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The Future of Work in the Philippines: Assessing the impact of technological changes on occupations and sectors

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International Labour Organization Country Office for the Philippines

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On the cover:

Business Process Outsourcing. © ILO/R. dela Cruz, March 2011

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Abbreviations

AI	Artificial Intelligence
ASEAN	Association of Southeast Asian Nations
CHED	Commission on Higher Education
DA	Department of Agriculture
DICT	Department of Information and Communications Technology
DOLE	Department of Labor and Employment
DOST	Department of Science and Technology
DTI	Department of Trade and Industry
GDP	Gross Domestic Product
ICT	Information and Communications Technology
ILO	International Labour Organization
ISCO	International Standard Classification of Occupations
ISIC	International Standard Industrial Classification
I^3S	Inclusive Industrial Innovation Strategy
ITM	Industry Transformation Maps
IT-BPM	Information Technology and Business Process Management
LFPR	Labour Force Participation Rate
NTESDP	National Technical Education and Skills Development Plan
PQF	Philippine Qualifications Framework
R&D	Research and Development
SGD	Sustainable Development Goal
STEM	Science, Technology, Engineering and Mathematics
TESDA	Technical Education and Skills Development Authority
TVET	Technical and Vocational Education and Training
VET	Vocational Education and Training

Preface and acknowledgements

The world of work is undergoing a major process of transformation driven by technological innovations, demographic shifts, climate change and globalization. In response to these challenges, a Centenary Declaration for the Future of Work was adopted in 2019 at the 108th Session of the International Labour Conference. The Declaration issues a call to action for a human-centred approach for the future of work that focuses on increasing investment in people's capabilities, strengthening the institutions of work and promoting sustained, inclusive and sustainable economic growth, and full and productive employment and decent work for all. Technological advancements have been among the core issues of national policy dialogues around the future of work as countries have embarked on national strategies related to Industry 4.0.

This report, *The Future of Work in the Philippines: Assessing the impact of technological changes on occupations and sectors,* examines the effects of digital technologies, in particular the adoption of artificial intelligence in the workplace, as regards disruption and transformation of occupations and their implications for sectors and skills development approaches in the Philippines. It maps and assesses existing national policy responses and initiatives related to Industry 4.0 in the Philippines and collects information on current upskilling policies and programmes.

The research was further informed by consultations and a validation process involving government, employers' and workers' organizations, private sector and other stakeholders in the Philippines with a view to further informing the development of sectoral initiatives for skills development and full and productive employment and decent work for all. The ILO extends its gratitude to the participants who contributed to the consultations.

This research initiative was supported by the Australian Government and implemented by the International Labour Organization (ILO). The research was led by the ILO Country Office for the Philippines in collaboration with the ILO Decent Work Technical Support Team for East and South-East Asia and the Pacific and the ILO Regional Economic and Social Analysis Unit. The main authors are Donald Jay Bertulfo and Francesco Carbonero under the overall technical guidance provided by Sara Elder, Felix Weidenkaff, Akiko Sakamoto, Ma. Concepcion Sardaña and Ma. Lourdes Macapanpan-Rivera. Virginia Creer, Gwendolyn Fabros, Ma. Carmela Tigno, Ma. Alicia Fernando and Marybelle Cruz Baylon provided administrative support throughout the process. Minette Rimando and Julita Yap provided communications support. Reggie Olalia organized and documented the consultations and dialogues.

The ILO extends its gratitude to the Philippine Statistics Authority (PSA) for its support to this initiative and its important contribution by granting access to the Labour Force Survey microdata at the four-digits level for industrial classification of economic activities (ISIC) and occupational classification (ISCO).

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1

Introduction

COVID-19 and the world of work. © ILO/F. Latief, June 2020

I. Introduction

Prior to the COVID-19 pandemic, the Philippines had been experiencing a robust economic growth.[1] Its gross domestic product (GDP) grew at an annual rate of over 6.0 per cent for eight straight years from 2012 to 2019. Thus, among the fastest-growing economies in South East Asia, the economy grew by 6.0 per cent in 2019, at a higher rate than other countries in the region such as Indonesia, Malaysia, Singapore and Thailand.[2] While the Philippines is considered a country with a strong production base, research has pointed to its "low readiness for the future of production" (WEF, 2018).[3]

The country benefited from globalization as the nature of production became much more geographically dispersed and fragmented (the so-called "global value chain" phenomenon). Moving production to the Philippines made sense from the point of view of foreign businesses which saw promise in a growing population that could be a source of potential customers or of labour, resulting in economies of scale. This model is currently being challenged, however, by the emergence of new, more sophisticated and advanced technologies that are seen to trigger structural changes in global value chains (GVC) such as selective reshoring, near shoring, more distributed value chain activity and greater competition for skills specific to certain GVC segments. As new production techniques, technologies and business models transform global production systems, the transition to a new era of industrial revolution (also known as Industry 4.0 or the Fourth Industrial Revolution) puts at risk the viability of low-cost manufacturing and services exports as drivers of sustainable growth and development.

While risks abound, the Government of Philippines acknowledges that advanced technologies could complement production and enhance the country's productive efficiency.[4] Hence, the seamless integration of new technologies in current plans that chart the future of production is essential to properly manage the risks and opportunities that Industry 4.0 might bring.

From the perspective of labour and skills, this requires, to some extent, knowledge of the occupations and sectors that will be affected by Industry 4.0 technologies. In accordance with this, this report assesses the impact of digitalization on employment inthe Philippines at the occupational and sectoral levels using a quantitative approach that takes into account both the destructive and transformational impacts of digitalization.

1 The massive economic and labour market disruption in the Philippines caused by the COVID-19 pandemic is analysed in ILO (2020a). The report is entitled *COVID-19 labour market impact in the Philippines: Assessment and national policy responses*.

2 The growth rates of other countries in the ASEAN, based on official national statistics are: 5.0 per cent for Indonesia; 4.3 per cent for Malaysia; 0.7 per cent for Singapore; 2.4 per cent for Thailand; and 7.0 per cent for Viet Nam. Note, however, that the Philippines' 2019 target growth rate range was 6.0 per cent to 6.5 per cent; the 2019 growth also represented a slowdown from 2018 growth of 6.2 per cent.

3 In WEF (2018), countries with a strong current production base but low readiness for the future are called "legacy" economies.

4 The challenges of upgrading industrial production in preparation for Industry 4.0 or 4IR is recognized in the country's New Industrial Strategy, also known as the Inclusive Innovation Industrial Strategy. The Department of Trade and Industry acts as the lead agency of the programme.

The idea is that digitalization could render tasks or occupations previously carried out by human workers obsolete – "destructive digitalization". In the same vein, exposure to new technologies could transform existing occupations – "transformative digitalization". These two ideas are combined to map occupations into four categories according to the extent to which these are susceptible to either destructive or transformative digitalization (Fossen and Sorgner, 2019a). This typology differs from the traditional approach of analysing jobs based on their routine task intensity (Autor, 2015; Jaimovich and Siu, 2020), and therefore opens up an additional view and contribution to the jobs and technology debate to inform policymaking.

The analysis aims to determine to what extent occupations are disrupted and transformed. It aims to identify sectors that are most vulnerable to digitalization, as well as those which may offer employment opportunities based on their occupational structure, and link the results of the analysis in relation to current industrial priorities outlined in national economic strategies and plans.

While the analysis focuses on the workforce impacts of digitalization, the findings take into account prevailing economic conditions, such as the socio-economic impact of the COVID-19 pandemic which is likely to increase future demand for the adoption of digital technologies in education and work. For instance, the Philippines' Department of Education has started encouraging schools to explore alternative learning modalities such as blended learning alongside distance education and home-schooling as the "new normal" for the next school year.[5] The pandemic situation has also affected many jobs that require face-to-face interaction, as well as those that require use of workplace-based tools (for example, machineries for factory workers). In crisis contexts where person-to-person interaction (and even access to offices) is limited to ensure public safety and health, technologies offer a viable alternative to keep productive activities running.

In addition to the quantitative assessment of the impact of digitalization on occupations and sectors, the implications of the analysis were further contextualized using inputs from stakeholder consultations. Ultimately, the goal is to provide a basis for informed decision-making related to the future of work in the Philippines against the backdrop of a new technological wave, and to identify potential policy directions and implications for skills development towards full and productive employment and decent work for all.

The structure of this paper centres on an assessment of the impact of digitalization on occupational and sectoral employment in the Philippines and its link to current programmes and policies that relate to workforce and skills development in response to Industry 4.0. Sections 2 and 3 provide an overview of the current macroeconomic landscape and labour market situation. Section 4 presents a quantitative assessment of the destructive and transformative impacts of digitalization on occupations.

5 M. Hernando-Malipot: "DepEd allows schools to choose 'appropriate' learning delivery methods for the new SY," *Manila Bulletin*, 13 May 2020.

COVID-19 and the world of work. © ILO/F. Latief, June 2020

Section 5 discusses the implications of these findings in relation to skills development, as well as current policies and programmes that support workforce and skills development in the Philippines and in other economies. Section 6 synthesizes the findings and concludes the report.

2

Economic trends in a changing world of work

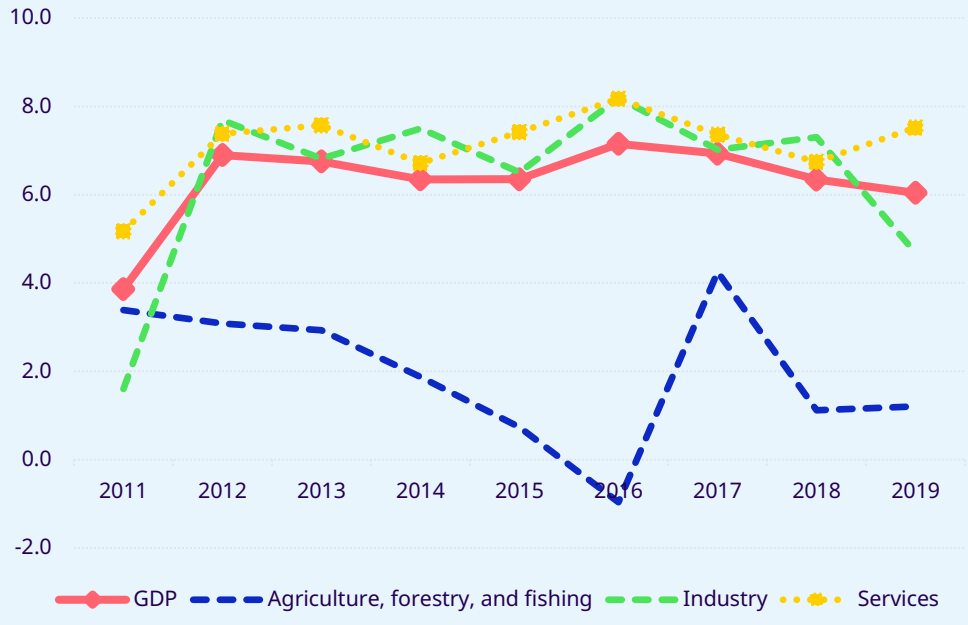
Safety and health in manufacturing. © ILO/M. Fossat, October 2015

2. Economic trends in a changing world of work

Global economic challenges such as the rise of global protectionism, reshoring threats and, more recently, the socio-economic impact of the COVID-19 pandemic pose challenges to Philippine economic growth.

The Philippines marked the past decade with a robust economic growth performance, with GDP growing at an annual rate of over 6 per cent in the past eight years from 2012 to 2019 (figure 1).[6] A buoyant services sector and an industrial sector that is rapidly catching up supported the economy. The average growth of services and industry stood at 7.4 per cent and 6.8 per cent, respectively, from 2016 to 2019, representing higher rates compared to those reported from 2011 to 2015 (6.9 per cent for services and 6.0 per cent of industry).

Figure 1. Economic performance of the Philippines by economic sector (per cent change), 2011–2019



Note: Values at constant 2018 prices.

Source: Philippine Statistics Authority (PSA), National Accounts of the Philippines, April 2020.

6 Unless otherwise specified, statistics cited in this section reflect data from the *National Accounts of the Philippines* as of April 2020. Growth rates are expressed at constant 2018 prices and represent simple averages in the specified time periods.

Recent global economic challenges, however, threaten the country's economic growth. The rise of global protectionism (for instance, the recent US-China trade conflict), the observed global economic slowdown in the past few years, reshoring threats and, more recently, the COVID-19 pandemic constitute macroeconomic headwinds that pose challenges to the country's goal of achieving an upper-middle income status by the end of the current administration. To elaborate, the economy contracted (for the first time since 1998) by 0.2 per cent in the first quarter of 2020, mostly due to the negative impact of the pandemic. GDP data for the second quarter of 2020 show a dimmer picture, with the Philippine economy contracting by 16.5 per cent, the lowest recorded growth starting the 1981 series.[7]

Services dominates the country's economic structure, accounting for an average of 58.8 per cent of total value-added (or contribution to GDP) from 2011–19. The average contribution of industry and agriculture to GDP were 30 per cent and 11.2 per cent, respectively, during the same period. As shown in Appendix table C.1, total value-added attributed to agricultural production is declining (from an average of 12.4 per cent during the period 2011-15 down to 11.8 per cent in 2016-19) while shares of industry and services value-added appear to be increasing (58.0 per cent to 58.4 per cent for services and 29.7 per cent to 29.9 per cent for industry between the two time periods).

Interestingly, services carrying technologies that complement manufacturing activities show rising contributions to total GDP. New technologies enable services to become increasingly embedded in manufactured goods by either facilitating the use and purchase of a manufactured good without altering its features (such as offering warranties or insurances on the use of a good) or expanding the functionality of a manufactured product (such as augmenting devices with customizations or integrating them with other products).[8] They are commonly related to financial and business services which enter production either at the beginning or towards the latter stage of production. In the Philippines, while the services sector has displayed a stable reliance on value-added coming from trade-related services, the shares of financial and insurance services as well as professional and business services have been growing. In fact, these subsectors have displayed remarkable growth patterns, averaging 3 percentage points higher than the usual GDP growth from 2011–19.

Within industry, manufacturing has consistently held the largest share in value-added. It grew by 5.8 per cent on average during the period 2016–19, representing a marginally higher average increase from 5.4 per cent during the period 2011–15. However, these rates are lower than the corresponding rates of GDP and services growth, thus explaining why the contribution of manufacturing in total GDP appear to be on a decline from 19.4 per cent during the 2011–15 period to 19.3 per cent during the 2016–19 period. Agriculture, meanwhile, grew at a modest average rate of 2.4 per cent from 2011 to 2015 then decelerated to 1.4 per cent from 2016–19.

7 ILO (2020a) provides a more detailed exposition of the impact of COVID-19 on the Philippine labour market.

8 See Mercer-Blackman and Ablaza (2018) for a more detailed discussion of the so-called "servicification" of manufacturing with a particular focus on Asian economies.

A comfort and safety controller works on the Final Test machine. © ILO/Ruben Hamahiga Dela Cruz, March 2011

Workforce and skills development is an important pillar of the country's industrial policy that requires attention.

The interest in the sectoral make-up of macroeconomic development is partly motivated by the fact that industrial development constitutes an important part of the country's socio-economic agenda. To elaborate, the Philippines' current industrial policy gears towards cultivating globally competitive and innovative industries. This goal is subsumed within the *Ambisyon Natin 2040*, which articulates the country's national vision of achieving *matatag, maginhawa at panatag na buhay* (or a strongly rooted, comfortable and secure life) by 2040. In view of this collective aspiration, the new industrial strategy known as the Inclusive Industrial Innovation Strategy (I^3S) conveys a growth-oriented stance to industrial development that is founded on the dynamic relationship of competition, innovation and productivity. By leveraging the strategic links among these three factors, industries are well-positioned to become crucial catalysts of sustainable economic transformation.

Under the I^3S, twelve priority sectors were identified to drive industrial and employment activity and spur positive knowledge and technology spillovers through value chain links: (1) automotive and automotive parts; (2) electronic manufacturing services; (3) aerospace parts; (4) chemicals; (5) shipbuilding and ship repair; (6) furniture, garments, creative industries manufacturing and design; (7) iron, steel, tool and die; (8) agribusiness; (9) construction; (10) information technology and business

process management (IT-BPM) and e-commerce; (11) transport and logistics; and (12) tourism. The five pillars that underpin the I^{3}S are: (a) building agglomerative industrial clusters; (b) fostering a culture of innovation and entrepreneurship; (c) encouraging the growth and development of micro, small and medium-sized enterprises (MSMEs); (d) removing barriers to doing business which includes creating a favourable investment environment; and (e) developing human resource capabilities.

While industrial policies have focused on trade liberalization, investment attraction and industry upgrading, an important pillar that requires attention is workforce and skills development. Current plans for the future of skills development in the Philippines are laid down in the *National Technical Education and Skills Development Plan (NTESDP) 2018-2022*. The plan identifies priority industries tagged as "'key employment generators", which include tourism and hotels and restaurants, construction, IT-BPM, transport, communication and storage, manufacturing, health, wellness and other social services and agriculture, fisheries and forestry. These key employment generators share a significant amount of linkages with the priority industries outlined in the I^{3}S.

The impact of Fourth Industrial Revolution technologies on jobs can be shaped by present and future national policies.

The urgency of tackling skills development becomes apparent when viewed against the backdrop of a new wave of technological changes. The Fourth Industrial Revolution or Industry 4.0, characterized by widespread digitalization of organizational processes and commoditization of data and information, has disrupted business models all over the world. The phenomenon is expected to ignite a massive transformation in the world of work. For instance, Industry 4.0 is estimated to induce a switch in occupational categories in about 14 per cent of the global workforce by 2030 (McKinsey Global Institute, 2017). Re-learning and re-tooling also become much more essential as individuals on a 30-year career may need to refresh their skills at least six times throughout their entire careers.[9] Such observations understandably rouse feelings of automation anxiety.

While there is indeed some evidence that automation-induced job displacement is already taking place (Acemoglu and Restrepo, 2019a; Carbonero et. al., 2020), a pessimistic view on the impact of automation on jobs offers a limited perspective on the complex nature of human-machine interaction. In particular, the impact of automation on jobs can be shaped by, and will depend on, present and future national policies.

Previous research has shed light on how digitalization is changing jobs and enterprises and has documented the impacts of emerging technologies on the manufacturing and services sectors in the Association of Southeast Asian Nations or ASEAN region (ILO, 2016).[10] A salient finding from this literature is that digitalization will affect jobs in many

9 J. Schwartz, H. Stockton and K. Monahan: "Forces of change: The future of work," *Deloitte Insights*, 9 Nov. 2017.

10 ILO (2016) focused on emerging technologies in five prominent sectors in the ASEAN region, which are: automotive and automotive parts, electrical and electronics, textiles, clothing and footwear, business process outsourcing and retail.

key sectors such as automotive and automotive parts, business process outsourcing, electronics and electrical equipment, retail and textiles, clothing and footwear. To help workers adapt to the rapidly changing world of work, comprehensive and multifaceted growth and investment strategies need to be complemented by adjustments in skills, training and education systems. Many governments in dialogue with employers' and workers' organizations, and other stakeholders have already put in place policies and initiatives to prepare for the future of work (ILO, 2019).

For many economies, the full consequences of digitalization are not yet clear. The general nature of digitalization has the potential to shift labour markets in three dimensions. First, it can lead to job displacement if hiring machines becomes more cost-effective than employing human labour (Frey and Osborne, 2017). The magnitude of job displacement effects would then depend on the extent to which machines substitute for human labour. Second, digitalization has the potential to create more jobs via the productivity or scale effect, or when automation can boost productivity and, in effect, increase labour demand (Acemoglu and Restrepo, 2018; Bertulfo, Gentile and de Vries, 2019). Third, automation can create new tasks and transform occupational profiles (ADB, 2018; Acemoglu and Restrepo, 2019b). Esguerra (2019) provides a detailed review of these issues alongside the growth of alternative work arrangements in relation to Philippine employment trends.

Most of the debate so far has concentrated on the job displacing effects of automation; and less is known about the potentially transformative nature of digitalization, particularly in the Philippine context. In Section 4 of this report, measures of job displacement and job transformation are combined to map occupations in the Philippines onto the typologies of Fossen and Sorgner (2019a). The extent to which sectors could be affected by digitalization from the labour perspective are subsequently assessed.

3

Labour market trends

Electronics factory workers. © ILO/Asrian Mirza, December 2007

3. Labour market trends

Understanding the future of jobs requires a diagnostic of the labour market situation. In this section, key labour and education market indicators prior to the COVID-19 crisis[11] are reviewed, focusing on aspects of the labour market landscape that links to skills development and decent work. Further details on the current occupational structure of employment are then presented to motivate the discussion on how digitalization can impact jobs in the Philippines.

A group of aircraft technician trainees work on a piece of an aircraft outer shell. © ILO/Ruben Hamahiga Dela Cruz, March 2011

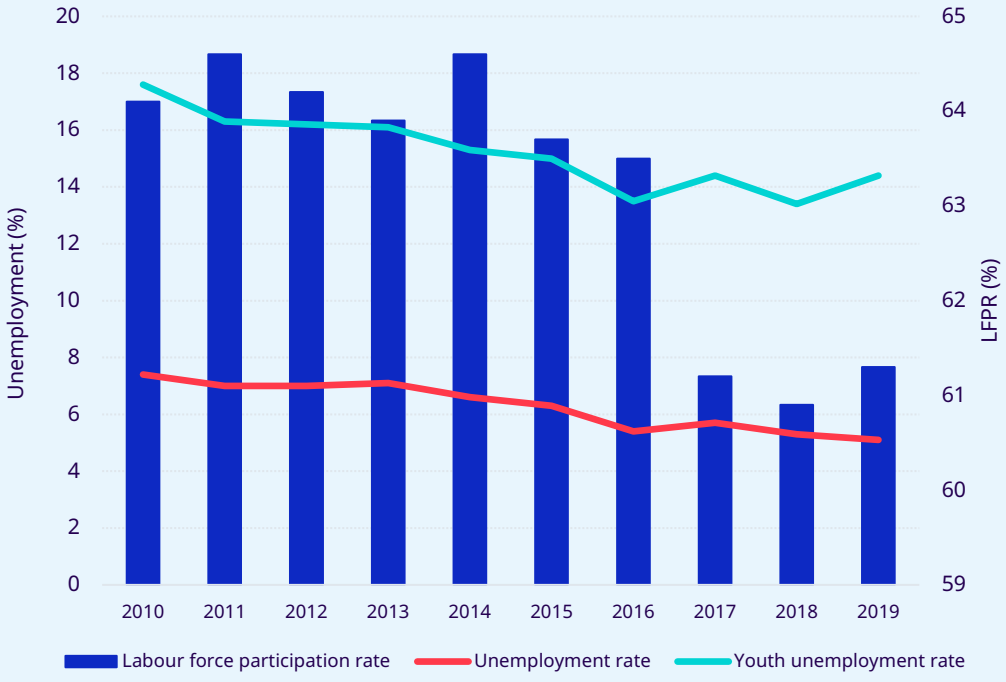
11 A more detailed discussion of the impact of the COVID-19 crisis on the Philippine labour market may be found in ILO (2020a).

