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Digitalisation and Labour Markets in Developing Countries

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Digitalisation and Labour Markets in Developing Countries

Abstract

Digitalisation has a major impact on labour markets in developing countries. While Internet access expands, digital platforms proliferate and "gig-work" is performed in the Global South, access to and use of digital technologies remains far from universal. As the scope and speed of digitalisation vary across countries and "context matters". The present study reviews the evidence on the effects that selected key aspects of digitalisation on labour markets in developing economies with a focus on digital platforms. Although several studies find considerable effects regarding the employment impacts of digital infrastructures, the evidence on the impacts of digital platforms remains relatively patchy. For example, while transaction data from global online labour platforms demonstrate the important role of the Global South as a supplier on online platforms, we know very little about the extent of work on location-based online platforms. We discuss digital skills to harness digitalisation gains and identify several evidence gaps.

Keywords: Digitalisation, labour markets, employment, digital platforms, digital skills
JEL codes: O14, O33, E24, J21

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Digitalisation and Labour Markets in Developing Countries

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Article Outline

1 Introduction and Scope

Digitalisation is having an impact on economies and labour markets around the world. The advent of the Internet, the increasing use of mobile phones, and the rise of digital platforms are changing not only the way people live but also the way they work. Digital tools, particularly digital platforms, can improve products and services, connect buyers and sellers regardless of physical location, enhance information and transparency in all kinds of markets, and improve production and business processes. Thus, they have the potential to increase the effi-

ciency of input, credit, and consumer markets, as well as the productivity of firms and workers. However, there are caveats to digitalisation. For example, market concentration due to network effects can work against efficiency gains and create market power that monopolies use to the detriment of other firms, consumers, and workers.

Through these various channels, digitalisation ultimately affects labour market outcomes: employment, wages, and working conditions. It has long been recognised that "digital dividends" are not equally distributed, neither between nor within countries (World Bank 2016). Developing countries generally lag behind developed ones in the adoption of digital technologies, with some notable and unexpected exceptions, including the rapid growth of mobile phone use and the proliferation of digital platforms, even in very poor contexts. Labour markets and their context-specific characteristics play a crucial role in the transmission of the "digitalisation shock" to welfare and living standards. Therefore, it is crucial to understand the impact of digitalisation on labour markets in developing countries and the relevant contextual factors in order for developing countries and their workers to benefit from digital technological progress.

This study reviews the evidence on the effects of selected key aspects of digitalisation on labour markets in developing economies. We highlight the characteristics of developing countries and their labour markets that are important for the transmission of digitalisation into employment, wages, and working conditions. We also look at the policy implications of the presented evidence and assesses selected development interventions. We cover two key aspects of digitalisation.[1] First, access to digital technologies is far from universal in important parts of the developing world, despite the considerable expansion of mobile phone coverage. The ongoing process of digital expansion in terms of Internet and mobile phone coverage provides an interesting laboratory to study its effect on labour markets. The first section of our review looks at the evidence regarding the broad labour market impacts that this expansion has had in developing countries, mainly at the employment effects of expanding Internet access. Second, digital labour platforms, including for location-based services (such as taxis or domestic services) and for online labour (such as for programming tasks) have become important "employers" in many developing countries. These platforms meet labour markets that are typically characterised by high degrees of informality and self-employment, and we provide some conceptual considerations on the economics and labour market impacts of digital labour platforms. We further look at attempts to quantify the extent of such platform work and

1 We do not investigate in this review a third key facet of digitalisation: the computerisation and automation of task. Especially in developing countries, a wide range of tasks are still executed manually by humans but have the potential to be eventually replaced by computers or robots. This computerisation will have profound and ambiguous labour market impacts – through replacement, productivity and reinstatement (new jobs) effects (Acemoglu and Restrepo 2019) as well as through the potential re-shoring of production and jobs to high-income countries. The impacts of automation and re-shoring may not be immediately felt by countries with little industry that are not as heavily integrated into global production networks.

review the evidence on the quality of work on both location-based and online labour platforms.[2] We conclude this section of our study with a review of the effects of other digital platforms on labour markets, such as mobile money. The next section addresses selected key policy issues, including the regulatory framework for the digital economy and digital labour, as well as digital infrastructure and (affordable) Internet access. Before we conclude our study with a summary of the main findings and an outlook, we turn to the digital skills and policies that can support their enhancement, as they are a pre-condition to harness the gains from digitalisation.

2 Digital Infrastructures: Internet and Mobile Phones as Drivers of Productive Employment

There are many pathways through which digital infrastructures, such as mobile phones/networks and the Internet, affect the labour market. The economic activities related to building and operating these infrastructures are sizable; in particular, the mobile ecosystem of Sub-Saharan Africa also directly creates employment. More importantly, Internet access and mobile phone coverage lower transaction costs, imply better market access (to bigger markets), and improve information on prices, products, suppliers, and customers. They open up access, for both individuals and firms, to all kinds of digital services, including access to finance and financial services, as well as digital platforms (digital labour platforms will be discussed in detail later). Internet infrastructure is a pre-condition for an information and communication technology (ICT) industry to grow, which may employ high-skilled labour in operating "hard" digital infrastructure and in the "tech industry" (as developers or programmers). Access to digital infrastructure allows firms to use technology that improves firm-level productivity, thus increasing labour demand by firms that become more productive (World Bank 2016), although there may be opposing effects when labour is reduced because of (digital) automation or when less productive firms, which have not adjusted to the new technologies, exit.

The proportion of individuals who use the Internet has increased significantly. Most regions (Latin America and the Caribbean, East Asia and the Pacific, and the Middle East and North Africa) saw a sharp increase in individuals using the Internet in the early 2000s, with South Asia and Sub-Saharan Africa experiencing the same trend a decade later. As of 2019, Latin America and the Caribbean has the highest share of individuals using the Internet among the developing regions (68 per cent), compared to only 29 per cent in Sub-Saharan Africa (see Figure 1).

2 Our review does not provide much detail on (direct) employment in the ICT (information, communication, telecommunication) industry, mainly because of the sector's limited contribution to overall employment. Also, we do not look in detail at rural labour markets, which are dominated by smallholder agriculture in many low (and some middle) income economies.

Even though mobile phone coverage has become almost universal (at levels of more than 100 subscriptions per 100 people), South Asia and Sub-Saharan Africa lag behind. However, they are catching up faster than in terms of Internet usage, and Sub-Saharan Africa is approaching 100 subscriptions per 100 people (Figure 2).[3]

Figure 1. Individuals using the Internet (% of the Population)

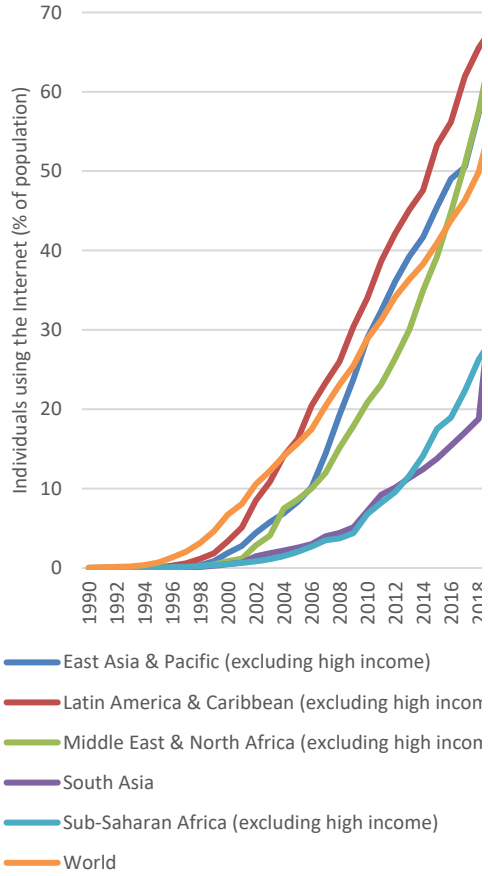
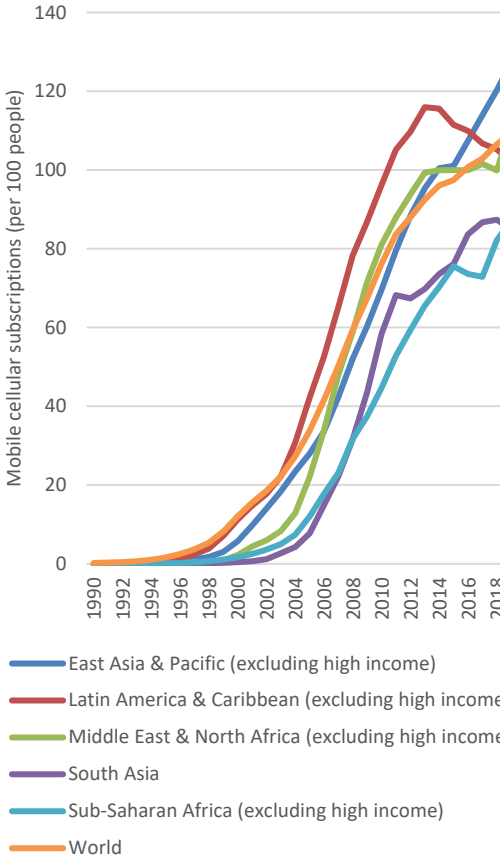


Figure 2. Mobile Cellular Subscriptions (per 100 People)



