have continued to grow (from 38% to 58%), only 22% of PwDs own a mobile phone. This number is even lower for PwDs in their 60s and above (13%).[31] Based on an interview we conducted with a training institution for PwDs, the low rate of mobile phone ownership among PwDs is due to the "unavailability of a friendly mobile interface that is accessible to PwDs".[32]

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[31] SUSENAS (2020).

[32] Raised during the in-depth interviews with digital training institution.

Figure 5. Internet users by location, gender, age, disability, education, and income level

Location and Region

Legend: Rural, Urban, Non-Java, Java

Gender and Location

Legend: Female in Rural, Male in Rural, Female in Urban, Male in Urban

Age Group

Legend: <10, 10-19, 20-29, 30-39, 40-49, 50+

Disability

Legend: 2018, 2019, 2020

(Categories: Non-PwDs, 5-17 yo; PwDs, 5-17 yo; Non-PwDs, 18-59 yo; PwDs, 18-59 yo; Non-PwDs, 60+; PwDs, 60+)

Income Quintile

Legend: First quintile, Second quintile, Third quintile, Fourth quintile, Fifth quintile

Education Level

Legend: No schooling, Elementary, Junior secondary, Senior secondary, College/University

Source: National Socioeconomic Survey (Susenas), 2011-2020

Gendered differences also influence access to digital tools. 57% of all adult males are able to access and make use of the internet. This number is significantly lower for women, with only 51% of all adult women using the internet.[33] In 2019, Indonesia's "digital gender gap" (11%) was, however, found to be lower than the global gap (17%). Although lower than the global average, the gender gap statistics still suggest a significant divide; in Indonesia, women and girls use the internet 11% *less* than men and boys.[34] This gap is widened in rural areas, where women were found to use the internet 14% less than men. The digital gender gap is, however, less prominent in urban area, at 8%. This urban-rural divide also warrants policy attention. In rural areas in several regions of Indonesia, patriarchal cultures remain highly entrenched and respected, especially among lower-income families. One of the implications of this is that husbands or sons often control the use of mobile phones/smartphones and internet connections. Changing this trend requires community leaders to adhere to and promote the importance of equal access to digital devices. The challenges faced to bridge the gender and urban-rural divide are, thus, not only a lack of infrastructure, but importantly also the need for widespread information and knowledge on the benefits of ensuring access for all individuals.

Increasing women's participation in the digital economy in rural areas, for example, has many advantages. Providing more internet access for these women will increase their digital skills and opportunities to receive higher-paying jobs, facilitate access to essential goods and services, and enhance their engagement in broader information sharing and community activities. It has been proven that internet availability increases the probability of Indonesian women aged 15-45 with lower levels of education having been engaged in full-time employment (Kusumawardhani et al., 2021).

Individuals with higher levels of education are more likely to access the internet. 78% of individuals with a senior high school education have used the internet.[35] Meanwhile, 94% of people with college/university education use the internet. Internet use trends are also increasing among individuals with a junior high school education. However, compared to other countries in ASEAN, the gap in internet use marked by education is most pronounced in Indonesia. Individuals with a college/university education are 80% more likely to use the internet than those with elementary or no schooling. Compared to Indonesia's closest neighbors, the nation's digital gap by

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[33] SUSENAS (2020).
[34] See ITU (2019).
[35] SUSENAS (2020).

educational attainment is significantly larger than in Thailand (27%)[36] and the Philippines (54%)[37]. Furthermore, significant concerns have been raised that the COVID-19 pandemic will deepen this gap, particularly as all learning activities are conducted online.

Income levels determine an individual's opportunities to access the internet. Having a low income is correlated with low levels of internet use. This conclusion was made through an analysis of Susenas 2020 data, which showed that those within the top consumption quintile are much more likely to use the internet than those within the lower quintile groups. Roughly 77% of individuals in the top quintile own a mobile phone compared to only 38% of those in the bottom quintile. Individuals with higher incomes are also more likely to own tablets/computers/laptops and multiple devices that enable them to go online. Many also have home broadband services. With fewer options for online access at their disposal, Indonesians in the lower-income quintile rely more heavily on mobile phones. This reliance also means that less affluent individuals are more likely to use mobile phones for tasks traditionally reserved for larger screens. For example, mobile phone owners with lower incomes are likely to use their mobile devices when applying for jobs or seeking out training programs to increase their level of digital skills (Pew Research Center, 2015).

Narrowing the internet gap across regional and socioeconomic factors requires the GoI to provide universal access to the internet and digital devices. The provision of high-quality internet access is an enabler to allow societies to improve their digital skills. Without high quality internet infrastructure and access, it is difficult for individuals to be able to integrate with the digital world. This later also affects people's opportunities to develop their digital skills and to participate in the digital economy system. Table 6 below outlines the existing conditions of Indonesia's internet user profile and the GoI's targets for internet user expansion up until 2024. The table also describes constraints faced in achieving these targets. The constraints will guide our discussion on the digital skill fundamentals.

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[36] UNCTAD (2016) on Thailand Internet User Profile 2015, a report by Electronic Transactions Development Agency and Ministry of Information and Communication Technology.
[37] Labucay (2014) on Patterns of Internet Usage in the Philippines.

Table 6. Digital inclusion gap in Indonesia

Existing condition	Target	Constraint	Digital skills fundamentals
In 2020, 132 million people were internet users. This is equivalent to 54% of the total population.	The percentage of internet users is expected to be 82% of the population by 2024. This target requires an additional 7% of internet users on average per year.	Internet users are largely concentrated in urban areas or on Java. More than 50% of the outermost and least developed regions (3T regions) have no access to internet. 30% of villages in some provinces of the 3T regions, including Maluku, Maluku Utara, Papua, and Papua Barat, are covered by 3G and 4G with more than 70% reporting weak signals. The Palapa Ring is available, but providers have not made use of the land and sea cables to provide connections as it is costly and less profitable.	Infrastructure, Policy
		Internet prices are relatively expensive, with the lowest internet speed compared to other ASEAN countries (Indonesia 78$PPP, 10 Mbps; Thailand 51$PPP, 50 Mbps). In remote areas outside Java, the price is increasingly expensive as the majority of data interconnections transit in several Indonesia Internet Exchanges (IIX) in Jakarta. Areas further from Jakarta must compensate for these higher internet data traffic costs.	Infrastructure, Policy
		Mobile phone ownership has increased from 38% to 58% over the last decade. However, around 50% of population in rural areas still have no access to mobile phones due to affordability concerns.	Infrastructure, Policy

Source: Authors

4.1.2. Digital Literacy

Digital literacy relates to being able to understand and use digital tools with confidence. "Digital literacy is the ability to access, manage, understand, integrate, communicate, evaluate, and create information safely and appropriately using ICTs for employment, decent jobs, and entrepreneurship. Digital literacy includes various competencies referred to as computer literacy, ICT literacy, information literacy, and media literacy." (UNESCO, 2018). The main challenge in harnessing the positive impacts of digital advancements is that digital literacy is not equally accessible to all. This is the crux of the problem and acts as the main reason behind the digital divides discussed in the previous section. Our FGD results, although not aiming to be representative of the entire community, confirm this claim in the context of Indonesia. Low digital literacy was

mentioned as a key reason behind why Indonesia is falling behind in terms of the digital divide.

Digital literacy is closely related to digital inclusion. Often when people opt not to use ICTs, it is because they do not have the digital literacy skills required to operate technological devices. A lack of knowledge around digital skills also often *prevents* people from considering the use of digital devices. A digitally capable society requires digital inclusion; that no-one is left behind in the digital economy, and that all individuals have equal access to the internet and are given equal opportunities to increase their digital capacity, irrespective of where they live, their gender, age, education level, or economic status. The FGDs, conducted with representatives from a number of government institutions and private sector companies, found that digital literacy is important in order to prevent entrenched digital divides in Indonesia. Ensuring that all individuals in Indonesia possess adequate and high-quality "basic literacy" skills in reading, writing, and numeracy, was suggested as a pre-cursor to the uptake of digital skills. We explore this concept further below.

Digital development demands more developed literacy competencies than simply traditional literacy, including reading, writing, and numeracy skills. Before an individual can understand how digital technologies operate, a high level of basic literacy skills is required. A basic literacy survey conducted by PISA in 2018, however, found that, particularly in numeracy, Indonesia is lagging behind, with average students' math skill scores (379) being significantly lower than the OECD average (487). To increase digital literacy, this lack of basic skills represents a crucial challenge, particularly as digital readers are not only required to follow linear information structures, but must also often construct their own texts by selecting and assessing information from different sources. The ability to think about, monitor, and adjust activities for a particular goal is also essential when reading in digital environments. Ensuring digital access and literacy, therefore, must go hand-in-hand with initiatives to promote high-quality basic literacy. These basic skills then need to be complemented with the ability to understand, engage, and critically use or produce digital services to improve digital literacy.

As digital literacy is strongly dependent on basic reading, the MoE has set a target for 36% of students to have PISA reading scores above the minimum standard by 2024. Above the minimum standard means that students attain at least Level 2 proficiency. Level 2 proficiency in reading is considered to be the "basic literacy level", as at this level, students are expected to have the ability to identify the main idea in a text of moderate length, find information based on explicit, though sometimes complex criteria,

and be able to reflect on the purpose and form of texts when explicitly asked to do so (OECD, 2019). Compared to other ASEAN countries, Indonesia's 2024 target is relatively low. To illustrate, in Malaysia 54% of students have attained PISA scores above the minimum standard, while in Thailand the figure is 40%.

To be more specific on the target of digital literacy, the MCI projects that 50 million individuals will be digitally literate by 2024. During discussions we conducted with the MCI, digital literacy was identified as a requirement for implementing the "Indonesia Digital Nation" program. The program's main focus is "developing a digitally literate citizenry, or digital people". For the MCI digital literacy includes: 1) digital skills, 2) digital ethics, 3) digital culture, and 4) digital safety. The latter three aspects reflect that digital literacy is not only essential to labor competitiveness, but also to ensuring cyber safety by helping citizens identify threats, fraud, and misinformation on the internet. Although these are equally important goals, within this section, we only focus on the first aspect of digital literacy identified by the MCI: digital skills.

Digital literacy skills in Indonesia

Statistics show that Indonesia, overall, scores relatively low when it comes to digital literacy. The Indonesia Digital Literacy Survey, conducted in November 2020 by the MCI, found that digital literacy in Indonesia is particularly poor, especially when it comes to the skills required to be able to handle digital information and data. Indonesia's poor levels of digital literacy are mainly due to critical thinking not being applied properly when obtaining information online. Approximately 60% of respondents to the survey were not accustomed to seeking out the sources of information online, including comparing various sources of information and discovering the background of the source and its credibility. Results from the CSIS pilot survey on the digital literacy and skills toolkit emphasize this issue (**Box 1**).

The low levels of digital literacy in Indonesia are in line with its poor performance in basic literacy skills. Supporting the findings outlined above, the 2018 PISA Survey, which assesses these skills, ranked Indonesia 71st out of 79 countries.[38] Only 30% of Indonesian students have a higher than level 2 proficiency in reading compared to the OECD average of 77%. The PISA's basic reading assessment includes a test evaluating whether students can distinguish between facts and opinions when presented with

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[38] See OECD (2019). Results from the PISA Survey are similar to the results of the PIAAC Survey, which assesses adults' skills in literacy, numeracy, and problem solving in technology-rich environments. The results show that 70% of adults living in Jakarta perform lower than level 1 in literacy, compared to the OECD average of 15% (OECD, 2016).

multiple texts. Indonesia's position in the 2018 PISA ranks Indonesian students the lowest compared to other countries in reading strategies for assessing the credibility of sources (the x-axis in Figure 6 below). The students in countries where the average student is more aware of effective strategies for assessing the credibility of sources also tend to perform better on PISA reading assessment tests.

Figure 6. Relationship of distinguishing facts from opinion and assessing sources' credibility
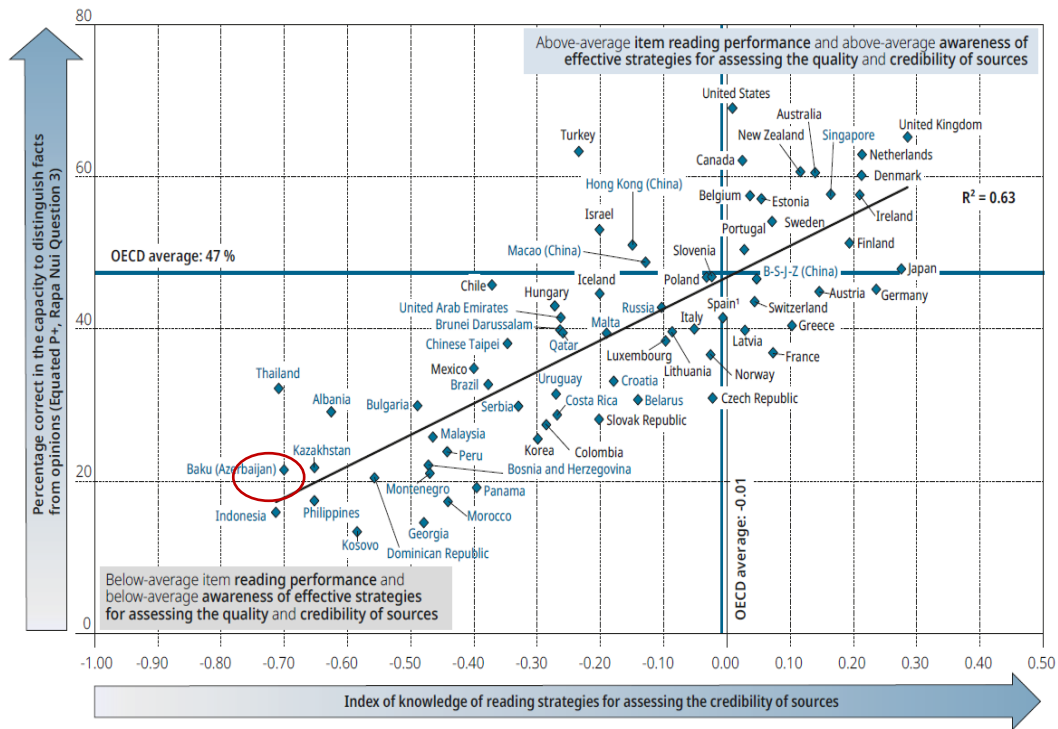
Source: OECD, 2021

Significant weaknesses present in the skills of Indonesian students in "assessing the credibility of sources" indicate the likelihood of Indonesian's citizens being vulnerable and susceptible to hoaxes, fake news, scams, frauds, and cyberbullying. This leads to harmful online behavior, including being drawn into hate speech by fake news, which may affect the international and regional stability of the nation. Our discussions with the MCI concluded that developing digital literacy by equipping individuals with skills, including fact-checking and encouraging critical thinking whilst on the internet, will help to develop a sustainable online culture, create a set of positive norms, and keep society safe.