3.1 Labour market and education trends

Facing constraints in the labour market, a growing proportion of the working age population from vulnerable demographic groups such as young women are not in the labour force.

Official statistics show a declining unemployment rate trend from 7.4 per cent in 2010 to 5.1 per cent in 2019,[12] a pattern that is consistent across gender and age groupings. The decline in the unemployment rate coincided with a decline in the labour force participation rate (LFPR) from 64.1 per cent in 2010 to 61.3 per cent in 2019 (figure 2). This suggests that a growing fraction of the working age population has either opted out of the labour force or has chosen to engage in other activities outside the labour market (for example, continuing education).

Figure 2. Unemployment rates and labour force participation rates, 2010-2019



Notes: Unemployment and labour force participation rates reflect preliminary results of PSA's Annual Labour and Employment Estimates for 2019 based on the average of four Labour Force Survey rounds. Youth unemployment rate for 2019 corresponds to the July 2019 estimate.

Source: PSA, Labour Force Survey.

12 Unless stated otherwise, statistics cited in this section reflect labour and employment statistics sourced from the Philippine Statistics Authority.

The gender gap in the LFPR is a significant driver of this picture. In 2019, only 37.9 per cent of women in the working age were in the labour force compared to 59.8 per cent of men (Appendix figure C.1). The gap has widened since 2010, excluding a large number of women from the world of work with less chances than men to build their career.

As regards LFPR for different age categories, only an estimated 32.4 per cent of 15- to 24-year-olds were actively engaged in the labour market, either working or looking for work in the first three quarters of 2019, compared to 69.8 per cent of those aged 25–34, about 76 per cent of those aged 35-54, and 63.6 per cent of those aged 55-64. The distribution of the LFPR in this context seems to have gone through very few changes during previous years (table 1).

Table 1. Labour force participation rate across age groups (per cent), between 2010 and 2019

Age group	2010	2013	2016	2019
15-24	37.3	38.0	36.9	32.4
25-34	68.0	68.1	69.9	69.8
35-44	76.0	76.1	77.2	76.1
45-54	76.8	76.9	77.5	75.5
55-64	66.1	65.7	66.4	63.6
65+	37.2	35.5	36.1	33.2

Note: 2019 data reflect estimates up until the third quarter of 2019.
Source: ILO estimates using the Labour Force Survey.

This report links and contributes to the Sustainable Development Goals (SDGs), in particular SDG 4 (Quality education), SDG 5 (Gender equality) and SDG 8 (Decent work and economic growth). With regard to SDG 8, which promotes "sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all," Yap, Tabuga and Mina (2020) analysed the likely drivers of declining LFPR and showed that it may be partly explained by the high proportion of young people not in employment or education. It also appears that the gender gap in labour force participation starts at a young age. In particular, their study found that the high proportion of young people not in employment or education consists of young women who are either married at a young age and/or people who belong to households that rely on the agricultural sector. Likewise, young people in poor households and those with lower educational attainment are found to be more likely to be unemployed, out of school or out of the labour force. The declining LFPR picture therefore connects with vulnerable demographic groups that face constraints in the labour market.

Unemployment is also more severe among the youth. While youth unemployment was declining prior to the COVID-19 crisis, it remained more than three times the adult (aged 25 and above) unemployment rate of 3.6 per cent. In 2018, 13.4 per cent of youth aged 15-24 who were in the labour force were unemployed. The prevalence was higher for women (14.8 per cent) than for men (12.6 per cent). Most of the unemployed completed at least their secondary education, numbering about 2 million of the 2.3 million unemployed in 2018.

The Philippines is at an early demographic dividend stage with millions of young people entering the working age population in the near future.

The Philippines is at an early demographic dividend stage[13] with productivity impacts foreseen to be felt by 2025.[14] A large cohort of young people (aged 10-14), estimated at 10.8 million in 2019[15], will enter the working age population (beginning at age 15) in the near future. While this cohort may not necessarily join the labour force directly since they might continue in education, training or stay outside the labour force for other reasons, this poses an immense challenge for the education and training system to prepare young people for the future of work.

Several reform areas in the Philippine education system have been identified. The *Philippine Development Plan 2017-2022*, for instance, emphasized the need to ensure lifelong learning opportunities for all. The plan also recognized the role of higher education systems in accelerating innovation and sociocultural transformation. The strategies to leverage the power of education in cascading societal transformation include strengthening early care and development programmes, enhancing teacher competencies and undertaking continuous curricular reforms, improving access to quality and relevant technical and vocational training and education (TVET), expanding access to higher education and integrating twenty-first century competencies in the curriculum.

These reforms are seen to help address current issues faced by the country's education system. For instance, findings of a national graduate tracer study revealed that graduates do not feel that higher education enabled them to develop communication, critical thinking and problem-solving skills (Tutor, Orbeta and Miraflor, 2019). The same study found that at least half of the graduates do not consider occupational skills as their main entry point to landing their first or current job, while about two thirds think that their college degree was relevant to their first job. The results of the 2018 Programme for International Student Assessment (PISA) also generated a national buzz when it was reported that the Philippines ranked last in reading comprehension and second lowest in both mathematics and science among 79 participating countries (OECD, 2018).

13 See ILO (2018). Early dividend = total fertility rate below 4 and increasing working-age population share, 2015-30

14 "NEDA expects demographic dividend impact felt by 2025," BusinessMirror, 20 Dec. 2018.

15 Taken from PSA's Updated Projected Mid-Year Population based on the 2015 Census of Population, released in October 2019.

Dressmaking trainee works on a dress using an industrial sewing machine. ©ILO/Ruben Hamahiga Dela Cruz, March 2011

The global impact of the COVID-19 pandemic on economic activities and labour market is seen to disproportionately affect workers in less-protected and less-paid jobs. These workers may need further support in their labour market transitions and skills development, especially if firms respond to the crisis by adopting more technologies that could potentially disrupt jobs.

More recently, the Philippines has embarked on a more proactive stance towards using digital technologies to augment learning tools[16]. Digital technologies present a myriad of opportunities for learners to engage in an active search for personally-tailored learning. The COVID-19 pandemic has placed stronger pressure on the adoption of digital technologies in education as uncertainty over the future of education post-pandemic looms. Young and adult learners, including those who possibly do not have access to digital devices, may find themselves being compelled to adapt to the demands of a post-pandemic world.

16 T. Umali: "The Philippines' Department of Education advocates digital transformation in education," OpenGov Asia, 5 Jul. 2020.

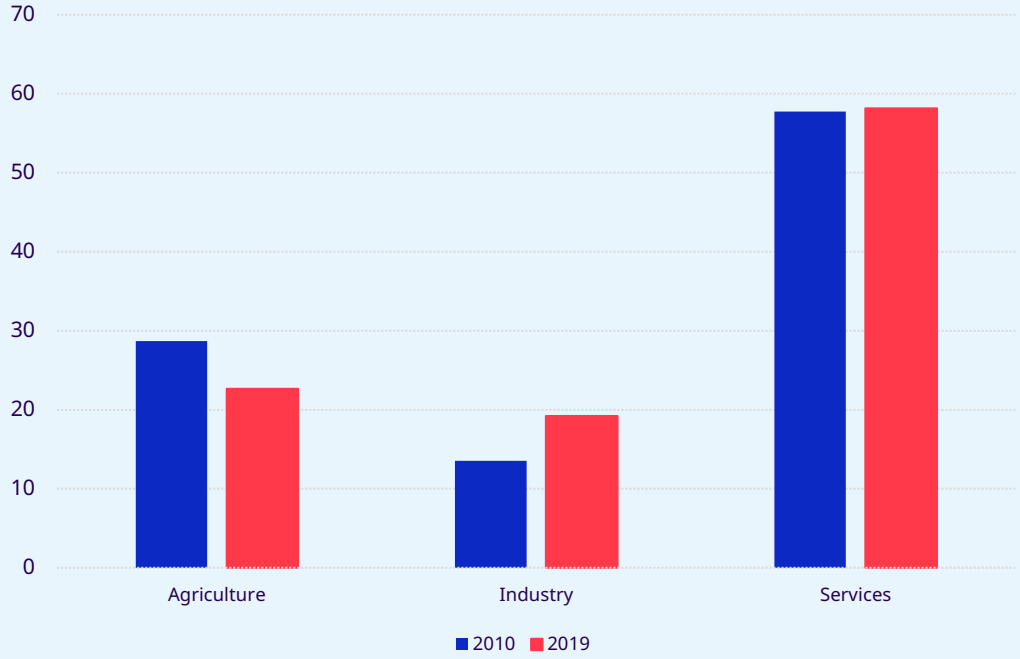
ILO (2020b) provides estimates on the global impact of the COVID-19 pandemic on working hours, workers, sectors and enterprises. The impact on economic activities and labour market is seen to disproportionately affect workers in less-protected and less-paid jobs, particularly the youth, women, older workers, workers in informal employment and migrants. To the extent that the pandemic will trigger layoffs and reduction in working hours and incomes, these demographic groups may need, among other support measures, further attention in terms of upskilling efforts as they may encounter challenges to improve their labour market outcomes, especially if firms respond to the crisis by adopting more technologies that could potentially displace workers. This is analysed in more detail in ILO (2020a).

Labour market statistics reveal decent work "deficits" such as low-paid work, low productivity, excessive working hours, precarious work, and underemployment, with differences across sectors and across gender and type of worker.

Besides weaknesses in education quality and relevance to industry needs, other bottlenecks faced by the labour market include migration of high-skilled workers (or brain drain) and job-skills mismatch. These factors contribute to constraining the optimal allocation of productive labour across sectors, which may pull the overall level of wages downward. While minimum monthly wages in the country are among the highest in the ASEAN region, more than one tenth of wage and salary workers are engaged in low-paid work. In 2018, 15.8 per cent of employed women were engaged in low-paid work versus 10.2 per cent of employed men. The services sector has the highest share of workers engaged in low-paid work at 13.3 per cent; it is 12.7 per cent in agriculture and 9.0 per cent in manufacturing.

More than half of the employed work in the services sector (58.1 per cent in 2019 from 57.8 per cent in 2010). Major changes have taken place within the sector in the past decade with a substantial shift of workers from transportation and storage to wholesale and retail trade. In addition, many new jobs have been created in the public sector. From 13.6 per cent in 2010, industry's share of employment increased to 19.2 per cent in 2019, mainly driven by increased employment in construction and, to a lower extent, in manufacturing. Agriculture's share of employment was at 22.6 per cent in 2019, down from 28.7 per cent in 2010 (figure 3 and Appendix table C.2). The persistingly low productivity levels in agriculture raises concerns over the quality of employment in the sector.

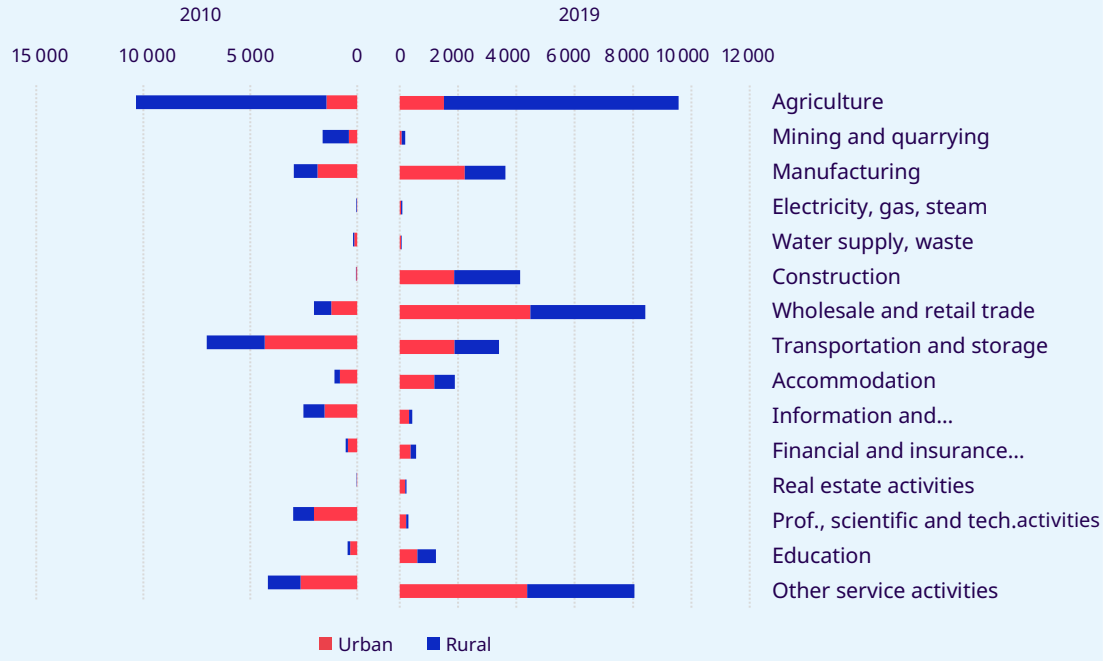
Figure 3. Employment distribution by major economic sector (per cent), 2010 and 2019



Note: 2019 data reflect estimates up until the third quarter of 2019.
Source: ILO estimates using the Labour Force Survey.

While most agricultural employment is in rural areas, industrial and service employment is typical of urban areas. Between 2010 and 2019, a sizeable shift in employment structure occurred in both rural and urban areas: from transportation to wholesale and retail and, to a higher extent in the rural regions, a sharp increase of workers in construction. The shift towards wholesale and retail is the result of labour market adjustments to the needs of the product markets. However, this does not necessarily imply better working conditions as revealed by the median salary in retail, which is one of the lowest at the sectoral level. Conversely, the education sector, for which the government has more than doubled public expenditure between 2014 and 2017 (ILO, 2017), reveals a sharp increase in the estimated number of employees especially in the rural areas (figure 4).

Figure 4. Number of employees across industries, rural vs. urban, 2010 and 2019



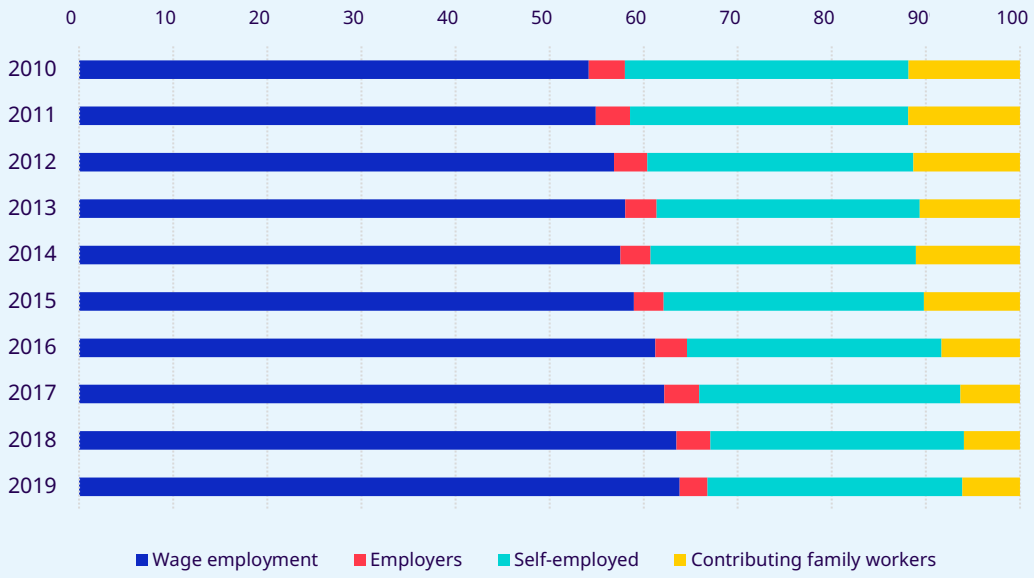
Note: 2019 data reflect estimates up until the third quarter of 2019.
Source: ILO estimates using the Labour Force Survey.

Data on average real daily basic pay reveal that workers in the services sector are paid more than twice as much as those in agriculture (426.04 Philippine pesos versus 202.37 Philippine pesos in 2018). This raises concerns regarding the quality of employment, especially in rural areas. However, that many workers in the services sector are also engaged in low-paid work implies that there is substantial variation in earnings. Occupational wage data may help provide more context on this front. The average real daily basic pay of services and sales workers, craft and related trade workers and workers in elementary occupations are among the lowest. In contrast, professionals as well as technicians and associate professionals receive about twice as much daily basic pay, on average.

Decent work statistics paint a mixed picture across broad sectors and across gender and type of worker. In 2018, nearly one fourth of the employed worked an excessive number of hours (49 hours or more): 26.0 per cent of women and 22.0 per cent of men. Excessive working hours is also more prevalent among workers in the services sector (30.5 per cent) and the self-employed (33.5 per cent). Engagement in precarious work is higher among men (20.1 per cent) than women (15.4 per cent), and among workers in the industrial sector (33.3 per cent). Nearly one third of wage and salary workers constitute short-term, seasonal or casual workers. Underemployment is higher among men (18.1 per cent) than women (13.6 per cent), among the self-employed (23.3 per cent), and workers engaged in the agricultural sector (19.2 per cent).

Concerning employment status between 2010 and 2019, there are considerably more wage earners: from an estimated 54.2 per cent to 63.8 per cent of total employment. This is the consequence of, first, many new workers hired in the formal sector and, second, a substantial reduction of contributing family workers (about 1 million workers less in almost ten years). The number of self-employed workers slightly increased from 10.9 million to 11.4 million, while the number of employers decreased by 150,000 (figure 5).

Figure 5. Employment by class of worker (per cent of total employment), 2010-2019



Note: 2019 data reflect estimates up until the third quarter of 2019.
Source: ILO estimates using the Labour Force Survey.

3.2 Occupational structure of employment

The evolution of the structure of occupational employment between 2010 and 2016 will be examined in this section. Following the routine task classification employed in Jaimovic and Siu (2020) using Philippine labour force surveys[17], occupations are aggregated into three types: routine, non-routine cognitive and non-routine manual.

- **Routine occupations** refer to jobs that involve tasks that tend to be rule-based, codifiable and require minimal discretion. In the language of automation, these occupations have a high likelihood of being replaced by machines. They can be further decomposed into two types: cognitive and manual. Routine cognitive occupations, such as secretaries, bank tellers and bookkeepers, involve cerebral tasks that can be translated into codifiable rules. Routine manual occupations, such as factory workers and machine operators, pertain to jobs that are rule-based yet require physical involvement.
- **Non-routine cognitive occupations**, as in all non-routine occupations, are those whose task content is hard to define using a codifiable set of rules. These include financial analysts and computer programmers and require cerebral tasks such as problem-solving that current machines are not able to replicate (yet) with an accuracy that is comparable to those of humans.
- **Non-routine manual occupations** such as janitors and personal care aides require physical human activity and manual dexterity that robots are not (yet) able to replicate.

Because machines are now able to perform a larger subset of tasks that human workers perform, the overall direction of skills demanded by employers gravitates towards tasks that machines cannot perform just yet.

A key insight from the intersection of literature on occupations, skills and digitalization is that while occupations tend to belong to any of the aforementioned categories, automation substitutes for a subset of the tasks performed by occupations. It is therefore possible for jobs to still exist while their task content evolves. Because machines are now able to perform a larger subset of tasks that human workers perform, the overall direction of skills demand gravitates towards tasks that machines cannot perform just yet, and understandably so. These relationships provide further rationale to examine occupations with a view to disentangling the complex relationship of jobs, skills and digitalization.

17 Practical reasons motivate this choice. A change in the nomenclature of occupations used in the Philippine labour force surveys occurred during the second quarter of 2016. Therefore, for illustrative purposes, change in the occupational distribution between 2010 and 2016 is shown in this subsection, but the analysis in the next section makes use of data that is consistent with the ISCO-08 occupational classification. The appendix provides evidence that the change in classification that occurred in 2016 did not result in substantive change in the occupational distribution (Appendix figure C.2).

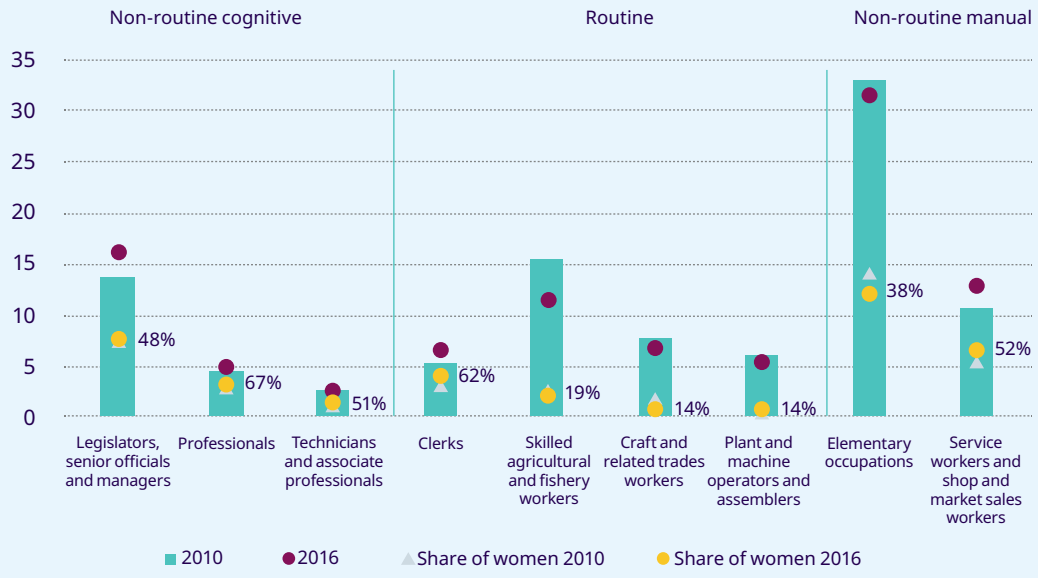
A group of aircraft technician trainees work on a piece of an aircraft outer shell. ©ILO/Ruben Hamahiga Dela Cruz, March 2011

Between 2010 and 2016, the share of non-routine cognitive occupations in the Philippines increased from an estimated 21 per cent to 24 per cent, the share of non-routine manual occupations remained constant, while the share of routine occupations decreased from 34 per cent to 31 per cent (figure 6). Within the routine group, the sole occupation which saw an increase in relative employment was clerks (in particular, receptionists and information clerks), while employment of skilled agricultural workers, craftsmen and machine operators fell. Among non-routine cognitive occupations, the rise of manager-proprietors in the transportation, storage and communications sector explains half of the overall growth. A subset of non-routine manual occupations, elementary occupations[18] offers important insights on reshuffling: low-skilled farm workers almost entirely shifted to construction, and the share of other agricultural occupations (especially rice farmers) dipped.

18 "Elementary occupations involve the performance of simple and routine tasks which may require the use of hand-held tools and considerable physical effort" (ILO 2012, p.337).