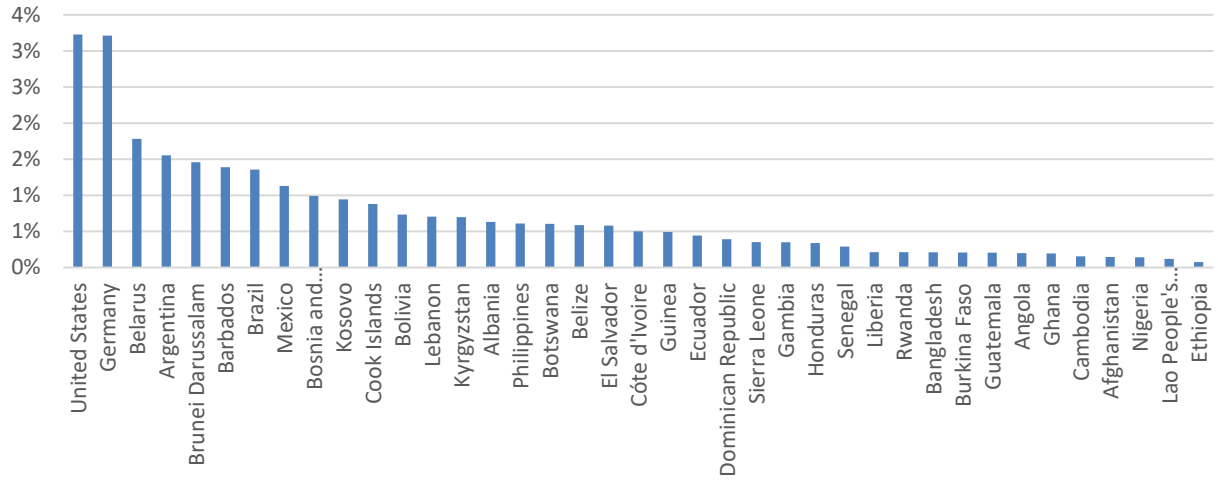
Source: World Development Indicators 2022.

The direct employment effect of a growing ICT sector is relatively small in low- and middle-income countries. The World Bank Development Report 2021 "Data for better lives" estimates that the ICT sector accounts for 2.1 per cent of total employment in high-income countries, 0.2 to 0.6 per cent in middle-income countries, and 0.1 per cent in low-income countries. Among low- and middle-income countries, Belarus has the highest share of ICT employment of total employment (1.8 per cent), while Nigeria, Lao People's Democratic Republic and Ethiopia have the lowest share, with 0.1 per cent. By way of comparison the share in Germany and the United States is 3.2 per cent (Figure 3).

3 Note that these figures conceal considerable heterogeneity within Africa.

However, it is important to note that the ICT sector, beyond strict statistical definitions, looks different in the developing world. GSMA[4], an industry body, estimates that mobile ecosystems, which include the retail activities related to mobile networks, "formally support" 300,000 jobs, to which it adds another 1.1 million informal jobs. The corresponding figures for the Middle East and North Africa are 390,000 direct jobs plus about 650,000 indirect jobs (AUC/OECD 2021; GSMA 2020).

Figure 3. Share of ICT Employment, Latest Year Available



Source: ILOSTAT 2022.

Assessing the impact that the arrival of digital technologies has had on economic activity and labour markets is not trivial. First, it often happens simultaneously with other economic forces, and causality may not be as assumed. This is the case when these technologies are adopted because economic activity accelerates and not vice versa. Second, because firms and workers self-select into adoption, we cannot simply compare adopters to non-adopters to learn about impacts. Most likely, it is relatively dynamic and versatile firms and workers who might have performed better even in the absence of digital progress.

2.1 Employment and Earning Impacts of Internet Access and Mobile Phones

In the African context, Hjort and Poulsen (2019) seek to overcome the above-mentioned challenges and estimate the causal impact of the arrival of the Internet on employment. The authors measure the effect of Internet arrival by comparing (a) employment changes in locations that gain access to fast Internet in a given period with (b) employment changes in locations that are not yet connected to fast Internet. To yield causal impact estimates, this so-called differences-in-differences approach needs to assume that locations would have experienced the

4 Groupe Speciale Mobile Association.

same employment growth if the Internet had not arrived in one of them. That study uses various micro datasets (Demographic and Health Surveys, Afrobarometer) with employment information from 12 Sub-Saharan countries and combines these surveys with information on the gradual arrival of submarine Internet cables. This – to our knowledge – most convincing study on this subject finds a very sizable effect of fast Internet access on employment: the probability of being employed increases between 3.1 and 13.2 per cent depending on the set of countries studied. This effect appears to be driven by increases in (moderately) skilled employment, while the probability of having an unskilled job is not affected by the arrival of fast Internet.

A more recent study by Ndubuisi, Otioma, and Tetteh (2021) relies on a cross-country panel regression (1996–2017) of 45 Sub-Saharan African countries. The study finds a significant increase in employment levels in the service sector due to digital infrastructure, as proxied by an index composed of Internet use and mobile and fixed-line subscriptions.[5] Unfortunately, the effect sizes are not well explained in the paper, but the effects appear to be small to moderate: A 1 per cent increase in mobile phone subscriptions is associated with a 0.03 per cent increase in service sector employment. These results must be interpreted with some caution as the study's approach is unlikely to fully account for unobserved factors.

For Nigeria, Kalvin et al. (2020) evaluate the welfare effects of mobile broadband Internet and find that it has a positive impact on household consumption levels and thus reduces poverty. Looking at transmission mechanisms, the authors find a higher likelihood of being in the labour force and in wage employment if an area is covered by 3G or 4G technologies. Making use of three waves of Nigeria's General Household Survey over a seven-year period, the authors can observe trends in locations that are uncovered and eventually covered by 3G and 4G technologies. The authors show that labour market trends in covered and uncovered regions were similar before the arrival of broadband Internet, which lends credibility to their causal estimates. The study found sizeable effects when locations become covered by 3G or 4G technologies: an increase in labour force participation of 3.3 per cent and wage employment of 1.4 per cent.

Klonner and Nolen (2010) examine the employment effects of mobile phone network expansion using data from South Africa but limit their analysis to rural areas. In line with the previous studies, they show that employment increases significantly by 15 per cent when a location is covered by cell phone networks.[6] The positive employment outcomes are entirely

5 The authors use a fixed effect instrument variable approach, and instrument digital infrastructure with the average total digital infrastructure in other African countries. This common practice in similar studies relies on the assumption that any unobserved factors that explains both employment outcomes and digital infrastructure in one country is not also driving digital infrastructure expansion in other countries. This "identifying assumption" cannot be tested and may not hold. However, controlling for observables (here, for example, trade openness, and inflation) mitigates this concern.

6 Again, it is difficult to estimate the causal relationship between mobile phone network roll-out and labour market outcomes. For example, the authors mention that locations with high demand for mobile phone services are more likely to receive coverage earlier than other places and that locations close to already covered areas are

attributed to increases in wage employment and are mainly driven by women. For men, a shift out of agricultural employment can be observed (Klonner and Nolen 2010).

Although evidence on the employment impacts of digital infrastructures is patchy, there is even less evidence on the impacts of digitalisation on wages and incomes. This is also due to the fact that some data sources used in the above analyses (for example, Afrobarometer or the DHS surveys) do not report income.[7] Suggestive evidence on wages comes from a study by Navarro (2010), which finds a positive impact of Internet usage on earnings in several Latin American countries. To account for selection problems that occur due to the non-random use of the Internet, the author creates a treatment and control group by matching individuals based on their probability of Internet use (propensity score matching). This approach, which is unlikely to fully account for (unobserved) differences between users and non-users, suggests large effects of using the Internet on the wages of salaried workers: between 18 per cent in Mexico and 30 per cent in Brazil and Honduras. For the self-employed, the author also finds a significant impact of Internet usage for all of the countries he studies except Costa Rica. However, the author acknowledges that future studies should make use of panel data in order to better isolate the effect of Internet usage on wages.

2.2 Firm entry and Productivity

Firms play a crucial role in transmitting the potential benefits (and risks) of digital infrastructure to the labour markets.[8] There is still ample scope for firms in developing countries to adopt digital technologies, as illustrated by Figure 4a and Figure 4b. Adoption varies by region; while almost 90 per cent of firms in Latin America and the Caribbean correspond with their clients via e-mail, only slightly more than half of firms in the Middle East and North Africa do so. Only 31 per cent of firms in the Middle East and North Africa have a website, compared to 68 per cent in Europe and Central Asia (Figure 4a). There are also considerable differences between countries within the regions. For example, almost all firms in Argentina, Ecuador, and Colombia have a website, whereas the figure is only 73 per cent in Bolivia. Almost 80 per cent of firms in South Africa correspond with their clients via email, compared to a respectable 47 per cent of firms in Kenya, but just slightly more than 20 per cent of firms in Nigeria (Figure 4b).

more likely to receive coverage earlier than other non-covered regions. The authors choose an instrument variable approach to remedy these problems, proposing a variable that captures the topographic characteristics of the location (terrain curvature at the location level), which should explain mobile phone expansion but not directly affect employment.

7 There is more suggestive evidence on relatively large employment impacts. For example, Zhao (2020) shows that Internet use is significantly correlated with rural self-employment, which is 5–7 percentage points higher for household that use the Internet. However, our review has focused on those studies that can more or less plausibly claim to show some causal impact estimates.

8 Firms include one-person firms – that is, the self-employed – which account for a large share of employment in developing countries.