Box 1. Results of CSIS pilot surveys on the current state of digital literacy

In 2021, the Centre for Strategic and International Studies (CSIS) conducted pilot survey to collect information and data for a digital literacy and skills toolkit, which aims to provide an in-depth overview of Indonesia's digital skills landscape. The survey was conducted in Jakarta and had a sample size of 500 individuals, focusing on individuals in greater Jakarta area.

Although not aiming to be nationally representative, this survey revealed that individuals included in the data collection process, on average, had a *medium* level of digital literacy. We describe what "medium" refers to below.

This result is similar to an analysis conducted by the Ministry of Communications and Information (MCI) using the nationally representative survey basing the computations on Indonesia's Digital Literacy Index, which concluded that the digital literacy index score for Indonesia is at the medium level of 3.47 out of 5.00, with higher numbers indicating higher levels of digital literacy. Results from the CSIS survey on levels of "ICT familiarity" also match the MCI's findings on Indonesia's score for the sub-index of "technological skills" in that both the CSIS and MIC surveys found that Indonesia received a relatively high score for this sub-index, compared to the nation's scores on other sub-indices.

We focused on the results for the above two indices (Digital Literacy and Technological Skills) as, given limited data and information concerning digital skills development, these measurements are pivotal in describing the current digital skills landscape in Indonesia. Taking this into consideration, results for these two indices, as found within both the CSIS and MCI surveys, show that in Indonesia, individuals are more literate in terms of their understanding of the use of technological/ICT devices for daily use. These results also indicate a relatively higher level of ability in Indonesian citizens to articulate information needs, and to locate and retrieve digital data, information, and content, compared to other digital abilities as captured within other sub-indices/indicators.

For example, of the other indicators measured in the CSIS survey, Indonesia scored the lowest in the "communication and collaboration" indicator. This low score represents a challenge for digital development in Indonesia, as communication & collaboration are essential for the future development of increased access to jobs, training, and skills upgrading. In particular, individuals were found to be not confident in the use of cloud service platforms to work and collaborate with others. Despite this, instant messaging and social media literacy questions within the communication & collaboration indicator exhibited a relatively high score (3.89 out of 5.00).

While results from the CSIS survey found no clear gap between male and female digital literacy attainment levels, disparities were found among rural vs. urban areas, as well as among different age groups, educational levels, and work statuses. In particular, those living in urban areas, young people, individuals with higher levels of education, and those in paid employment, are among those most

Source: Summarized by authors based on the CSIS survey results

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Narrowing the gap in Indonesia's digital literacy targets requires special attention to the quality of basic education and basic literacy outcomes in Indonesia. Digital literacy outcomes depend on the quality of inputs and outputs of ICT learning and teaching activities, including their interaction with activities to improve basic literacy skills. The table below summarizes the points highlighted above, outlines the existing condition of basic literacy skills in Indonesia, and presents the targets that Indonesia aims to achieve by 2024. The table also describes constraints that may prevent the nation from achieving the targets set. These constraints will later be referred to in the section of this report which discusses "digital skills fundamentals" for Indonesia.

Table 7. Digital literacy gap in Indonesia

Existing condition	Target	Constraint	Digital skills fundamental
Indonesia scores poorly on several aspects of basic literacy competencies required for digital development. In the 2018 PISA Report, 30% of students achieved a minimum level of proficiency (Level 2 or higher) in reading.	▪ 50 million individuals to be digitally literate by 2024. ▪ 36% of students obtaining PISA reading scores above the minimum standard by 2024.	The ICT curriculum is limited to the use of digital tools and applications, rather than fostering a culture of skills upgrading to be more adaptable in the ever-changing digital technology landscape. In a mandate to produce high-order-thinking skills (HOTS), ICT was removed as an independent subject and integrated into each subject to develop skills in the use of ICT for learning.	Formal education
		Teachers were not equipped with the knowledge and pedagogical skills required to deliver HOTS. As a result, they are unable to incorporate ICT into their lessons, while ICT teachers remain confused about the removal of ICT as an independent subject in schools.	Formal education; Policy

4.2. Digitally Competent Workforces

The development of the workforce's digital competencies is crucial in maximizing the potential of a digital economy. Having a talent pool with digital competencies can extend the development and application of digital tools and processes to strengthen business models in various sectors, including a platform economy, e-commerce, and Industry 4.0. Indonesia has many good examples of the ways in which digital talent benefits business productivity and scalability, for example, the business expansion of

GoJek and Tokopedia into the GoTo Group.[39] At a social level, digital innovations and transformations also benefit service improvement and job creation, increasing the availability, demand for, and utilization of digital tools, and thus participation in the digital economy.

Digitally competent workers receive higher incomes, granted that they are in the 'correct' occupations. Workers from ICT backgrounds, who have completed higher levels of education, and who are working within the ICT job sector or who are employed in medium- to high-skilled occupations, enjoy higher earning premiums. Figure 7 shows that ICT graduates with a 4-year diploma (D4) or university degree who work in the ICT job sector[40] or medium- to high-skilled occupations[41] can receive monthly earnings of approximately IDR 5 million, or the equivalent of a national minimum wage in Indonesia of US$350 per month. ICT graduates with a one-to-three-year diploma (Diplomas 1, 2 or 3), who work in a high-skilled occupation, earn more than the average monthly earnings of a middle-class worker. These increased income levels are particularly effective at moving workers out of poverty and vulnerability. The higher incomes also leads to job satisfaction, benefits, and security levels that are suitable to support comfortable living arrangements for a family of four (Wihardja and Cunningham, 2021).

Narrowing the digital skills gaps in the workforce is also increasingly important. We conducted FGDs with government and private sectors in October 2021, focusing on the discussion of Indonesia's "digital skills gap". From these discussions, we uncovered an urgency to upskill unskilled workers to support the workings of digitalized business models in Indonesia. For example, during a discussion with representatives from a digital infrastructure company, we found that digital skills are required throughout the company

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[39] GoJek and Tokopedia are two digital business companies in Indonesia with the highest valuation of more than USD 18 billion (DS/Innovate, 2021).

[40] The classification of the ICT job sector is adapted from ILO (2020), which classifies the ICT job sector based on the International Standard Industrial Classification of All Economic Activities (ISIC), Rev.4 on ICT sector job classifications. It includes classifications 2610, 2620, 2630, 2640 and 2680 (ICT manufacturing industries), 4651 and 4652 (ICT trade industries), 5820 (ICT service industries), 6110, 6120, 6130 and 6190 (telecommunications), 6201, 6202 and 6209 (computer programming, consultancy, and related activities), 6311 and 6312 (data processing, hosting and related activities; web portals), and 9511 and 9512 (repair of computers and communication equipment).

[41] Skilled occupations refer to the International Standard Classification of Occupations (ISCO)-08. Managers, professionals, and technicians are categorized as workers in high-skilled occupations. Clerks, services and sales workers, skilled agricultural workers, craft workers, and plant or machine operators are classified as medium-skilled workers. Those working in elementary occupations are categorized as workers in low-skilled occupations.

structure. In particular, when advanced skilled workers occupy professional and managerial positions, lower-occupational workers, including technicians and machine operators, should also be able to understand basic digital technology in order to be able to install and maintain the operations of on-site infrastructure. To address this need for skills development across the work force at both the managerial and clerical level, as well as skills development for small business owners, we found that a number of ministries, including the MoSMEs and MCI, and tech companies, such as GoJek and Bukalapak, have responded by implementing 'MSMEs Go Digital' programs to introduce micro and small enterprises to simple digital tools and platforms.

Figure 7. Earning premiums of ICT graduates by education and job type

Earnings of ICT Graduates, by Education and Job Sector

■ Non-ICT Job Sector ■ ICT Job Sector

Earnings of ICT Graduates, by Education and Skilled Occupation

■ Low-Skilled Occupation ■ Medium-Skilled Occupation
■ High-Skilled Occupation
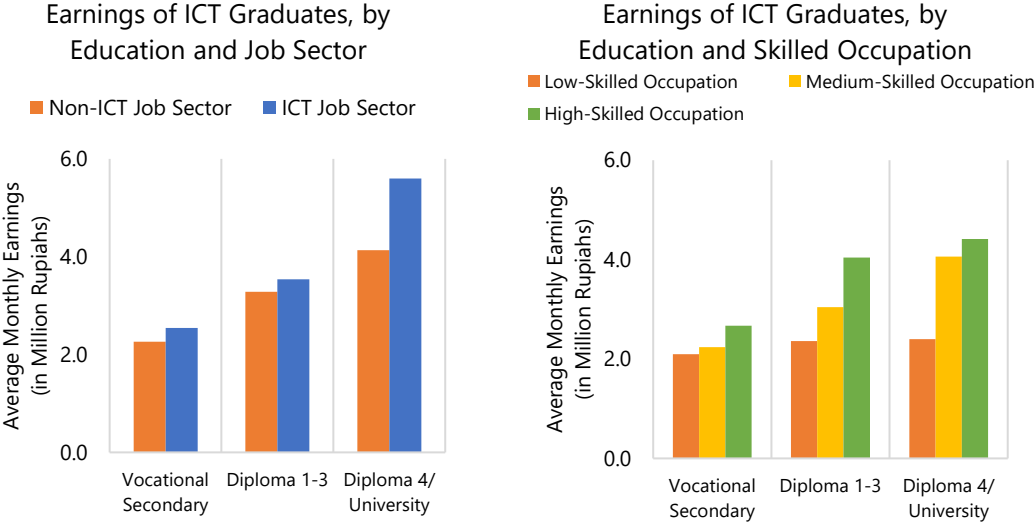
Source: National Labor Force Survey (Sakernas), 2018

Analyzing the workforce's digital skills profile is essential to mapping the country's ability to fulfill demand for these skills. As there is no specific data set on digital skills, this report uses National Labor Force Survey (Sakernas) data to roughly predict the supply of digitally competent workforces in Indonesia. The data, however, have limitations as they do not provide an accurate digital skills portrait using competency assessments. Using this data, we created proxies to analyze workforce skills based on working conditions and workers' ICT educational backgrounds to measure digital competencies in Indonesia (see 7. Appendix

A1: Classification of the digitally competent workforces

for a detailed outline of the methodology). In the analysis, "digital skills" are classified using the World Bank's framework (see Table 8).

Table 8. The scope of digitally competent workforces

Category	Description
Unskilled	A workforce that is not familiar with using simple digital technology or has low exposure to digital technology.
Basic skilled	The workforce is able to conduct simple tasks using simple digital technologies for non-job-specific occupations, for example, Microsoft office, google chrome for browsing, and email.
Intermediate skilled	The workforce uses a range of digital technologies that are related to their occupantions. This level of skills is typically required in middle-level occupations, for example, journalists should be able to use digital tools to collect, search, and analyze information.
Advance skilled	The workforce uses more advanced analytical skills and theoretical knowledge. This level of skills is typically required in occupations with a high level of ICT intensity, for example, artificial intelligence specialists.

Source: Adapted from the World Bank's framework outlined in Bashir and Miyamoto (2020)

Sakernas is an annual, nationally representative, recurrent cross-sectional labor force survey in Indonesia that records the employment status and labor force activities of individuals aged 15 years and older from a sample of households. The data was administered for the first time in 1976 and has been collected periodically since 1986. In 2018, Sakernas included questions on "the use of internet in an individual's main job" to capture data on workers involved in the digital economy. Although the survey is not ideal for our purposes, as the question included does not assess skills competency, it is the *only* nationally representative dataset that allows us to observe annual trends in the use of the internet for work activities within the labor force.

Sakernas also collects information on the highest level of education completed. Specifically, it provides information on the field of study of those who have completed vocational high school, a diploma 1-3, or a diploma 4/university degree (bachelor, master, and doctoral degrees) allowing us to identify whether some form of ICT-specific training was provided by the educational institutions attended by each individual. Individuals are classified as ICT graduates if their field of study is computer sciences, logic, mathematics, information sciences or information systems, computer/ telecommunication/ informatics/

software engineering, or related fields. In this study, we use these fields as proxies for individuals who have received a *significant* level of IT training. Although it would have been ideal to be able to measure the level of IT content within the curriculum of each study program, for this study we assume that "ICT graduates" receive *more* training and knowledge on ICT issues than individuals enrolled in other subject areas and programs.[42]

Based on the four dimensions of i) employment status (employed/unemployed); ii) internet use at work; iii) education level; and iv) ICT education background, we assigned each individual in the labor force to a "digitally competent workforce" category (unskilled, basic, intermediate, or advanced). [43] Possessing an ICT educational background reflects on the knowledge workers are equipped with. In the current study, we assume that completing an ICT-specific education program provides workers with the theoretical and practical knowledge required to progress within occupations with a high level of ICT intensity. We then assume that "internet use within an individual's main job", reflects the level of IT-skills exposure an individual has experienced through their employment. Increased exposure to the internet through the daily use of ICT tools at work and in conducting other tasks would increase the need for complementary skills, such as information processing, self-direction, problem-solving, and communication. Combining these dimensions offers an estimate of the supply of digital skills through the formal education system and their application at work. This mapping, however, should be viewed as indicative only, as we could not specifically identify the digital skills of the labor force based on competency assessments. Figure 8 in the next sub-section summarizes the main results of this analysis.