The occupational change has mainly affected routine occupations, where men were over-represented in 2010. In 2016, male workers drove the structural shift of employment toward non-routine occupations. Moreover, new jobs created between 2010 and 2016, especially those in high-wage occupations, have been to the detriment of female employment. This is the case especially for professionals, where women in 2010 accounted for 68 per cent of employees. Conversely, skilled agricultural workers and machine operators had the lowest share of female employment. As Appendix table C.3 shows, of legislators, senior officials and managers, women held 48.0 per cent of these occupations in 2016, down from 55.7 per cent in 2010. A reduction in the share of female workers in all non-routine cognitive occupations was also observed between 2010 to 2016.

Figure 6. Employment shares across occupations, by routine task classifications (per cent), 2010 and 2016



Source: ILO estimates using the Labour Force Survey.

At this stage, it is important to mention that changes in the routine task structure of occupational employment is not necessarily attributable to, or caused by, technological change. Rather, an analysis of occupational employment presents a simple snapshot of the labour market situation which allows one to rapidly assess which types of routine, non-routine manual or non-routine cognitive occupations have increased their employment shares over time, noting that routine occupations are more vulnerable to the job-displacing impacts of technological change. The next section tackles this issue in greater detail, moving beyond the task-based approach to labour markets and assessing the susceptibility of occupations to either destructive or transformative digitalization.

An assembly section where workers put together parts of the air conditioner. © ILO/Asrian Mirza, May 2010

4

Transformation versus destruction: Which occupations are at risk due to digitalization?

Safety and health in manufacturing. © M. Fossat, October 2015

4. Transformation versus destruction: Which occupations are at risk due to digitalization?

The future of occupations in the new technological revolution will be shaped by ongoing policy dialogues and decisions, including the extent to which those jobs might be disrupted or transformed by digitalization. In this section, the destructive-transformative typology of occupations is discussed and a quantitative assessment is employed to map occupations into this typology. The results are then further analysed to reveal the destructive and transformative impacts of digitalization on sectors. Findings are subsequently linked to current industrial priorities to describe how jobs in these sectors are likely to be affected by digitalization.

4.1 Transformative and destructive effects of digitalization on occupations

The previous section expounded on how the routine task structure of occupational employment could reveal which occupations can be translated into codifiable rules, making them more likely to be displaced by new technological advances. To reiterate, an important lesson from this strand of literature is that automation has the potential to replace a subset of tasks performed by particular occupations.

Building on the routine task categorization of occupations, the analysis carried out by Frey and Osborne (2017) examined the susceptibility of jobs to computerization by computing the "probability of computerization" of 702 occupations. The authors posited that recent advancements in computerization resulted in the capacity to not only replace tasks that are considered routine in nature; in fact, new technologies are increasingly able to substitute for non-routine tasks. For example, machine learning algorithms are able to perform complex non-routine tasks such as language translation, fraud detection and facial recognition. Hence, the propensity of occupations to be computerized is not anymore limited by the routine task intensity of jobs. Frey and Osborne (2017) focused on which occupations are vulnerable to automation by modelling the extent to which computerization can substitute for human tasks.

ILO (2016) analysed the impact of automation on jobs in ASEAN using Frey and Osborne's (2017) methodology. The report mentioned that certain sectors such as the retail sector are likely to be transformed by automation in a way that is not job-displacing. However, the extent to which jobs could be transformed by automation is beyond the scope of Frey and Osborne (2017). To explicitly model prospects for job transformation, Fossen and Sorgner's (2019a) conceptualization is utilized.

Fossen and Sorgner (2019a) extend Frey and Osborne (2017) and posit that automation (or digitalization, as the authors call it) has the potential to transform jobs as much as destroy them. The degree of transformation is important because it provides the extent to which digitalization may actually increase labour demand. Historical evidence shows that this is not out of touch from reality. As an illustrative example, the term "data science" emerged only in the 1970s and did not gain much traction before the 2000s.[19] Online job portals then started becoming flooded with a new occupational title – data scientist – that many analysts started to regard as among the "sexiest jobs of the twenty-first century".[20] The demand for data scientists ballooned as firms started to realize that in the information age, data may be considered the new currency.

The rise of new occupational titles shows that occupations are not static: they adapt to changing times and labour market needs.

The rise of new occupational titles such as data scientist shows that occupations can be adapted to changing times and needs of the labour market. Moving beyond a model which focuses on machine capabilities that could potentially replace human tasks, the analysis presented in this report adds a new dimension – that is, the possibility that machines would transform or complement existing occupations without necessarily destroying them.

This offers a more nuanced, and arguably more holistic, view of the future of work in the age of digitalization. More specifically, digitalization as discussed in this section is operationalized as computerization of routine and non-routine tasks (Frey and Osborne, 2017), which includes advances in artificial intelligence or AI (Felten et. al, 2018).

19 G. Press: "A Very Short History of Data Science," *Forbes.com*, 28 May 2013.

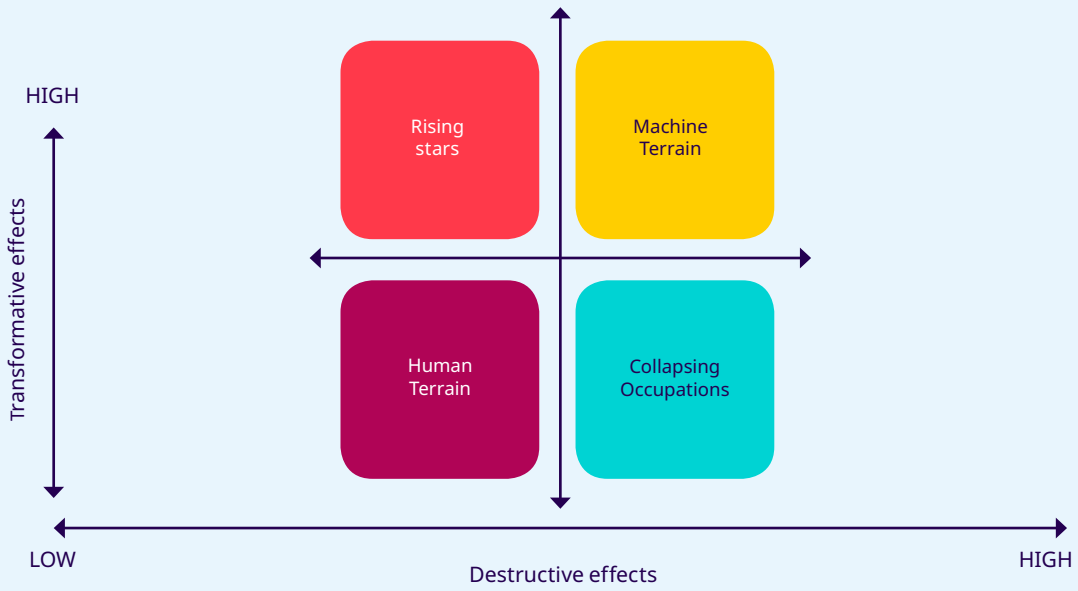
20 T. Davenport and D. J. Patil: "Data Scientist: The Sexiest Job of the 21st Century," *Harvard Business Review*, Oct. 2012.

To understand how the destructive and transformative effects of digitalization could impact jobs, occupations are mapped into a four-quadrant plane based on the typology of occupations developed by Fossen and Sorgner (2019a), shown in figure 7. In particular, the typology allows for the characterization of occupations as belonging to one of four groups based on the extent to which they are expected to be affected by transformative and destructive digitalization (box 1 provides an elaboration of the methodology).[21]

These groups include:

- **Rising stars** or occupations for which the potential for transformative digitalization is high, while the risk of destructive digitalization is low.
- **Machine terrain** or occupations that have a high potential to be transformed in a way that makes human workers obsolete.
- **Human terrain** or occupations that embed skills currently not performed by machines (that is, facing low risk due to destructive digitalization) and are not likely to be transformed by digitalization either (with low potential for transformative digitalization).
- **Collapsing occupations** or occupations that face high risk of destructive digitalization with less potential for transformative digitalization.

Figure 7. Classification of occupations based on destructive and transformative potential of digitalization



Source: Authors, based on Fossen and Sorgner (2019a).

21 Destructive digitalization destroys occupations that require skills which are substituted for by machines. Transformative digitalization affects occupations, without necessarily replacing human workers.

▶ Box 1. Methodology: Characterizing occupations based on destructive and transformative digitalization propensities

The analysis applies the framework of Fossen and Sorgner (2019a) to disentangle the potential transformative and destructive nature of digitalization on occupations in the Philippines. The distinction provides important insights on the potential implications of technological change to the world of work. For instance, Fossen and Sorgner (2019b) and Sorgner (2017) show that transformative digitalization shapes the type of entrepreneurship incentives in a completely different (and beneficial) way compared to destructive digitalization.

Fossen and Sorgner (2019a) use the computerization risk measure developed by Frey and Osborne (2017) as an index for the destructive nature of digitalization. It captures the risk of displacement on workers that is attributable to the adoption of computers. A two-step process underpins the construction of this computerization risk measure. First, experts were asked to rate the computerization risk of 71 occupations. Second, the authors used a machine learning algorithm to automatically score the remaining 651 occupations in the O*NET database.

Concerning the transformative index, Fossen and Sorgner (2019a) use the scores of technical progress of artificial intelligence given by Felten et al. (2018). Basically, the authors have used advances in 16 AI categories (such as image recognition, speech recognition), linked to the US O*NET ability description, to obtain a measure of AI exposure at the occupational level.

In order to adapt the destructive and transformative scores to the context of the Philippines, a measure of technological distance between the United States of America and the Philippines is used to adjust the computerization risk measure and the transformative index score. This proxy measure of technological divide corresponds to the ratio of robots in the two countries multiplied by the ratio of their GDP per capita in agriculture, industry and services.

$$\text{Tech. divide}_i = \frac{\text{ROBOTS}_{PH}}{\text{ROBOTS}_{US}} \times \frac{\text{GDPpc}_{iPH}}{\text{GDPpc}_{iUS}} \quad \text{where i = (agriculture, industry, services)}$$

Finally, the adjusted computerization risk (destructive score) and transformative index scores were obtained by multiplying the uncorrected scores with their respective index of technological divide.

Note on data used

Felten et. al. (2018) use AI scores that represent advancements in AI between 2010 and 2015. The data that is closest to this time period which uses the International Standard Classification of Occupations 2008 (ISCO-08) is Labour Force Survey data for the first quarter of 2017. This

corresponds to the dataset to which the results in this section are based on. Industries, meanwhile, reflect International Standard Industrial Classification (ISIC) 4 two-digit classifications.

Limitations and caveats

- Cross-country homogeneity in the task content of occupations

One main concern in the analysis of occupations, such as the quantitative assessment employed in this report, is that the task content of occupations is assumed to be fixed across countries. Furthermore, the use of standard occupational classifications, in a way, limits the scope of analysis. In particular, some new and emerging job titles, which are potentially relevant when discussing the adoption of modern technologies, cannot be tracked from the standard occupational classification systems.

- Correction for the Philippine technological frontier

Although the stock of robots represents a good proxy for the degree of digitalization in a country, some limitations should be noted. First, the data on robots used for this analysis refer mainly to industrial robots[22], and it is likely to expect digitalization spreading beyond the industrial sector. Second, using robots as a proxy may not be able to capture all types of digitalization. Third, due to data constraints, the ratio of sectoral labour productivity cannot be measured at a finer level, which would be more consistent with the four-digit occupational codes. Therefore, it is suggested to read the results with caution and in the context of broader national dialogues and policy responses around the future of work.

- Job creation due to productivity effects

The analysis is not able to capture potential job creation effects due to increased labour demand as digitalization improves efficiency along production lines.

- Timing of impacts

The timing of future and current technological impacts is not explicitly modeled in this analysis. Countries may differ in their pace of technological adoption and it may take a while for the Philippines to adapt to the pace of advanced economies on this front. This would depend on a confluence of factors such as improvements in the current skill mix, availability of incentives for industrial upgrading and organizations' investment in new technologies.

22 Data from the International Federation of Robotics indicate that in 2015 there were about 1,000 robots installed in the Philippines (compared to 234,000 in the United States).

4.2 Occupational impact of digitalization

Figure 8 splits the employment structure in the Philippines into twelve bins by combining the routine task classification of occupations (Jaimovich and Siu, 2020) and the destructive-transformative occupations typology presented in this section. The decomposition reveals intriguing results.

- **Human terrain occupations account for more than a third of total employment in the analysed occupations.**

Human terrain occupations are least affected by either destructive or transformative digitalization. Relevant illustrative occupations in terms of employment size include retail and wholesale managers, field, crop and vegetable growers, tree and shrub crop growers, shopkeepers, primary school teachers and inland and coastal waters fishery workers. Human terrain occupations are estimated to account for 35 per cent of employment in the analysed occupations. It may be encouraging that a sizable share of jobs in the country still reside in occupations that are projected to see the least turbulent impacts of digitalization. However, many of these human terrain occupations serve in the agriculture, forestry and fishing sector or in low value-added services sectors where wages are low.

- **Close to half of the human terrain occupations represent non-routine cognitive workers.**

The result was derived by examining the employment structure of the human terrain occupations by routine task classification. Non-routine cognitive workers, representing close to half of the human terrain occupations, include managers and associate professionals primarily serving in the services sector as restaurant managers, education managers and other teaching professionals, financial and insurance services branch managers, social work professionals, information and communications technology (ICT) service managers, among others. This subset of workers receives relatively higher pay than the rest of workers in the human terrain category.

- **"Collapsing occupations", which have low potential for transformative digitalization and high risk of destructive digitalization, represent one third of total employment in the analysed occupations.**

With a share of 31 per cent of total employment in the analysed occupations, collapsing occupations are at high risk of destructive digitalization, and with less potential for transformative digitalization. A large share of collapsing occupations is accounted for by non-routine manual occupations such as domestic cleaners and helpers, shop sales assistants, security guards, stall and market salespersons, gardeners and horticultural and nursery growers. Most of these workers serve in the agriculture or services sectors.

Moreover, women dominate occupations such as domestic cleaners and helpers (87 per cent), shop sales assistants (59 per cent) and stall and market salespersons (60 per cent).

While workers in these occupations could be deemed to be performing tasks that are mostly non-routine in nature, it is not difficult to imagine that these tasks could be replaced by AI advances in the future. For instance, a combination of AI technologies such as surveillance cameras and automated monitoring and facial recognition systems could potentially render selected tasks of security guards obsolete. In addition, the rise of online selling platforms and chatbots who are able to answer sales queries, among other digital technologies, could radically substitute for the tasks that stall and market salespersons usually perform. Notably, included among "collapsing occupations" are contact centre information clerks, which is a subset of workers in the IT-BPM sector that is of particular interest to policymakers (see further elaboration in box 2).

- **Machine terrain occupations account for 28 per cent of total employment in the analysed occupations.**

Machine terrain occupations are susceptible to both the transformative and destructive impacts of digitalization. Interestingly, about three fifths of machine terrain occupations are also classified as routine occupations. Supply, distribution and related managers, building and construction labourers, car, taxi and van drivers, carpenters and joiners, stonemasons, stonecutters and splitters and carvers occupy the largest shares of jobs in machine terrain occupations. Advances in digitalization are likely to transform machine terrain occupations in a way that could render them obsolete. Drivers, for instance, may be replaced by self-driving cars. Supply, distribution and related managers could be displaced by AI advances with particular applications in the logistics and supply chain management industry. High-level simulation and optimization can reduce lead times in the logistics industry. The Internet of Things is revolutionizing predictive maintenance, reducing the risk of failing customer needs and expectations.[23]

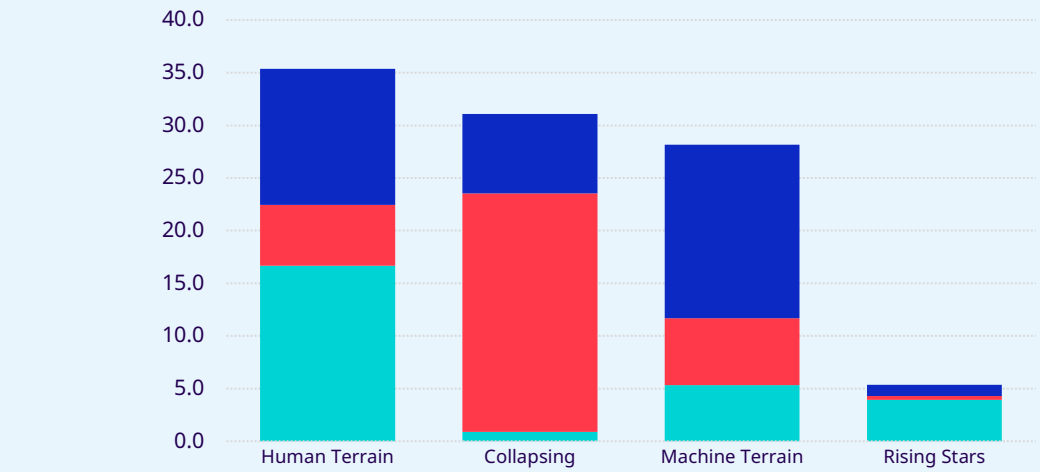
- **Only about 5 per cent of total employment in the analysed occupations are engaged in "rising star" occupations.**

The potential for transformative digitalization is high while the risk of destructive digitalization is low for "rising star" occupations. This category is led by manufacturing managers, building and related technicians, commercial sales representatives and sales and marketing managers. Workers in non-routine cognitive occupations such as managers, technicians and professionals, whose pay is substantially higher than the average worker, dominate this category. This finding suggests that digitalization puts the least risk and promises the largest gains to occupations already enjoying higher wage privileges.

23 "How Artificial Intelligence and Machine Learning Are Revolutionizing Logistics, Supply Chain and Transportation," *Forbes,* 4 Sep. 2018.

Safety and health in manufacturing. © ILO/M. Fossat, October 2015

Figure 8. Employment shares by routine task and destructive-transformative occupational categories (per cent), current scenario

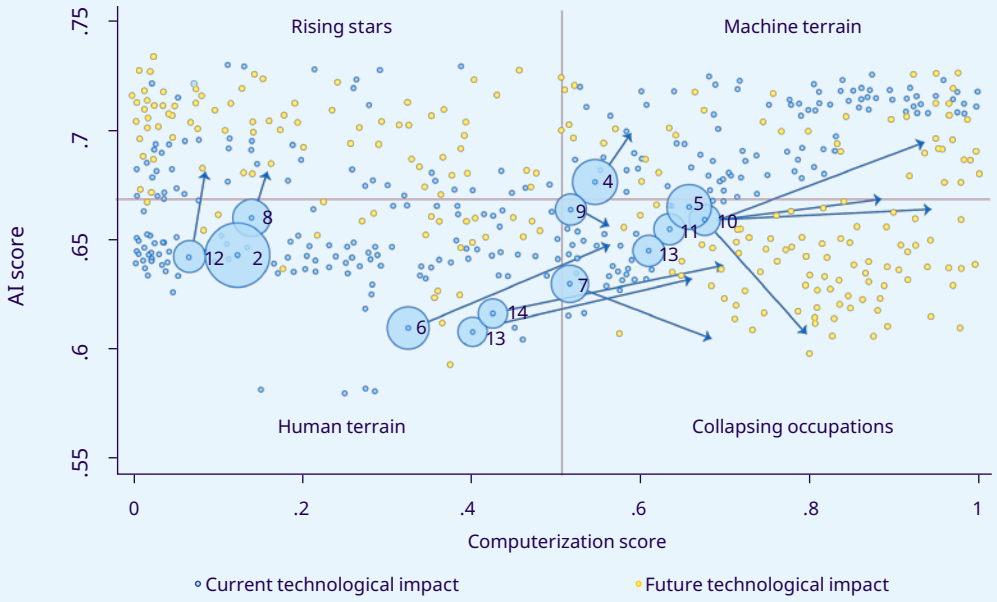


Note: "Unclassified" occupations or occupations that do not have corresponding AI and computerization risk scores, which account for 14 per cent of total employment, are excluded in the chart.

Source: Calculations based on the methodology outlined in box 1.

Figure 9 visualizes occupations in the Philippines in a two-dimensional plane based on their respective AI (transformative) and computerization risk (destructive) scores (see Appendix A for the full list of occupations arranged by destructive-transformative occupational category). The quadrants are divided by the mean of each measure, and the largest 15 occupations are numbered. Moreover, the map presents both the current (light blue) and the future (light green) technological impacts. "Current technological impacts" pertains to the current state of digitalization in the Philippines (and the current state of occupations), after correcting for technological differences between the Philippines and the United States (on which the AI transformative scores were based, as discussed in box 1). "Future technological impacts" denotes the likely state of occupations if the Philippines and the United States had the same level of digitalization. The visualization, to some extent, can provide an indication of the future direction of digitalization in the Philippines assuming that global technologies converge.

▶ Figure 9. Map of computerization risk and AI transformative potential across Philippine occupations



Notes: Light blue points represent scores adjusted to the technological frontier of the Philippines. Light yellow points represent the scores in the US, taken to be the benchmark for future technological impact. The largest 15 occupations in terms of employment size are numbered based on Appendix table C.4. Occupation 1 does not appear in the graph because it lacks the computerization score. Occupations 3 and 6 have identical computerization and AI scores; thus, they overlap. The size of the bubbles represents the size of occupations in terms of employment. The arrows indicate the direction from current to a potential future impact scenario for each of the 15 largest occupations.

Source: Calculations based on the methodology outlined in box 1.

Three key findings are illustrated in the figure. First, almost half of those employed in the 15 largest occupations (in terms of employment size) is in the human terrain quadrant, which means that many jobs are currently reliant on tasks that machines cannot perform and which are not likely to be radically affected by digitalization. Stated another way, at least six of the 15 largest occupations are human terrain occupations, and three of these are projected to move to the rising stars quadrant under the potential future impact scenario: wholesale trade managers (occupation 2 in the figure), shopkeepers (occupation 8) and primary school teachers (occupation 12). These occupations will likely be transformed by digitalization with little room for disruption, thus potentially benefiting the most from the productivity effects of digitalization. The remaining occupations in the human terrain quadrant consist of agricultural occupations (occupations 6, 14 and 15) that are foreseen to move to the collapsing occupations quadrant under the potential future impact scenario.

Second, more than one fourth of workers in the 15 largest occupations are in the collapsing occupations quadrant and are expected to remain there in the future. These occupations include building construction labourers (occupation 5), domestic cleaners and helpers (occupation 7) and shop sales assistants (occupation 10). The continuous digitalization of tasks performed by workers in these occupations could have the potential to render them obsolete provided that their task content remains constant.

Third, few occupations are in the machine terrain quadrant and will likely remain there in the future. Moreover, security guards (occupation 11) and stall and market salespersons (occupation 13) are occupations exposed to high destructive and transformative digitalization effects, which could include substitution by machines as digitalization transforms their task content.

4.3 Sectoral impact of digitalization

A sectoral decomposition of the destructive-transformational occupational structure (table 2) revealed several salient findings.

Jobs classified as collapsing occupations dominate many industries in the Philippines.

These include: accommodation and food service activities; real estate activities; administrative and support service activities; human health and social work activities; and arts, entertainment and recreation (Appendix B provides the detailed breakdown by two-digit ISIC 4 industries). Jobs in these sectors are most vulnerable to destructive digitalization with little potential for automation-induced job transformation.