Figure 4. Innovation and Technology Indicators (Latest Year Available); Percentage of Firms that

Figure 4a. By Region

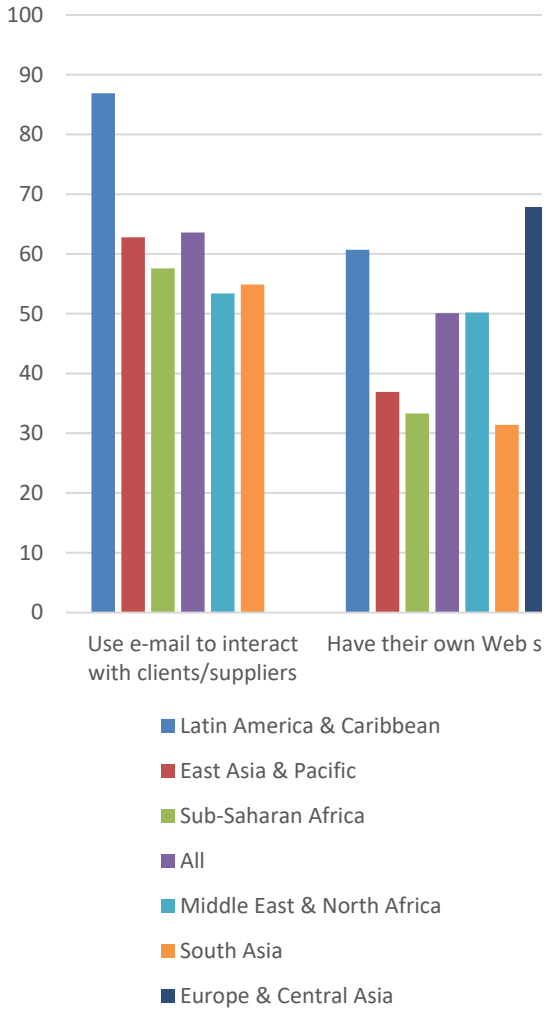
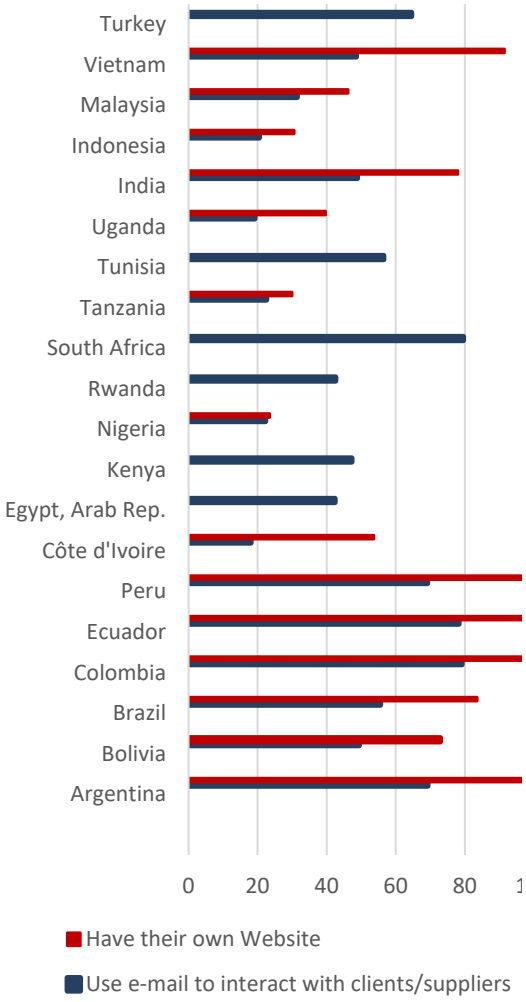


Figure 4b. By Country



Source: World Bank Enterprise Survey 2022.

As with the above studies on labour market impacts, it is challenging to measure the causal impact of the Internet on firms. Internet use may be correlated with firm productivity, which means that already more productive firms are also adopting digital practices more quickly. Again, few studies convincingly address these empirical problems. An exception is the above-mentioned study by Hjort and Poulsen (2019) on Africa, which also examines firm-level data to assess the channels that drive the authors' results on positive employment effects. Using South African data, their analysis shows that the arrival of fast Internet is associated with positive net firm entry; that is, firm entry increases and firm exit decreases. Those effects are especially strong for sectors that use ICT intensively, such as finance and services. For manufacturing firms in Ethiopia, the authors find an increase in firm-level productivity. Finally, using

the World Bank Enterprise Surveys, which have detailed information on management practices of firms, Hjort and Poulsen (2019) show that the arrival of the Internet leads to an increase in on-the-job training, which might increase the productivity (and wages) of workers.

Also using the World Bank Enterprise survey, Cariolle, Le Goff, and Santoni (2019) build a pseudo-panel dataset of 130 municipalities and provinces from approximately 40 developing and transition countries by aggregating firm-level data at the municipal or province-level.[9] They estimate the impact that using email has on employment. In addition to controlling for (unobserved) differences between localities, they use a set of instrument variables to address the possible endogeneity between e-mail usage and firm performance; for example, because firms' performance may drive email usage and not vice versa. These variables explain email use but do not directly affect firm performance. One such instrument is the location's vulnerability to seismic shocks in the submarine cables network (seaquakes).[10] The results show that a 10 per cent increase in e-mail usage leads to a large increase (12 to 14 per cent) in the average number of full-time permanent workers in firms. While results are mainly driven by the service sector, there is also a positive effect on the employment of unskilled production workers in the manufacturing sector.

2.3 Gender Differences

The labour market impacts of digital infrastructure may as well have a gender dimension because employment opportunities opened by the Internet may be more flexible and have low barriers to entry. Both – flexibility and low entry barriers – may favour women since they may want to work part-time, and they may be even more asset-constrained than men. Some studies find particularly positive employment effects for women – of certain aspects of digital infrastructure and service. However, the evidence does not support the hypothesis that labour market impacts would generally be biased in favour of women. For Jordan, Viollaz and Winkler (2022) document that Internet adoption causes an increase in female labour market participation, which can partially be explained by an increase in online job searches.[11] While using the Internet in a household does not statistically significantly affect the employment of men, the authors find a relatively large impact on female labour force participation (a 1 percentage point increase in Internet adoption caused an increase of female labour market participation of 0.7 or 0.8 per cent, depending on the set of control variables included).

9 This allows the authors to hold constant/control for any average differences between municipalities/provinces that do not change over time.

10 The underlying idea is that locations more exposed to those shocks have a lower probability of being connected to the Internet since submarine cables are exposed to a higher risk to be damaged, so there is a lower incentive to connect those areas. The authors focus explicitly on seaquakes and not on earthquakes, since the latter might have an impact on the overall economic development of the region, whereas the former only impact the Internet rollout.

11 The authors use an instrumental variable approach to overcome potential endogeneity biases (interaction between the distance to mobile phone towers and the per capita expenditure on communications).

Mixed evidence comes from Indonesia. Kusumawardhani et al. (2023) find ambiguous results regarding the impact of Internet availability on female labour market outcomes. Like previous studies, the authors use Internet availability at a district level as an explanatory variable to look at individual- or household-level outcomes. If anything, the study finds small effects: while Internet availability has a significant but small positive effect on female labour force participation, the chances of being employed conditional on being in the labour force are not influenced by Internet availability. However, there is a larger effect on females being employed full-time (5.6 per cent; on average, 53.2 per cent of women are already in full-time employment). Internet availability does not influence whether someone is formally employed or employed in a skilled job.

The gender impacts of digital infrastructure appear to be highly context-specific. In Vietnam, a country that has experienced major structural change (from agriculture to manufacturing) in the past 20 years, firm-level data shows that the use of broadband Internet increases the relative demand for female workers, especially for those who are college-educated. Chun and Tang (2018) find that a 10 per cent increase in the number of computers connected to LAN per worker led to a 3 per cent increase in the female share of labour in the firm. The findings from India are similar. Based on the Indian World Bank Enterprise Survey, Jain (2021) shows that female labour force participation increases significantly through the use of ICT. However, these effects can only be found for the skilled workforce.[12]

3 Digital Labour Platforms: Opportunities, Pitfalls and a Dearth of Evidence

Among other things, digital infrastructures provide access to digital platforms, which are an important element of the digital economy. In this section, we focus on digital labour platforms, but we also review some studies that examine the (labour market) impacts of other digital platforms.