Digital skills of the workforce in Indonesia

The GoI has calculated the need for 9 million digital talents by 2030 or 600 thousand digital workers on average per year. Within policy dialogues and FGDs/interviews

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[42] The data did not include, for example, students majoring in urban planning who may have completed courses on geographic information systems or students in library studies who would have received modules on computers and data processing.

[43] See the matrix table in the Appendix. We also constructed the categories based on age cohorts to capture skill differences due to the start of the digital era in Indonesia (before and after 1980). However, the results do not differ greatly between all cohorts due to issues on age selection already covered in these two dimensions. Younger individuals, or those who were born after 1980—the year in which the digital era began in Indonesia—are more likely to have a higher education level and to use the internet at work. Therefore, for simplicity, the next analysis conducted will be based on all ages as this will allow us to observe the digital skills profile of all individuals in the labor force.

conducted with representatives of the government and private sector, the levels and forms of these digital skills were not explicitly discussed. However, policy dialogues and FGDs/interviews with ministries/institutions found that these institutions tend to favor "advanced" digital skills. The term advanced digital skills refer to an individual's ability to use theoretical ICT knowledge and analytical skills to solve digital problems. These qualitative findings are in line with results compiled using a 2020 survey conducted by the MCI on 48 big industries, from 8 business sectors in Indonesia. [44] The 2020 survey identified that full-stack programmers (27.18%), big-data analysts (16.77%), and network engineers (10.04%), are the most needed ICT occupations in Indonesia. To further triangulate these findings, policy dialogues and FGDs/interviews conducted with government, education and training institutions, industry practitioners, and ICT graduates found that there were significant "concerns about the shortage of advanced skilled talents in the field of ICT".[45] The reasons behind this concern are outlined in Table 9 below.

Table 9. Reasons behind the digital skills attainment gap in Indonesia

No	Reason why the digital gap exists in Indonesia	Percent of PDs, FGDs, and interviews stating this reason
1	Competition in the labor market	68%
2	Un-supportive regulations	65%
3	Lack of investment in R&D and on-the-job training	41%
4	Lack of quality ICT graduates and opportunities for upskilling	85%
5	Limited access to higher education and reluctance of workers to learn new ICT skills	56%

*Note: the results in this table are based on 7 policy dialogues (PDs), 3 FGDs, and 24 interviews conducted with the government, universities, vocational/training institutions, and private sector organizations. These findings do not aim to be representative of the general opinion of these institutions in Indonesia, however, simply aim to illustrate a cross section of opinions on the issues.

Source: Author's analysis of policy dialogues and FGD/interview results (July–September 2021)

To summarize the table above, most policy dialogues, FGDs, and interviews stated that the reason behind the digital skills attainment gap in Indonesia is primarily a lack of quality ICT graduates and opportunities for workers to upgrade their digital competencies. These factors are related to the ability of the country's education and

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[44] The purpose of the survey was to determine the demand for ICT workers in Indonesia. The survey focused on the 48 largest firms in mining, finance, construction, manufacturing, logistics, healthcare, ICT, and wholesale/ retail.

[45] This issue was raised in the policy dialogues with government institutions, the private sector, and experts.

training system to equip more individuals with industry-required digital skills. The lack of skilled workers creates fierce competition between industries in the labor market, especially between tech companies. There are also issues related to un-supportive regulations, which hinder the development of ICT skills in Indonesia. For example, although Indonesia has made progress in supporting digital transformation,[46] there is an absence of a detailed policy framework on digital skills development, which is fundamental to implementing digital transformation. The lack of a proper framework has led to unclear digital skills demand-supply mapping, which in turn affects the relevancy of competency-based standards used to develop ICT curriculums in education, vocational, and training institutions.

Our rough estimate of the supply of digital skills in Indonesia using Sakernas data outlined within the previous sub-section indicates that Indonesia is still dominated by digitally unskilled workers, while advanced skilled workers only represent a small percentage of the workforce (**Figure 8**). Approximately half of the current workforce in Indonesia consists of digitally unskilled workers, and the proportion increases to around two-thirds of the current workforce when including those with basic IT skills. These numbers indicate that the majority of the workforce has limited ability to participate in, contribute to, and benefit from the growth of the digital economy in Indonesia.

The majority of digitally unskilled workers live outside of Java. They are predominately older individuals who have lower levels of education and incomes. More than half of all digitally unskilled workers are women residing in rural areas outside of Java. These characteristics confirm that disparity, particularly between region, age and, gender, is one of the underlying problems affecting workers' digital skills levels and their ability to improve their digital literacy.

Regional differences are also evident between Java, an island dominated by large urban areas, and islands outside of Java. More than half of all workers living outside Java are unskilled; in Java the composition of unskilled workers (40%) is significantly lower than in non-Javanese regions. Two provinces with proportionally lower numbers of digitally unskilled workers are DKI Jakarta and Kepulauan Riau. This is expected as DKI Jakarta is the country's capital, which is located on Java Island. This is also expected for Kepulauan Riau, a province in Sumatra where the largest city, Batam, is an industrial "boomtown" and

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[46] The 2020-2024 RPJMN and the Indonesia Digital Nation Roadmap (developed by the MCI) emphasize the role of digital transformation in boosting economic productivity and improving service delivery.

part of a free-trade zone between Indonesia, Malaysia, and Singapore. Batam's proximity to these neighboring countries and its role as an emerging transport hub may have had a spillover effect on the educational levels and internet use of its labor force.

Figure 8. Digital skills of the labor force

Legend: Unskilled, Basic, Intermediate, Advanced

2018:
- ±800 thousand (0.61%)
- ±16 million (12%)
- ±42 million (32%)
- ±72 million (55%)

2020:
- ±880 thousand (0.63%)
- ±18 million (13%)
- ±52 million (37%)
- ±67 million (49%)
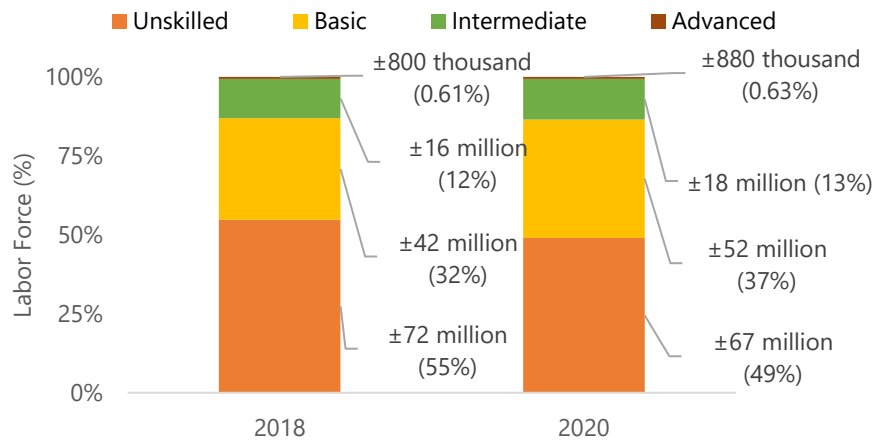
Y-axis: Labor Force (%), 0% to 100%

The high proportion of unskilled and basic skilled workers in Indonesia originates from the fact that more than half of the current workforce is made up of workers with a low level of education and who are not exposed to the internet in their main job. These are also older workers, i.e., those born before 1980, who are generally over 40 years of age. Looking first at the education dimension, overall, younger workers (individuals born after 1980) tend to have at least a high school level of education. This is in contrast to older worker, who tend to have lower levels of education. The effect that age demographics may have on the overall picture of the workforce's level of IT skills must be taken into account when looking at our estimates of digital skills levels. As lower educated workforces tend to be made up of older workers, younger workers are more likely to take up occupations that require basic and intermediate digital skills. Additionally, younger workers, commonly recognized as "digital natives", are more likely to have higher levels of familiarity with digital tools (Prensky, 2001), even though those with lower educational attainment levels in this category still must be categorized as digitally unskilled. This familiarity with digital tools among younger workers leads to higher levels of ease when using digital tools and when navigating the internet, at least at the basic functioning level (Bennett & Maton, 2010; Dingli & Seychell, 2015). Higher digital functioning levels in younger workers is also due to increased exposure to these digital tools (Ibid).

Most digitally unskilled workers work in low-intensity sectors or sectors with less exposure to digitalization processes, indicating low relevance of digital skills in these sectors. The agriculture, hunting, forestry, and construction sectors have the highest proportion of digitally unskilled workers (approximately 60%-80% of whom are unskilled in digital skills). This is likely due to the fact that most workers in these sectors are traditional workers with low-skilled occupations, for example farm laborers or construction/building laborers. Workers in these sectors are typically engaged in physically demanding jobs, which do not require a formal education or familiarity with internet use.

Workers with basic and intermediate digital skills generally have jobs in sectors that are beginning to be digitalized and where the internet is used as a supporting tool. More workers with basic digital skills are engaged in the informal sector, while those with intermediate digital skills are able to acquire formal jobs due to their higher educational attainment levels. 43% of individuals with basic digital skills work in the informal sector, compared to only 16% of workers with intermediate digital skills (Figure 9). A Statistics Indonesia survey of "Business Practitioners" (Survey Pelaku Usaha 2021) found that this may be due to workers in the informal sector being typically engaged in micro, small, and medium-sized enterprises (MSMEs). Although some of these businesses may require internet skills to expand their business and gain benefits in the digital economy, most have no formal education requirements. Nevertheless, the 2021 Business Practitioners survey also highlighted the impact of COVID-19 on the need for the informal sector to embrace digital skills. The survey found that businesses that could adapt by conducting their operations using digital platforms were most likely to survive the pandemic.

To increase the productivity of MSMEs, the GoI has set a target of helping 30 million MSMEs to enter the digital ecosystem by 2024. MSMEs are the backbone of Indonesia's economy. With a total number of 65 million, MSMEs account for approximately 99% of all business activities in Indonesia. The large number of MSMEs and the business revenue that they generate, however, currently does not amount to a significant contribution to Indonesia's GDP growth and export value. In 2018, the contribution of MSMEs to Indonesia's GDP was around 57% and the export value was approximately 13.7%. Internet and digital technology may act as a channel through which MSMEs may contribute to larger GDP growth and export values. Through an increase of MSME participation in digital activities, their market share and coverage could be extended, thus contributing to increases in revenue and incentivizing entries into the export market by easing access to

digital methods to market products overseas. In Indonesia, however, many MSMEs have not used the internet as a tool to connect them with their online markets. Of the total target of 30 million MSMEs, 46% are integrated into the digital economy.[47] The GoI must digitalize 5 million MSMEs or more, on average, per year in order to reach the target stated at the beginning of this paragraph.

Figure 9. Digital skills of the labor force by work status
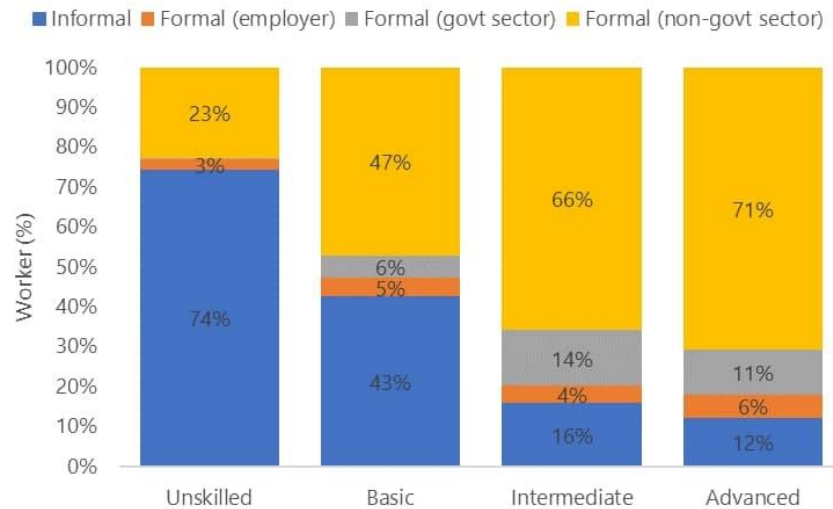
Source: Sakernas 2020

An overview of the different job types and sectors of unskilled, basic, and intermediate skilled workers reveals a reinforcement process in the digitalized economy. Sectors where most workers are unskilled or have minimal digital skills reinforce the low relevance of using digital tools within their business practices. This reinforcement process exacerbates the challenges of transforming business sectors, for example agriculture, which remain left behind in regard to IT advancements, into digitally competitive sectors. This stagnation in the process of digitalizing sectors, such as agriculture, then reinforces the lack of digital skills within these sectors. This creates a significant challenge, particularly as such sectors may be pushed toward the need for sudden technological advancements to maintain productivity and competitiveness. As this need arises, low digitally skilled workers will become further excluded and their livelihoods will become threatened, especially when there are no means and access to upskilling opportunities for these workers.

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[47] This issue was raised during the policy discussion with MSMEs.

Shifting to more digitalized business operations has deemed upskilling necessary. This finding was strengthened by results from an interview we conducted with representatives from a renowned large tech company. During the in-depth discussion, we found that workers who refuse to or cannot upgrade their skills to acquire basic digital competencies, especially relating to the use of new digital productivity tools, tend to lose their employment to those with higher levels of skills. Although not aiming to be representative of all IT business sectors in Indonesia, this finding highlights the need for workers to continue upgrading and intensifying their digital skills and digital tool usage. The findings from this interview also point to the necessity for sectors with low digital intensities to absorb new talents with significant digital skills. This creates a significant dilemma for companies who aim to employ "new" digitally skilled talents, while also needing to uphold the obligation of protecting current workers who have no or minimal digital skills.

Furthering the above conclusions, an interview conducted with representatives of a multinational company, which possesses relatively large levels of resources to support the inclusion of digital strategies within their organizational planning, found that the "shift to digitalization" needs to be conducted by following a "step-by-step" process. This particular multinational company focused on describing its upskilling programs and the processes it undertook to digitalize its workforce. The step-by-step process this company implemented to upskill its workers started with requiring all workers in particular divisions to participate in compulsory training to level up their digital skills and to support the new business model developed. This resulted in a decrease in the risk of current workers being laid off.