As a case in point, more than half of collapsing occupations in real estate are comprised of real estate agents and managers. To see why this makes sense, one can list down the tasks real estate agents and managers perform. According to the O*NET database,[24] real estate agents:

- prepare documents such as representation contracts, purchase agreements, closing statements, deeds and leases;
- present purchase offers to sellers for consideration;
- act as intermediary in negotiations between buyers and sellers;
- generate lists of properties that are compatible with buyers' needs and financial resources;
- confer with escrow companies, lenders and other stakeholders to ensure that terms and conditions of purchase agreements are met.

24 The database (https://www.onetonline.org/) provides standardized and occupation-specific descriptors on almost 1,000 occupations in the United States.

Occupational safety and health. ©ILO/M. Fossat, October 2015

Such tasks can now be conducted virtually, without the physical presence of brokers, as enabled by online real estate platforms. An example of this is NoBroker, an India-based technology start-up that uses AI and machine learning to create an online "one-stop shop" for the real estate transaction journey. The platform allows one to register rental agreements, find flatmates, avail of a range of home services (such as home painting, cleaning, sanitization, pest control, carpentry, packing, moving, electric repair and plumbing services), rent, and buy and sell properties without brokerage fees online. Recent news indicate that the start-up operates in six Indian cities, with over 62,000 consumer registrations processed, 1,100 deals facilitated, 27,000 listings lodged in its platform and 20,000 transactions handled per month.[25] The case of NoBroker demonstrates that while no-broker platforms have not yet penetrated the Philippine market, the rise of online one-stop shops can, indeed, impact the jobs of real estate brokers.[26]

25 "NoBroker expands to Delhi NCR; aims to be present in 20 major cities over the next four years," *Economic Times*, 5 Dec. 2019.

26 The use of machine learning and AI to generate optimal matches between buyers and sellers online with just a few clicks is also the principle behind the operations of popular transport network vehicle service (TNVS) companies such as Grab.

Human terrain occupations account for the largest share of jobs in wholesale and retail trade, information and communication, public administration and defence and education.

Jobs in these sectors are the least vulnerable to both destructive and transformative digitalization. Classified as "human terrain", the education sector offers a good illustration of this point. More than 90 per cent of workers in the sector are teachers. It appears that teachers' jobs cannot be replaced by digitalization even as technology has transformed where learning takes place, as seen in efforts to digitalize the classroom such as massive online open courses offered by universities or learning how to code or cook a meal through YouTube. Besides preparing materials for learning activities and delivering lectures, teachers provide emotional support and guidance, assess student behaviours, monitor the development of students' socio-emotional skills, provide student-specific feedback, among others. Machines and AI are still far from being able to mimic such largely dynamic, social and affective nature of the teaching occupation.

Jobs in mining and quarrying, manufacturing, utilities, construction, logistics, and finance sectors are largely "machine terrain".

These jobs face high risk of destructive digitalization and exhibit high potential for transformative digitalization. Sectors with the largest share of machine terrain occupations are mining and quarrying, manufacturing, water supply, sewerage, waste management and remediation activities, construction, transportation and storage, financial and insurance activities, professional, scientific and technical activities, and activities of territorial organizations and bodies.

For the financial and insurance services sector, bank tellers, debt collectors, accountants and bookkeepers and data entry clerks account for a large share of machine terrain occupations. The case of UnionBank on digital banking in the Philippines offers insights on how the shift to digital banking can transform occupations in the sector. The bank invested on upgrading its technology infrastructure to accommodate "straight-through transactions processing" or transactions that can be undertaken quickly after a sequence of presses using one's device. The massive reform enabled bank customers to carry out their transactions outside the bank's premises, endangering the jobs that bank tellers used to occupy. UnionBank tackled this challenge by evolving the role of bank tellers from transaction processors to branch ambassadors, taking on higher margin transactions such as financial advising for loans and investment.[27] The transformation of the role of bank tellers required an organization-wide re-tooling and retraining programme, which is now facilitated through the UnionBank University. The University helps the bank in communicating its commitment to technological innovation and in supporting the continuous learning of its employees.[28]

27 C. Schnabel: "UnionBank sets out to hack PH banking with digital transformation." *Rappler*, 14 Dec. 2017.

28 S. Sendingan: "How UnionBank is future-proofing its workforce against digital disruptions," *Asian Banking & Finance*, 18 Nov. 2019.

"Rising stars" occupations dominate in the electricity, gas, steam and air conditioning supply sector. However, manufacturing, real estate and professional and scientific activities also show quite sizeable shares of workers engaged in rising stars occupations.

Electrical line installers and repairers, electrical, mechanical and civil engineers and building electricians are examples of rising stars occupations in the electricity, gas, steam and air conditioning supply sector. While digitalization is likely to transform the jobs of engineers in this field, they are not likely to be displaced by digitalization: engineers' jobs require a lot of hypothesis testing and experimentation, and the nature of innovation that ensues from this iterative learning process does not follow a linear and certain path. Among the ways that new technologies are revolutionizing engineers' jobs is through the enhanced connectivity among systems that engineers work with, made possible with advances in information technology. Enhanced connectivity helps by shortening product development cycles, in generating quick demand forecasts and in arriving at fast and informed decisions.[29] Advanced manufacturing tools also enable engineers to use virtual simulators or small-scale prototypes to test their ideas. These developments illustrate how new technologies could complement and transform jobs in rising occupations.

▶ Table 2. Destructive-transformative occupational structure, by sector (per cent), current technological change

	Collapsing	Human Terrain	Machine Terrain	Rising Stars	Unclassified
A - Agriculture, forestry and fishing	18	39	0	0	43
B - Mining and quarrying	2	0	93	5	0
C - Manufacturing	9	1	66	22	2
D - Electricity, gas, steam and air conditioning supply	5	0	47	48	0
E - Water supply; sewerage, waste management and remediation activities	6	0	77	4	13
F - Construction	1	0	88	11	0
G - Wholesale and retail trade; repair of motor vehicles and motorcycles	34	54	8	3	0
H - Transportation and storage	10	18	71	0	0
I - Accommodation and food service activities	74	23	2	1	1
J - Information and communication	20	31	20	12	17
K - Financial and insurance activities	17	16	49	11	6
L - Real estate activities	57	3	11	30	0

29 Gagan (2018) discusses how AI is transforming the future of the energy sector.

	Collapsing	Human Terrain	Machine Terrain	Rising Stars	Unclassified
M - Professional, scientific and technical activities	9	18	47	13	13
N - Administrative and support service activities	85	2	7	2	4
O - Public administration and defence; compulsory social security	23	33	20	4	19
P - Education	8	78	3	2	9
Q - Human health and social work activities	24	23	12	3	39
R - Arts, entertainment and recreation	73	21	1	3	1
S - Other service activities	63	24	9	2	3
T - Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	100	0	0	0	0
U - Activities of extraterritorial organizations and bodies	13	15	72	0	0

Notes: "Unclassified" are occupations with no computerization risk and AI transformative scores. Each row corresponds to the share of each occupational category in total employment per ISIC 4 Section. Cells are coloured from green (0 per cent share) to red (100 per cent share).

Source: Calculations based on the methodology outlined in box 1.

In view of the COVID-19 pandemic, some sectors are likely to face exacerbated labour challenges. In the short term, the pandemic affects employment, working hours and incomes in these at-risk sectors. In the medium term, occupations in the same sectors may face high exposure to the risk of destructive or transformative digitalization.

The ILO Monitor on COVID-19 and the world of work (ILO, 2020b) identified the sectors that are at risk of labour market disruptions and produced global estimates on the sectoral impact of the pandemic. The at-risk sectors include wholesale and retail trade, repair of motor vehicles and motorcycles, manufacturing, accommodation and food services, real estate activities and business and administrative activities. While the sectoral impact of the pandemic differs by country, many of the at-risk sectors are also identified as facing high risk of destructive digitalization in the Philippines in this report.[30] More than two thirds of jobs in the manufacturing sector are classified as machine terrain, while collapsing occupations dominate administrative and support service activities, accommodation and food service activities and real estate activities.

30 A more detailed discussion of the impact of the COVID-19 crisis on the Philippine labour market and sectors may be found in ILO (2020a).

Garment factory in the Philippines. ©**ILO**, March 2002

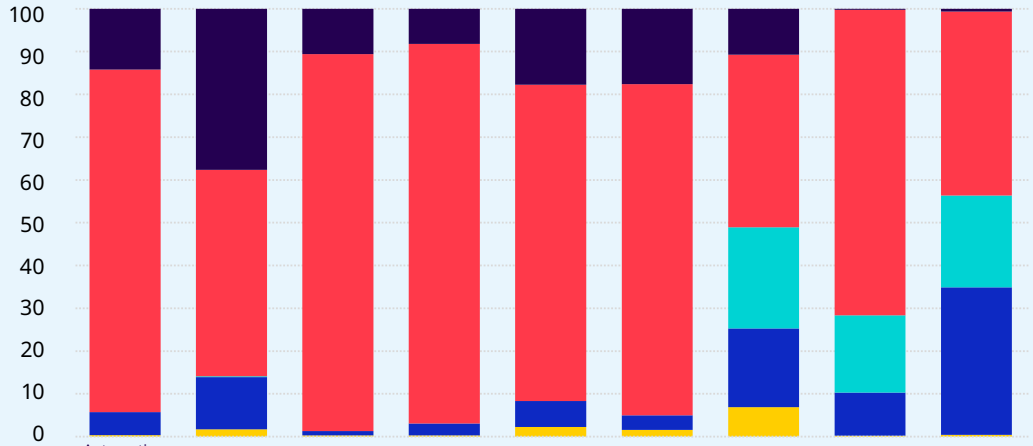
The COVID-19 pandemic introduced an abrupt change to the world of work, which made the call for the adoption of digital technologies more prominent.[31] To the extent that firms will adopt more digital technologies, workers in at-risk enterprises may be rendered more vulnerable. In the phase of socio-economic recovery, enterprises may adopt new technologies and workers may seek to improve their labour market situation. Social dialogue among government, workers' and employers' organizations will be play an important role to navigate a fair transition and shape a human-centred future of work to achieve decent work and sustainable development (an in-depth analysis is provided in ILO, 2020a).

31 UN DESA (2020): "Digital technologies critical in facing COVID-19 pandemic," *United Nations*, 15 Apr. 2020.

4.4 Examining priority industries in the context of destructive and transformative digitalization

To link the results of the analysis with the current priority industries outlined in the national industrial strategy I3S, Figure 10 shows the destructive-transformative occupational structure of each priority sector (ISIC 4 two-digit industry codes were mapped to the priority sectors).

Figure 10. Destructive-transformative occupational structure, by priority sector (per cent), current technological change



	Automotive, Aerospace and Shipbuilding	Chemicals	Construction and Infrastructure	Electronics and Electrical Equipment	Furniture, Garments and Textiles	Iron and Steel, Tool and Die	IT-BPM	Logistics	Tourism
Rising Stars	14.2	37.6	10.6	8.2	17.7	17.6	10.8	0.2	0.6
Machine Terrain	80.1	48.2	88.1	88.7	73.9	77.5	40.3	71.4	43.0
Human Terrain	0.0	0.2	0.0	0.0	0.0	0.0	23.6	18.0	21.5
Collapsing	5.3	12.2	1.0	2.8	6.1	3.4	18.4	10.1	34.5
Unclassified	0.4	1.7	0.3	0.3	2.3	1.6	6.9	0.2	0.4

Note: The chart excludes agribusiness as the industry spans plenty of sectors that require more granular sectoral information. Presented is the share of each occupational category in the total employment of each priority sector.

Source: Calculations based on the methodology outlined in box 1.

The key findings illustrated in the figure are as follows.

Machine terrain occupations dominate all priority sectors.

The shares of machine terrain occupations are most disproportionate in the following priority sectors:

- electronics and electrical equipment (88.7 per cent);
- construction (88.1 per cent);
- automotive, aerospace and shipbuilding (80.1 per cent);
- iron and steel, including tool and die (77.5 per cent);
- furniture, garments and textiles (73.9 per cent);
- logistics (71.4 per cent).

Again, machine terrain occupations include jobs where high transformative digitalization could enhance the job displacement effect of digitalization. This pattern is driven by certain occupational titles. In the automotive, aerospace and shipbuilding industry, for instance, mechanical machinery assemblers, welders and flame cutters, motor vehicle mechanics and repairers, plumbers and pipe fitters, painters and related workers, sheet-metal workers and manufacturing labourers are some of the machine terrain occupations at risk. The robotization of manufacturing may disrupt and replace human tasks in these occupations, but the nature of their tasks could also be transformed by digitalization. Recent news indicates that robotics adoption in Philippine manufacturing sectors has already commenced. The world's leading collaborative robotics (cobots) company, Universal Robots, has partnered with Asia Integrated Machine, Inc. to support the growing demand for industrial robots in the country.[32] The entry of cobots may open up avenues for collaborative human-machine interaction in machine terrain occupations. Worker upskilling may help workers transition to newer ways of doing things.

Rising occupations account for a sizeable share of employment in priority sectors such as chemicals, iron and steel, furniture, garment and textiles and automotive, aerospace and shipbuilding.

The shares of rising occupations to total sectoral employment are: 37.6 per cent for chemicals; 17.6 per cent for iron and steel, including tool and die; 17.7 per cent for furniture, garments and textiles; and 14.2 per cent for automotive, aerospace and shipbuilding. In the chemicals industry, rising occupations include manufacturing supervisors, technical and medical sales professionals, chemical engineers, manufacturing managers, chemists, office supervisors, among others.

32 "Robotics is key to continuing competitiveness of PH industry – Universal Robots," *Interaksyon,* 6 Mar. 2018.

The shares of human terrain and collapsing occupations are quite significant in IT-BPM, logistics and tourism.

Box 2 relates this finding to current efforts to upgrade workforce skills in the IT-BPM industry.

▶ Box 2. Upskilling the Philippine IT-BPM industry

Contact centre salespersons and clerks, also known as call centre agents, constitute a cohort of collpsing occupations in the Philippine IT-business process management industry. Wielding its large base of English-speaking workers to its advantage, the country is hailed as the "Call Centre Capital of the World". The IT-BPM industry is currently valued at over US$25 billion and employs about 1.3 million workers. It is estimated that about half of industry workers are employed in "low-skill jobs" and immersed in tasks that mostly involve answering calls and processing inquiries.[33] There are already AI-powered machines available that are able to execute these tasks with immense accuracy: virtual agents that are able to detect sentiment, predict customer behaviour and are trained to operate in multilingual and cultural contexts, and AI-assisted platforms that operate round the clock. The advent of these new technologies brings challenges to the Philippine IT-BPM industry. Challenges that the industry as well as government, workers' and employers' organizations need to address, taking into account skills development and employment prospects.

The *Philippine IT-BPM Roadmap 2022* cites the expected negative impact of automation on low-skilled IT-BPM jobs as an impetus to advance the industry's transition towards having a higher value-added service mix. According to the roadmap, high-impact programmes that support the infusion of higher-skilled human capital into the industry include:

- Actively advocating for a strategic Science, Technology, Engineering and Mathematics (STEM) policy framework.
- Establishing a High Entry Placement Programme (HEPP) targeted at graduates to directly take on mid- and high-skill roles in the industry.
- Creating Higher Education Technology Consortiums (HETCs) to hone high-skilled specialists.
- Building programmes that upskill current manpower in specialized competency areas.

33 E. Lopez: "Artificial intelligence: Friend or foe to Philippine call centre workers?" South China Morning Post, 9 Mar. 2020.

5

Workforce and skills development in an era of technological disruptions

Safety and health in manufacturing. © ILO/M. Fossat, October 2015

5. Workforce and skills development in an era of technological disruptions

Viewed from the context of Industry 4.0, the skills debate is interspersed with the challenge of fostering an innovative, creative and entrepreneurial workforce. In this section, strategies related to upskilling or reskilling the workforce in response to the new technological wave are reviewed. The exposition starts with a brief discussion of the implications for skills development and education based on the results of the analysis presented in Section 4. Next, a review of Industry 4.0-related workforce and skills development policies and programmes in the Philippines is provided. These policies are then juxtaposed against upskilling policies in other countries.

5.1 Implications for skills development and education

Skills and tasks are two important concepts in the literature that discusses the intersection between jobs and digitalization. A rich family of literature analysed jobs and their exposure to automation given their task content (for instance, Autor, 2015). The changing task content of jobs has significant implications on skills demand. Empirical evidence has in fact shown that recent technological change is skill-biased (for instance, Acemoglu and Restrepo, 2020; Akerman, Gaarder and Mogstad, 2015).

The analysis presented in this report so far contends that digitalization may transform occupations in a way that either disrupts the need for human involvement in jobs, complements human tasks or both. A key caveat of this analysis is that it does not capture the timing of digitalization impacts. Whether or not digital transformation is already impacting the jobs market remains in question. To what extent has digitalization transformed the current demand for workers? What does the current picture say about the future direction of skills demand in the country?

According to LinkedIn's *2019 Emerging Jobs Report* (Appendix table C.5), the ten fastest growing jobs in the country are robotics engineers, cybersecurity specialists, customer success specialists, data scientists, sales development representatives, full stack engineers, DevOps engineers, data engineers, JavaScript developers and cloud engineers. While the analysis in LinkedIn's 2019 Emerging Jobs Report does not provide a representative picture of all available employment opportunities in the Philippines, most of these fast-growing jobs require intensive interaction with machines. The tasks of robotics engineers and cloud engineers, for example, involve creating or managing digital platforms for automating organizational processes. The former study business processes that require mundane, codifiable human effort and then leverage existing tools to computerize them, building so-called "robotics process automations".

Business Process Outsourcing. © ILO/R. dela Cruz, March 2011

The latter manage the technical aspect of the cloud, enabling organizations to make a smooth transition to cloud-based solutions for file management and storage.

These fast-growing jobs that require intensive interaction with machines demand a broad range of skills. Future skills demand may thus be gravitating towards individuals who are versatile, able to multitask and equipped with multiple intelligences and sharp problem-solving skills. Full stack engineers, for example, manage all technologies required of a project from start to end, eliminating the need for engineers to manage segments of the task at hand. DevOps engineers are "hybrid engineers", managing both technology development and technology operations and mitigating linkage-related problems in business processes.

Others require the ability to interact well with people while aided by machines for greater task efficiency. Customer success specialists, for example, do not simply answer specialized queries (as what many call centre agents do); they are trained to proactively respond to client needs by working with them along the problem-solving process. Sales development representatives not only sell products to clients but also work on client retention, consulting and lead generation.

Fast-growing occupations demand unique skills that are generic and embedded in the application of technical skills and are difficult to be taught as stand-alone subjects.

Each of the aforementioned occupations require unique skills that are generic and embedded in the application of technical skills and are difficult to be taught as stand-alone subjects. They require a lot of experimentation, hypothesis testing, creativity, critical thinking, grit and even failure tolerance. The rise of these emerging occupations brings to the fore the need to link the jobs-technology debate with the current education landscape.

To provide an overview of the current picture of education as it relates to sectors and the current labour situation, Appendix table C.6 details the share of workers by level of formal education in each sector. One fourth of workers in the Philippines have a tertiary education degree, about 40 per cent have a lower-secondary education degree, and another one fourth have completed primary education.

In general, the service sector, which contributes substantially to the GDP, absorbs a huge fraction of educated workers. Highly-educated workers also account for a high share of employment in some of the sectors that are likely to be mostly affected by the adoption of digital technologies, like administrative and financial activities. This is less the case for manufacturing where the share of workers with tertiary education is only 19.7 per cent. In construction and retail trade, the said share falls below the mean. These two sectors employ a high ratio of workers in machine terrain occupations. As such, destructive digitalization may affect and possibly displace workers who are not yet equipped with the skills that enable them to wield relevant digital tools.

Identifying emerging jobs in the Philippines and supplementing this with key labour market statistics vis-à-vis education-related variables provide a helpful snapshot of where the demand for labour stands and is headed with respect to industry demands. However, much needs to be done in order to flesh out the complex relationships of skills, jobs and digitalization as these relate to occupational and sectoral labour market structures.

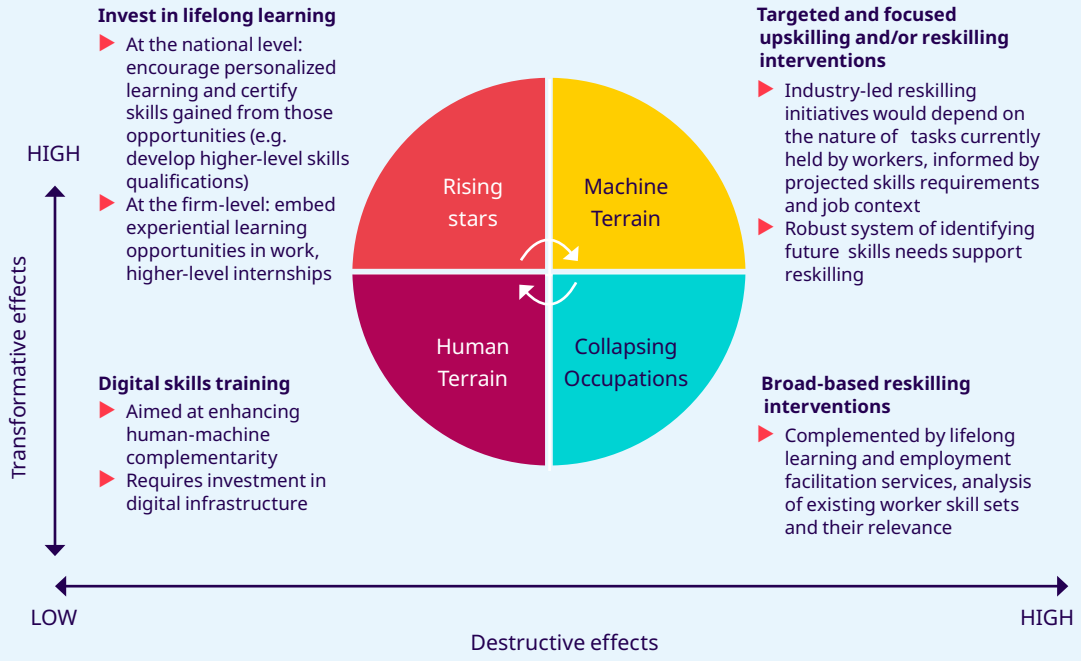
For one, anticipating the future of skills against the backdrop of Industry 4.0 technologies requires a deeper look at the forces that drive current and future demand and supply for skills. From the demand perspective, this entails understanding how digitalization impacts work tasks and skills needs in particular occupations and sectors. The supply perspective, meanwhile, reflects on the state of skills supply and its ability to deliver existing and emerging skills demands. This would include spillover of human capital and of training to other economies due to talent outmigration (or brain drain), and how current institutions in place shape cross-border talent mobility.