3.1 Digital Platform Economics and the Labour Market

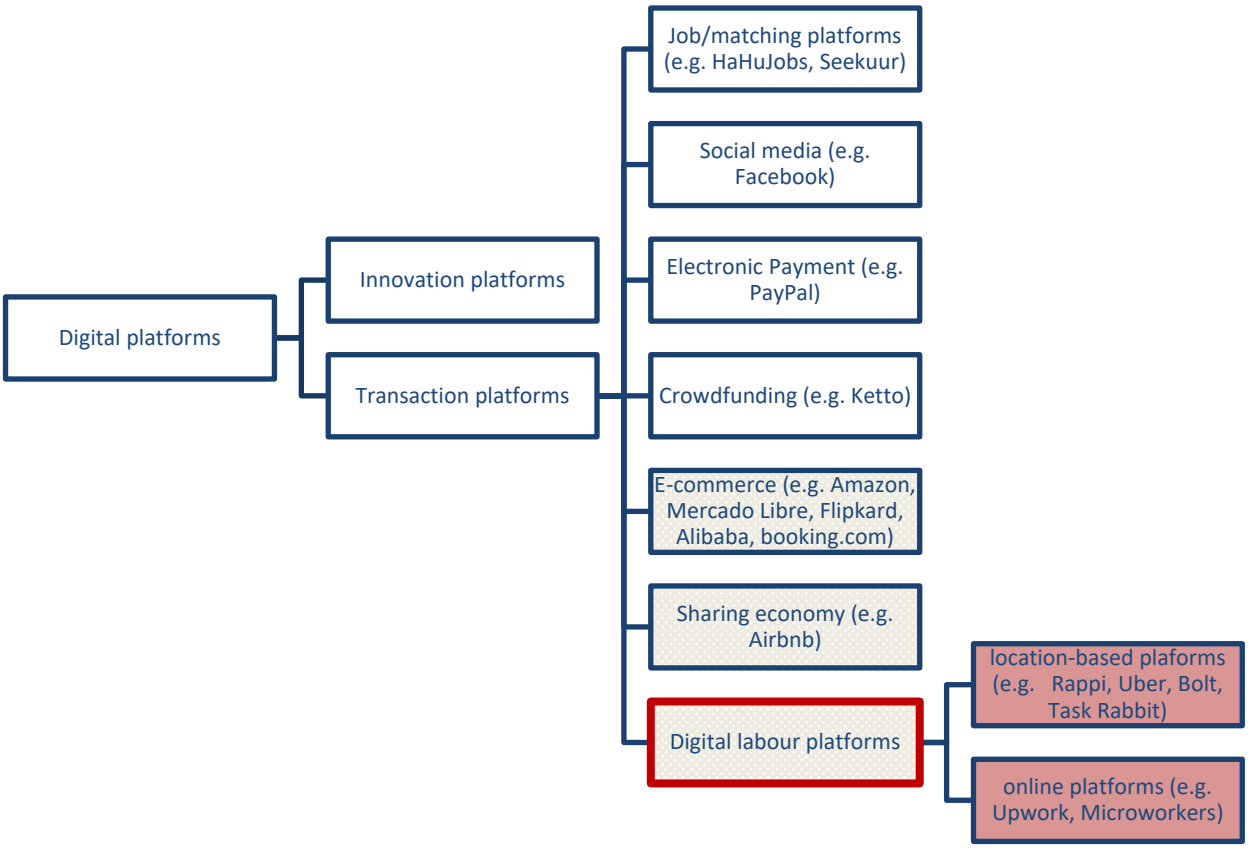
Digital labour platforms are digital platforms through which some form of work or service is directly transacted. The ILO's World Employment and Social Outlook "The role of digital labour platforms in transforming the world of work" (ILO 2021) distinguishes between *online platforms*,[13] where workers offer their services independent of their location (for example, on

12 Both studies use (more or less convincing) instrument variables to mitigate endogeneity concerns.

13 Work on online platforms probably comes closest to what is sometimes referred to as the GIG-economy. We avoid the term GIG-economy because many workers on digital platforms, and more so on digital labour platforms, are often involved in platform work on a continuous basis and thus not occasionally as the word "GIG" might suggest.

Upwork) and *location-based platforms*, such as taxi or food delivery services.[14] Digital labour platforms are one type of so-called transaction platforms (see Figure 5), which, generally speaking, facilitate the interaction between buyers and sellers and are often referred to as multi-sided markets (Koskinen, Bonina, and Eaton 2019). In particular, these platforms overcome the various information barriers (World Bank 2016) of "analogue" exchanges.[15] Transaction platforms can be seen as a new type of firm; they provide the infrastructure to intermediate between different user groups (Srnicek 2017) and thus facilitate value-creation. The platform typically takes a share of that value but does not entirely control the scope of interaction between users or the outcomes of the intermediated transactions (Pathways for Prosperity Commission 2020).

Figure 5. Digital Platforms



Source: Authors based on (ILO 2021; Aneja and Pragya 2021; Koskinen, Bonina, and Eaton 2019).

14 In addition, Aneja and Pragya (2021) differentiate between freelancing and crowd work on online platforms. Online freelancing can be divided into open service platforms – where labour demanders and suppliers can communicate directly – and managed service platforms – where the matching process is managed. Crowd work can be divided into microwork and contest-based work.

15 Digital platforms also include innovation platforms defined as systems that enable the operation of certain products and services, the most prominent example being Google's operating system Android.

In addition to digital labour platforms, transaction platforms encompass social media, electronic payment, crowdfunding, e-commerce platforms, job matching, and sharing economy platforms (see Figure 5 for examples). Many specific platforms cannot be unambiguously classified as one type of platform; for instance, platforms that were initially conceptualised and operated as sharing platforms. In particular, Uber and Airbnb quickly evolved – to an important extent – into market platforms where services are traded, even though the service providers, as well as the customers, are still different from those in an offline market. In addition, specific transaction platforms may combine different types of transactions. Amazon, for example, is not only an e-commerce platform but also offers an electronic payment system.

3.1.1 Some Economics of Platforms

Economies of scale and the network effects are two central elements of the economics of digital platforms. Supply-side economies of scale arise if average costs (per user or transaction) drop with an increasing number of users or consumers since, unlike in most analogue activities, an increasing number of buyers/users does not require (much) more physical infrastructure to be built. Traditionally, supply-side economies of scale have been the drivers of monopolies, a tendency that is also pertinent in markets dominated by digital platforms. In the present case, however, demand-side economies of scale and network effects are more important. They arise, for example, because services improve and become more widely available with more users and/or information on service providers/sellers and customers/buyers improves with the number of users (ratings, etc.). Network effects also create lock-ins: While changing the service does not require a lot of individual effort, it does require collective action to switch platforms that can provide the same quality of service, which, in turn, is determined by the number of users (World Bank 2016). Because of the demand- and supply-side economies of scale, network effects, and lock-ins, there are tendencies in platform markets for winners to "take it all". The resulting market concentration can eventually lead to higher prices for consumers and a weak bargaining position for firms and individuals who provide goods and services through digital platforms. This has important implications for the relations between service and platform providers, including fees.

Platforms often charge fees, which go directly to the platform provider. In highly concentrated markets, it may happen that powerful platforms charge "monopoly fees" to their users. Further costs to service providers or workers on platforms include physical capital, which firms in traditional labour markets provided; for example, cars when working on a ride-hailing platform (ILO 2021). While platform-using service providers (firms and individuals) may now save on intermediary costs, they incur digital marketing costs, which may put additional pressure on small and medium-sized firms in developing countries.

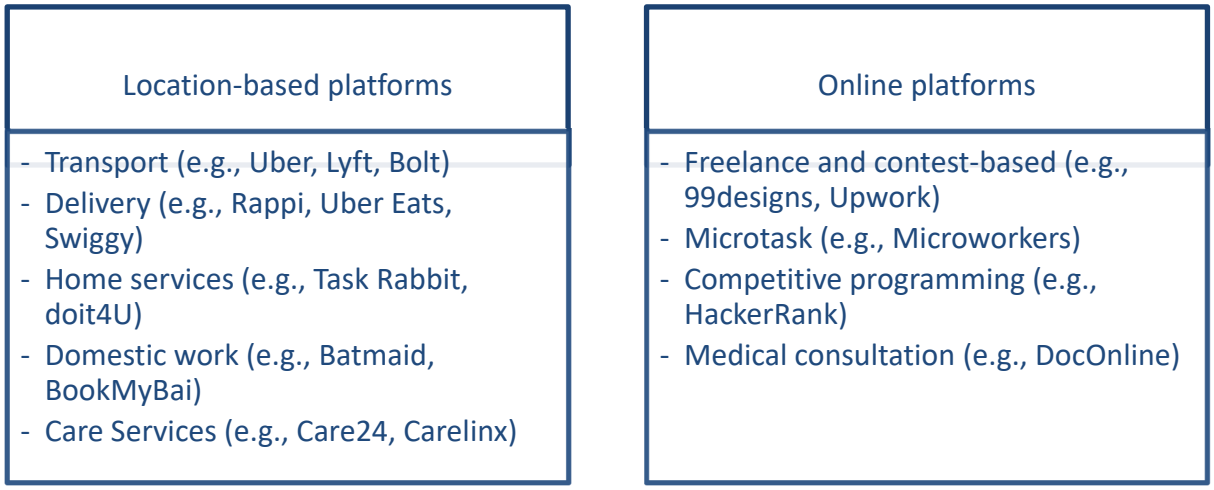
The potential adverse effects must be weighed against the potential benefits. Digital platforms promise to increase (i) inclusion, in particular, because entry barriers are typically low; (ii) efficiency, through such means as quicker responses to changes in supply and demand

(Rossotto et al. 2018); and (iii) innovation – for example by diffusing innovative practices through the network (ADB 2019) and by serving as a potential route to formalisation (OECD, Economic Commission for Latin America and the Caribbean, and CAF Development Bank of Latin America and European Commission 2020).

3.1.2 Labour Market Impacts of Platforms

As indicated above, the different types of digital platforms indirectly affect labour markets and workers in various sectors – from retail to hotels – through numerous pathways. However, it is digital labour platforms that have directly transformed employment, employment conditions, and earnings for many people. Jobs on both digital labour and location-based platforms existed previously – taxi driving, food delivery, as well as coding and programming activities, were common practices before digital labour platforms – but the Internet has changed the way in which customers/buyers and providers/suppliers are matched, as well as the way in which the tasks or services are executed.

Figure 6. Digital Labour Platforms



Source: (ILO 2021).