Overall, as summarized in the two examples above, our interview and FGD results indicate that there is no single formula for "going digital". Each company and business sector must develop its own strategy to level up the digital skills of its workers. The critical factor is how companies and governments ensure that the opportunity to upskill, from unskilled to basic or from basic to intermediate digital skills, is accessible to a broader section of Indonesia's workforce. Results from pilot surveys conducted by the Centre for Strategic and International Studies (CSIS) on the digital literacy and skills toolkit, undertaken in parallel to this project, strengthen this finding (Box 1 and Box 2). These surveys are being undertaken in the greater Jakarta area and only individual surveys are representative of this area.

Box 2. Results of CSIS pilot surveys on the current state of digital skills for empowerment and jobs

Referring back to Box 1 in this report, the current box also highlights the results of the pilot surveys conducted by CSIS in 2021, which collected information and data for a digital literacy and skills toolkit. These surveys were only conducted in Jakarta and are only representative of the individuals/entities included in the data collection process.

On the topic of the state of "digital skills for empowerment and jobs", within the pilot surveys, CSIS surveyed individuals and firms who work and operate in the field of "empowerment" and "jobs".

Here "Empowerment" represents the operationalization of digital literacy and skills through the involvement of individuals in digital-related activities: digital financial services, e-commerce, marketplaces, and e-learning either as users/consumers or providers/sellers. Meanwhile, "Jobs" focused on the use of digital skills for job-related activities.

The pilot survey revealed that in the field of "empowerment", digital skills are mostly leveraged for commerce-related digital platforms. Lack of interest and skills, as well as expensive internet access, were found to be factors that prevent individuals from taking advantage of the digital platforms available. In the area of job demand, the most important digital skills for all occupations were proficiency in office suite and project management skills. Most companies agreed that digital skills have become more important in the last five years due to high business competition, high standards of the products and services consumers demand, and adjustments in firms' organization/strategies. Despite this, only 39% of firms expressed that they had conducted digital skills-related training for their workers.

Basic digital skills were found to be required for workers to enter the labour market, whereas intermediate digital skills were required for occupations including advertising and marketing professionals, financial analysts and managers, engineers, and graphic multimedia designers. Dependent on the firm size, 73% of firms in the sample already employed ICT specialists. However, only 25% agreed that outsourcing is still required in their firms. In terms of job supply, higher digital skills within workers are present in the following skills: office applications, internet searches, and digital content editing. The most advanced sector in terms of digital skills is the tertiary sector, followed by the secondary, and primary sectors. Younger individuals tend to have higher digital skills. Based on a supply and demand analysis, 64% of firms in the sample agreed that the digital skills level of their existing workers is already in accordance with their needs, while the rest of the sample stated that their workers' skills were below or far below what was needed. Some strategies implemented by firms to fill this digital skills gap, from the most often employed to the least, included: providing training, none (no strategy), opening new job vacancies, and subcontracting work/tasks.

Source: Summarized by authors based on the CSIS survey results

Advanced digitally skilled workers

Our rough estimate from the analysis of Sakernas (2018 and 2020) data indicates that advanced digitally skilled workers make up less than 1% of all workers in the current Indonesian workforce.[48] Contrary to unskilled workers, workers with advanced digital skills are generally younger, male, and reside in urban areas in Sumatra and Java. Most workers with advanced digital skills work in the services sector, particularly in the ICT and financial and insurance service sectors.

The challenges that prevent accessible opportunities to increase digital skills to the advanced level reflect multifaceted disparities in Indonesia's education system. Advanced skilled workers tend to come from higher-income families. Based on our calculations using National Socioeconomic Survey (Susenas) data, approximately a quarter of college/university graduates come from the top income quintile. Workers living in urban areas are also significantly more likely to possess advanced digital skills. Furthermore, there is a slightly higher probability for men to be advanced skilled workers compared to women, indicating a gender gap in Science, Technology, Engineering, and Mathematics (STEM).

The relatively low proportion of women in STEM training represents a challenge that may hinder women's access to IT-related jobs and prevent them from becoming advanced skilled workers. IT graduates consist of more men than women, whether from vocational education or college/university (Figure 10). A 2017 ILO Survey also revealed that only 24.4% of Indonesian women studied in STEM courses, compared to 50% of Indonesian men (ILO, 2017).

Overall, non-STEM related fields dominate the courses offered in Indonesian colleges/universities. Of 29,777 study programs offered by higher education institutions (inclusive of public, private, religious-based, and institution-based colleges/universities), 57% are non-STEM courses (MoE, 2021). Only in the provinces of Bangka Belitung, Kalimantan Utara, and Sulawesi Tenggara did the number of STEM courses exceed non-STEM. In terms of the quality, the accreditation of STEM and non-STEM courses also differ by region, with STEM courses in Java being more likely to be accredited as A and B grade

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[48] This finding is similar to the results of a study conducted by ILO (2020) that estimated the percentage of ICT specialists among the labor force in several countries including Canada, China, Germany, India, Indonesia, Singapore, and Thailand. For Indonesia, they estimated that around 0.5% of the labor force are ICT specialists.

courses compared to those offered outside of Java, most of which possess a B-or C- level accreditations (Figure 11). This highlights that colleges/universities in Java provide a better quality of education for students to pursue higher education in IT-related studies. On the other hand, this also reflects that colleges/universities outside of Java that provide IT-related courses need to improve their quality of education services in order to produce higher quality STEM graduates.

Figure 10. Distribution of Vocational and College/University IT Graduates

Vocational IT Graduates

Male **58%** Female **42%** Urban **72%**

Rural **28%**

Younger **97%** (15—34 years old) Older **3%** (35—64 years old)

Sumatera **17%** Kalimantan **4%** Sulawesi **7%** Maluku & Papua **1%**

Java **67%** Bali/NT **4%**

College/University IT Graduates

Male **60%** Female **40%** Urban **83%**

Rural **17%**

Younger **66%** (15—34 years old) Older **34%** (35—64 years old)

Sumatera **24%** Kalimantan **4%** Sulawesi **7%** Maluku & Papua **2%**

Java **60%** Bali/NT **3%**
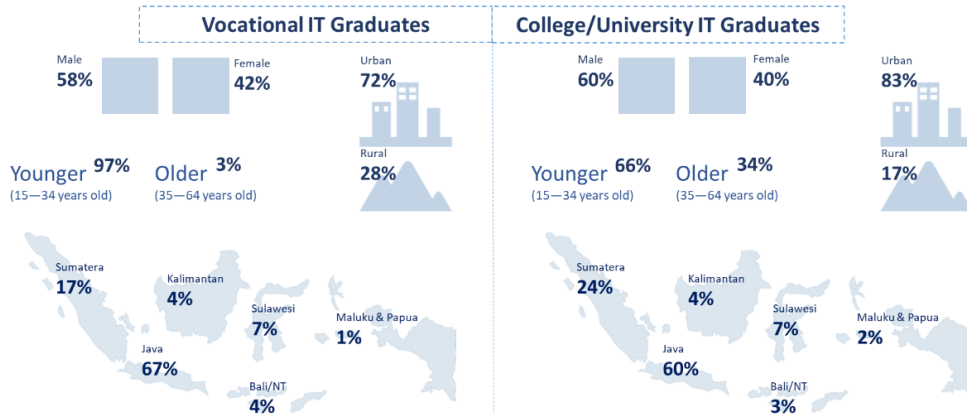
Source: Sakernas, 2018

Although more new IT courses are available, the number of students enrolled in these programs is still relatively small. IT program majors are not necessarily the most preferred courses of those who can afford a higher education. The latest data from the national university admission test (SBMPTN) indicate that approximately 57% of 777 thousand test-takers chose social science studies as their first choice.[49] The majority of students are more interested in studying law, management, and psychology. In terms of science subjects, the three top favorite majors were chemical engineering, medical studies, and electrical engineering.

Figure 11. Quality gap of STEM courses in Indonesia

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[49] The Ministry of Education's press release, "184.942 Siswa Lolos SBMPTN 2021", 14 June 2021.
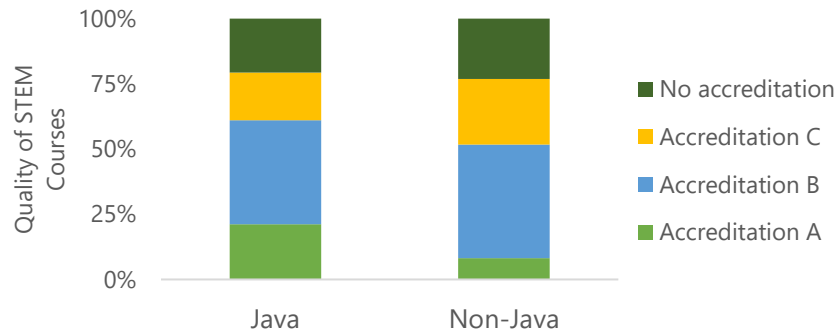
Over the past five years, there have been fewer IT students than non-IT students. Students' interest in studying IT courses increased between 2016 and 2019 but declined from 2019 to 2020 (Figure 12). This trend is also evident in non-IT students. However, the reduction in IT students was found to be more significant. Discussions we conducted with stakeholders from the MoE sought to explore the reasons behind this decline. Stakeholders revealed that high school students tend to have low interest in studying ICT subjects in higher education. One of the causes behind this lack of interest was that students experience a lack of exposure to the job options available for ICT graduates as they are faced with the choice of choosing IT-related courses at higher education levels. Students also significantly lack information on the different courses offered within ICT departments. Schools in Indonesia are generally required to have a career guidance bureau. However, most have not been effectively managed. As a result, the majority of students must search for information outside of the school to be aware of and to prepare for admission to an ICT university or college.

Figure 12. Trends in the number of ICT and non-ICT students, 2016-2021

Number of students

(Chart showing two lines from 2016 to 2020. Y-axis: Number of students, from 0 to 900.000. X-axis: Year, from 2016 to 2020.)

High gap

From 2019 to 2020, students' interest on IT-courses declined, including on informatics engineering

Non-IT students

IT students
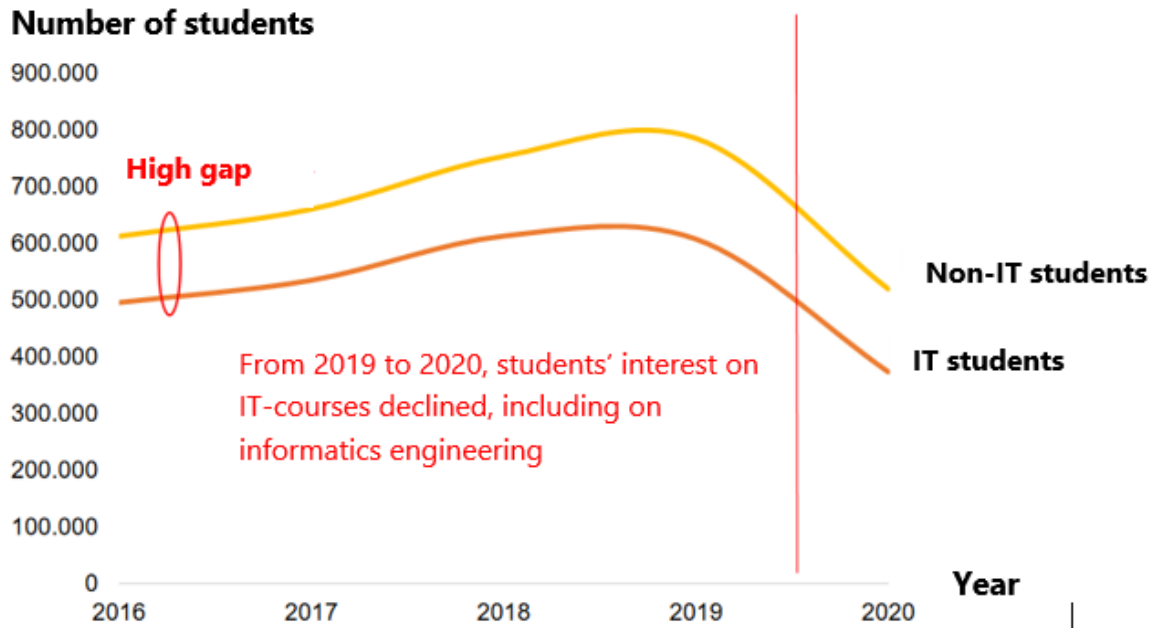
Source: MoE, 2021

**When examining the distribution of advanced skilled workers based on their job type, only 7% have jobs in the ICT sector.[50]** This low number does not necessarily mean that there is a skills mismatch or skill shortage; the relatively low numbers could be a result of many other factors, for example, the country's economic transformation, the skills gap between industry requirements and what is offered in mainstream curriculums, the proportional number of advanced skilled workers compared to workers with lower levels of digital skills, and so on. Keeping this in mind, Figure 13 illustrates the distribution of advanced skilled workers by industry type. Noting the limitations within the data stated above, the figure indicates that advanced skilled workers are employed in the non-ICT job sector and in occupations where one is required to perform digital tasks. It is important to note that we found the industries in which these skilled workers are employed to not specifically operate within the ICT sector (exclusion). The majority of advanced skilled workers already working in the ICT job sector are employed in high-skilled occupations, with technicians requiring the highest skills, followed by professionals and managers. This

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[50] The classification of ICT job sector is adapted from ILO (2020). It classifies ICT job sector based on the International Standard Industrial Classification of All Economic Activities (ISIC), Rev.4 on ICT sector job classifications. It includes classifications 2610, 2620, 2630, 2640 and 2680 (ICT manufacturing industries), 4651 and 4652 (ICT trade industries), 5820 (ICT service industries), 6110, 6120, 6130 and 6190 (telecommunications), 6201, 6202 and 6209 (computer programming, consultancy, and related activities), 6311 and 6312 (data processing, hosting and related activities; web portals), and 9511 and 9512 (repair of computers and communication equipment).

could point to the fact that having a higher digital skill level leads to a higher position in the industry. This is in in contrast to unskilled individuals, who are mostly employed as casual workers or work in low-skilled occupations.