The skills anticipation and planning challenge is beyond the scope of this report, but it nevertheless surfaces an important insight regarding the need to leverage the power of data, supported by social dialogue, in skills planning for the future of work. In particular, policies can benefit from combining harmonized labour force data with real-time hiring information to generate timely and accurate insights on skills dynamics. Meanwhile, social dialogue among government, industry, employers' and workers' organizations and other stakeholders can help in establishing shared industry guidelines and standards pertaining to workforce planning.

While some types of occupations may benefit more from particular skills-related interventions, all occupations will benefit from overall investment in capabilities of people.

In linking skills development to the typology of occupations along the destructive-transformative effects of digitalization, it is important to emphasize that some types of occupations may benefit to a varying extent from particular skills-related interventions, though all of them will benefit from overall investment in capabilities of people. Figure 11 provides an indicative and non-exhaustive illustration of skills-related interventions in support of occupations depending on their destructive and transformative potential of digitalization.

Figure 11. Simplified overview of skills development interventions for occupational categories based on destructive and transformative potential of digitalization



Implications for rising stars: Occupations with higher potential for transformative digitalization, lower risk of destructive digitalization

Occupations belonging to the "rising stars" category are likely to be transformed by digitalization in a way that does not reduce demand for tasks performed by humans. Because digital technologies evolve at a fast pace, apart from keeping abreast with emerging disruptive technologies, one way to support the growth of rising stars occupations is to invest in lifelong learning both at firm-level and at the level of national policymaking.

Cultivating learners with self-directed, personalized and planned learning goals may help nurture an agile workforce that is flexible enough to withstand the challenges brought about by fast-paced technological change. Skills obtained from lifelong learning are particularly beneficial for workers in rising occupations such as policy and planning managers, office supervisors and electrical engineers who occasionally deal with complex problems.

At the national policy level, lifelong learning can be promoted by encouraging learners to seek personalized learning opportunities and creating a system that certifies acquired skills. To expound on the latter, the national qualification framework can be strengthened to facilitate reskilling at higher education levels. This can be complemented by companies through embedding experiential learning opportunities in everyday work. The increased use of work-based learning initiatives such as

on-the-job training, job rotation or higher-level apprenticeships can expose workers to evolving job roles and functions, creating an organizational ecosystem that rewards and encourages skills utilization and increases productivity. Benefits from work-based learning can be optimized by tapping or developing qualified trainers who have frontline industry knowledge and experience.

Implications for machine terrain: Occupations with higher potential for transformative digitalization, higher risk of destructive digitalization

Workers in machine terrain occupations, which account for the majority of jobs in the Philippines' priority sectors, are likely to benefit from targeted and focused upskilling and/or reskilling interventions as these jobs have higher potential for transformative digitalization and higher risk of destructive digitalization. Upskilling entails learning new competencies needed in current job roles, while reskilling involves training to acquire skills needed to occupy a new role. For machine terrain occupations such as assemblers or manufacturing labourers, upskilling can help workers upgrade their skills in a manner that increases their skill complementarity with machines such as cobots.

In addition to upskilling initiatives, industry-led reskilling efforts can help workers within the same sector transition to a new job role. Training would depend on existing competencies and current tasks held by workers, as well as the prevailing job context, business models, nature of work and extent of technological adoption in the sectors they are engaged in. As such, industry-led reskilling can benefit from further research (such as industry surveys and labour market analysis) and social dialogue on emerging jobs, career mapping and skills anticipation. Insights generated from these can help establish a robust system for the identification of future skills needs to support reskilling initiatives.

Implications for human terrain: Occupations with lower potential for transformative digitalization, lower risk of destructive digitalization

For workers in human terrain occupations, gaining and developing digital skills remains essential, without undermining the importance of enhancing broader skills development (such as building emotional intelligence and honing generic skills and competencies). Even though current digitalization advances are not yet powerful enough to mimic or replace tasks in human terrain occupations, there is space for productivity-augmenting technologies to complement work performed in these occupations. An example would be teachers. While digitalization has not essentially replaced or transformed teachers' tasks, the COVID-19 pandemic has forced many of them (especially in areas placed under community quarantine) to work from home and deliver their modules through online platforms. The pandemic has required teachers to reimagine a future of work hinged on distance learning and the use of digital tools to ensure continuous service delivery.

COVID-19 and e-learning. © ILO/F. Latief, June 2020

The use of digital technologies will likely be ubiquitous in the future. It may be prudent to embrace the opportunities they bring and complement these with investments in digital infrastructure and skills training.

At this stage it is important to note that fostering digital skills requires investment in digital infrastructure.[34] Supporting the adoption of innovations in sectors and occupations may disrupt status quo organizational practices and business models but may increase resilience. As the use of digital technologies will likely be ubiquitous in the future, it may be prudent to embrace the opportunities they bring rather than avoid them from seeping into established practices. For example, digital applications that help farmers link their produce to the market have already been developed. These types of digital technologies in no way make farmers' tasks obsolete but can help them in navigating through logistical difficulties. Such advances enhance human-machine interaction, and so there is opportunity for farmers to be trained to wield such digital tools.

34 The extent and pace of innovation and digitalization will likely be experienced differently across sectors (such as industry versus services), thus the provision of ICT resources should take into account sector heterogeneity.

A supervisor discusses the TPM Autonomous Maintenance Activity Board with employees. © **ILO/Ruben Hamahiga Dela Cruz**, March 2011

Implications for collapsing occupations: Occupations with lower potential for transformative digitalization, higher risk of destructive digitalization

Supporting the skills development of collapsing occupations is critical for inclusive growth and productive employment. Workers in this category may benefit from reskilling initiatives that help them broaden their skills base by enabling them to obtain micro-credentials for immediate new jobs or job roles, while strengthening their generic skills base for further reskilling and upskilling in the future. Reskilling initiatives to strengthen generic skills base (for instance, sharpening workers' non-cognitive skills such as grit, critical thinking, problem-solving and social and/or emotional intelligence) can be injected into the curriculum of formal learning institutions. This can be done by, for example, upgrading teacher training that facilitates teaching, and assessing students in terms of twenty-first century skills such as complex reasoning, creativity, active and collaborative learning and the growth mind-set.

Recognizing that reskilling needs vary considerably from one sector (or subsector) to another, effective reskilling of those in collapsing occupations requires differentiated and (sub)sector-specific approach. In some cases, highly specialized training may help to upgrade the skills of workers in such occupations. Contact centre information clerks, for instance, may have to reskill towards more analytical and/or consulting roles as chatbots become more powerful at answering basic queries.

For workers whose skills are not formally certified, recognition of prior learning would help boost credentials and assist them to take up further certified training. Doing so may provide a safety net for workers in occupations at high risk of destructive digitalization, helping them transition to new job roles that complement their skill sets or to move to another sector with different skills requirements. In this regard, an in-depth analysis of existing skill sets of workers in collapsing occupations and the transferability of these to other jobs would help generate more focused and specific evidence-based policy recommendations for this category of workers.

To facilitate the smooth job transition of workers in collapsing occupations towards other occupations or sectors, efforts for broadening the skill base of workers shall be delivered alongside employment services such as labour market information and job-skills matching assistance. The potential of digital labour platforms to generate real-time job-employee matches can be leveraged to optimize job fit across vacancies. Likewise, digitalization of public employment services may be critical in supporting jobseekers in the labour market and achieving better matches with employers.

The discussed interventions for each of the destructive-transformational occupational categories are illustrative and emphasize skills development strategies that can be deployed to a varying extent depending on how digitalization is likely to impact particular types of occupations. It is important to note that while certain skills development programmes intuitively complement specific occupational categories, this does not mean that occupations associated with the other categories would not benefit from the same programmes. As a case in point, lifelong learning initiatives have cross-cutting impacts on all types of occupations but may particularly be more important for those experiencing the impacts of destructive digitalization. Likewise, worker upskilling and reskilling can benefit all types of workers but are especially helpful for those in occupations with high propensity to be transformed by digitalization.

Other relevant recommendations that appear to be important for all categories of workers are: establishing a robust labour market information system for identifying future skills needs; promoting work-based learning; strengthening the development of foundational skills, digital skills and generic STEM skills; and adopting (sub)sectoral approaches to skills anticipation and planning, with a view to making (re)skilling efforts more effective for workers and employers.

Industry and training institutions play key roles in governing the process of structural change in skills, facilitating dialogue with employers' and workers' organizations, and aligning national priorities with anticipated skills needs and projected labour demand.

Overall, the findings of this report underline the key roles played by industry and training institutions. They contribute to governing the process of structural change in skills, facilitating dialogue with employers' and workers' organizations and aligning national priorities with anticipated skills needs and projected labour demand.

This finding is even more relevant for developing countries such as the Philippines where the lack of skills can pose a challenge to sustainable growth. The rise of emerging occupations highlights the need for private sector-led, in-house organizational training programmes that enable new entrants in the labour market to actually apply and hone their skills. It also highlights the need for the current education and training systems to explore where jobs are headed and to implement reforms that meet anticipated future skills needs. This is important since most of the priority industries outlined in the I^{3}S and the NTESDP 2018-2022 are dominated by machine terrain occupations.

The research presented in this report provides the first analysis of the transformative and destructive effects of digitalization on occupations and sectors in the Philippines, and points to potential implications for skills development. Building on this analysis, additional in-depth research would be required to draw further implications for skills development, including at sectoral and subsectoral levels. For example, policy can benefit from a more comprehensive examination of skills demanded in the Philippine labour market–in particular, skills utilization in occupations of particular sectors, job retention and separation patterns, work conditions that promote technology adoption in firms, and current efforts undertaken by firms to embrace Industry 4.0 opportunities. The next section discusses workforce and skills development policies related to Industry 4.0 in order to further expound on how the current set of policies in place interact to tackle issues surrounding skills, education and new technologies or innovations.

5.2 Industry 4.0-related workforce and skills development policies and programmes in the Philippines

In the Philippines, there are at least five interrelated clusters of policies and programmes on workforce and skills development in relation to Industry 4.0[35] (Appendix table C.7 for a detailed mapping and summary). These include national policies and programmes that (a) tackle innovation-led development, (b) highlight the importance of government-academe-industry collaboration in skills development, (c) enhance worker employability and address the job-worker mismatch challenge, (d) seek to upskill or reskill the current and future workforce, and (e) support research and development initiatives.

▸ Cluster 1: Policies and programmes promoting innovation-led development

The Inclusive Industrial Innovation Strategy, which draws a clear link between innovation and industry priorities, belongs to this cluster. In connection with the I^{3}S, the *Inclusive Filipinnovation and Entrepreneurship Roadmap* outlines the government's strategy towards building an inclusive innovation and entrepreneurship ecosystem. It explicates how the national industrial innovation agenda links strongly with human capital and skills development. Relating to I^{3}S and the aforementioned roadmap, the *Philippine*

35 These thematic clusters emerged from ILO's mapping of skills development policies in the Philippines. While discussed separately, these clusters are interrelated and complement each other.

Development Plan 2017-2022 clearly elucidates the need to build strong foundations for a globally competitive knowledge economy by vigorously advancing science, technology and innovation in all economic sectors. The Philippine Innovation Act guides the whole-of-government approach to innovation governance, bringing together several agencies for cooperation in innovation (including the National Economic Development Authority (NEDA), Department of Science and Technology (DOST) and Department of Trade and Industry (DTI). Finally, the Innovative Start-up Act incentivizes the creation, growth and expansion of new and innovative businesses.

While the aforementioned policies aptly position innovation in long-term development planning, an important type of innovation – that is, digital innovation – merits further attention in relation to Industry 4.0. Current policies and programmes that promote digital innovation include digitalPH, which aims to stimulate innovation in digital and multimedia technologies and services, and the *Philippine Roadmap for Digital Startups*, which outlines the government's plans to invigorate the digital start-up community. Both are managed by the Department of Information and Communications Technology (DICT).

The national programmes and policies pertaining to innovation-led development touched on aspects concerning business viability, investment promotion and incentive provision while underscoring the importance of multi-stakeholder collaboration in industry development. However, there is still room for emphasis on the role that digitalization will play in industrial transformation and resulting labour market adjustments (in addition to improving the quality of ICT infrastructure in the country). Moreover, the link between the overall industrial transformation and innovation strategy by the Government and the development and application of particular skills in industries appears to be at its early stage of development. Discussions surrounding sector skills issues can therefore benefit from tapping multiple stakeholders in identifying gaps in sector-skills policies and identifying industry- and national-level strategies that can be deployed to address those gaps.

▸ Cluster 2: Policies and programmes strengthening government-industry-academe linkage

Recently, policy has placed greater weight on the importance of strengthening coordination mechanisms for these three key stakeholders. The consensus view specifies the role of the government as a "facilitator" of innovation, wielding its strategic resources to address the main constraints to development and employing those resources to cultivate a conducive environment for innovation to thrive.

Industry demands are changing, and they have become much more volatile and competency-focused due to the rising adoption of Industry 4.0 technologies. Closing the gap between the skills needs of the industry and the current supply of worker skills requires the participation of government, industry and academe.

TESDA trainees add final touches to the table set designed for fine dining. © ILO/Ruben Hamahiga Dela Cruz, March 2011

Governments can help close this gap by encouraging industry-academe research collaboration and providing on-site industry exposure to academic professionals, and vice versa. In accordance with this, DOST's Collaborative Research and Development to Leverage Philippine Economy (CRADLE) programme provides a maximum of 5 million pesos to one- to three-year industry-academe collaborative projects that help the industry gain an innovative market advantage or aid in small- and medium-sized enterprise (SME) product development.

The Sectoral Engagement Grants of the Commission on Higher Education (CHED) links faculty and non-teaching staff from higher educational institutions by having them work on commissioned researches and extension activities with industry collaborators. In so doing, those in the academe may upgrade their skills by applying their theoretical knowledge on practical problems faced by their industry partners. This model shares a semblance with DOST's R&D Leadership Programme, which engages experts with strong leadership, management and innovative capacities to shepherd the development of research capacities in higher educational institutions and research and development (R&D) institutions.

Most of the aforementioned programmes are exemplar cases of policies and programmes that promote government-academe-industry collaboration in skills development. They relate to financial and social incentives to push stakeholder coordination forward. Thus, the demand-led industry-skills development model may be explored with government acting as a coordinator and/or overseer of partnerships among industry associations and formal training institutions.

▸ Cluster 3: Policies and programmes enhancing worker employability and addressing job-worker mismatch

After spending more than ten years in school, graduates grapple with employability problems outside the academe. In fact, according to the *JobsFit Report 2022* of the Department of Labor and Employment (DOLE), almost half of the Philippines' unemployed consists of young adults who are mostly first-time entrants in the job market; DOLE's Philippine TalentMap initiative, which makes use of competency-based and standardized assessment tools to identify gaps in the market for talent, also found that about one third of jobseekers need additional training.[36] This presents a challenge for an economy that seeks to balance employment generation and technological innovation. To address worker employability issues, programmes such as the Job Bridging Internship Programme of the Technical Education and Skills Development Authority (TESDA) and DOLE's JobStart Philippines provide employment facilitation services through labour market information initiatives, worker training and job referrals.

Industry is responsible in forecasting future skills needs, communicating these to learning and training institutions and possibly building internal capacity for continuous skills development within firms. Since industry is a recipient of talent cultivated

36 M. Jaymalin: "Many Filipino students, jobseekers not 'employable'," *The Philippine Star*, 27 Dec. 2018.

in formal training institutions, there is potential for putting more emphasis on industry players' voice in industrial policymaking. This requires frequent interactions between the Government and industry associations in mapping skills priorities and in communicating these to training institutions, which would then have to adjust their curricula to meet industry demands.

Workers would do their share. To keep up with current workforce demands, workers are expected to anticipate the future demand for skills, engage in skills development to meet labour market needs and contribute to their own personal and professional development through lifelong learning. Because individuals, more so young and inexperienced learners, have limited market information, there is scope for government intervention to reorient and adjust the supply of skills towards the direction of future skills demands. Indeed, the dynamic process involved in workforce skills demand and supply requires a constant exchange and social dialogue among workers, employers, government and other stakeholders, as also emphasized in Cluster 2.

▸ Cluster 4: Policies and programmes addressing worker upskilling and reskilling

Notably, the notion of lifelong learning for continuous skills upgrading and updating is a tenet of *Ambisyon Natin 2040*. It espouses the vision of nurturing smart and innovative Filipinos by fostering not only foundational literacies (including numeracy, scientific, ICT, financial and cultural and civic literacy), but also competencies (such as critical thinking, problem-solving, creativity, communication and collaboration) and character values (including curiosity, initiative, persistence, grit, adaptability, leadership and social and cultural awareness).

Recent policies suggest that the education system is making adjustments to hone competent, work-ready, lifelong learners. This partly relates to a careful review and re-appropriation of curricular programmes aimed at skills development. Among those is the shift to a K-12 educational system, which has effectively lengthened the time it takes for a student to finish basic education by adding two more years to the ten-year Basic Education Curriculum. The last two years of the K-12 programme is called Senior High School, where a student is required to pick one of four career tracks. A K-12 graduate is one who is presumably adept in basic education competencies, but has taken time to master a specialized learning domain. The individual is work-ready even before entering college.

Moreover, the *NTESDP 2018-2022* has incorporated Industry 4.0 concerns in planning strategic directions for technical-vocational education in the country. Its internal assessment of weaknesses revealed that TVET providers are currently unable to cope with the rapid pace of innovation and the more advanced workforce skill requirements Industry 4.0 entails. Thus, the development plan recognized the value of crafting flexible learning systems for timely, continuous and responsive technical-vocational training to accommodate new and emerging Industry 4.0 tasks. A concrete example of a programme that does this is TESDA's Enterprise-Based Programmes, which offer, in cooperation with industry partners, apprenticeship, learnership or dual training

programmes that allow learners to gain first-hand experience in learnable occupations. Aside from this, there are also efforts outside the technical-vocational system that offer upskilling and reskilling opportunities for workers in marginalized sectors. One example of this is the Digital Farmers Programme of the Department of Agriculture, which offers farmers a suite of training programmes on the use of technologies that help support their agricultural endeavours.

▸ Cluster 5: Policies and programmes supporting research and development initiatives

The Philippines needs a reliable supply base of scientists and researchers to support its innovation activities, especially in the automation, digitalization and robotization of industrial processes in the context of Industry 4.0. However, the current picture of workers involved in scientific and technical activities does not look encouraging. In 2015, there were only about 199 researchers per million of the population. This ratio is strikingly low compared to other countries such as Viet Nam (1,414), Thailand (1,575), Malaysia (2,969) and Singapore (7,721) in the ASEAN region.[37]

Brain drain is among the factors contributing to the low number of researchers in the Philippines. Researchers and scientists leave the country and work elsewhere due to low wages, lack of incentives in R&D work, lack of research collaboration opportunities, among other reasons. There is room for policy to create a domestic environment that is favourable for the incubation of new ideas in order to thwart the emigration of scientific professionals. For instance, the DOST's Balik Scientist Programme, institutionalized in 2018 but implemented since 1986, provides incentives for returning scientists. Included in the suite of benefits are exemptions from licensing and permitting requirements, accident and medical insurance, reimbursements, tax and duty exemptions and other term-specific benefits and incentives and privileges. Aside from mitigating brain drain, R&D initiatives could help bolster the supply of scientific skills within the country through direct funding, especially for the installation of research infrastructure outside the National Capital Region (like DOST's Niche Centres in the Regions for R&D).

Imagining the future of work in the Philippines does not end with examining hard evidence from data. It also entails listening to a multiplicity of voices to see how experiences from the ground could enrich data-driven conversations. In accordance with this, consultations were conducted to triangulate the results of this study with insights by stakeholders from the government, employers' and workers' organization, civil society, youth and the academe. Discussions revolved around the implications of the study to workforce and skills development in the context of the Fourth Industrial. Revolution. The main themes that emerged from the conversations are outlined in Appendix D.

37 Data correspond to 2015 values, the most recent available for the Philippines, and sourced from the UNESCO Statistics website, http://data.uis.unesco.org/ (accessed May 2020).

5.3 Lessons from Industry 4.0-related upskilling policies

Embracing technological advances as vital engines of long-term sustainable economic growth, some countries have explicitly incorporated Industry 4.0 responses in their national industrial strategic plans. Aside from the Philippines, notable examples include Indonesia (*Making Indonesia 4.0*), Malaysia (*National Policy on Industry 4.0*), the Republic of Korea (*I-Korea 4.0*), and Thailand (*Thailand 4.0*). Details of the priority sectors identified in each of these strategies, as well as specific clauses that pertain to upskilling initiatives are outlined in Appendix table C.8. A more comprehensive inventory of national policies for the future of work in ASEAN+6 is reviewed in ILO's *Preparing for the future of work: National policy responses in ASEAN+6*.

A common theme across the upskilling strategies of countries from ASEAN+6 relates to the realignment of training and educational curricula to fit industry needs in light of Industry 4.0.

A common theme across these upskilling strategies relates to the realignment of training and educational curricula to fit industry needs in light of Industry 4.0. This appears to be a blanket strategy that applies to all sectors. Interestingly, some countries approached upskilling policies in relation to the unique needs of particular sectors. For example, Malaysia's national strategy for Industry 4.0 mentioned a plan to appropriate the enhancement of worker capabilities to specific manufacturing sectors. The Republic of Korea's plans is elaborate, defining strategies to attract foreign talent to help advance its Industry 4.0 goals in industries that lack manpower. Furthermore, it vowed to address automation anxiety through labour protection programmes (such as employment support in occupational transitioning, provision of employment benefits and unemployment insurance).

Countries such as India and Singapore have embarked on efforts to understand the current situation of their skills and talent markets and, in the case of Singapore, to act upon this knowledge to shape the skills of the future. Since 2014, the yearly *India Skills Report* has been presenting current trends in worker employability and hiring, emerging occupations, as well as job seekers and employer preferences. The *India Skills Report 2020* states that a positive work attitude, adaptability, learning agility, domain expertise and interpersonal skills constitute the top five most preferred skills among Indian employers. Emerging job areas and skills in the next five years include data science and analysis, digital marketing, robotics and process automation, human-centred design and compliance. According to the same report, the Indian jobs market is being held back by skill-specific bottlenecks such as "questionable" quality of education, dated curriculum in institutions, lack of training in practical and/or life skills and deficits in reskilling and formal training efforts. These are challenges that significantly overlap with those faced by the Philippines.

Studying at the Technical Education and Skills Development Authority. © ILO/Ruben Hamahiga Dela Cruz, March 2011

Meanwhile, Singapore has taken an action-oriented stance, using policy as a leverage to shape the national supply of skills in the country**.** Its nationwide skills development initiative, SkillsFuture, aims to develop Singaporeans' "fullest potential throughout life, regardless of their starting points". Led by the Future Economy Council in coordination with the government, industry, unions and educational and training institutions, SkillsFuture provides a host of programmes catered to students, early and mid-career employees, employers and training providers. These programmes are carefully designed to help individuals make well-informed choices in education, training and careers and to develop a system of education and training that is integrated and highly responsive to constantly evolving needs. Furthermore, the initiative emphasizes the value of skill mastery and the importance of fostering a culture that celebrates lifelong learning. As of this writing, the Philippines has taken strides in developing its technical-vocational education and training system, though a coordinated national skills development policy that is as far-reaching as Singapore's SkillsFuture initiative is yet to be conceived.