Location-based platforms can also be defined as "work on-demand via the app", with work being mainly executed locally and offline. These applications have changed several economic activities quite dramatically. Probably the most prominent examples are platform workers in the transport and delivery sector. Applications such as Uber, Lyft, and Bolt offer application-coordinated rides and compete with traditional taxi services but are also likely to have enlarged the size of the ride-hailing market. Particularly in developing countries and during the pandemic, the market for app-based food delivery (Rappi, Uber Eats, etc.) experienced rapid growth, partly competing with but also complementing offline restaurant visits and direct deliveries from restaurants to consumers (see Arroyo, Payola, and Molina (2021) for evidence from Latin America). Furthermore, platforms connect demand and supply in numerous other

services, including in-home services, domestic work or care services through applications such as Task Rabbit, Batmaid or Care24 (ILO 2021).

Online platforms are used to offer and supply online and remote tasks. They constitute the GIG economy, narrowly defined, where individuals are paid for certain GIGs that they were contracted for on online platforms. Upwork is an example of a platform on which people from all over the world offer their services to clients that are also distributed worldwide. In other more traditional activities, such as in the health sector (one case being digital medical consultation platform DocOnline), such platforms are yet to gain traction.

The rise of digital labour platforms raises important employment issues. While platform work holds the potential for economic inclusion, it also exhibits mechanisms of exclusion. So does flexible low-entry-cost platform work come at the price of precarisation?

An important aspect of an answer to this question relates to the classification of workers on digital labour platforms. Typically, platform workers are independent workers who are considered self-employed, independent contractors, freelancers, or third-party service providers. This status often excludes these workers from certain rights, such as social protection coverage and collective bargaining (ILO 2021). However, digital labour platforms can increase economic inclusion. Graham, Hjorth, and Lehdonvirta (2017) point out that digital labour platforms allow workers, who face barriers and disadvantages in the local labour market (such as missing certification or work permits), to participate in the online labour market. Location-based platforms, such as in the transport sector or in some service sectors, exhibit low entry barriers. New entrants gain access to customers immediately and may need less liquidity to sustain their business in its infant stage. Although physical capital is required in some cases (such as in the taxi business), contractual models of leasing, renting and profit-sharing have emerged that allow credit-constrained individuals to work on location-based platforms, such as ride-hailing platforms.[16] Furthermore, platform work tends to be very flexible because the workers themselves decide when and how long to participate. This may be particularly attractive to women who are often constrained to working full-time (see Box 3) (Aneja and Pragya 2021). On the downside, workers on digital platforms might experience discrimination due to their ethnicity, language skills, age, or sex, although such discrimination might not be more pronounced than it is in "offline" non-platform work.

The status of these individuals as self-employed or non-standard workers may provide a wide range of flexibilities, which are often a main reason for working on the platforms (see next section for details). However, the majority of platform workers lack health and work-related injury insurance, unemployment and disability insurance, and access to pensions and

16 For example, Moove is working together with Uber in Sub-Saharan Africa. Moove sells new cars to drivers and finances up to 95 per cent of their purchase. Drivers choose if they want to repay their loan over 24, 36, or 48 months. The company has grown substantially since its launch (Pittaway 2021). Other examples are Uber providing rental options in South Africa (Uber 2022) and the ride-hailing platform Didi provides loans to its drivers in Latin America (Pinedo 2022).

retirement benefits (ILO 2021). Furthermore, as self-employed individuals, platform workers do not participate in collective bargaining. Generally, collective action by and organisation of platform workers tends to be difficult because they are geographically dispersed – sometimes around the world, albeit it is conceivable that they might organize online. Instead, unorganised platform workers typically have little choice other than to accept the terms of service agreement of the platform, which cannot be negotiated.

Overall, the so-called "uberisation" of employment and the rise of gig work may not lead to jobs that are much better than comparable "analogue" jobs. However, some platforms (such as the food delivery platform Deliveroo) have started to offer insurance plans for workers and aim to improve working conditions, albeit this is clearly not the norm in developing countries.[17] More generally, participation in the platform economy may also hold the potential to formalise jobs (see Lakemann and Lay (2010) for more detailed arguments for Africa). As the below account of the sparse empirical insights on platform workers in developing countries demonstrates, most of these workers are self-employed without the benefits of formal salaried work (ILO 2021). However, it is important to take into account the relevant counterfactual for the respective platform worker, which might be no employment at all or employment conditions that may still be worse than those on the platform. This is why the challenges and benefits of the platform economy should be evaluated carefully (De Stefano 2015).

3.2 Quantifying Employment on Digital Platforms

The scarcity of research on the quality of platform employment is less surprising than the limited nature of knowledge on the extent of the platform economy. The number of platforms is relatively straightforward to observe and has increased over the last few years (Evans and Gawer 2016). The ILO (2021) estimates that the number of platforms increased from 142 in 2010 to over 777 in 2020, with a pronounced increase in the number of taxi and delivery platforms. Most platforms are based in the United States, followed by India, the United Kingdom, and Northern Ireland. However, platforms based in developing countries are increasing as well (Aneja and Pragya 2021).

Nevertheless, few statistics exist regarding the total number of workers engaged in platform work. This phenomenon appears to be too recent to be systematically considered in official labour statistics, which typically rely on labour force or household surveys that are frequently conducted in almost all developing countries. Information on platform workers may not need to be provided through surveys of workers as it can, in principle, be derived or harvested from the platforms' providers. To date, however, these firms have been reluctant to

17 Deliveroo exists mainly in high-income countries, where the insurance plan is already implemented and extended through other components such as new-child payments. In the United Arab Emirates and Qatar, workers have insurance that includes coverage for accidental death and permanent disablement, permanent partial disablement, and accident medical expenses to a certain extent.

publicly share detailed statistics on the number of workers engaged with them. Even if that number was enclosed, it may be of little value, since being registered on a digital labour platform does not necessarily mean that the person is also actively engaged on the platform. Thus, additional information on the activity of the registered person may be required. In addition, the time spent by workers on platform work is likely to vary very considerably – across types of activities but also across individuals. Many people hold other jobs and sometimes offer their work in the same trade/business on another platform. Thus, simply adding up workers on different platforms is likely to lead to double-counting. In contrast, if multiple workers used one account, this would underestimate the number of workers.

3.2.1 Online Platforms

Perhaps surprisingly, there is probably more information on workers on digital online labour platforms than on location-based ones. The Online Labour Index produced by the Oxford Internet Institute aggregates activity on global online labour platforms and is based on information on the number of projects and tasks on the five largest English[18] – and, since 2020, also on three Russian and Spanish – language platforms. This index makes it possible to examine the activities on the platforms as well as the geographical patterns of demand and supply (Kässi and Lehdonvirta 2018; Stephany et al. 2021). For example, the data show that more than a quarter of the global labour supply comes from India (28.6 per cent), followed by Bangladesh with 14.3 per cent and Pakistan with 11.9 per cent. Software development represents the biggest share of online freelance work in India and Pakistan, whereas creative and multimedia represent almost 50 per cent of the online freelance work of Bangladeshi workers (Kässi and Lehdonvirta 2018; Stephany et al. 2021).

Thus, labour supply primarily comes from low- and middle-income countries, although a substantial share of online platform workers (approximately one-fifth, including Russia and China) are from high-income countries. In contrast, labour demand originates almost exclusively in the high-income countries, implying a very unequal geographical distribution between supply and labour demand (Graham, Hjorth, and Lehdonvirta 2017). Kässi, Lehdonvirta, and Stephany (2021) estimate that there are approximately 163 million freelancer profiles globally, of which around 14 million have worked at least once for a platform and 3.3 million have completed at least 10 projects or earned at least $1,000. These data are partially based on imputations. First, the authors compile a list of online labour platforms. For 162 of the 351 platforms in their list, they are able to observe registered workers.[19] For the remaining platforms, the authors impute the number of workers by training a machine learning model with predictive features that measure website popularity, such as the Alexa rank (compiled by

18 Those platforms account for at least 70 per cent of the market traffic.

19 In addition, for seven platforms the authors observed the numbers of workers who had ever worked for the platform, and for six platforms they were able to observe the number of workers who had completed at least 10 projects or earned more than $1,000.

a web traffic analysis company) and the median of daily Google trends index values. The authors also try to correct for workers registered at multiple platforms and multiple workers using one profile. For example, surveys have indicated that workers are active on average on 1.83 platforms, meaning that the total number of workers imputed should be corrected downwards accordingly.

3.2.2 Location-Based Platform Work

Statistics on how many workers work on location-based digital platforms are even more limited. Research ICT Africa conducted a survey in 2016 and found that, on average, 1.3 per cent of adults in Ghana, Kenya, Nigeria, South Africa, Rwanda, Tanzania, and Uganda generate income through platform work (Smit et al. 2019). In

Table 1, we attempt to collect information from a variety of sources on the number of Uber drivers in different places worldwide. Worldwide, Uber has about 3.5 million drivers.[20] To put this highly imperfect approximate number in perspective, we contrast it with the number of (all) individuals employed in the transport sector. Uber drivers as a share of workers in the transport sector vary between 1.2 per cent in Ghana and 26.8 per cent in India. Eisenmeier (2018) estimates that, in Mexico City, almost 60 per cent of legally operating taxi drivers are Uber drivers. These estimations highlight the important role of location-based transport platforms in the transport sector, and the difficulties in computing them are indicative of the paucity of data on such platforms.

Table 1. Uber Statistics

Country	Year	Uber Drivers in thousands	Share of transport sector workers in %
Worldwide[1]	2020	3,500	
Mexico[2]	2017	249	10.8
Mexico City[2]	2015	15	
Mexico City[2]	2017	83	59.5*
Colombia[3]	2020	88	7.6
South Africa[4]	2019	13	1.3
Kenya[5]	2020	12	17.4
Ghana[6]	2017	3	1.2
India[7]	2018	1,500	26.8
Rio de Janeiro[8]	2021	90	

Note: * = percentage of legally operating taxi drivers.