Figure 13. Distribution of advanced skilled workers by job type
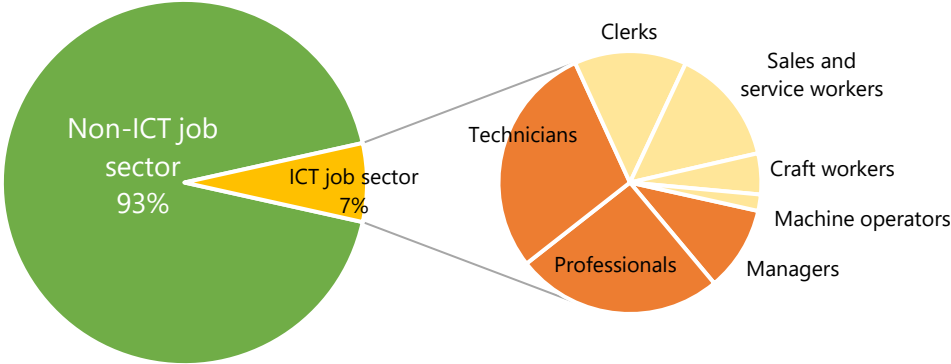
Source: Sakernas, 2018

Despite the above findings from the secondary data analysis, discussions conducted with relevant stakeholders suggest a more nuanced picture describing the reasons behind the shortage of workers with advanced digital skills. Interviews and focus group discussions conducted with universities, tech and non-tech companies identified "advanced digital skilled workers" as those who "not only have ICT knowledge and experience, but also possess significant soft skills such as communication skills and the motivation for self-development or continuous learning". Those who are willing to learn and can adapt in many different functions can more easily be upskilled. These are also the workers who have the potential to drive innovation. Communication skills are just as important, as workers with good communication skills are likely to occupy middle to top management positions. Less skilled workers equipped with managerial skills also require the ability to create a comfortable working environment.

Some advanced skills are scarce or lacking in Indonesia's workforce, including data scientists and specialized programmers and developers. These specific skills are particularly lacking at the middle to top managerial levels. Findings from the FGDs conducted with representatives of tech companies in Indonesia found that the "skill shortage" and "mismatches" between existing ICT skills and the skills required to contribute as a valued employees within the business were expressed as key reasons behind losses of productivity. The mismatch can be attributed to the low skill capacities taught by formal education institutions, which tend not to meet industry requirements for

the formation of an advanced skilled workforce. As a result, companies tend to find it difficult to hire workers with ICT backgrounds who fulfill the requirements for specific positions. This has prompted a number of companies to outsource their work to workers from other countries.

The need for "complementary" qualities was also regarded as a determinant of the mismatch between the capacity of the workforce and industry requirements. These complementary qualities include creativity, problem-solving, and analytical thinking, which some companies regarded as complementary to a higher level of technical skills, and essential to ensuring general productivity. Companies indicated that recent graduates tend to match specific technical skills and the complementary qualities required by the company *less* than those with more experience. This may therefore, again, be linked to the content of the curricula delivered in schools, which from these examples, tend not to match job market expectations.

Narrowing the gap in producing digitally skilled workers requires attention to access to ICT education and relevant training to improve workers' digital skills. The table below summarizes the discussion in this chapter, first outlining the existing condition of Indonesia's workforce broken down by skill levels. The table also notes the GoI's targets for 2030 regarding the advancement of IT skill up-take within the nation and presents a descriptive summary of the constraints Indonesia faces in achieving the targets set. The summary table acts as a guideline for the discussion on digital skills fundamentals outlined in Chapter 4.

Table 10. The workforce's digital skills gaps in Indonesia

Existing condition	Target	Constraint	Digital skills fundamental
In 2020, 50% of the labor force in Indonesia possessed basic and intermediate digital skills, while individuals with advanced digital skills represented less than 1% of the workforce.	▪ There is a need to produce 9 million digital talents by 2030, or 600 thousand advanced digitally skilled workers on average per year. ▪ 50% of workers possessing intermediate to	Access to higher education is one means of producing more digital talents as it allows students to study computational thinking skills and to develop the problem-solving skills required for digital development. However, access to higher education varies depending on economic status, with 14% of individuals in the bottom quintile having completed high school and above, compared to 49% of those in the top quintile. Local government spending on higher education is limited, especially in provinces with tight fiscal capacities.	Formal education

	advanced digital skills by 2024.	No minimum standard of digital competencies has been required for non-ICT students. The ICT competencies of non-ICT students are generally limited to the use of digital applications and tools.	Formal education
		Students exhibit low interest in studying ICT-related fields. 57% of participants in the national university admission test chose social sciences as their field of study. Students have a lack of exposure to the job prospects of ICT graduates, including the details of courses offered by ICT departments. Schools generally provide a career guidance bureau. However, they are generally ineffective, meaning that the majority of students are required to search for information outside of school to prepare them for ICT university and college admission.	Formal education, Finance
		The quality of BLK graduates is still insufficient to meet industry requirements and issues remain on how to involve industry in the preparation of BLK curricula and instructor training. Several BLKs were reoriented by the government leading to the elimination of ICT-related courses. The GoI focuses on courses that are in high industry demand, of which ICT is not one. Several BLKs have now returned to providing ICT training. However, this is limited to BLKs in Java.	Vocational training; Policy
		On-the-job training is an opportunity for workers to masterskills according to the industry/company's needs. However, it is still rare for industries/companies to provide OJT (limited to big companies with well-designed organizational planning). A super tax deduction exists as regulated by PP No. 45/2019, which forces industry to provide OJT to its workers. To date, only 42 taxpayers have made use of the super tax deduction incentive scheme.	On-the-job training; Policy
		Upskilling activities in private training institutions generally provide better-quality training that helps workers to develop industry-relevant skills. This is due to the support ofcurricula that are more in line with industry trends, the provision of access to professional instructors/mentors, and support in searching for jobs. However, the relatively high cost of participating in private training institutions further limits opportunities for workers to access the training provided.	Vocational training

| In 2021, the number of MSMEs that had been on-boarding reached 13.7 million, or 21% of all MSMEs in Indonesia. | The GoI aims to have 30 million MSMEs enter the digital ecosystem by 2024. | Knowledge on the benefits of participating in the digital economy is not evenly distributed across SMEs, especially among vulnerable groups: individuals in rural areas, with lower levels of education, and above 40 years of age. A lack of knowledge on the benefits of digital MSMEs has implications on limited experience in the digital economy and basic digital literacy and skills. | On-the-job training; Policy |

Source: Authors

5. Fundamentals to Improve Indonesia's Digital Skills

This chapter summarizes the main findings presented in the previous chapters. The **digital skills fundamentals outlined in Chapter 3 emphasize the core elements that should be addressed in creating digitally literate citizens and digitally competent workforces.** Furthermore, this chapter indicates pathways to improve the current state of Indonesia's digital skills by outlining specific strategies regarding the uptake of ICT skills, which should be implemented to accelerate Indonesia's development goals.

Based on the research steps outlined in Chapter 1: triangulating grey literature reviews with secondary data analysis, and a consolidated analysis of the results of FGDs, interviews, policy dialogues, and thematic workshops, we found that three channels and three enablers are required to develop digital skills in Indonesia. Digital skills channels cover formal education, vocational training, and on-the-job training. The effectiveness of these channels requires that the government facilitate policy, financial, and infrastructural frameworks that enable the creation of a conducive ecosystem for ICT skills development.

5.1. Channels

Formal education, vocational training, and on-the-job training are strategic channels to improve digital skills in Indonesia. Based on a consolidated analysis of the results of thematic workshops, policy dialogues, FGDs, and in-depth interviews, the importance of each digital skills channel is summarized in the table below:

Table 11. Indonesia's digital skills channels

No	Channel	Core elements	Importance
1	Formal education	Access to education, curriculum, and teaching quality	Systematic and structured channel to improve digital literacy and foundational digital competency for work.
2	Vocational training	Access to quality training	Flexible and inclusive channel to upgrade digital skills outside of formal education.
3	On-the-job training	Upskilling programs for both formal and non-formal workers	Systematic and purposive channel to reskill and upskill workers' digital competencies.

Source: Author

5.1.1. Formal Education

Formal education is a strategic channel to equip the Indonesian workforce with digital skills in a systematic and structured way. Primary education will provide individuals with the basic digital literacy skills to be able to use technology for their daily needs in meaningful ways. Secondary and tertiary education will then equip students to embrace intermediate to advanced digital skills, which are key to ensuring sound employment opportunities. Individuals with higher education levels will then have the opportunity to master more advanced digital skills.
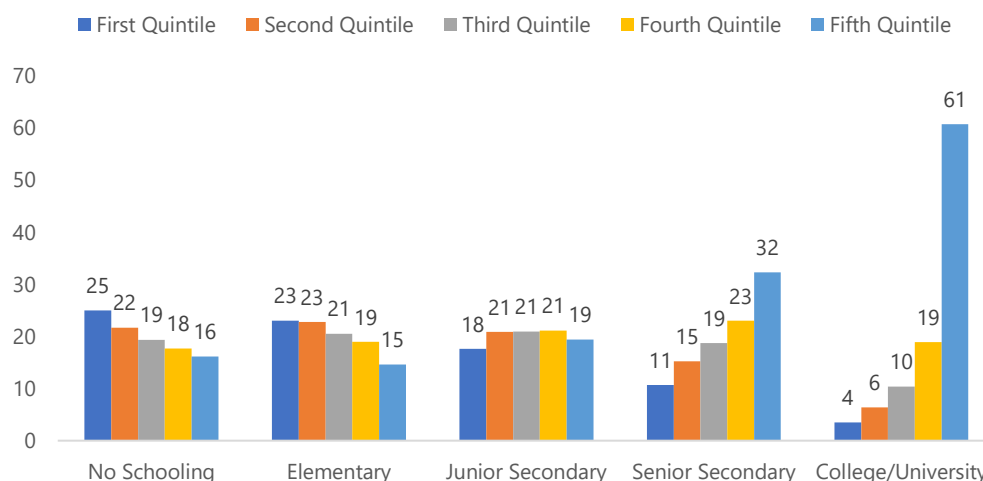
The effectiveness of the formal education system in improving students' competencies is, however, highly dependent on the quality of education. Based on policy discussions and thematic workshops[51], we found two key elements influencing this aspect: the curriculum and teaching staff. The curriculum applied directs the set of competencies students are expected to achieve. The success of the curriculum is then determined by the teaching staff's capacity to support the delivery and effective functioning of the study goals set out within the curriculum.

Access to education

Education policies in Indonesia have been successful in increasing participation at the primary level. However, social inequality and geographical challenges, particularly outside of Java, prevent people from continuing to secondary and higher education. Although the government has implemented various scholarship programs, public participation in higher levels of education, particularly among those from lower-income groups, has gradually declined (Figure 14). Without scholarships, access to higher education is prohibitively expensive. Poor communities also face difficulties fulfilling the merit-based scholarship selection criteria to access tertiary education (Hill and Thee, 2013).

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[51] This issue was highlighted during thematic workshops on basic education and vocational/higher education.

Figure 14. School attainment by quintile

Figure 14. School attainment by quintile

Legend: First Quintile, Second Quintile, Third Quintile, Fourth Quintile, Fifth Quintile

Category	First Quintile	Second Quintile	Third Quintile	Fourth Quintile	Fifth Quintile
No Schooling	25	22	19	18	16
Elementary	23	23	21	19	15
Junior Secondary	18	21	21	21	19
Senior Secondary	11	15	19	23	32
College/University	4	6	10	19	61

Source: Susenas, 2020

Curriculum to improve digital skills

Indonesia has updated its national curriculum for primary and secondary education over the last two decades. The current curriculum policy is the 2013 Curriculum (K13), which has implications for ICT subjects.

Before 2013, ICT subjects were considered compulsory. The main orientation was to introduce basic ICT hardware and tools, including the skills needed to use a computer and for typing in word processors, including Ms. Word. The Ministry of Education's evaluation, however, led to changes in the curriculum in order to urge schools to focus on high order thinking skills (HOTS). Conceptually, HOTS extend learning outcomes from remembering, understanding and applying, to analyzing, evaluating, and creating.

In terms of digital skills, the implementation of K13 resulted in the elimination of ICT subjects as stand-alone compulsory subjects. ICT learning is expected to be integrated into other subjects in order to equip students with basic digital literacy skills, as well as to enable them to demonstrate these skills across different subject areas. Unfortunately, the integration of ICT material into other subjects has not taken place. Most learning is re-taught through conventional methods, only aiming to introduce basic digital hardware skills (similar to the focus of the curriculum before the changes in K13). In extreme cases, ICT subjects are not provided, due to the K13's mandate to make these subjects not mandatory. The poor translation of the national curriculum into schools'

teaching and learning activities creates significant barriers for Indonesian students to access basic ICT skills training.[52]

At the tertiary education level, the policy dialogues highlighted the importance of developing an "occupation-based" curriculum. Vocational IT school and college/university level curriculums are not in line with current digital trends and industry needs. The current curriculum focuses on equipping students with foundational skills, including basic coding and computational thinking. However, industry requires more advanced skills. ICT graduates must possess the skills to master emerging digital tools complemented by significant levels of analytical, critical thinking, and problem-solving skills. This will enable graduates to translate data and information they produce through technical skills into valuable insights for decision making and business model improvements, which aim to increase industrial productivity.

Such industry demands may be problematic for formal education institutions as they have limited room to incorporate rapid changes in emerging technologies and tools into their teaching materials. The opening of new courses or study programs may be an alternative solution to these challenges. Nevertheless, most ICT schools continue to experience difficulties in complying with applicable regulations, for example, the compulsory criteria to employ lecturers with a specific linear background.[53]

Another opportunity is presented through the implementation of the 'Kampus Merdeka'[54] program, initiated by the MoE. This program encourages universities and vocational schools to open flexible courses to students that are outside of the school, for example, offering industry-based internship programs for longer periods of time. The program requires a greater commitment between educational institutions and industry, particularly to ensure the improvement of students' digital competencies for work. ICT schools continue to face obstacles in the program's implementation, ranging from challenges in reaching agreements to preparing an internship syllabus that matches industry requirements.