In countries such as Japan, the Republic of Korea and Singapore, lifelong learning programmes have been institutionalized.

Aside from Singapore, Japan and the Republic of Korea are two exemplar countries that have institutionalized lifelong learning.[38] Japan's commitment to the promotion of learning beyond formal education systems and in all life stages began as early as three decades ago with the Lifelong Learning Promotion Law. The law formalized the establishment of Lifelong Learning Councils under a decentralized leadership scheme and supported the development of a society of lifelong learners in cooperation with the private sector.[39]

In its fourth National Lifelong Learning Promotion Plan, the Republic of Korea outlined a 4Ps (people, participation, prosperity and partnership) approach to the advancement of a sustainable society of lifelong learners. Under the plan are programmes such as improving the K-MOOC (Korean Massive Open Online Course) platform and the National Lifelong Learning Portal; establishing professional colleges as vocational and lifelong learning hubs; strengthening civic competencies through community-based lifelong learning; and implementing a voucher scheme that enables disadvantaged persons and persons with disabilities to access lifelong learning opportunities. These are initiatives that the Philippines may consider adopting.

While lifelong learning programmes offer opportunities to engage in continuous training for personal and career growth, their link to overall industrial priorities are not well-defined. Singapore's Industry Transformation Maps (ITMs) provides a good model for achieving a synergistic link-up of industrial strategies and manpower development policies at the national level. Like the I3S, crucial to the ITMs is the strategic partnership among government, firms, industries, trade associations and chambers and other stakeholders.

Singapore ITMs for 23 industries were developed to address specific challenges faced by each industry.[40] Overseen by the Future Economy Council, six broad subcommittees representing clusters of related industries were formed to support the ITMs; the subcommittees are manufacturing, built environment, trade and connectivity, essential domestic services and modern services and lifestyle. Each ITM has four pillars (jobs and skills, productivity, innovation and internationalization) and its own skills framework that is divided into sections (such as sector information, career pathways, occupations and job roles, existing and emerging skills and training programmes for skills upgrading and mastery). The skills frameworks connect to the SkillsFuture initiative and to other government agencies such as Workforce Singapore and the Singapore Economic Development Board.

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38 UNESCO's Institute of Lifelong Learning houses an extensive collection of lifelong learning policies and strategies across its member states. Further details are available at https://uil.unesco.org/lifelong-learning/lifelong-learning-policies.

39 M. Budenberder: "Japan's Lifelong Learning Promotion Law." *Centre for Public Impact.* 2 Aug. 2018.

40 For more details on the Singapore Industry Transformation maps, see https://www.mti.gov.sg/Transforming-Industries/For-Industries.

Safety and health in manufacturing. © ILO/M. Fossat, October 2015

The elaborate design of the ITMs as they relate to specific skills frameworks per industry clearly lays down the synergies among industries, training providers, government agencies in streamlining the future of work on a national scale. To further illustrate the Singapore ITMs model, sections of the skills framework for the energy and chemicals industry under the manufacturing cluster, for example, are described as follows.

- Sector Information section, which provides a review of trends and workforce profiles in the industry.
- Career Pathways section, which defines options for vertical and lateral progression for advancement and growth in the industry.
- Occupations and Job Roles section, which links career pathways with job roles (for energy and chemicals, 53 job roles are embedded in six career pathways).
- Skill Maps section, which takes each of the identified job roles and lists down critical work functions, key tasks, skills and competencies associated with the role. The technical skills and competencies as well as generic skills and competencies are defined in a hierarchical way (that is, based on competency levels).
- Training Programmes section, which lists down an array of available modular programmes for each skill and/or competency with a list of training providers for each proficiency level. For each career pathway, specific training programmes are outlined for new entrants and in-service employees.

Meanwhile, Australia establishes the sector-skills linkage by emphasizing the industry's role in ensuring that workers are equipped with industry-relevant skills for the jobs of the future. Established in 2015 by the Council of Australian Government (COAG) Industry and Skills Council, the Australian Industry and Skills Committee (AISC) is an industry-led body that plays an integral role in the implementation of national vocational education and training (VET) policies.[41] Operating under a partnership arrangement with the Australian Government, Industry Reference Committees (IRCs) and Skills Services Organizations (SSOs), the body is responsible for overseeing the development of national training package products for the VET sector. It acts as a key consultative body in the development of the COAG VET Reform Roadmap and the COAG Streamlining National Training Products Project, a programme that aims to hasten, simplify and upgrade national training processes.

IRCs act as conduits for industry feedback to the Australian Government on industry trends and VET promotion to employers; they are comprised of industry representatives who volunteer to share their expertise and perform advisory roles regarding the skills needs of the industries where they belong. IRCs' inputs are integral to the development, review and implementation of training packages especially tailored to their industries. They work with SSOs, which are independent service providers identified through a competitive grants process, and provide technical, operational and secretariat services

41 More details about AISC can be accessed in https://www.aisc.net.au/content/skills-service-organisations.

that help IRCs actualize the development, review and implementation of training packages that reflect current industry skills needs. The tripartite collaboration of the AISC, IRCs and SSOs help cultivate a VET system with occupational skills standards packaged into qualifications that are both nationally recognized and aligned with industry needs.[42]

Relating current programmes that link industries with skills development systems to current practices in the Philippines, DTI taps "industry champions" or industry members who liaise with government in pursuit of the collective goals of the industry they are part of. Industry champions resemble Australia's IRCs, though IRCs have a special role in charting industry skills requirements and reviewing skills packages. Furthermore, sectoral roadmaps have been created for many industries, not only for the priority industries outlined in the I^{3}S.[43] These sectoral roadmaps are a product of the joint collaboration between industry players and government, led by DTI. However, how these sectoral roadmaps link to specific skills and competencies for each sector has not yet been defined. The building blocks may already be present, but the connections are still nascent.

In particular, there may be an opportunity to link the sectoral roadmaps initiative with the Philippine Qualifications Framework (PQF), which outlines national qualification standards for individuals who are trained and educated in the Philippines. The PQF describes the qualification levels and set standards for qualification outcomes. Republic Act No. 10968 institutionalized the PQF and provided for the establishment of the National Coordinating Council (PQF-NCC), which is composed of the Department of Education (DepEd), CHED, TESDA, Professional Regulation Commission (PRC) and DOLE with representatives from the industry. The law mandates the establishment of links with industry to identify priority sectors and programmes for the PQF (to be done in coordination with NEDA, DTI and DOST). Establishing industry linkages for the priority sectors and programmes of the PQF, as mandated by law, may pave the way towards a skills development programme that is more responsive to current industry demands, especially to new manpower challenges brought about by Industry 4.0.

The insights from stakeholder consultations surfaced some practical concerns beyond the scope of this report, as well as some analytical angles which future research could explore in order to provide a more nuanced view of the future of work in the Philippines. Some potential research avenues include: (a) exploring the role of digitalization in supporting sustainability, resilience and empowerment initiatives; (b) a more in-depth look at technical competencies and soft skills fostered in formal training institutions and how these link to current skills demanded in different industries; (c) examining adoption of digitalization across geographical locations; (d) industry-specific studies and digitalization initiatives and occupational impacts; and (e) understanding the process of structural change in skills occurring due to technological change (and resulting transitional experiences at the firm level).

42 Details of the Industry Reference Committee Operating Framework is discussed more thoroughly in https://www.aisc.net.au/sites/default/files/documents/IRC%20Operating%20Framework%20-%20201912_0.pdf.

43 The Philippines' sectoral roadmaps can be accessed in http://industry.gov.ph/roadmaps/.

6 Conclusions

An architect works on a project. © ILO/ Thierry Falise, March 2008

6. Conclusions

The analysis of macroeconomic and labour market trends coupled with a quantitative assessment of the impact of technological changes on occupations and sectors and contextualized using current policies for workforce development in the Philippines and in other ASEAN+6 economies yielded several insights and recommendations.

Advocating for and promoting globally competitive and innovative industries

The Philippines' new industrial strategy advocates for cultivating globally-competitive and innovative industries founded on strategic partnerships between the government, academe, industry and other stakeholders. Priority industries are set to propel the country towards a long-term sustainable and innovation-led growth path.

To help realize its industrial transformation goals, the country needs to pay attention to certain growth drivers, among which is workforce and skills development. Tackling the relationship between industrial transformation and skills development becomes urgent when viewed against the backdrop of a new wave of technological revolution. Also known as Industry 4.0, this new technological wave, characterized by widespread technological disruptions in business models, processes and even mindsets due to digitalization, brings with it the fear that jobs might be lost due to heightened human-machine task substitutability. However, occupations are not static – rather, they are evolving and thus, digitalization could potentially transform occupations. Furthermore, the impact of technology on occupations and sectors can be managed by the policy responses emerging from national dialogues among government, employers' and workers' organizations and other stakeholders to shape a human-centred future of work.

It is possible to characterize occupations based on the extent to which they are susceptible to the destructive and transformative effects of digitalization. Applying Fossen and Sorgner's (2019a) framework, findings show that 35 per cent of current employment in the analysed occupations in the country belong to the "human terrain" category, which are neither susceptible to destructive digitalization nor likely to experience the transformative impacts of digitalization. About 31 per cent are associated with "collapsing" occupations, or occupations where jobs have a high likelihood of being replaced by machines with little opportunity for transformative digitalization. In contrast, only about 5 per cent belong to "rising stars occupations" or occupations for which digitalization exhibits a high likelihood of transforming jobs without necessarily replacing them. This finding shows that while a sizeable share of jobs is not exposed to the turbulent impacts of digitalization, this does not undermine the importance of cultivating agile lifelong learners in the context of increasing investment in human resource capabilities. It also emphasizes the need to take measures aimed at strengthening the institutions of work and promoting sustained,

inclusive and sustainable economic growth, and full and productive employment and decent work for all.

A sectoral dissection of employment in priority industries in the Philippines reveals that all of them are dominated by "machine terrain" occupations. Jobs in these occupations, such as assemblers in manufacturing and bank tellers in the financial services sector, are likely to experience substantial changes as these jobs face high risk from both destructive and transformative digitalization. In as much as digitalization could replace jobs in these sectors, digitalization also has a high likelihood of transforming the nature of tasks performed in these occupations. To avoid being "left out" in a fast-paced and volatile future of work, employers and workers in machine terrain occupations and sectors may need to leverage opportunities for worker re-training or upskilling and for adapting business strategies in addition to more comprehensive and strategic support measures.

Linking skills development to the occupations typology of the transformative-destructive effects of digitalization, the analysis emphasizes that certain skills-related interventions may complement specific occupational categories more than other categories, though all of them will benefit from broad-based investment policies and programmes on people's capabilities. For instance, those in rising star occupations may benefit most from lifelong learning initiatives. Workers in machine terrain occupations may benefit from targeted and/or focused upskilling and reskilling interventions, while gaining and developing digital skills may be of particular importance for workers in human terrain occupations. For workers in collapsing occupations, efforts for broadening the skills base of workers would help provide more skill and job mobility. Employment services to support in occupational and sectoral job transitions also appear to be particularly important for workers in this category.

In view of anticipated changes in the distribution of occupations across sectors due to digitalization, programmes and policies that pertain to workforce and skills development in the Philippines were outlined and juxtaposed against programmes and policies currently in place in other ASEAN+6 economies. Broad themes suggest that economies approach upskilling or reskilling as an umbrella strategy to upgrade the overall human capital base of an economy. In the Philippines, where brain drain can limit potential gains from an already scarce base of skilled human capital, retaining high-skilled workforce becomes an important agenda. Manpower and skills development is also already embedded in national aspirations to cascade innovation-led development in the country.

Results from the mapping of skills development programmes and policies indicate that while skills development is regarded to be essential for industry upgrading, it is still discussed quite broadly in policy, and the link between sectors and skills is not fully articulated yet. Some economies have, however, recognized that skills development in relation to industrial transformation requires that certain industry-specific technical competencies be honed strategically. Having identified jobs that are at risk due to the destructive and transformative effects of digitalization may contribute towards an informed and systematic approach towards crafting an integrated skills development

Safety and health in manufacturing. © ILO/M. Fossat, October 2015

plan that connects strongly with the country's overall industrial transformation and economic development plan.

In the Philippines, the ILO Centenary Declaration for the Future of Work (2019) provides a framework for government, workers' and employers' organizations to address the challenges arising from technological changes through a human-centred approach to the future of work. This framework has three main areas. The first area underscores the need to strengthen the capacities of all people to benefit from the opportunities of a changing world of work. Under this area, the government can consider promoting lifelong training programmes to help workers weather the risks and leverage the gains of digitalization. While technical skills matter, emerging jobs in the Philippines require broader skill sets with specialties underpinned by general competencies such as critical thinking, problem-solving, experimentation and failure tolerance, as revealed in the analysis presented in this report. Hence, promoting lifelong learning for all, especially youth, women, and the self-employed, can help ensure that no one is left behind as the country transitions to a world of work where technological disruptions are increasingly commonplace.

Promoting the effective realization of gender equality in opportunities and treatment, and effective measures to support people throughout multiple transitions in the labour market will remain important aspects to be addressed in the context of digitalization.

Moreover, identifying areas where digitalization can help promote social inclusion and decent work (in support of persons with disabilities, stay-at-home mothers or disadvantaged populations, for example) can foster a human-centred approach to technological change in the world of work.

Strengthening the institutions of work and reaffirming the continued relevance of the employment relationship

The second area of the framework provided under the ILO Centenary Declaration for the Future of Work calls for the strengthening of the institutions of work to ensure adequate protection of all workers. It also emphasizes reaffirming the continued relevance of the employment relationship as a means of providing certainty and legal protection to workers, while recognizing the extent of informality and the need to ensure effective action to achieve transition to formality.

For all workers, in particular those in occupations facing high risk due to destructive digitalization and are classified as "collapsing," supporting their fundamental rights at work, safety and health at work including mental health, and access to social protection measures is critical. Social protection mechanisms will need to be accompanied by upskilling programmes and other active labour market programmes that could help these workers transition to more complex and possibly higher-value added roles with increased labour productivity. Likewise, social protection mechanisms surrounding "decent digiwork" may be supported to address concerns over how digitalizationcan challenge the spirit of collective bargaining and unionization in industries while promoting remote work and the dispersion of business processes.

Promoting sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

The Philippines has taken strides in articulating a national industrial strategy that recognizes skills development as a key pillar in advancing towards an inclusive and sustainable economic growth path. However, as insights from the stakeholder consultations suggest, there is still potential for greater involvement of workers' and employers' organizations and other stakeholders in the refinement of the country's industrial policy and the promotion of productive employment.

The analysis shows the heterogeneous impact of digitalization across sectors and occupations. While knowledge of occupations and sectors could help identify potential focus areas, this alone will not be sufficient to identify new skills requirements in each occupation across sectors. A detailed identification of new skills requirements per occupation per sector is a choice which policies can address by taking into account multi-stakeholder perspectives of government, employers' and workers' organizations and other stakeholders.

As such, there is opportunity to integrate national industry priorities with skills development goals to craft a holistic national qualifications framework that is tailored to particular skills requirements of specific sectors. Further industry-focused studies

on digitalization can be undertaken in order to tease out how industry-specific digitalization initiatives are likely to impact the occupational composition of sectors, leading to industry-specific recommendations on skills upgrading or reskilling programmes and policies. Skills development will need to also be accompanied by investment in strategic sectors to address the drivers of transformative change in the world of work and contribute to promoting productive employment. The strengthened linkages of policies surrounding these two national agendas will help streamline efforts and close policy gaps.

In addition, results of the analysis suggest that some sectors are at heightened risk due to both digitalization and the socio-economic impact of the COVID-19 pandemic. Policies can be instrumental in identifying and supporting focus sectors for a socio-economic recovery from the pandemic. In particular, upskilling or reskilling the workforce and advancing productive employment in these focus sectors could help expedite economic recovery as well as make these sectors future-resilient, including through investments in the digital economy and green economy. In this regard, the future of work will, indeed, also depend on how national policies will adjust or respond to dynamic and volatile disruptions in the labour market in order to facilitate the transitions to full and productive employment and decent work for all.

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Appendix

Appendix A: Full list of occupational classifications based on Fossen and Sorgner (2019a)

I. Rising stars

ISCO Code	Description
1120	Managing directors and chief executives
1211	Finance managers
1213	Policy and planning managers
1219	Business services and administration managers not elsewhere classified
1221	Sales and marketing managers
1321	Manufacturing managers
1322	Mining managers
1323	Construction managers
2113	Chemists
2133	Environmental protection professionals
2141	Industrial and production engineers
2142	Civil engineers
2144	Mechanical engineers
2145	Chemical engineers
2146	Mining engineers, metallurgists and related professionals
2149	Engineering professionals not elsewhere classified
2151	Electrical engineers
2152	Electronics engineers
2161	Building architects
2162	Landscape architects
2163	Product and garment designers
2166	Graphic and multimedia designers
2262	Pharmacists
2263	Environmental and occupational health and hygiene professionals

ISCO Code	Description
2265	Dieticians and nutritionists
2267	Optometrists and ophthalmic opticians
2412	Financial and investment advisers
2413	Financial analysts
2423	Personnel and careers professionals
2431	Advertising and marketing professionals
2433	Technical and medical sales professionals (excluding ICT)
2512	Software developers
2651	Visual artists
3119	Physical and engineering science technicians not elsewhere classified
3121	Mining supervisors
3122	Manufacturing supervisors
3123	Construction supervisors
3322	Commercial sales representatives
3341	Office supervisors
3432	Interior designers and decorators
5222	Shop supervisors
7111	House builders
7127	Air conditioning and refrigeration mechanics
7317	Handicraft workers in wood, basketry and related materials
7319	Handicraft workers not elsewhere classified
7411	Building and related electricians
7413	Electrical line installers and repairers
7534	Upholsterers and related workers
7541	Underwater divers
9321	Hand packers

II. Machine terrain occupations

ISCO code	Description
1324	Supply, distribution and related managers
2165	Cartographers and surveyors
2411	Accountants
3112	Civil engineering technicians
3113	Electrical engineering technicians
3114	Electronics engineering technicians
3115	Mechanical engineering technicians
3117	Mining and metallurgical technicians
3118	Draughtspersons
3131	Power production plant operators
3132	Incinerator and water treatment plant operators
3133	Chemical processing plant controllers
3134	Petroleum and natural gas refining plant operators
3135	Metal production process controllers
3139	Process control technicians not elsewhere classified
3213	Pharmaceutical technicians and assistants
3214	Medical and dental prosthetic technicians
3251	Dental assistants and therapists
3257	Environmental and occupational health inspectors and associates
3313	Accounting associate professionals
3323	Buyers
3511	Information and communications technology operations technicians
4110	General office clerks
4120	Secretaries (general)
4132	Data entry clerks
4211	Bank tellers and related clerks
4214	Debt-collectors and related workers
4311	Accounting and bookkeeping clerks

ISCO code	Description
4313	Payroll clerks
4322	Production clerks
4416	Personnel clerks
4419	Clerical support workers not elsewhere classified
7112	Bricklayers and related workers
7113	Stonemasons, stone cutters, splitters and carvers
7114	Concrete placers, concrete finishers and related workers
7115	Carpenters and joiners
7119	Building frame and related trades workers not elsewhere classified
7121	Roofers
7122	Floor layers and tile setters
7123	Plasterers
7124	Insulation workers
7125	Glaziers
7126	Plumbers and pipe fitters
7131	Painters and related workers
7211	Metal moulders and coremakers
7212	Welders and flamecutters
7213	Sheet-metal workers
7214	Structural-metal preparers and erectors
7215	Riggers and cable splicers
7221	Blacksmiths, hammersmiths and forging press workers
7222	Toolmakers and related workers
7223	Metal working machine tool setters and operators
7224	Metal polishers, wheel grinders and tool sharpeners
7231	Motor vehicle mechanics and repairers
7233	Agricultural and industrial machinery mechanics and repairers
7311	Precision-instrument makers and repairers

ISCO code	Description
7312	Musical instrument makers and tuners
7313	Jewellery and precious-metal workers
7314	Potters and related workers
7315	Glass makers, cutters, grinders and finishers
7316	Sign writers, decorative painters, engravers and etchers
7318	Handicraft workers in textile, leather and related materials
7321	Pre-press technicians
7412	Electrical mechanics and fitters
7421	Electronics mechanics and servicers
7422	Information and communications technology installers and servicers
7512	Bakers, pastry-cooks and confectionery makers
7513	Dairy-products makers
7514	Fruit, vegetable and related preservers
7515	Food and beverage tasters and graders
7521	Wood treaters
7522	Cabinet-makers and related workers
7523	Woodworking-machine tool setters and operators
7531	Tailors, dressmakers, furriers and hatters
7532	Garment and related pattern-makers and cutters
7533	Sewing, embroidery and related workers
7535	Pelt dressers, tanners and fellmongers
7536	Shoemakers and related workers
7549	Craft and related workers not elsewhere classified
8111	Miners and quarriers
8112	Mineral and stone processing plant operators
8113	Well drillers and borers and related workers
8114	Cement, stone and other mineral products machine operators
8121	Metal processing plant operators
8122	Metal finishing, plating and coating machine operators
8131	Chemical products plant and machine operators

ISCO code	Description
8141	Rubber products machine operators
8142	Plastic products machine operators
8143	Paper products machine operators
8151	Fibre preparing, spinning and winding machine operators
8152	Weaving and knitting machine operators
8153	Sewing machine operators
8154	Bleaching, dyeing and fabric cleaning machine operators
8156	Shoemaking and related machine operators
8160	Food and related products machine operators
8171	Pulp and papermaking plant operators
8172	Wood processing plant operators
8181	Glass and ceramics plant operators
8183	Packing, bottling and labelling machine operators
8189	Stationary plant and machine operators not elsewhere classified
8211	Mechanical machinery assemblers
8212	Electrical and electronic equipment assemblers
8219	Assemblers not elsewhere classified
8322	Car, taxi and van drivers
8331	Bus and tram drivers
8332	Heavy truck and lorry drivers
8342	Earthmoving and related plant operators
8343	Crane, hoist and related plant operators
8344	Lifting truck operators
9311	Mining and quarrying labourers
9312	Civil engineering labourers
9313	Building construction labourers
9329	Manufacturing labourers not elsewhere classified
9333	Freight handlers
9611	Garbage and recycling collectors
9623	Meter readers and vending-machine collectors

III. Human terrain occupations

ISCO code	Description
1112	Senior government officials
1113	Traditional chiefs and heads of villages
1114	Senior officials of special-interest organizations
1222	Advertising and public relations managers
1223	Research and development managers
1330	Information and communications technology service managers
1342	Health services managers
1343	Aged care services managers
1344	Social welfare managers
1345	Education managers
1346	Financial and insurance services branch managers
1349	Professional services managers not elsewhere classified
1411	Hotel managers
1412	Restaurant managers
1420	Retail and wholesale trade managers
1431	Sports, recreation and cultural centre managers
1439	Services managers not elsewhere classified
2120	Mathematicians, actuaries and statisticians
2131	Biologists, botanists, zoologists and related professionals
2132	Farming, forestry and fisheries advisers
2143	Environmental engineers
2153	Telecommunications engineers
2164	Town and traffic planners
2230	Traditional and complementary medicine professionals
2240	Paramedical practitioners
2250	Veterinarians
2261	Dentists
2264	Physiotherapists