Sources: [1](Dean 2021); [2](Eisenmeier 2018), (INEGI 2017); [3](Bocanegra 2020), (Dane 2020); [4](Walker 2019), (Statista 2020); [5](Sperber 2020), (CEIC 2017); [6](Welsing 2017), (Ghana Statistical Service 2016), [7](Erickson 2018), (Srija 2015); [8](Abé 2022).

20 Similarly, Bolt reports to offer rides though more than 3 million "partners" (Bolt Press 2022).

3.3 Workers on Digital Labour Platforms: Who they are and how they fare

Empirical evidence on the impacts of digital labour platforms on labour market outcomes, such as wages and employment conditions, is deficient. As we have shown above, representative data on online workers are scarce, but several studies work with larger samples, typically of certain groups of location-based or online workers. One such example is a study by the IDB on Latin American Uber drivers, which is also one of the very few studies to include a sample drawn with the support of Uber (Azuara, González, and Keller 2019); yet with very low survey response rates. To our knowledge, the most comprehensive study on platform workers is the ILO's 2021 World Employment and Social Outlook (ILO 2021), which draws on extensive original data collection among both online and location-based platform workers. This flagship report draws on previous work by the Oxford Internet Institute and the ILO on the extent and patterns of online platform work, which relies on data on projects and tasks from some of the largest online platforms. The report, as well as several other studies, which typically rely on much smaller samples of workers from specific platforms (or several platforms) or qualitative approaches, provide some important insights into the characteristics of platform workers. They also hint at some benefits and downsides of platform work, for workers and beyond.

3.3.1 Location-Based Platform Workers

The abovementioned ILO study (ILO, 2021) is the most comprehensive effort to date to document the work and the working conditions of location-based platform workers. We summarise some of the study's main findings here but would like to stress that they are still based on a relatively small sample, the representativeness of which remains somewhat unclear.[21] The report surveyed 5,000 location-based workers from Arab States, Africa, Asia, the Pacific, Eastern Europe, and Latin America in transportation and food-delivery platform work. In addition, over 2,200 surveys were conducted among workers in the traditional taxi and delivery sector.

The report finds that workers engaged in location-based platforms are, on average, younger than workers in the traditional taxi and food delivery sector. For example, when working on location-based platforms, taxi drivers are, on average, 36 years old and food delivery workers are 19 – compared to 44 and 31, respectively, in the traditional sector. Overall, location-based workers are predominantly male. Nevertheless, some exemptions stand out.

21 The ILO engaged in a serious effort to ensure representativeness despite the lack of official records that could have served as sampling frames. Location-based platform workers were typically located when executing their tasks; for example, at gas stations, restaurants etc. From the description of the data collection it seems that some sort of (implicit) stratification was used (for example, similar sample sizes for digital vs. traditional sectors). However, the sample of the traditional sector remains smaller. In some countries, workers were "snowballed", starting from social networks. The sample of online platform workers comes from five major microtask platforms. Recruitment was done by posting the survey as a paid task on the platform, identifying workers through other digital platforms, online advertisement, coordination with online content creators, and online forums. We could not find response rates in the documentation of the survey, but a substantial share of the sample (30 per cent) had to be removed due to participants only partly completing the survey.

For example, in Indonesia, 13 per cent of location-based taxi drivers are female, most probably because female clients prefer female-only taxis.

Location-based platform workers are better educated than traditional taxi and delivery workers. For example, 24 per cent of taxi platform workers and 21 per cent of delivery platform workers are highly educated. Despite only representing a small share, women engaged in platform work are, overall, better educated than their male counterparts. In addition, young platform workers have higher education levels than their age peers in the traditional sector. The report flags that the findings on highly educated youth working on location-based platforms reflect challenges in youth employment.

The share of migrants working on location-based platforms, as well as the reported health status, differs by country. For example, in Argentina and Chile, two countries that have seen a significant increase in migrants from Venezuela, the share of migrants in the delivery sector is over 70 per cent. This share of migrants is higher than the average share of migrants in the traditional delivery sector. In addition, in the digital taxi sector, between 0 and 4 per cent of workers report very poor or poor health conditions, which is slightly lower than in the traditional taxi sector.

The main motivations for working on a platform are the lack of alternative employment opportunities, followed by job flexibility and better pay. Differences exist between and within countries. In Chile, for example, the primary motivation for digital delivery workers born in Chile is job flexibility, while for migrants working in the same sector, it is the lack of other employment opportunities. The flexibility aspect could explain why most workers are satisfied with their jobs. In the transport sector, workers are more satisfied with working on a platform than workers in the same sectors who are not engaged in platform work. In the food delivery sector, the picture is more heterogeneous. In India and Kenya, for example, workers in the traditional sectors are more satisfied than those working on a location-based digital labour platform. The report assumes that long working hours and high time pressure are the reasons behind this dissatisfaction. In addition, the report itself flags the point that satisfaction levels might be overestimated when workers are only asked about their overall satisfaction level. It is essential to consider working conditions and the organisation of work in order to understand workers' overall well-being. Further, job and life satisfaction may also change over time. Genesis Analytics (2019) reports that some workers' satisfaction in the platform ride-hailing market in Kenya is declining, mainly due to a decrease in earnings caused by increased competition.

Workers of location-based taxi and delivery platforms earn more than workers in the respective traditional sectors. At the same time, traditional taxi drivers reported that their earnings decreased compared to when they started to work as taxi drivers. In a very simple regression that controls for basic socio-economic driver characteristics, the report shows that app-based transport platform workers in Ghana earn approximately 86 per cent more than traditional taxi drivers. This finding should be interpreted with caution, as such differences could

be caused by the drivers' unobserved characteristics, including skills to organise themselves. In the app-based delivery sector, workers in Kenya and Lebanon earn 39 per cent and 25 per cent more than traditional workers, a pattern that does not hold for all countries; platform workers in Chile's delivery sector earn 24 per cent less than workers in the traditional sector. These ambiguous patterns can be explained by ambiguous forces at work. First, the prices for services offered on platforms are typically lower than in the traditional sector (with exceptions, such as higher peak time prices), but demand is often higher. Second, platforms often provide additional incentives, such as bonuses, that can raise income. Third, higher earnings can attract other workers, which increases competition, depresses prices, and places pressure on income.

For most workers engaged in platform work, this work is their main source of income (84 per cent for digital transport workers and 90 per cent for platform delivery workers). Furthermore, even though most location-based platform workers work an average of 65 hours per week in the taxi sector and 59 hours in the delivery sector, most would like to work more, but a lack of demand for (well-paid) tasks is hindering them from doing so. It appears that discrimination is an essential issue, at least in some subsectors. For example, 29 per cent of workers in the delivery sector reported experiencing discrimination (ILO 2021).

While there is little evidence regarding gender-based discrimination on location-based platforms, women face some specific challenges and opportunities on location-based platforms. In line with the above general assessment of the perceived quality of platform work by the ILO (2021), a study among female platform workers in South Africa and Kenya who work through the domestic work platform SweepSouth finds that these women see the platform as facilitating access to employment and providing more flexibility. More than two-thirds of the workers said that the platform work represented the largest share of their income. However, around half of the women were engaged in another job and the majority (67 per cent) would accept a more permanent job offer (Hunt et al. 2019); that is, the platform would still not provide sufficient employment opportunities.

In some contexts, an important concern of female location-based platform workers is their security (Tang et al. 2021). Women are often exposed to violence and sexual harassment. For example, Uber drivers in Mexico reported an increase in violence since the company allowed cash payments. Uber Mexico created a feature in its application that allows female drivers to only accept rides from female passengers. The new feature also aims to enhance female labour market participation. A similar programme has been started by the ride-hailing platform DiDi, which introduced DiDi Mujer (DiDi Women), which also allows female drivers to only accept female passengers (MBN Staff 2020).

According to the ILO study, many app-based taxi drivers own the car they use to execute the rides, and about 70 per cent of them took out a loan to pay for them. Anecdotal evidence of the authors from platform rides in West Africa suggests that this percentage may be much smaller elsewhere. Some respondents stated that the platform provided the loan (to purchase

a vehicle), which can be seen as creating lock-in effects and dependencies between the worker and the platform (ILO, 2020).

Most workers lack sufficient social protection coverage. According to the ILO (2021), only 51 per cent of app-based taxis and 53 per cent of app-based delivery platform workers are covered by health insurance. However, these percentages are similar to or higher than the traditional taxi and delivery sectors. Unemployment and disability insurance are particularly low among workers, but again, similar to the traditional sector. The report states the example of Mexico, where 70 per cent of the app-based taxi drivers claimed to have employment injury insurance, of which 91 per cent of workers acquired their insurance privately. Some countries have introduced measures to include platform workers in the social protection systems of their countries. Uruguay, for example, created a public mobile phone application on which drivers of ride-hailing platforms need to register as a small business with social security and the tax authority (under a simplified regime called monotax). Registration is a necessary condition for participating in the platform work (Freudenberg 2019; BMAS 2017).[22]

In a few cases, the platforms themselves have taken action. For example, Zomato and Swiggy (both active in India's app-based food delivery business) have full-time workers. They are guaranteed a minimum income based on a minimum number of orders executed and hours worked (ILO 2020). However, the minimum working hour requirement on Zomato is between 60 and 65 hours per week (Salman 2020), while Swiggy requires full-time employees to work 10-hour shifts, with a one-hour break, six days a week (Anney 2019). In addition, Swiggy in India provides accident insurance to workers engaged with the platform, but respondents of the ILO (2021) survey stated that they did not receive support from the platform after an accident.