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[52] This issue was raised during the thematic workshop on basic education.
[53] e.g., an information systems lecturer must hold a bachelor, master, and doctoral degree in a similar major to information systems.
[54] Previously, the internship program was non-obligatory lasting 1-2 months or 3 course credits. Currently, through the Merdeka Belajar program, the internship is obligatory, lasting up to 6 months or 20 course credits.
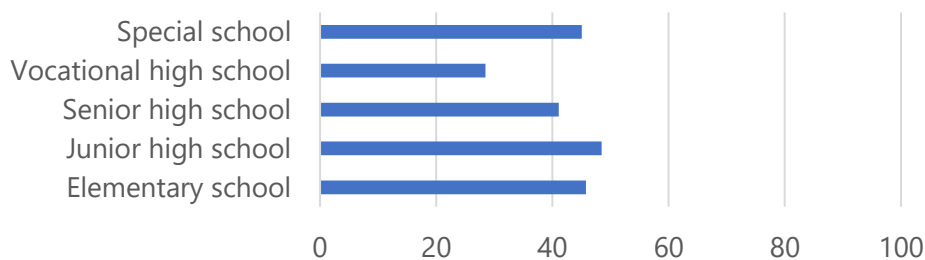
Teaching quality

The quality of formal education teachers at all levels is important to support the development of the ICT curriculum and to ensure its content is delivered effectively. This is not only related to substantive abilities but also methodological skills to deliver teaching materials (pedagogy).

The low quality of teaching staff is caused by limited opportunities for staff to participate in quality professional teacher training programs and the weak desire of educators to continue learning[55]. Data from the Ministry of Education and Culture (2019) show that more than half of educators at the primary and secondary levels have not been certified. The rate of teacher certification in vocational high schools was only 28.49% (Figure 15).

Figure 15. Percentage of certified teachers by education level

Source: MoE, 2019

In vocational schools and universities, the expertise of educators is crucial to improve the quality of teaching. According to National Development Planning Agency data, only a few lecturers in IT colleges have doctoral degrees. Although scholarships are available, only few lectures meet the criteria, especially if they wish to continue studying abroad.

Efforts to improve the expertise of educators/lecturers through research and development (R&D) activities are also limited. The implementation of R&D is still in the normative realm; there are a limited number of applied research program that have been tested to support the development of teacher expertise and improve curriculums to align with industry needs. Our FGD with lecturers demonstrated the difficulties in conducting R&D programs, as they are burdened by administrative matters and are not equipped with sufficient funding. Indonesia's higher education system obliges lecturers to teach, conduct R&D,

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[55] This issue was raised during the thematic workshop on vocational and higher IT education.

and carry out community development projects. This approach differs from other countries, including Australia and the UK, which allow lecturers to specialize in research, thus, allowing them to have a lower teaching load.

5.1.2. Vocational Training

Vocational training normatively has a more agile and inclusive approach in providing digital upskilling programs. It can offer various majors and digital upskilling programs for individuals from various educational backgrounds, and high school and university graduates. Outside of formal education, vocational training opportunities generally revolve around government-owned training institutions (BLK) and private training institutions (PTI). The availability of quality training can act as a strategic channel to equip workforces that are currently dominated by individuals with low educational backgrounds.

Access to quality training

Private training institutions are typically more agile in developing competency-based syllabuses than BLKs. They have experienced instructors and the resources to research industry demands. Private training institutions are able to research industry demands faster than formal institutions, including universities, which usually take at least four years to adjust their curriculums.

Private training institutions are also able to offer more specific ICT competencies related to industry needs, for example, data science, programming languages, full-stack web development, UI/UX design, Android-based engineering, and so on. Almost all BLK training programs are basic and intermediate level. However, the price of training packages at private training institutions is relatively high, making it unaffordable for the unskilled worker group, which is dominated by the poor.

Moreover, private training institutions are not evenly available in all provinces of Indonesia. As addressed in the TNP2K study (2015), almost 50% of all private training institutions are located in Java, in West, Central, and East Java provinces. These numbers may be due to the fact that Java is one of the wealthiest and most populated regions in Indonesia. Due to the disparity between Java and non-Javanese regions, it is crucial to consider infrastructural inequality between the regions. The importance of taking this infrastructural gap between the regions into account within policies, in particular, is highlighted as it has become a significant obstacle, which is hindering the upgrading of

unskilled workers to skilled workers in Indonesia, i.e., those who possess skills that are on par with an intermediate level of digital skills literacy.

On the other hand, BLKs are places/platforms for vocational learning that are spread out more evenly across the regions, being located in almost all *urban* centers in Indonesia. The quality of BLK centers managed by the national government is higher regarding their ability to increase the competencies of participants compared to BLKs that are managed by sub-national governments. Of the 23 BLKs operating under the MoM, however, only eight prioritize ICT courses.

The lack of ICT courses provided by BLK managed by the MoM is also caused by the government's intention to implement the reorientation, revitalizing, and rebranding (3R) program. Since 2016, the 3R program has been mainly designed to accelerate the increase of talents in specific prioritized competencies. The MoM's policy is to prioritize vocational skills that are in high industry demand. Despite the increasing importance of technology, however, this prioritization of competencies has led to the elimination of IT-related courses in some BLKs. For example, IT-related courses in BBPLK Medan were closed after the reorientation program, as MoM instructed the institution to prioritize two focus areas in their training programs: tourism and construction. As a result, IT-related trainers at BBPLK Medan were transferred to other regions. Out of all BBPLK training centers, the only BBPLK specifically assigned to focus on IT-related skills is BBPLK Bekasi, located in West Java. This BBPLK is mostly only accessible to individuals living in the main urban areas and suburbs of the Jakarta Metropolitan Area, where many private training institutions are already available. Meanwhile, 282 BLKs under the authority of local governments continue to face challenges relating to quality, both in terms of compiling competency-based curricula and in terms of the capacity of teaching instructors[56].

5.1.3. On-the-Job Training

On-the-job training is a strategic channel to increase the digital competencies of workers. A more systematic approach is required to develop digital competencies in formal and non-formal workers, including those operating within SMEs, benefiting industrial productivity through digital transformation.

According to interviews with tech and non-tech companies, currently, upskilling efforts rely mostly on individual initiatives, for example, initiatives to enroll in free

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[56] This issue was raised during the thematic workshop on upskilling opportunities.

online platforms rather than the upskilling programs required by employers. Start-ups that have developed into big tech companies are relatively more aware of the importance of talent mapping and upgrading. They provide more systematic upskilling programs for their employees, for example, three-month induction programs for new workers, buddy and mentoring programs, and regular internal knowledge sharing.

The government is encouraging more entrepreneurs, especially in micro and small enterprises, to go digital. This effort is implemented by developing SME on-boarding programs with tech-industry experts and practitioners, including e-commerce, EdTech, and on-demand service companies. However, the government's efforts still face the challenge of reaching broader SME actors, especially those operating outside of Java.

5.2. Enablers

The functioning of digital skills channels requires *enabling* support in terms of policies, finances, and infrastructure. The table below summarizes the importance of each digital skills enabler:

Table 12. Indonesia's digital skills enablers

No	Enabler	Core elements	Importance
1	ICT and energy infrastructure	ICT infrastructure, internet, and digital device prices, and electrification.	Enabling people opportunities to access digital networks and participate in the digitalized economy ecosystem.
2	Investment in education and innovation	The financial structure of education sectors and research and development	Determining investment in the development of digital skills and digital technology advancement.
3	Policy enabling environment	Policy framework on digital economy and digital skills	Leading the vision of digital skills development in Indonesia

Source: Authors

5.2.1. ICT and Energy Infrastructure

**Access to affordable internet and connected devices is the main means of encouraging the development of digital skills and the use of digital tools.** Ensuring access to the internet as the civil right of every citizen is the best way to leave no one behind in digital economic development. To be effective, the provision of internet access must be in line with access to digital supporting devices, such as mobile phones and

computers. The importance of both internet access and access to digital tools has been enhanced during the pandemic as most school-based activities must be conducted online using the internet and digital devices. This has made learning difficult for poor communities, for whom owning a mobile phone or other devices is a luxury. This has prompted many initiatives led by the private sector, community organizations, and fundraising platforms to assist in providing smartphones to poor students.

The provision of ICT infrastructure

More than 50% of the frontier, outermost, and least developed regions have no access to the internet. More than 70% of villages in the provinces of Maluku, Maluku Utara, Papua, and Papua Barat reported weak or under-3G signals (Figure 16). Of the 34 provinces in Indonesia, only in DKI Jakarta were all municipalities found to have access to 4G internet. Bali and NTB have more villages with 4G internet access than the rest of Indonesia's provinces, as these two provinces depend on tourism for their economy. For the two provinces, in which the tourism industry supports the livelihoods of almost all communities, the urgency for high-quality internet connection to reach all remote villages, for example to support local and foreign tourists' ability to obtain information on available tours, may have led to their more advanced development in regard to access to internet connection within these provinces.

Figure 16. Villages with internet access
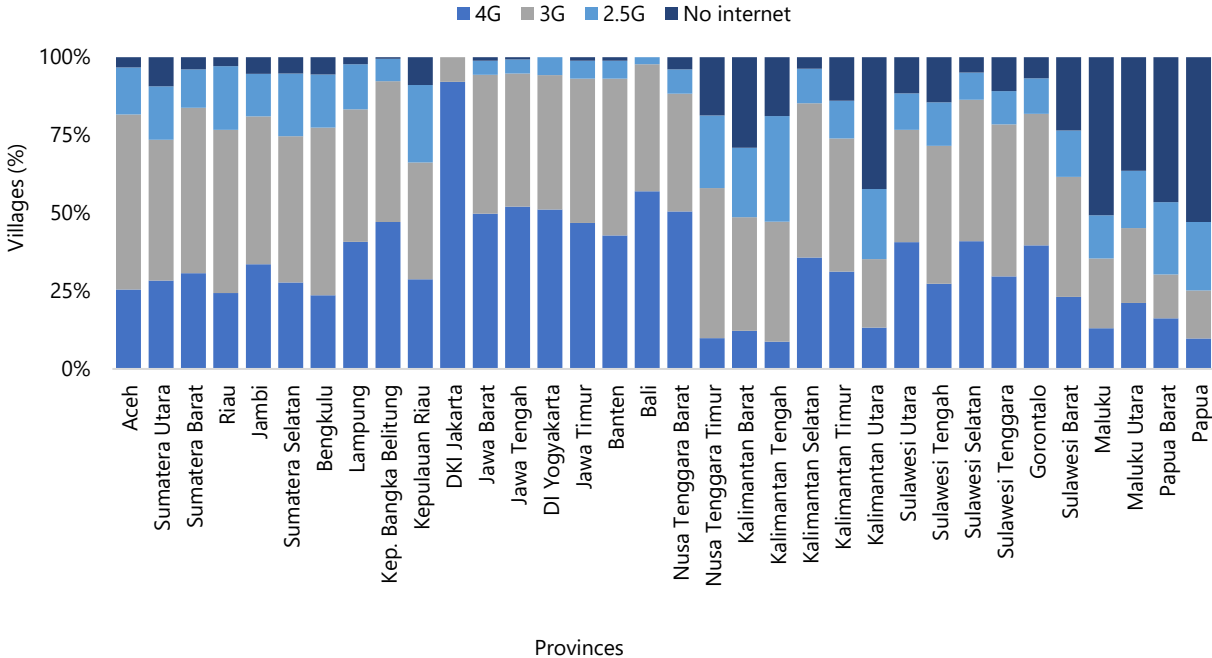
Source: Podes, 2020

For most Indonesians, internet access in public spaces is rare. In a 2020 APJII survey, 43% of respondents stated that local governments did not provide internet hotspots in public areas. Providing internet access in public places can improve people's digital connections. Our analysis of Susenas 2020 data found that 12-20% of people access the internet through public spaces, including schools and local government offices. The MCI (2020) noted that as many as 150,000 of the 501,112 public service points in Indonesia do not have internet access. The public service points include 3,700 health facilities, 93,900 schools, 47,900 village offices, and 4,500 other public service points.

Although the skeleton infrastructure for network connections is available through the Palapa Ring[57], backhaul networks and last-mile networks, which determine the quality of access to both 3G and 4G networks, depend on the decision of telecommunication providers on whether to invest. The equitable distribution of internet infrastructure development is strongly influenced by cooperation with the private sector (Bachtiar et al., 2020). For areas located far from the backbone network, the alternative is to build many base transceiver stations (BTS) or increase the capacity of existing BTS to achieve 3G or 4G internet networks. This, however, requires significant infrastructure support that only the government can provide, including electricity networks, roads, and maintenance costs. Public-private collaboration is, thus, key to establishing high-quality internet connections in remote areas.

In addition to the challenges described above, the provision of internet networks is constrained by geographical conditions, particularly in the 3T regions. The provision of internet networks within these regions is expensive, particularly considering the relatively small population sizes of these regions and the fact that most individuals living within the regions fall under the low-middle-income bracket. These reasons lead to the 3T regions being less profitable for internet network providers, despite higher internet package costs.

Internet price

Compared to other Southeast Asian countries, the price of internet plans in Indonesia is among the highest.[58] For example, Thailand citizens pay 51$PPP per month to receive 50 Mbps of internet speed, while in Indonesia, 78$PPP is required for only 10 Mbps of internet speed (CEIC, 2020).

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[57] The Palapa Ring is a telecommunications infrastructure project in the form of fiber optic network constructions throughout Indonesia covering a length of 36,000 kilometers. The project consists of seven small fiber optic loops (for Sumatera, Java, Kalimantan, Bali & NT, Sulawesi, Maluku, and Papua) and one backhaul to connect them all.

[58] Comparing the price of fixed broadband plans.

Within the nation, the disparity in digital infrastructure across the regions has caused a price gap between Java and areas outside of Java. The price of internet is high for the poor, in particular individuals living in the 3T regions. For example, in Nunukan District, North Kalimantan, the price of 1GB of internet is IDR 120 thousand or the equivalent of US$8.5. In comparison, the equivalent value of IDR 120 thousand can be used for 10GBs of internet on Java Island (Jatmiko, 2021).