ISCO code	Description
2269	Health professionals not elsewhere classified
2320	Vocational education teachers
2330	Secondary education teachers
2341	Primary school teachers
2342	Early childhood educators
2351	Education methods specialists
2353	Other language teachers
2354	Other music teachers
2355	Other arts teachers
2359	Teaching professionals not elsewhere classified
2421	Management and organization analysts
2422	Policy administration professionals
2432	Public relations professionals
2434	Information and communications technology sales professionals
2611	Lawyers
2612	Judges
2619	Legal professionals not elsewhere classified
2621	Archivists and curators
2622	Librarians and related information professionals
2631	Economists
2633	Philosophers, historians and political scientists
2634	Psychologists
2635	Social work and counselling professionals
2636	Religious professionals
2641	Authors and related writers
2642	Journalists
2643	Translators, interpreters and other linguists
2652	Musicians, singers and composers
2653	Dancers and choreographers

ISCO code	Description
2654	Film, stage and related directors and producers
2655	Actors
2656	Announcers on radio, television and other media
3143	Forestry technicians
3151	Ships' engineers
3152	Ships' deck officers and pilots
3153	Aircraft pilots and related associate professionals
3154	Air traffic controllers
3211	Medical imaging and therapeutic equipment technicians
3221	Nursing associate professionals
3240	Veterinary technicians and assistants
3255	Physiotherapy technicians and assistants
3256	Medical assistants
3258	Ambulance workers
3259	Health associate professionals not elsewhere classified
3311	Securities and finance dealers and brokers
3312	Credit and loans officers
3324	Trade brokers
3332	Conference and event planners
3339	Business services agents not elsewhere classified
3351	Customs and border inspectors
3353	Government social benefits officials
3354	Government licensing officials
3355	Police inspectors and detectives
3412	Social work associate professionals
3422	Sports coaches, instructors and officials
3423	Fitness and recreation instructors and programme leaders
3431	Photographers
3434	Chefs
4221	Travel consultants and clerks
4414	Scribes and related workers

ISCO code	Description
5111	Travel attendants and travel stewards
5112	Transport conductors
5113	Travel guides
5141	Hairdressers
5142	Beauticians and related workers
5162	Companions and valets
5163	Undertakers and embalmers
5164	Pet groomers and animal care workers
5165	Driving instructors
5169	Personal services workers not elsewhere classified
5221	Shopkeepers
5245	Service station attendants
5311	Child care workers
5321	Health care assistants
5322	Home-based personal care workers
5411	Fire-fighters
5412	Police officers
5413	Prison guards
6111	Field crop and vegetable growers
6112	Tree and shrub crop growers
6114	Mixed crop growers
6123	Apiarists and sericulturists
6129	Animal producers not elsewhere classified
6130	Mixed crop and animal producers
6222	Inland and coastal waters fishery workers
6223	Deep-sea fishery workers
6224	Hunters and trappers
7232	Aircraft engine mechanics and repairers
7234	Bicycle and related repairers
7544	Fumigators and other pest and weed controllers
8321	Motorcycle drivers

IV. Collapsing occupations

ISCO code	Description
3111	Chemical and physical science technicians
3142	Agricultural technicians
3155	Air traffic safety electronics technicians
3212	Medical and pathology laboratory technicians
3252	Medical records and health information technicians
3254	Dispensing opticians
3314	Statistical, mathematical and related associate professionals
3315	Valuers and loss assessors
3321	Insurance representatives
3331	Clearing and forwarding agents
3333	Employment agents and contractors
3334	Real estate agents and property managers
3342	Legal secretaries
3343	Administrative and executive secretaries
3344	Medical secretaries
3352	Government tax and excise officials
3359	Regulatory government associate professionals not elsewhere classified
3411	Legal and related associate professionals
3435	Other artistic and cultural associate professionals
3521	Broadcasting and audio-visual technicians
3522	Telecommunications engineering technicians
4131	Typists and word processing operators
4212	Bookmakers, croupiers and related gaming workers
4222	Contact centre information clerks
4223	Telephone switchboard operators
4224	Hotel receptionists
4225	Enquiry clerks
4226	Receptionists (general)
4227	Survey and market research interviewers

ISCO code	Description
4229	Client information workers not elsewhere classified
4312	Statistical, finance and insurance clerks
4321	Stock clerks
4323	Transport clerks
4411	Library clerks
4412	Mail carriers and sorting clerks
4413	Coding, proof-reading and related clerks
4415	Filing and copying clerks
5120	Cooks
5131	Waiters
5132	Bartenders
5151	Cleaning and housekeeping supervisors in offices, hotels and other establishments
5152	Domestic housekeepers
5153	Building caretakers
5211	Stall and market salespersons
5212	Street food salespersons
5223	Shop sales assistants
5230	Cashiers and ticket clerks
5241	Fashion and other models
5242	Sales demonstrators
5243	Door-to-door salespersons
5244	Contact centre salespersons
5246	Food service counter attendants
5249	Sales workers not elsewhere classified
5312	Teachers' aides
5329	Personal care workers in health services not elsewhere classified
5414	Security guards
5419	Protective services workers not elsewhere classified

ISCO code	Description
6113	Gardeners, horticultural and nursery growers
6121	Livestock and dairy producers
6122	Poultry producers
6210	Forestry and related workers
6221	Aquaculture workers
6330	Subsistence mixed crop and livestock farmers
6340	Subsistence fishers, hunters, trappers and gatherers
7132	Spray painters and varnishers
7511	Butchers, fishmongers and related food preparers
8157	Laundry machine operators
8182	Steam engine and boiler operators
8341	Mobile farm and forestry plant operators
8350	Ships' deck crews and related workers
9111	Domestic cleaners and helpers
9112	Cleaners and helpers in offices, hotels and other establishments
9121	Hand launderers and pressers
9129	Other cleaning workers
9212	Livestock farm labourers
9214	Garden and horticultural labourers
9215	Forestry labourers
9216	Fishery and aquaculture labourers
9331	Hand and pedal vehicle drivers
9334	Shelf fillers
9411	Fast food preparers
9412	Kitchen helpers
9520	Street vendors (excluding food)
9621	Messengers, package deliverers and luggage porters
9622	Odd job persons
9624	Water and firewood collectors
9629	Elementary workers not elsewhere classified

Source: Calculations based on the methodology outlined in box 1.

Appendix B: Destructive-transformative employment structure by sector

	Collapsing	Human Terrain	Machine Terrain	Rising Stars	Unclassified
01 - Crop and animal production, hunting and related service activities	14	36	0	0	49
02 - Forestry and logging	94	1	1	0	4
03 - Fishing and aquaculture	34	61	0	0	4
05 - Mining of coal and lignite	0	0	100	0	0
07 - Mining of metal ores	3	0	94	3	0
08 - Other mining and quarrying	1	0	94	5	0
09 - Mining support service activities	3	0	39	58	0
10 - Manufacture of food products	16	3	58	23	1
11 - Manufacture of beverages	17	0	56	27	0
12 - Manufacture of tobacco products	11	0	61	29	0
13 - Manufacture of textiles	2	0	59	25	14
14 - Manufacture of wearing apparel	4	0	84	12	0
15 - Manufacture of leather and related products	4	0	89	6	1
16 - Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	12	0	39	49	0
17 - Manufacture of paper and paper products	7	0	69	23	0
18 - Printing and reproduction of recorded media	7	0	16	21	56
19 - Manufacture of coke and refined petroleum products	0	0	62	38	0
20 - Manufacture of chemicals and chemical products	12	0	46	40	1
21 - Manufacture of pharmaceuti-cals, medicinal chemical and botanical products	12	0	52	32	4
22 - Manufacture of rubber and plastics products	8	0	82	10	0
23 - Manufacture of other non-metallic mineral products	4	0	78	18	0
24 - Manufacture of basic metals	3	0	77	16	4

	Collapsing	Human Terrain	Machine Terrain	Rising Stars	Unclassified
25 - Manufacture of fabricated metal products, except machinery and equipment	3	0	78	19	0
26 - Manufacture of computer, electronic and optical products	3	0	87	10	0
27 - Manufacture of electrical equipment	3	0	93	4	0
28 - Manufacture of machinery and equipment n.e.c.	1	0	78	14	8
29 - Manufacture of motor vehicles, trailers and semi-trailers	7	0	78	15	0
30 - Manufacture of other transport equipment	3	0	82	13	1
31 - Manufacture of furniture	17	0	44	39	0
32 - Other manufacturing	5	0	46	49	0
33 - Repair and installation of machinery and equipment	3	0	87	10	0
35 - Electricity, gas, steam and air conditioning supply	5	0	47	48	0
36 - Water collection, treatment and supply	10	0	82	9	0
37 - Sewerage	87	0	13	0	0
38 - Waste collection, treatment and disposal activities; materials recovery	1	0	74	0	25
41 - Construction of buildings	1	0	91	8	0
42 - Civil engineering	4	0	81	15	0
43 - Specialized construction activities	1	0	69	29	0
45 - Wholesale and retail trade and repair of motor vehicles and motorcycles	17	16	57	9	1
46 - Wholesale trade, except of motor vehicles and motorcycles	28	34	24	10	3
47 - Retail trade, except of motor vehicles and motorcycles	35	59	3	3	0
49 - Land transport and transport via pipelines	6	20	74	0	0
50 - Water transport	63	4	30	2	2
51 - Air transport	32	38	24	6	0
52 - Warehousing and support activities for transportation	33	1	64	2	0
53 - Postal and courier activities	81	0	18	1	0

	Collapsing	Human Terrain	Machine Terrain	Rising Stars	Unclassified
55 - Accommodation	73	19	6	3	0
56 - Food and beverage service activities	74	24	1	1	1
58 - Publishing activities	26	26	14	19	14
59 - Motion picture, video and television programme production, sound recording and music publishing activities	9	51	34	6	0
60 - Programming and broad-casting activities	36	44	6	13	1
61 - Telecommunications	22	44	15	12	6
62 - Computer programming, consultancy and related activities	10	8	23	10	49
63 - Information service activities	20	16	50	10	5
64 - Financial service activities, except insurance and pension funding	12	16	54	11	7
65 - Insurance, reinsurance and pension funding, except compul-sory social security	43	12	30	15	0
66 - Activities auxiliary to financial service and insurance activities	31	23	24	14	8
68 - Real estate activities	57	3	11	30	0
69 - Legal and accounting activities	9	10	77	1	2
70 - Activities of head offices; management consultancy activities	6	0	50	10	34
71 - Architectural and engineering activities; technical testing and analysis	0	0	41	57	1
72 - Scientific research and development	38	29	17	10	7
73 - Advertising and market research	15	16	23	33	14
74 - Other professional, scientific and technical activities	6	37	13	3	41
75 - Veterinary activities	0	91	9	0	0
77 - Rental and leasing activities	55	6	20	18	0
78 - Employment activities	53	1	33	4	9
79 - Travel agency, tour operator, reservation service and related activities	21	62	14	2	0
80 - Security and investigation activities	97	0	1	1	0

	Collapsing	Human Terrain	Machine Terrain	Rising Stars	Unclassified
81 - Services to buildings and landscape activities	93	0	1	4	2
82 - Office administrative, office support and other business support activities	80	2	9	3	6
84 - Public administration and defence; compulsory social security	23	33	20	4	19
85 - Education	8	78	3	2	9
86 - Human health activities	22	22	12	3	41
87 - Residential care activities	55	28	8	5	5
88 - Social work activities without accommodation	13	67	5	0	15
90 - Creative, arts and entertainment activities	32	45	2	12	9
91 - Libraries, archives, museums and other cultural activities	18	70	12	0	0
92 - Gambling and betting activities	96	2	0	1	0
93 - Sports activities and amusement and recreation activities	48	46	3	3	1
94 - Activities of membership organizations	14	33	14	1	37
95 - Repair of computers and personal and household goods	3	8	66	15	9
96 - Other personal service activities	68	24	6	1	1
97 - Activities of households as employers of domestic personnel	100	0	0	0	0
98 - Undifferentiated goods- and services-producing activities of private households for own use	100	0	0	0	0
99 - Activities of extraterritorial organizations and bodies	13	15	72	0	0

Notes: "Unclassified" are occupations with no computerization risk and AI transformative scores. Under current technological change. Each row corresponds to the share of each occupational category in total employment per ISIC 4 Section. Cells are coloured from green (0 per cent share) to red (100 per cent share).

Source: Calculations based on the methodology outlined in box 1.

Appendix C: Other tables and figures

Appendix table C.1. Economic structure and growth rates, by sector

	Contribution to GDP (%)			Growth Rate (%)		
	2011-2015	2016-2019	2011-2019	2011-2015	2016-2019	2011-2019
AGRICULTURE, FORESTRY AND FISHING	12.36	11.77	11.22	2.40	1.40	1.96
INDUSTRY	29.70	29.87	30.01	6.02	6.80	6.37
Mining and quarrying	1.04	1.01	0.99	2.36	3.31	2.79
Manufacturing	19.41	19.28	19.23	5.36	5.81	5.56
Electricity, steam, water and waste management	3.09	3.09	3.07	4.93	6.68	5.71
Construction	6.15	6.50	6.72	9.61	10.04	9.80
SERVICES	57.95	58.36	58.76	6.85	7.45	7.12
Wholesale and retail trade; repair of motor vehicles and motorcycles	17.93	17.89	17.83	5.64	7.01	6.25
Transportation and storage	3.41	3.51	3.61	9.44	7.88	8.75
Accommodation and food service activities	1.94	1.97	2.01	6.86	9.59	8.07
Information and communication	2.91	2.90	2.88	6.00	5.91	5.96
Financial and insurance activities	7.45	7.64	7.83	9.14	9.37	9.24
Real estate and ownership of dwellings	6.68	6.71	6.71	7.83	5.18	6.65
Professional and business services	5.32	5.58	5.89	11.02	8.01	9.68
Public administration and defense; compulsory social activities	4.03	3.95	3.89	3.57	11.33	7.02
Education	4.15	4.04	3.97	3.08	7.13	4.88
Human health and social work activities	1.74	1.76	1.77	7.39	4.44	6.08
Other services	2.38	2.41	2.37	7.34	5.10	6.34

Notes: Values represent structure and growth rates based on constant 2018 prices. Values represent simple averages across each time period.
Source: PSA, National Accounts of the Philippines, April 2020.

Appendix table C.2. Employment structure by sector, 2010 and 2019

	Employees 2010 ('000)	Per cent in total employment	Employees 2019 ('000)	Per cent in total employment
AGRICULTURE, FORESTRY AND FISHING	10 336	28.7	9 557	22.6
INDUSTRY				
Mining and quarrying	1 616	4.5	190	0.4
Manufacturing	2 965	8.2	3 621	8.6
Electricity, gas, steam and air conditioning supply	42	0.1	94	0.2
Water supply; sewerage, waste management and remediation activities	195	0.5	67	0.2
Construction	65	0.2	4 130	9.8
SERVICES				
Wholesale and retail trade; repair of motor vehicles and motorcycles	2 017	5.6	8 422	20.0
Transportation and storage	7 034	19.5	3 409	8.1
Accommodation and food service activities	1 063	2.9	1 891	4.5
Information and communication	2 510	7.0	426	1.0
Financial and insurance activities	543	1.5	562	1.3
Real estate activities	27	0.1	231	0.5
Professional, scientific and technical activities	2 993	8.3	304	0.7
Education	451	1.3	1 241	2.9
Other service activities	4 179	11.6	6 389	19.1

Source: ILO estimates based on the Labour Force Survey.

Appendix table C.3. Occupational employment shares, by gender (per cent)

	Male		Female	
	2010	2016	2010	2016
All Employment	60.1	60.2	39.9	39.8
NON-ROUTINE COGNITIVE				
1 - Legislators. senior officials and managers	44.4	52.0	55.7	48.0
2 - Professionals	32.4	32.9	67.6	67.1
3 - Technicians and associate professionals	47.5	48.6	52.5	51.4
ROUTINE				
4 - Clerks	37.9	38.0	62.2	62.0
6 - Skilled agricultural and fishery workers	84.4	80.9	15.7	19.1
7 - Craft and related trades workers	79.1	85.9	20.9	14.1
8 - Plant and machine operators and assemblers	91.0	86.0	9.0	14.1
NON-ROUTINE MANUAL				
5 - Service workers and shop and market sales workers	48.2	48.3	51.8	51.7
9 - Elementary occupations	57.4	61.7	42.6	38.3

Note: 2019 data reflects estimates up until the third quarter of 2019.

Source: ILO estimates based on the Labour Force Survey.

Appendix table C.4. Key statistics, largest 15 occupations (based on employment share)

No.	Occupation	Number of employees ('000)	Share of total employ-ment (%)	AI score	Compute-rization score	Share of women (%)	Average age of employee	Average wage (Philippine pesos)	Wage/ median wage
1	Crop farm labourers	3 699	9	0.62	NA	30	36	6 603	0.47
2	Retail and wholesale trade managers	3 277	8	0.68	0.16	73	45	15 973	1.14
3	Field crop and vegetable growers	1 451	4	0.65	0.57	10	49	NA	NA
4	Supply, distribution and related managers	1 418	4	0.70	0.59	23	41	32 225	2.30
5	Building construction labourers	1 411	4	0.61	0.80	2	34	9 091	0.65
6	Tree and shrub crop growers	1 223	3	0.65	0.57	11	46	NA	NA
7	Domestic cleaners and helpers	1 053	3	0.61	0.69	87	37	4 892	0.35
8	Shopkeepers	1 009	3	0.68	0.16	59	32	7 422	0.53
9	Car, taxi and van drivers	746	2	0.66	0.57	0	41	12 275	0.88
10	Shop sales assistants	661	2	0.67	0.95	68	30	7 538	0.54
11	Security guards	657	2	0.67	0.90	5	38	10 393	0.74
12	Primary school teachers	638	2	0.68	0.09	86	38	25 843	1.84
13	Stall and market salespersons	637	2	0.70	0.94	60	39	6 841	0.49
14	Gardeners, horticultural and nursery growers	631	2	0.64	0.67	40	49	NA	NA
15	Inland and coastal waters fishery worker	547	1	0.64	0.7	2	41	NA	NA

Sources: ILO estimates based on Labour Force Survey (first quarter of 2017), Frey and Osborne (2017), Felten et. al. (2018).

Appendix table C.5. Top ten emerging jobs in the Philippines

Job role	Role description	Skills unique to the job
Robotics Engineer	Robotics engineers build and deploy software known as robotics process automation (RPA), which is used to automate tasks like expense reporting. RPA automates mundane rules-based business processes and replicates those actions.	Robotic process automation (RPA), Blue Prism, UIPath, Automation Anywhere, Visual Basic for Applications
Cyber Security Specialist	Cybersecurity specialists keep computer information systems secure, primarily against cybercrimes such as phishing, denial-of-service attacks, malware, viruses and hacking. They also develop security programmes and implements them across organisations.	Security Information and Event Management (SIEM), Information Security, Vulnerability Assessment, Network Security, Penetration Testing
Customer Success Specialist	Unlike customer service representatives, who typically help customers when they have a question or issue, customer success specialists are expected to work proac-tively to understand core client needs and meet those needs.	Salesforce.com, Customer Retention, Customer Relationship Management (CRM), Customer Experience, Account Management
Data Scientist	The modern data scientist is part computer scientist, part mathematician. The best ones are also excellent trend spotters. The rise of the data scientist has largely mirrored the rise of big data as a phenom-enon. As organisations are delivered more and more data, they need data scientists to help them generate meaningful and actionable insights.	Machine Learning, Data Analysis, Python (Programming Language), R, Data Visualization
Sales Development Representative	Sales development representatives work to retain customers and help them get the most out of their products. They also identify further services a customer (or potential customers) may need. This role likely reflects the evolution of the Philippines' business process outsourcing sector.	Lead Generation, Sales, Sales Management, Customer Relationship Management (CRM), Setting Appointments
Full Stack Engineer	Full stack engineer is a combination of front-end web development and software development skills. Their versatility means they can run a project from start to finish and are in hot demand across a huge swathe of industries looking to add technological capacity as efficiently as possible.	React.js, Jquery, Laravel, JavaScript, AngularJS

Job role	Role description	Skills unique to the job
DevOps Engineer	DevOps engineers are the perfect example of the hybrid engineer. They bring together a deep engineering knowledge, with hands-on experience as well. Using a variety of open source technologies, they link these together with code to deliver new software, services and applications.	Ansible, Amazon Web Services (AWS), Jenkins, Docker Products, Kubernetes,
Data Engineer	Data engineers are concerned with the "how to" – so they are in charge of things like pipelines, data workflow management and ETL (extract, transform, load) processes.	Extract, Transform, Load (ETL), SQL, Data Modeling, Data Warehousing, Hadoop
JavaScript Developer	JavaScript developers build and implement the front-end logic that defines how those visual elements behave. The JavaScript developer is also charged with connecting these elements to the actual service on the back-end.	React Native, React.js, Node.js, AngularJS, MongoDB
Cloud Engineer	The cloud engineer is responsible for the technical aspect of the cloud. This includes design, planning, management, maintenance and support. As more companies shift to cloud-based solutions for their file management and storage, demand for those who know how to navigate the cloud grows.	Amazon Web Services (AWS), Cloud Computing, Virtualization, Linux System Administration, Linux

Source: LinkedIn 2019 Emerging Jobs Report (Philippines).

Appendix table C.6. Employment share across educational levels, by sector (per cent)

Sector	No grade completed	Primary	Lower secondary	Secondary	Post-secondary	First stage of tertiary	Second stage of tertiary
Agriculture, forestry and fishing	4.9	51.6	33.5	1.3	1.4	1.2	6.1
Mining and quarrying	1.1	39.3	40.8	1.1	2.5	1.9	13.4
Manufacturing	0.9	20.4	49.6	1.6	3.6	4.2	19.7
Electricity, gas, steam and air conditioning supply	0.0	6.4	29.7	0.5	6.6	8.9	48.0
Water supply; sewerage, waste management and remediation activities	0.0	26.0	37.0	1.0	4.2	5.5	26.3
Construction	0.7	32.4	51.8	1.3	2.1	2.0	9.8
Wholesale and retail trade; repair of motor vehicles and motorcycles	0.8	20.4	44.8	2.3	4.1	4.3	23.2
Transportation and storage	0.5	23.6	53.1	0.7	3.4	3.7	15.1
Accommodation and food service activities	0.2	10.5	46.2	3.2	4.6	5.6	29.8
Information and communication	0.0	1.8	20.6	1.3	5.9	8.8	61.7
Financial and insurance activities	0.1	1.3	13.3	0.2	4.6	4.7	75.8
Real estate activities	0.2	7.7	24.5	0.3	5.0	6.6	55.7
Professional, scientific and technical activities	0.1	1.3	9.9	1.0	4.5	6.3	76.9
Administrative and support service activities	0.2	3.7	33.3	1.1	6.1	6.5	49.2
Public administration and defence; compulsory social security	0.2	8.7	25.4	0.4	4.8	5.1	55.4
Education	0.1	1.0	3.8	0.2	0.6	0.9	93.4
Human health and social work activities	0.0	3.7	16.1	0.4	4.9	8.0	67.0
Arts, entertainment and recreation	0.2	16.9	44.4	1.4	4.5	4.3	28.3
Other service activities	1.1	29.4	51.5	1.7	2.6	2.5	11.3
Mean	1.7	27.4	39.6	1.4	3.1	3.3	23.5

Source: ILO estimates based on Labour Force Survey data from the first three quarters of 2019.