In addition to the above-mentioned ILO Study (ILO 2021), the Interamerican Development Bank (IDB) has made a major effort to systematically analyse the characteristics confirmed by Azuara, González, and Keller (2019), who conducted a representative survey among Uber drivers in Brazil, Chile, Colombia, and Mexico between February and March 2019.[23] Their survey shows that Uber drivers in Latin America are almost all male (94 per cent of the sample), on average 38 years old (83 per cent of the sample are between 25 and 54), live in households

22 There are similar examples from high-income contexts. For example, the government of Estonia launched a pilot collaboration with Uber in 2016, which sends information about the drivers directly to the Estonian tax authority (Freudenberg 2019; BMAS 2017). The government of Ontario (Canada) passed a Workers Acts in 2022, which equips platform workers, among other rights, with a right to minimum wage for active work hours (Legislative Assembly of Ontario 2022).

23 The study completed 5,251 web-based interviews among Uber drivers (1,470 in Brazil 1,387 in Chile, 1,152 in Colombia and 1,251 in Mexico) in cooperation with Uber Technologies. The response rate of interviews was 9.5 per cent. In addition, the authors received anonymised administrative data on Uber drivers' earnings and hours worked. The study uses sampling weights to make the sample representative. Uber cross-checked the sample including sample weights with the whole population of Uber drivers and found no differences between the groups.

with an average of four people, and have relatively high levels of education (90 per cent of the sample has either completed or incomplete secondary education, and around half had completed tertiary education). The education level among Uber drivers was highest in Colombia, with 64 per cent having tertiary education. The main motivation to start as an Uber driver was to earn more income and to have flexible working hours, but personal development and driving for a respectable international platform were other reasons mentioned by the workers.

There is a significant share of migrants in the Latin American Uber population. Around 4 per cent of Uber drivers were born in a different country than the one in which they currently work. Here, Chile stands out, with 10 per cent of drivers coming from a foreign country, which is above the overall share of 6.7 per cent of migrants in the whole population (although the share of migrants in the transport industry would be the more relevant figure to compare with). Another interesting observation by the study is that most Uber drivers had been working (either employed or self-employed) before joining Uber, and more than one-third (38 per cent) retained their job after joining Uber. Forty-two per cent worked in "other services" before joining Uber, and only 18 per cent originally came from the transport sector (varying between 14 per cent in Mexico and 21 per cent in Brazil).

Box 1. A Case Study of the Ride-Hailing Markets of Colombia and South Africa

Heeks et al. (2021) qualitatively study the ride-hailing market in Colombia and South Africa based on semi-structured interviews. The authors point out that the platform economy is more effective at matching customers and drivers, creates more efficient and formalised markets, and increases financial inclusion. By providing information on customers and drivers, the platform reduces adverse selection problems, thus increasing efficiency. These mechanisms are likely to contribute to higher service quality, including improved vehicles. Examining the "management aspect" of the ride-hailing markets, the authors again highlight the greater efficiency of transactions (including payments). However, they also indicate that drivers lose autonomy and that being managed by the app is opaque to them. Relatedly, the data on customers and drivers are now in the possession of the digital platforms, which increases the platforms' power relative to drivers, governments, and other public institutions. Finally, while the often-stated lower entry barriers might be true for some workers, platforms require other forms of entry capital, such as a smartphone and literacy (Heeks et al. 2021).

3.3.2 Online Platform Workers

According to the surveys conducted by the ILO (2021), the socio-economic characteristics of online platform workers resemble those of location-based platform workers. While the caveat of non-representativeness also applies here, these data, a survey of 2,900 online platform workers, are still the best available. The sampled workers are, on average, 35 years old, male (eight out of 10 workers are male), and highly educated (over 60 per cent have attained university). The latter share is higher among digital platform workers in developing countries than in developed countries. Female participation among online workers is relatively low and the figure

from the ILO sample compares to 28 per cent of female online workers in India and 41 per cent in the US (Kässi and Lehdonvirta 2018).

Few studies systematically examine the working conditions of online workers. Based on semi-structured interviews among online digital platform workers (125 interviews) in the Philippines (Manila), Malaysia (Kuala Lumpur), Vietnam (Ho Chi Minh City), South Africa (Johannesburg and Cape Town), Kenya (Nairobi), and Nigeria (Lagos), Graham, Hjorth, and Lehdonvirta (2017) report that these workers frequently raised concerns about downward pressure on wages and low bargaining power. Workers do not see themselves as being in a position to discuss and challenge paid wages, since they fear losing online work. Kingsley, Gray, and Suri's (2015) study of workers on Amazon's Mechanical Turk online labour platform (through online and in-person interviews) supports this view. Several findings suggest that the platform is a "buyer's market": Typically, requesters post their wage ex-ante and thus lower or eliminate the possibilities for wage negotiations. Further, workers feel that they have to incur high search costs to find lucrative offers, increasing the amount of time spent on unpaid work, which is already a substantial amount of time according to respondents of the survey of ILO (2021). Finally, workers are not paid according to their productivity, but only by task, being paid after the task is completed (Kingsley, Gray, and Suri 2015).

All of this evidence suggests that there may be excess labour supply on online labour platforms, which exerts downward pressure on wages (ILO 2021; Graham, Hjorth, and Lehdonvirta 2017). How platforms can increase competition is illustrated by the case of Upwork in Kenya. Online workers on this platform reported that the platform offered them upgraded accounts for a fee that would allow them to see the bids of other workers and adjust their own bids accordingly (Genesis Analytics, 2019).

The hourly earnings in online work differ depending on the type of online platform and activities performed (more comprehensive tasks versus microtasks, software development, etc.).[24] However, overall hourly earnings are lower for workers in developing countries than for those in developed countries. This also holds after controlling for basic characteristics (such as age, formal education, etc.) and workers from developing countries earn about 60 per cent less than workers in developed countries. This is probably less than the difference would be

24 The ILO (2021) distinguishes between certain types of platform. (1) Freelance platforms are marketplaces where relatively comprehensive services are being demanded and offered (for example, financial or legal services, design and data analytics). Examples include Freelancer, PeoplePerHour, and Upwork. (2) Microtask platforms specialise in tasks of short duration (such as transcribing short videos, checking data entry, adding keywords; often for machine learning purposes), or tasks related to accessing content (such as visiting websites to increase traffic) or checking for sensitive content. Platforms such as Amazon Mechanical Turk (AMT), Appen, Clickworker, and Microworkers provide offer to unbundle tasks into smaller segments and dispersing them to the crowd, then rebundle and deliver them back to the clients. (3) Contest-based platforms specialise in organising competitive design contests (such as graphic design). Example websites include 99designs, Designhill, and Hatchwise. (4) On competitive programming platforms, software developers and programmers compete to provide solutions in the fields of AI, data analytics, software development, etc. to problems specified by clients.

in comparable offline work. Concerning gender discrimination, there does not appear to be a gender pay gap in online work, although rigorous evidence is lacking. The ILO study (ILO 2021) suggests that women from developing countries who are engaged in online labour work have higher hourly earnings because they exhibit higher levels of education levels and are therefore able to perform better-paid tasks.

In addition to task-based rates and wages, online platform earnings are influenced by fees paid to platforms as well as costs related to converting currencies (ILO 2021). Respondents to the interviews conducted by Graham, Hjorth, and Lehdonvirta (2017) reported that they experienced discrimination due to ethnicity or the language or accent spoken. For example, African workers were perceived as uneducated and unable to speak international languages and therefore accepted whatever salary was offered.

Despite the mentioned problems and challenges, 92 per cent of online platform workers indicated that they would like to work more on platforms. However, they are held back by the lack of sufficient work opportunities, which also explains why 41 per cent of online platform workers are engaged in some other kind of work outside of the platform. Still, platform work is the primary source of income for almost half of the workers (44 per cent).

Box 2. Platform Economy and Financial Inclusion

In most cases, platform workers require a formal bank account, in addition to an Internet connection and basic digital skills. Thus, for the platform economy, digital payment methods are crucial and becoming increasingly important. Providing the necessary infrastructure to execute easy, quick, and safe international money transfers is important for platform workers in low- and middle-income countries (Aneja and Pragya 2021). Nevertheless, studies also show that 95 per cent of e-commerce transactions in Africa are payments upon delivery, which indicates a low level of trust in digital financial institutions (Mastercard Foundation 2019). Uber drivers in Latin America have a higher share of bank accounts than the average rate of the population, which is reasonable due to the requirement by Uber to own a bank account. Twelve per cent of Uber drivers reported that they use the bank account of a direct family member. This varies between countries: In Mexico, 18 per cent of workers made use of the bank account of a family member, compared to 16 per cent in Colombia, 10 per cent in Brazil, and 4 per cent in Chile. In Mexico, 34 per cent of drivers opened a bank account to receive Uber payments (Azuara, González, and Keller 2019), underlying the financial inclusion part of the platform economy.

Social protection coverage is rare among online platform workers: 43 per cent of workers engaged in digital platform work report to have health insurance, 23 per cent to have an old-age pension/ or retirement benefits, 9 per cent to have unemployment protection, 7 per cent to have disability insurance, and 18 per cent to have employment and injury insurance. Those coverage rates are higher in developed countries (for example, 61 per cent report having health insurance) (ILO 2021), but it is conceivable that a relevant counterfactual group in a developing country context might exhibit similar or lower rates of social protection.