Law No. 11/2020 on Job Creation changed several articles in Law No. 36/1999 on Telecommunications. These changes led to an emphasis on the need for telecommunications network operators to be able to independently determine the price range of their services. However, under certain conditions, the state government may determine the upper limit or lower limit prices. In addition to these policy options, the "one-price policy" for internet packages provides an opportunity to distribute equal access to the internet. This policy was brought forward by the Telecommunication and Information Accessibility Agency (BAKTI)[59], a body which continuously supports the implementation of a "one-price for the internet" policy in Indonesia to reduce inequality in internet access and to ensure that high-speed internet is evenly distributed throughout Indonesia. This "one-price" policy in the pricing of public goods may well succeed in reducing inequality, as it has been implemented in Indonesia previously within policies used to govern the subsidies related to fuel pricing. One key aspect that contributes to the success of the one-price policy for fuel, however, is the existence of *one* state-owned enterprise which is the *only provider* of fuel services. This is more difficult to apply to internet packages, as many private providers are involved in the distribution process[60].

Digital device ownership

Digital device affordability is essential for public digital connectivity. The APJII 2020 survey emphasized that ownership of digital devices, including mobile phones and computers, is the main obstacle individuals face in surfing the internet, second only to the problem of an "inability to use technology". Although trends in mobile phone ownership have continued to increase over the past decade, more than half of the population in rural areas (51%) do not own a mobile phone (Susenas, 2020). In Indonesia, the sale of low-end smartphones is increasingly dominant, particularly of devices within the price range of USD 100-300[61]. This price is equivalent to a minimum of 78% of the monthly income of

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[59] BAKTI is agency that is in charge of the realization of the Palapa Ring Project, expansion of BTS construction, the provision of internet access in the 3T regions, and the development of digital ecosystem.
[60] This issue raised in the thematic workshop on ICT infrastructure.
[61] See IDC 2020 Survey in https://tekno.kompas.com/read/2021/03/19/06270037/smartphone-murah-makin-mendominasi-di-indonesia.

the urban poor, and is potentially more expensive for those living in rural areas and regions outside of Java, due to high logistics costs.

Electricity

Electricity infrastructure deficits have led regions, especially in rural eastern Indonesia, to be unappealing to private players looking to expand their broadband services. Access to electricity is a fundamental enabler of digital participation. The electrification ratio in Indonesia is 99%, meaning that almost all households in electricity grid-connected areas have access to electricity. A reliable electricity grid supply is, however, lacking in hard-to-reach provinces, for example in NTT and Papua. Indonesia has 111 frontier-small islands, and more than 3,000 villages are located in valleys and 14,000 on slopes. Grid investment is costly as these areas typically have scattered and smaller populations. Several rural eastern provinces live with an erratic 12-hour-a-day electricity supply. This is reflected in the quality of the electricity supply in Indonesia, which ranks 86 out of 137 countries, behind both Malaysia (36) and Thailand (57).[62] These communities face difficulties in using the internet, which affects their efforts to improve their digital skills.

5.2.2. Investment in Education and Innovation

As a strategic human development agenda, the effectiveness of digital skills development is highly dependent on investment in the education and innovation sectors. Investment in education is required to ensure the availability of financial resources to support increased access to and quality of digital skills channels through formal education, vocational training, and on-the-job training. Investments in innovation will encourage the mastery of digital skills, focusing on the ability to harness emerging digital technologies.

Education spending

Since 2009, the GoI has been committed to achieving the 1945 constitutional mandate to allocate 20% of the state budget (APBN) to the education sector. This allocation is relatively maintained by gradually increasing the nominal value of

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[62] See WEF Global Competitiveness Index (2017) in http://reports.weforum.org/global-competitiveness-index-2017-2018. The index assesses the reliability of electricity in each country (lack of interruptions and lack of voltage fluctuations).

government transfers to the sector. This includes the latest investment decisions the central government has made with regard to education in the 2010-2020 period.

Most of the money allocated for education spending is sourced from the APBN and is managed by local governments. In 2019, for example, 62.62% of the IDR 492 trillion education budget was allocated through the Transfer to Regions and Village Fund (TD3) policy. [63] The central government manages approximately IDR 163 trillion spread across 21 Ministries/Institutions, with the largest allocations being granted to the MoRA (33.8%), Ministry of Research and Higher Education (26.2%), and MoE (23.4%).

The 1945 Constitution also mandates that each local government, at both the provincial and district/city level, should allocate 20% of their local budget (APBD) to education. However, to date, most local governments do not have the capacity to implement this mandate. At the provincial level, only Riau (20.7%), West Sumatra (20.9%), Riau Islands (25.7%), and East Nusa Tenggara (29.2%) allocated their 2019 APBD to education budgets at a level that was above 20% of their APBD (

Figure *17*). Only 22, or 4.3%, of the 502 districts/cities implemented the constitutional mandate in the same year.

By looking at such fiscal policies, it is evident that the role of sub-national governments is crucial in ensuring the quality of education spending. The level of understanding and commitment of local governments to the importance of skills development determines the translation and implementation of policy directions regulated by the central government to improve the quality of learning outcomes, including the strategy to enhance human resource quality through digital skills.

The results of our policy dialogues highlighted that a significant increase in educational sector spending has been used to cover substantial increases in teachers' salaries. Although this signals an advancement in the need to value teachers' role in educating the nation, these increases did not go hand-in-hand with an increase in learning outcomes in Indonesia. Education sectors are required to improve education quality, including in the implementation of the national curriculum, teacher governance, and learning activity

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[63] Around IDR 168 trillion or 54.8% of TD3 spending in 2019 was the General Transfer Fund (DTU), the allocation of which would depend heavily on local commitment to translating central government policies to improve the quality of learning outcomes. In addition to DTU, around IDR 134 trillion of TD3 was transferred in the form of the Special Allocation Fund (DAK), most of which was regulated by the central government for professional teacher allowances (42.2%) and School Operational Assistance (39.9%).

facilities. Increasing teacher compensation is of course required, however, this is only the first step in ensuring an increase in the quality of the delivery of teaching materials, which will later lead to significant increases in students' skills and achievements.

Figure 17. Subnational spending on education
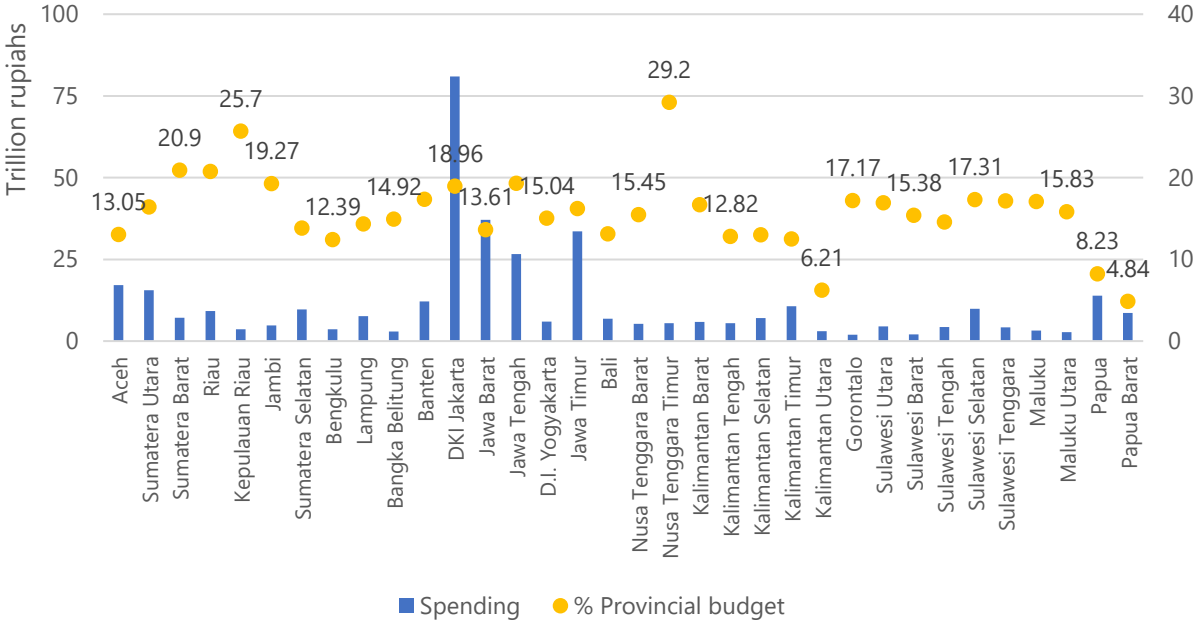
Source: MoE, 2019

Research and development

Indonesia has a relatively small proportion of research and development (R&D) spending compared to other countries. UNESCO Institute for Statistics (UIS) [64] noted that Indonesia's total R&D spending in 2018 was only around USD PPP 7,051.36 million or 0.23% of GDP (Figure 18). This percentage is lower than the average for middle-income countries, which allocated above 1% of their GDP to R&D.

The largest source of funding for Indonesia's R&D sector comes from the government (87.7%). Almost all of this allocated budget is used by government institutions themselves, including research units in ministries and local governments, and higher education

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[64] See UNESCO Institute for Statistics (n.d.) 'How Much Does Your Country Invest in R&D?' [online] <http://uis.unesco.org/apps/visualisations/research-and-development-spending/> [8 December 2021].

institutions. The contribution of business enterprises to R&D spending in Indonesia is still minimal, at around 8%.

Figure 18. R&D spending in selected countries
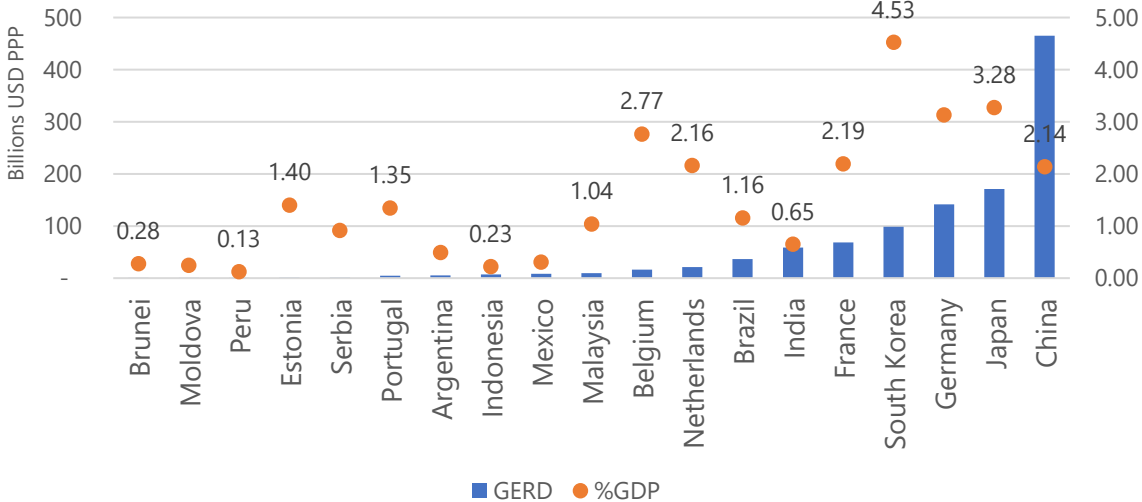
Source: UNESCO Institute for Statistics

Our policy dialogues strengthen the above findings and highlight the problematic quality of existing spending choices within the education sector. These issues arise due to a miss-match between the types of R&D projects implemented and the actual needs and demands of industry and business sectors. R&D continues to be implemented sporadically with a relatively small budget per activity. Although Presidential Regulation 11 of 2019 was issued to improve the R&D ecosystem in Indonesia, R&D activities do not yet have a strategic agenda and lack focus in terms of encouraging digital innovation and transformation.

Currently, not enough data exist to provide a detailed breakdown of the components of R&D-related budget spending in Indonesia. Therefore, it is challenging to specify whether R&D funding is specifically channeled toward activities promoting digital innovation and transformation. Despite this, the policy dialogues highlighted that investing R&D funds into ICT related projects is not yet a priority. One indication of this finding is that only 18 industries in Indonesia have achieved INDI 4.0, the standard to attain digital transformation. This demonstrates that, currently, industry-based research and development activities are mainly utilized to upgrade or upscale company products, and

not to mobilize digitalization to improve business models. Many of the company representatives interviewed, especially those in the agriculture or non-services sectors, felt that investing in ICT development was irrelevant, and that they were unwilling to risk the uncertain benefits that arise from investment in digitalization.

5.2.3.   Policy Enabling Environment

Indonesia's 2020-2024 RPJMN emphasizes "mainstreaming digital transformation" to accelerate the achievement of the nation's development goals. This mainstreaming aims to optimize the role of digital technology in increasing productivity and efficiency in modern production and to provide convenience and comfort within service delivery channels for consumers. Three important policies that are driving the transformation of the digital economy are outlined in the following table:

Table 13. Selected digital economy framework in Indonesia

No	Policy	Content	Leading ministry
1	Creating Indonesia 4.0	A roadmap to implement 4IR in 5 priority sectors: food and beverage, textile and apparel, automotive, electronic, and chemical. This roadmap will be the instrument to achieve Indonesia's aspiration to be one of the top 10 global economies in 2030.	Ministry of Industry
2	Presidential Regulation No. 74 of 2017 on Ecommerce Roadmap	A roadmap to increase access to funding and facilitate SME on-boarding to e-commerce. It also promotes consumer protection during e-commerce transactions.	Ministry of Trade
3	Presidential Regulation No. 95 of 2018 on Electronic-Based Government Systems	A framework to improve public service delivery by integrating data/information and digitalizing business processes between government institutions using digital systems, platforms, and infrastructure.	Ministry of State Apparatus and Bureaucratic Reform (MBR)

Source: Author

Policy framework on digital skills

Although the government already has a set of regulations that encourage digital transformation, there is no policy framework that specifically directs the

development of digital skills in Indonesia. This framework is essential, as it will determine Indonesia's success in implementing and benefiting from digital transformation, and must be included in Indonesia's human development agenda. Digital competence of the workforce is required to increase the business sector's productivity, while digital literacy allows individuals to access more value from a digitalized economy.