Appendix table C.7. Industry 4.0-related policies and programmes in the Philippines

Policy/Programme	Lead agencies
Cluster 1: PROMOTE INNOVATION-LED DEVELOPMENT	
Comprehensive National Industrial Strategy (CNIS): Charts the government's industry upgrading agenda. The CNIS highlights the need to grow industries that contribute largely to job generation and participation in global value chains.	DTI
Inclusive Industrial Innovation Strategy (I3S): Maps the government's strategy to foster innovative and globally competitive manufacturing, agriculture and services industries. The I3S aims to strengthen industries' links with local and global value chains, with innovation at the core of its strategy.	DTI
Inclusive Filipinnovation and Entrepreneurship Roadmap: Maps the government's strategy to foster a culture of innovation and entrepreneurship among industries. The roadmap explains channels through which human capital and skills development could help support the industrial innovation and entrepreneurship agenda.	DTI
Philippine Development Plan (PDP) 2017-2022: Articulates the government's plan to vigorously advance science, technology and innovation in all economic sectors. The aim is to build the foundations for a globally competitive knowledge economy for long-term economic growth.	NEDA
Republic Act No. 11293 or Philippine Innovation Act: Mandates the creation of the National Innovation Council that will steer the whole-of-government approach to innovation governance and put innovation at the forefront of the national development and sustainable growth agenda.	NEDA, DOST and DTI
Philippine Roadmap for Digital Startups: Maps out the government's plans to revitalize the community of innovative digital startups and to define the overall direction of digital innovation.	DICT
digitalPH: Promotes innovation in the field of digital and multimedia technologies and services, especially in the countryside. Under digitalPH are four specific initiatives geared to help the Philippine economy progress into a digital economy. These initiatives are (1) Stepping Up the Value Chain, (2) Rural Impact Sourcing, (3) seedPH, and (4) Digital Cities.	DICT
Republic Act No. 11337 or the Innovative Startup Act: Stipulates the government's role in the provision of incentives, as well as the removal of constraints, to encourage the creation, growth and expansion of innovative businesses and to foster the development of an innovative entrepreneurial ecosystem in the country.	DOST, DTI and DICT
Cluster 2: STRENGTHEN GOVERNMENT-INDUSTRY-ACADEME LINKAGES	
Collaborative Research and Development to Leverage Philippine Economy (CRADLE) Programme: Nurtures the synergistic relationship of the academe, research and development institutions and the industry by supporting collaborative research and development projects.	DOST
Research and Development (R&D) Leadership Programme: Engages experts with strong leadership, management and innovative competencies to shepherd the development of research capacities in higher education institutions and R&D institutions.	DOST
Sectoral Engagement Grants: Provides incentives for Higher Education Institution (HEI) faculty and non-teaching staff to engage in industry research, commissioned research and extension activities.	CHED

Policy/Programme	Lead agencies
Cluster 3: ENHANCE WORKER EMPLOYABILITY AND JOB-WORKER MATCH	
Job Bridging Internship Programme: Links TESDA graduates with potential employers through labour market information and job referrals.	TESDA
JobStart Philippines: Enhances youth employability through worker training, paid internship and full-cycle employment facilitation services.	DOLE
Cluster 4: UPSKILL AND RESKILL THE (CURRENT AND FUTURE) WORKFORCE	
Ambisyon Natin 2020: Aspires to cultivate smart and innovative Filipinos by ensuring that students obtain competencies (critical thinking, problem-solving, creativity, communication, collaboration) and develop character qualities (curiosity, initiative, persistence, grit, adaptability, leadership, social and cultural awareness). It emphasizes the value of lifelong learning for continuous skills upgrading and updating.	NEDA
National Technical Education and Skills Development Plan 2018-2022: Recognizes that the world of work demands a more knowledgeable and skilled workforce, innovative and sustainable approaches, globally competitive standards and ease of access and mobility for stakeholders of technical vocational education and training.	TESDA
Enterprise-Based Programmes: May come in any of the following forms: (a) apprenticeship, where a contract is facilitated between an apprentice and an employer to ensure worker skill-industry fit; (b) learnership programme, which is an on-the-job practical training programme designed for learnable occupations; and (c) a dual training system, which blends on-site work with training instruction.	TESDA
Digital Farmers Programme: A suite of training programmes to encourage farmers to utilize technologies in their agricultural endeavours.	DA
K-12 Programme: Designed to provide ample time for students to master skills and competencies for them to be ready for the world of work. The programme extends the ten-year Basic Education Curriculum into a 12-year programme, where the last two years (known as Senior High School) are geared towards specialization in a learning area of focus.	DepEd
Cluster 5: SUPPORT RESEARCH AND DEVELOPMENT INITIATIVES	
House Bill No. 4581 or "An Act Establishing the Science for Change Program": Aims to accelerate the advancement of science, technology and innovation (STI) through increased investments in science and technology (S&T) human resource development and R&D.	DOST
Harmonized National R&D Agenda 2013-2020: Discusses the priority research initiatives to be funded by the government. Research priorities recognize the role of STI research in the attainment of socio-economic development for all and in making current infrastructure and communities safer and resilient to disasters.	DOST
Niche Centres in the Regions for R&D (NICER) Programme: Bolsters the R&D capacity of HEIs in the regions by providing grants to develop their S&T infrastructure.	DOST
Business Innovation through S&T for Industry: Facilitates Filipino companies' acquisition of relevant technologies to support their R&D initiatives.	DOST
Republic Act No. 11035 or "An Act Institutionalizing the Balik Scientist Program": Awards incentives to returning Filipino experts, scientists, inventors and engineers in support of their research initiatives.	DOST

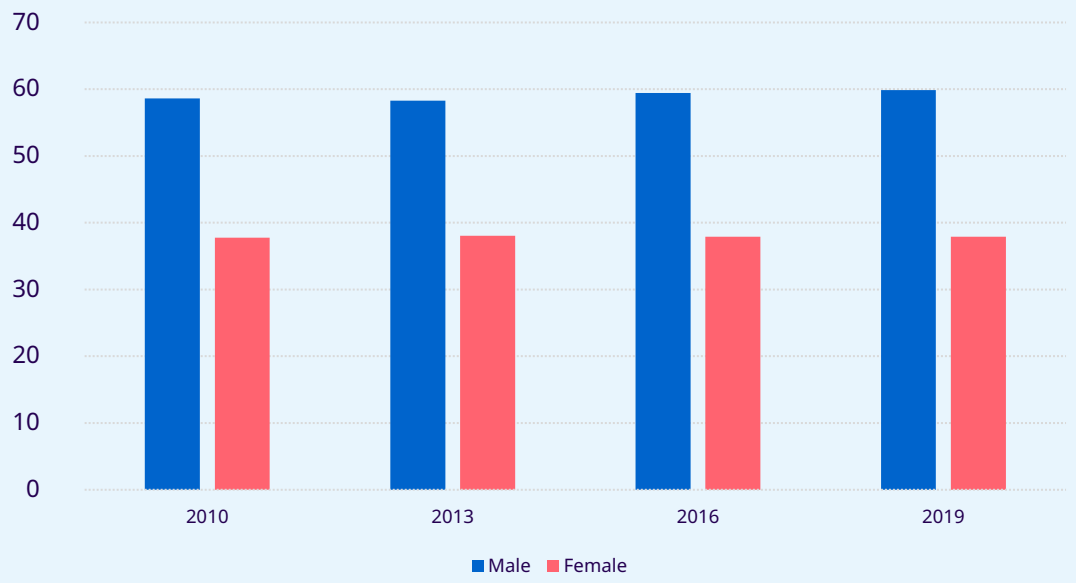
Appendix table C.8. National Industry 4.0 strategic plans, selected ASEAN+6 countries

Country	Plan	Priority sectors	Upskilling strategies
Indonesia	Making Indonesia 4.0	Food and beverages; textile and apparel; automotive; chemicals; electronics	Redesign education curriculum under the Industry 4.0 era. Create professional talent mobility programme.
Republic of Korea	I-Korea 4.0	Medical devices; unmanned and autonomous vehicles; ships; drones; smart grids; agriculture; manufacturing robots; smart factories for automobile, electronic parts, etc.	Strategically attract new and outstanding researchers from abroad to work in AI and other industries that lack manpower. Promote reorganization of the educational system towards fostering creative and competent individuals who possess the talent and capabilities that will be required by society in the future. Pre-emptively respond to pending changes in the employment structure by reinforcing employment support through job predictions to help people find jobs in new, promising industries and mitigate people's fear of unemployment; expand training for former and current workers; and reorganize employment insurance and unemployment benefits.

Country	Plan	Priority sectors	Upskilling strategies
Malaysia	National Policy on Industry 4.0	Chemicals, electrical and electronics; machinery and equipment; medical devices; aerospace	Enhance capabilities of existing workforce through national development programmes especially designed for specific manufacturing sectors and support upskilling and reskilling initiatives. Ensure the availability of future talent by equipping students with the necessary skillsets to work in the Industry 4.0 environment.
Thailand	Thailand 4.0	Next generation automotive; smart electronics; medical and wellness tourism; agriculture and biotechnology; food for the future; robotics; aviation and logistics; biofuels and biochemicals; digital technologies; medical hubs	Set up a system to integrate education, training and occupation development to allow Thais to adjust to changes and set their future skills paths (provision of alternatives for education, development of educational and training systems, development of skills to meet industry skills demands).

Sources: Documents listed in Column 2.

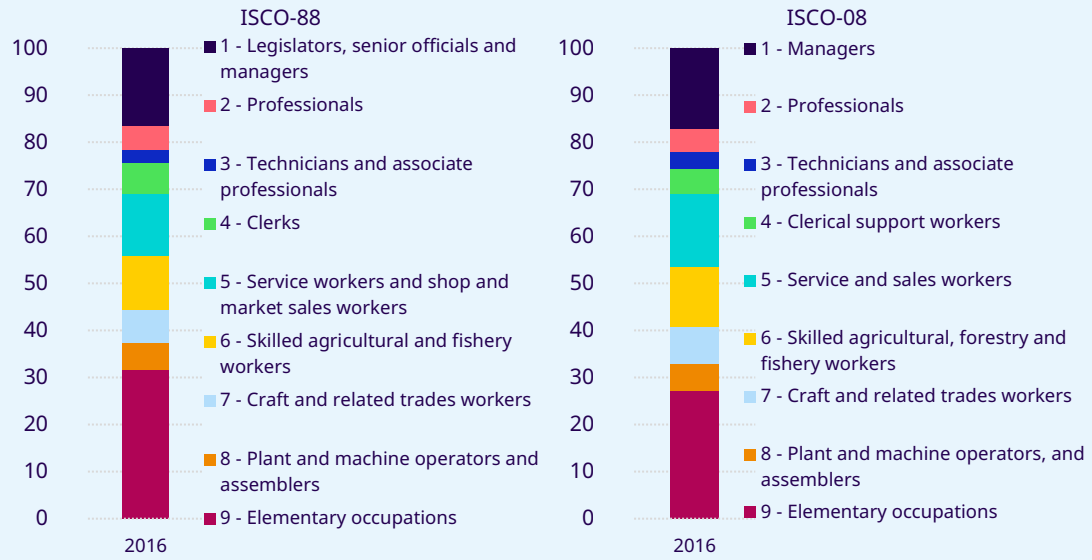
Appendix figure C.1. Labour force participation rate, by gender (per cent of working age population), between 2010 and 2019



Note: 2019 data reflects estimates up until the third quarter of 2019. The labour force participation rate is computed as the number of persons who are employed and unemployed but looking for a job divided by the working-age population.

Source: ILO estimates based on the Labour Force Survey.

Appendix figure C.2. Employment shares across occupations, ISCO-88 vs. ISCO-08 (per cent), 2016



Appendix D: Stakeholder consultations

Stakeholder consultations were conducted from July to August 2020 to validate the preliminary findings of the report and to gather reactions, comments and policy recommendations from different stakeholder groups. The method of qualitative inquiry adopted in the consultations took into account conditions based on the "new normal" brought about by the COVID-19 pandemic. Hence, all stakeholder consultations were conducted online.

A stakeholder consultation was conducted for each of the four groups of stakeholders. Attendees were comprised of representatives from:

- **Government:** Commission on Higher Education (CHED), Department of Education (DepEd), Department of Information and Communications Technology (DICT), Department of Labor and Employment (DOLE), Department of Science and Technology (DOST), Department of Trade and Industry (DTI), National Economic and Development Authority (NEDA), Professional Regulation Commission (PRC), Philippine Trade Training Centre (PTTC), and Technical Education and Skills Development Authority (TESDA).
- **Employers' organizations:** Bankers Association of the Philippines (BAP), Employers Confederation of the Philippines (ECOP), Federation of Filipino-Chinese Chambers of Commerce and Industry, Inc. (FFCCCII), IT and Business Processing Association of the Philippines (IBPAP), Philippine Association of Colleges and Universities (PACU), Philippine Chamber of Commerce and Industry (PCCI), Philippine Exporters Confederation, Inc. (PHILEXPORT), and Semiconductor and Electronics Industries in the Philippines, Inc. (SEIPI).
- **Worker's organizations:** Alliance of Workers in the Informal Economy/ Sector (ALLWIES), Federation of Free Workers (FFW), INDUSTRIALL, Philippine Independent Public Sector Association (PIPSEA), Public Services Labor Independent Confederation (PSLINK), Sentro ng mga Nagkakaisa at Progresibong Manggagawa (SENTRO), Trade Union Congress of the Philippines (TUCP), and UNI Global Union-Philippine Liaison Council (UNI-PLC).
- **Civil Society Organizations (CSOs), Youth and Academe:** Asian Institute of Management (AIM), Rizalino S. Navarro Policy Centre for Competitiveness, Ateneo Centre for Economic Research and Development (ACERD), Education Development Centre (EDC), Philippine Business for Social Progress (PBSP), Philippine Institute for Development Studies (PIDS), Unilab Foundation/STEM PH, United Nations Youth Advisory Board (UNYAB), UP-CIFAL Philippines, UP School of Economics (UPSE), Virtualahan and Women in Tech (WiTech).

The consultations ran for 1.5 to 2 hours. Follow-up questionnaires were then sent to the attendees to allow participants who were unable to give their inputs during the sessions to send in their answers, as well as to engage those who preferred to provide inputs in written form. Below is a summary of key themes which emerged from the consultations. They are based on the inputs and views shared by institutional stakeholders, classified by stakeholder group.

Government

- **Digital delivery of government services.** Going digital to promote resilience is part of the Government's plan. For instance, the Land Transportation Office has provided digital platforms for the renewal of driver's licenses. The government recognizes the value of digital transformation and, in turn, encourages its workers to develop digital skills necessary to boost their productivity. It also enjoins the top management (such as executives, local leaders) to participate in rethinking how digital transformation can be integrated into daily workplace activities.
- **Digital delivery of education and training.** The government indicated considerations for flexible learning options in education delivery. It recognizes the potential of digitalization in augmenting teachers' skills. DepEd and CHED support learning delivery modes that utilize digital technologies. Government-provided training services, such as those of TESDA and DTI, are also being provided via online platforms. Given the shift to flexible learning modalities in TVET, TESDA expressed its focus on capacitating its trainers on the use of online methodologies in the delivery of TVET programmes. In addition, TESDA reported that it has started translating its training modules into e-learning modules. DICT has partnered with the International Telecommunications Union and the Development Academy of the Philippines in designing a digital upskilling programme (with certification) for teachers. The agency is also in the process of establishing its own ICT academy, which would offer lifelong learning opportunities and after-school training to individuals interested in upskilling and reskilling.
- **Digital transformation in sectors.** Service sectors such as entertainment and tourism will experience digital transformation. For instance, contactless check-in/check-out registrations may lead to job disruptions for workers in these sectors. In the lifestyle sector, the government promotes digital designing and prototyping. Moreover, adoption of digital payments will revolutionize the e-commerce industry and will create more demand for digital skills. Digitalization in agriculture is subsumed within the agricultural modernization agenda which NEDA plans to include in its updated Philippine Development Plan.
- **Digital infrastructure.** DICT noted its support for digitalization initiatives through the crafting of a National Broadband Plan. However, large-scale investment in digital infrastructure may take some time to materialize. The challenge lies in ensuring connectivity across all geographical locations. Increasing the budget for digital infrastructure will help expedite the creation of national broadband facilities.

- **Adoption of digital technologies.** A business survey conducted by NEDA in April 2020 revealed that only 12.4 per cent of firms were able to implement work-from-home arrangements during the strict community quarantine imposed to curtail the spread of COVID-19. This implies a low-level of digitalization in firms, and points to the need to examine digitalization from the demand perspective. If the country's workforce is trained for Industry 4.0 in the absence of firm-level technological adoption, this may lead to brain drain. Hence, digital skills training should be provided not only to workers but also to entrepreneurs (including older ones) and business owners.
- **Skills development.** TESDA has partnered with the Bayan Academy to develop action and resource allocation plans for the eight sectors identified in the NTESDP 2018-2022. These plans include the identification of skills gaps and the formulation of curriculum and competency standards for specific skills needed per priority sector, as well as the inclusion of ICT and digital technologies in the implementation of TVET programmes. TESDA is using an "adapt and adopt" mechanism in developing its competency standards and regulations. When international standards are already available for certain qualifications, TESDA takes these and appropriates them to fit the country context. A skills window platform that is patterned after Singapore's SkillsFuture was expected to be rolled out before the end of 2020. Moreover, TESDA and DTI signed a memorandum of agreement with SkillsFuture Singapore in 2019 for the development of the country's skills framework. Other agencies such as DICT were engaged in identifying priority sectors for which skills roadmaps will be developed in coordination with TESDA and DOLE and in consultation with industry players.

Employers' and workers' organizations

- **Geographical differences in digitalization impacts.** Urbanized and well-off areas may be more exposed to the impact of digitalization according to stakeholders. Rural areas that are predominantly agricultural can benefit from new and more advanced equipment that can raise farm yield.
- **Shift to online learning.** Universities are shifting to online learning which can encourage independent learning and virtual collaborative work, with skills enhanced through frequent interaction with digital tools.
- **Mismatch between what schools teach and what industry needs.** Two specific skills were reported to be underemphasized in the academe. First is financial literacy and second is entrepreneurship. There is potential for new technologies to develop these practical skills to enhance worker employability.
- **Gaps in industrial policy.** Industrial policy should be built under the foundation of social dialogue. The sectoral view in industrial policy, with emphasis on how digitalization can help cascade industrial transformation and how it can influence human capital development and capacity building in industries, needs to be

emphasized. Moreover, the role of public sector unions in the development of industrial policy needs to be strengthened. As it stands, the government's industrial policy was reported to lack to some extent the perspective of some key stakeholders such as that of workers and employers.

- **Lack of information about youth and informal employment in the context of digitalization.** Official statistics were reported to lack coverage on the drivers of youth and informal employment. For one, the Philippines was one of few countries in the ASEAN that do not have statistics on informal employment. Moreover, there is potential to cover aspects of job mobility among the youth, as some studies contend that young workers tend to leave their jobs after a short while. The latter suggests that they may exhibit heightened propensity to be engaged in the informal economy. In relation to digitalization and skills development, statistics on youth, employment and informal economy would be useful in understanding how changes in the labour market (such as digitalization) have shaped job and skill transitions in these groups. These were considered important for labour demand and skills planning for the future of work.
- **On the function of technology.** Stakeholders expressed concerns that technology should not be utilized as a tool to displace workers. In fact, it can also be deemed as an enabler of capabilities – for instance, in making workplaces healthier and safer and in upholding decent work. For example, AI and drones can be used as tools for occupational safety. How technological advancements can be wielded to enhance people's capabilities may be enshrined in a skills development framework that is aligned with the decent work agenda.
- **Need for more sector-specific studies.** Future work could examine particular sectors of the economy such as the public sector and the banking industry to disentangle how digitalization can disrupt or transform occupations in those specific sectors.
- **Digitalization and the unionization outlook.** Digital tools were reported to have made it easier for workers to carry out their tasks in the comfort of their own homes. However, the fragmentation of the office environment may weaken the spirit of unionization. Frameworks need to be crafted and social protection measures and institutions must be strengthened to ensure that workers' rights are protected and that their voices are heard despite the organizational/workplace changes that would take place due to digitalization.

CSOs, youth and academe

- **On the use of technology.** Stakeholders reported that technology has the potential to become an employment equalizer. For instance, the e-commerce industry could absorb workers who are traditionally left behind (such as workers with disabilities and other disadvantaged groups such as stay-at-home mothers and indigenous people). Technology can also help the youth overcome employment barriers such as those that relate to accessing internship and start-up incubation opportunities. Digital advancements, in a way, increased the democratization of opportunities (that is, it has enabled access to opportunities previously restricted by geography or age). Furthermore, stakeholders highlighted the role of digital advancement to help improve market efficiency.
- **Education needs a paradigm shift.** A lot of schools were reported to maintain a focus on teaching via rote learning. This type of teaching was generally seen as inadequate in inculcating critical twenty-first century skills into the workforce of tomorrow. Operationalizing and integrating these twenty-first century skills into K-12 curriculum as well as in college and graduate education was considered important. This might entail ingraining a shift in the mindset of today's youth that leans towards entrepreneurial education as well as innovative and creative "out-of-the-box" thinking (possibly honed through strong science, technology, engineering and mathematics education).
- **Developing non-cognitive skills is important.** While Industry 4.0-related recommendations could lean towards the development of cognitive skills, stakeholders pointed to findings in the skills literature suggesting that soft skills or non-cognitive skills may be as important as technical, domain-specific knowledge as a prerequisite for doing well in the labour market. Non-cognitive skills also raise firm productivity by facilitating cooperation among workers.
- **Industry can help upskill workers.** As a case in point, stakeholders referred to the example of Globe Telecom that opened an upskilling course for 6,000 employees. Their strategy was to upskill all workers by engaging partner IT experts to train employees on IT basics. Globe's experience highlights the role that the private sector can play in adapting to changing market situations (in particular, with respect to fast-paced technological change).
- **Digital technologies can help uplift communities and promote social inclusion.** Digital tools, apart from being deployed for work, can help advance sustainability initiatives. For example, it can be used to develop monitoring systems that cater to the protection of land and traditional knowledge of indigenous communities. In this regard, making digitalization initiatives accessible to remote and indigenous communities can advance social reintegration. Empowering communities through digitalization also mitigates inequality in the distribution of opportunities across social groups.

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