The MCI is preparing Indonesia's 2021-2024 Digital Nation Roadmap, which includes a digital skills framework and roadmap. The roadmap is still in the early stages of its development, and the detailed policy document it contains is not yet publicly available. In general, however, the roadmap positions "digital skills" as a core element in the "digital people" pillar, which supports the realization and formation of a digital society, digital economy, and digital government. During the policy dialogues, the MCI explained that the roadmap will complement the MCI's strategic plan in regard to digital development.

Within MCI Regulation No. 2 of 2021 on the "MCI strategic plan", digital talent development and policies concerning this challenge are directed to increase (1) the society's digital literacy and (2) to accelerate digital transformation in the economic and business sectors. Increasing digital literacy aims to prepare and equip citizens with the basic skills to use digital technology and to avoid the dangers of spreading harmful content on the internet, including hoaxes, cyberbullying, and radicalism. The development of digital skills to accelerate economic transformation is then directed at increasing the technical and managerial skills of the workforce in order for them to achieve intermediate to advanced levels of ICT skills.

The MCI's initiative to prepare their digital skills framework must be connected with programs and policies implemented by other ministries. CIPS (2021) identified 14 ministries/ agencies at the national level that have interests in the digital economy setting. With regard to this issue, our policy dialogues revealed that the absence of a ministry/ agency specifically assigned to leading the digital transformation agenda in a holistic manner has acted as a significant barrier to successful digital development. In particular, stakeholders emphasized the need to recognize that there are many silos to digital skills development and that progress can only be achieved through an integrated system of policies across different ministries.

The digital skills development framework needs to be a strategic agenda for human development, and thus both the MoE and MoM must be involved. This synergy would be able to open collaborative discussions and solution finding. As an example,

stakeholders we interviewed outlined the possibility of applying a digital literacy module prepared by the MCI, but implemented by the MoE through its education curriculums, designed to integrate ICT training into mainstream subjects.

Furthermore, this implementation framework needs to foster commitments from other ministries/agencies that aim to implement digital transformation agendas, including the MoI, MoT, and MRB. This integrated framework will also support the promotion of sectoral contributions, in particular from the private sector, in the government's efforts to accelerate digital upskilling within the development agenda.

Government capacity

The GoI does not have a specific policy on digital government that stresses the importance of digital skills for public servants. Although the Ministry of State Apparatus Empowerment and Bureaucratic Reform—as the national agency responsible for developing bureaucratic efficiency and for recruiting public servants—has developed the Electronic-Based Government System (SPBE) as a national framework to drive public sector digital transformation, the framework does not include "intermediate and advanced digital skills among public servants" as a Key Performance Indicator (KPI). Only two digital skills are required in the SPBE: computer operating skills and informatics skills, which only emphasize the mastery of Microsoft Office at the basic level. To drive the country's digital transformation agenda, however, public servants should be required to master more advanced digital skills with specific ICT job classifications. In comparison, drawing on ICT job classifications of public servants in the UK, advanced ICT skills are required in order to fulfil the requirements of 39 public service job roles. In Australia, advanced and intermediate skills are required for 19 public service job roles. In comparison to these advanced economies, it is evident that Indonesia is still far behind in the journey to becoming a "digitally enabled state".

The absence of a national policy on digital skills development among public servants leads to unclear ICT job classifications within the public sector. As a result, several ministries and subnational governments have implemented sporadic initiatives to develop the digital skills of public servants. These initiatives include recruiting new digital talents and retaining existing human resources by equipping them with digital skills. For example, the MoF established a Chief Technological Officer (CTO) team to build and organize their system; the Ministry of Health Affairs formed a Digital Transformation Office (DTO) roadmap and hired a number of digital talents to support the successful implementation

of the roadmap; the provincial government of DKI Jakarta established the Jakarta Smart City (JSC) program; and the provincial government of West Java established the Jabar Digital Service (JDS). Although involving significant levels of innovation, these initiatives have not been included in the GoI's national agenda and, thus, are dependent on each institution's financial ability and executive leaders' visions on digital transformation.

Another challenge faced in the process of digitalizing public sector services is that a significant number of young digital talents have the common perspective that working in the public sector is less attractive or promising than being employed in the private sector. The public sector working environment commonly requires a strict hierarchy and is laden with bureaucracy, multiple checks and balances for decision making, slow-moving work rhythms, and does not have a flexible working policy in place, which acts as a major point of attraction for young digital talents entering the work force. These factors contribute to forming an image of the public sector as a less desirable work environment for digital professionals. Moreover, unlike start-ups and other ICT-based companies, the public sector does not provide competitive compensation packages or clear skills classifications and career paths. In addition, with limited opportunities to access professional ICT skills development in the public sector, many young digital talents tend not to be interested in working in the public sector. All of the above factors have led to the lack of digital skills within the public service in Indonesia.

National indicators for digital skills development

The GoI has not provided nationally representative indicators for digital skills development to track and match the supply and demand of digital talent, both within and outside the government sector. This lack of information limits the government's ability to ensure digital skill goals are achieved and prevents the government from being able to identify gaps in the supply and demand of digital skills. Currently, the Statistics Indonesia (BPS) does not track specific indicators for digital skills development, with existing surveys such as SUSENAS and SAKERNAS excluding digital skills-specific data. The BPS is the body responsible for providing ministries with official statistical data, allowing ministries to make informed decisions and formulate appropriate policies. Adding digital skills and development indicators to the statistics that the BPS reports to ministries is crucial.

6. Conclusion and Next Steps

Indonesia has tremendous opportunities to gain maximum dividends by increasing citizens' participation in the digital economy ecosystem and by undergoing a digital transformation of its labor force by promoting access to digital skills formation. Due to the nation's relatively low performance in digital business activities, the government ratified "mainstreaming digital transformation" as a key theme of Indonesia's Medium- and Long-Term Development Plan for 2020-2024 (RPJMN 2020-2024). Furthermore, digital development in Indonesia is also supported by the MCI's decision to initiate a Digital Nation Roadmap, aimed at supporting the formation of digitally literate citizens and a digitally competent workforce. The main goal of the roadmap is to ensure that no one is left behind in the benefits enjoyed from the digitalized economy.

Despite these concrete efforts, significant levels of inequality in access to digital skills and skills development in Indonesia are preventing the country from maximizing the gains that the nation could enjoy by digitalizing its economy. Disparities exist across all dimensions of digital skills development, including digital inclusion, digital literacy, and digital competency when working.

This study aims to assess the digital skills landscape in Indonesia and provide a thorough overview of the challenges and constraints Indonesia's faces in digital skills development, before suggesting policy steps, aimed at reducing inequality of digital access within the nation. To address these goals, the study employed a mixed-method approach, coupling the use of both quantitative and qualitative research tools, by first analyzing secondary survey data primarily collected by BPS (Statistics Indonesia) on digital access, technological literacy, and the key characteristics of Indonesia's labor market, before further exploring and triangulating this information with qualitative results from in-depth interviews and FGDs conducted with various stakeholders within the government and the private sector in Indonesia.

Using this methodological approach, the study found that constraints, which hinder the development of a healthy digital skills ecosystem in Indonesia, primarily stem from a lack of digital inclusion and low digital literacy among the nation's citizens. Gaps in inclusion and inequality in access to ICT tools and training have significant adverse impacts on the nation's goal of forming digitally literate citizens. Moreover, key challenges in achieving the objective of a digitally competent workforce are, in particular, related to access to ICT education and the availability of relevant training aimed at improving workers' digital skills.

The GoI has set out a development target, stipulating that 82% of the population should have access to the internet by 2024. Despite this goal, in 2020, 46% of the population, amounting to 135 million people, remained digitally excluded, with no access to the internet or supporting devices. Inequality in digital access is most pronounced when comparing Java with non-Javanese regions, with urban areas on Java Island enjoying the most access compared to significantly lower levels of access in rural areas in Indonesia's outermost and least developed provinces (the 3T regions). This inequality in access was primarily found to be due to a lack of digital and energy infrastructure in rural and remote areas of Indonesia. The issue of more affordable digital devices and internet prices in more developed areas compared to more remote regions was also found to contribute to the digital divide in Indonesia. To elaborate this point, in remote areas outside of Java, prices for digital tools and for internet usage increase, as the majority of data interconnection facilities and devices are required to transit in Jakarta before being shipped to more remote areas. Transportation and delivery costs to these remote areas significantly inflate prices. In addition, in terms of internet usage, areas further away from Jakarta must often compensate for higher internet data traffic costs. These aspects further hinder access to digital tools for those living in remote areas. As a result of these issues, secondary data analysis found that around 50% of the population in rural areas have no access to mobile phones due to affordability concerns.

Several drivers of digital exclusion relate to the issue of digital literacy and prevent the country from fully benefiting from participating in a digitalized economy. Using secondary data analysis, we found that Indonesia scored relatively low compared to other ASEAN and OECD nations in several aspects of basic literacy competencies required for digital development. By examining PISA 2018 data, 30% of students in Indonesia were found to have achieved a minimum level of proficiency (Level 2 or higher) in reading. These numbers suggest that the GoI still needs to implement significant policies to achieve its development target of increasing the level of students with Level 2 proficiency or higher to 36% by 2024. This challenge, coupled with the unresponsiveness of the education system to the ever-changing digital technology landscape, further deepens the digital literacy gap in Indonesia.

Furthermore, a number of government policies aimed at increasing exposure to digital skills training have led to adverse effects on digital literacy levels. These policies include, in particular, the mandate to develop students' high-order-thinking skills (HOTS), which led to ICT subjects being removed as independent subjects. This mandate aimed to integrate ICT skills into *each* subject taught, with the goal of developing ICT skills within different subject settings. Although, in an ideal setting, the goal has the potential to

significantly increase ICT skills levels, due to a lack of teacher training and teachers being ill-equipped with the knowledge and pedagogical skills required to deliver these HOTS programs, unfortunately, the mandate has led to a decrease in ICT skills training in schools. This is due to teachers not possessing the skills and relevant training to incorporate ICT into their lessons.

Furthering the above challenges, digital literacy skills gaps were found to be present between different age groups, disability statuses, genders, and educational and income levels. Individuals who possess these different socio-economic characteristics were found to face different challenges when aiming to increase their digital literacy levels.

Narrowing the digital skills gap within the workforce is also important for achieving the country's broader goals of digital economy growth and job creation. Adopted from the 2020-2024 RPJMN, the GoI set the target of "around 50% of workers having intermediate and advanced digital skills by 2024". Currently, only 13% of workers in Indonesia possess intermediate and advanced digital skills. Access to higher education is one means of allowing more workers to be equipped with digital abilities. The level of access to higher education institutions and services, however, varies for individuals with different socio-economic statuses. This disparity in access is further exacerbated in local areas where spending for higher education is limited.

The above challenges in infrastructure and service delivery with regard to access to higher education are further deepened by the fact that currently, students have a *low interest* in studying ICT-related courses, as discovered in our analysis of secondary data. According to an analysis of the in-depth interview and FGD results, this is due to a lack of exposure and available information for most students in Indonesia on the types of job options available to ICT graduates. Detailed information is also limited on the subjects that students are required to study during higher education level ICT courses.

Lack of access to training, coupled with information asymmetries on the benefits of pursuing ICT courses, has led to low levels of competencies in both ICT and non-ICT graduates in Indonesia, which then contributes to students not meeting industry requirements as they enter the labor market. To mitigate this challenge, the government has implemented policies to increase the number of government and non-government ICT training institutions. With regard to these initiatives, however, the issue still remains of the need to increase the quality of public training institutions and the affordability of training services, particularly in terms of training conducted by the private sector. Quality and affordability are two factors that we found played a significant role in

increasing access to training and ICT skills development among Indonesian graduates. Furthermore, in Indonesia, relatively few companies provide ICT training for their employees. This significantly impacts the private sector's ability to upskill and re-skill their workers' digital competencies.

To conclude, and as a subsequent step to this report, we suggest the application of a *strategy primer* document that employs a holistic approach to solving the challenges outlined in this paper. This follow up document is necessary to narrow the digital skills gap in Indonesia. The strategies outlined within the follow-up document aim to streamline and refine digital skills channels in Indonesia, including *improving* the quality of formal education, vocational training, and on-the job training in Indonesia; key aspects required to increase digital literacy and digital inclusion within the nation. These improvements, furthermore, require an enabling environment framework that is facilitated by the government to promote and support all stakeholders' commitments to contributing to digital skills development in Indonesia. This "enabling" framework includes policy, financial, and infrastructural dimensions, which are crucial for the formation of an inclusive digital economy in Indonesia. The strategy primer is presented as a separate document, accompanying this diagnostic report.

7. Appendix

A1: Classification of the digitally competent workforces

The matrix table below provides an indicative tool to roughly assess the digital skills of the labor force based on four dimensions: (i) employment and unemployment status; (ii) the use of internet in an individual's main job; (iii) the highest level of educational attainment; and (iv) ICT background for those in vocational, diploma, and university level education.

Individuals with a junior secondary education and below with no exposure to the internet at work are categorized as unskilled. If they use the internet for their jobs, they are classified as having basic digital skills. They are also assumed to have the same digital skills level as those graduating from senior secondary education and non-ICT vocational secondary education. ICT graduates from vocational secondary schools, all Diploma 1-3 graduates, and Diploma 4/university graduates in non-ICT subjects are considered to have intermediate digital skills. Finally, individuals with advanced digital skills include Diploma 4/university graduates in ICT.

Classification of the digitally competent workforces (all age groups)

Highest education		Employed		Unemployed
		Not using internet	Using internet	
No schooling		Unskilled	Basic	Unskilled
Elementary		Unskilled	Basic	Unskilled
Junior secondary		Unskilled	Basic	Unskilled
Senior secondary		Basic	Basic	Basic
Vocational secondary	Non-ICT	Basic	Basic	Basic
	ICT	Intermediate	Intermediate	Intermediate
Diploma 1-3	Non-ICT	Intermediate	Intermediate	Intermediate
	ICT	Intermediate	Intermediate	Intermediate
Diploma 4	Non-ICT	Intermediate	Intermediate	Intermediate
	ICT	Advanced	Advanced	Advanced
University (S1/S2/S3)	Non-ICT	Intermediate	Intermediate	Intermediate
	ICT	Advanced	Advanced	Advanced

Source: Authors' construction

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