According to ILO (2021), the main motivation for becoming engaged in online platform work is the ability to work from home and job flexibility, followed by the opportunity to complement earnings. This is in line with the findings by Pogorevici and Serobe (2018), who interviewed 82 active online platform workers in South Africa. Workers appreciated income opportunities, flexible working hours, independence, the ability to grow skillsets due to greater exposure and variety of tasks, and a lowered risk of job and income loss, although they also pointed to volatile income, lack of employment benefits, social isolation, and stress. Women in particular valued the option to work from home. Eighty per cent of all workers on online labour platforms in developing countries and 84 per cent of men in developing countries stated that they are satisfied or very satisfied (ILO 2021).

3.4 Beyond Digital Labour Platforms

While this review focuses on digital labour platforms and the workers directly employed on these platforms, other digital technologies and platforms are having an equally if not more important impact on labour markets in developing countries. However, there is scarce evidence on the development and labour market impacts of digital platforms (not labour platforms), with the notable exception of mobile money. We first review the evidence on the effects of mobile money and then summarise selected studies on e-commerce.

Digital payment solutions, most notably mobile money services, have immediate impacts on labour markets with a high share of self-employment. The effects of mobile money have been subject to a relatively large empirical literature, which has been reviewed by Aron (2018), who concludes that there is robust evidence that mobile money fosters risk-sharing. However, in her judgement the evidence on the positive welfare impacts, including through higher labour market incomes, and higher savings are less convincing. A widely cited study on the impact of digital payment solutions is that of Suri and Jack (2016), which examines the effect of M-Pesa, Kenya's largest mobile money service. Using household survey data collected between 2008 and 2014 and using a difference-in-differences design, the authors show large positive impacts on poverty reduction and occupational choices. Specifically, the authors examine the impact of exposure to mobile money services proxied by the presence of mobile money agents on (i) average consumption per person in a household and household poverty rates, (ii) physical and financial wealth, and (iii) occupational choices and migration. The authors argue that the geographic rollout of agents up to 2010 was quasi-random; that is, it was not systematically correlated with individual and household characteristics that would affect the outcomes of interest. As Aron (2018) noted, this "identification assumption" can be contested. Therefore, the results of Suri and Jack (2016) may be considered an upper-bound estimate of the real effect if rollout was systematically biased towards places that would have exhibited more favourable development outcomes even without mobile money presence. They find that mobile money lifted 194,000 households out of extreme poverty during the observation period

– the equivalent of a two percentage point reduction in the poverty headcount ratio – and led to 185,000 women switching their occupations from agriculture to small business or retail.

Some quantitative evidence on the impacts of the e-commerce sector comes from China. Liu et al. (2021) study the impacts of e-commerce adoption in China's apple sector. Using data on farmers and a so-called "endogenous switching regression",[25] the authors estimate the impact of e-commerce on selling price, marketing cost, and gross return for e-commerce products and non-e-commerce products. The authors find that the adoption of e-commerce increases selling prices significantly but it also raises marketing costs, which is why the effect on gross returns is only moderate. Further, farmers located closer to urban areas tend to benefit more from the use of e-commerce. Another study on China, by Couture et al. (2021), investigates a policy of connecting rural villages to e-commerce based on a partnership between a firm and the Chinese government. Specifically, the policy provided transport logistics to villages in order to make e-commerce available in a rural setting. To evaluate the programme, villages receiving the support were selected randomly and could therefore be compared to control villages that did not receive the intervention. The results showed that e-commerce had little positive impact on rural producers and workers, and the results are heterogeneously driven by a reduction in the cost of living. Young and richer households who live closer to the e-commerce terminal benefit more from the programme.

4 Policies for Harnessing the Potential of Digitalisation for Labour

A consensus emerges from our review of various policy documents and "digitalisation strategies" at regional and national levels, and from different organisations emerges, that policies that harness the potential of digitalisation for productive and decent employment will have to consider three areas. The first is the enhancement of digital skills, starting in school but, very importantly, through training adults and as an important component of active labour market policies. The second is the regulatory framework for the digital economy at large, but specifically addressing the challenges that arise in the context of both online and location-based platform work. The third is "hard" digital infrastructure and (affordable) access to the Internet and hardware as a pre-condition to participating in the digital economy.[26] In this section, we first briefly illustrate how these policy areas are reflected in different regional digitalisation strategies that partially reflect different digital realities that have become strongly visible during and after the pandemic. Then we briefly discuss key policy issues with regard to regulatory

25 This model attempts to correct for self-selection bias, which is likely to occur in the present case as more productive farmers self-select into adopting e-commerce.

26 In its recent strategic realignment of digital policy, the BMZ devises similar priorities, albeit in reverse order: (1) promoting digital public goods and infrastructure, (2) promoting fair regulation of the digital economy, and (3) promoting digital skills (see https://www.bmz-digital.global/en/strategy/).

issues and "hard infrastructure", before dealing with "digital skills" in more detail in the subsequent section. We decided to cover digital skills in more detail since we think that this is the policy arena where evidence from empirical economic research has the most to contribute.

Numerous digitalisation strategies have been formulated in recent years. For example, in 2020, the African Union issued a digital transformation strategy for Africa for the period from 2020 to 2030. A key element of the strategy is to "build inclusive digital skills and human capacity across the digital sciences, judiciary, and education, both technical and vocational, to lead and power digital transformation including coding, programming, analysis, security, blockchain, machine learning, artificial intelligence, robotics, engineering, innovation, entrepreneurship, and technology policy and regulation" (African Union 2020). The strategy includes concrete policy recommendations to achieve this end: (i) the review of education curricula in the scope of a digital economy and society, (ii) the provision of technology equipment and a (where possible) broadband Internet connection to schools and other educational institutions and train teachers, (iii) multi-stakeholder partnerships, (iv) mainstreaming digital skills and responsible online behaviour among citizens, and (v) facilitating digital skills development across all sectors of the economy. Furthermore, the strategy points out that digital education needs to be improved by (i) promoting the use of ICTs for formal and informal education, (ii) improving formal and informal education in ICTs, and (iii) raising public awareness of ICTs (African Union 2020). Strategy documents with similar elements but different emphases can be found in other world regions. For example, the "Digital Agenda for Latin America and the Caribbean (eLAC2022)" emphasises digital skills and the accessibility to digital technologies (CEPAL 2022). ASEAN's (Association of Southeast Asian Nations) latest "Digital Masterplan 2025" prioritises an increase in the quality and coverage of fixed and mobile broadband infrastructure and regulatory issues, such as consumer protection and anti-trust regulation (ASEAN 2021). Digital skills and firm capabilities are also part of the plan but are less prominently mentioned under Objectives 7 and 8 (of eight overall objectives). In addition to these regional strategies, hardly any countries except some low-income ones) do not have a national digital strategy.

The COVID-19 pandemic has changed the way how people work all over the world. Digital technologies have played a crucial role in this process that very considerably increased teleworking arrangements and a shift towards online markets and digital platforms. However, there are important differences among countries and regions. For example, with regard to teleworking, the ILO (2020) estimates that approximately 16 per cent of workers in middle income-countries and 12 per cent of workers in low-income countries work in occupations that could be potentially done from home. In high-income countries, this share is 27 per cent. The lowest share of workers who are potentially able to work from home is found in Sub-Saharan Africa (6 per cent), followed by Southern Asia (8 per cent). In Latin America and the Caribbean, approximately 23 per cent of workers can work from home, and the equivalent figure in Northern Africa is 14 per cent. Such estimates have to be interpreted with caution, as they do not

take potential cultural differences and practices into account. Similarly, it remains unclear what a future "equilibrium" share of digital markets will look like. For example, the share of online purchases varies widely around the globe (The Economist 2022). In China, 24.5 per cent of retail purchases are made online versus 14.7 per cent in the US and minor shares even in digitally more advanced countries in Africa; for example, 4 per cent in South Africa, Kenya and Egypt (figures from 2021). However, given the rapid growth of several e-commerce platforms in many developing countries, this situation is likely to change rapidly.

Millions of workers are and will be affected by such trends. Even more, workers will be active on online labour and location-based platforms, and more people will rely on digital technologies in performing (part of) their work from home. Harnessing those digital opportunities will require better accessibility to digital technologies and some of the policies designed to achieve this are relatively straightforward.[27] First, many developing countries will need to emphasise investment in infrastructure that extends Internet coverage, especially beyond big cities. Second, policy makers should pay attention to affordability and corresponding regulation. For example, the average cost for 1GB of data is approximately 7.2 per cent of the average monthly salary in Africa, compared to 1.5 per cent and 2.7 per cent in Asia and the Americas, respectively. At the country level there is even more pronounced heterogeneity: 1GB of data accounts for around 2 per cent of the average monthly salary in Ghana and 30 per cent in the Democratic Republic of Congo (ITU 2020). Third, and on top of regulating telecommunications, electronic transactions, data protection, and cyber security will require appropriate regulation and supervisory bodies. Fourth, complementary "soft infrastructure" will have to be put in place. In its "Digital Economy Kit", the Pathways for Prosperity Commission highlights the role of these complementary elements, including digital ID systems, digital finance, and e-government. While the last mile of delivery is important, especially for e-commerce platforms, many developing countries still lack effective postal delivery systems, especially in rural areas. Overcoming inequality in access to digital technologies, both between and within countries, requires policy action in all these areas, and while the objectives and means are straightforward, implementation is unlikely to be straightforward as well.

Much more complicated to address are the many regulatory challenges that arise from digitalisation, including those regarding the business environment for digital sectors (market

27 The alliance for affordable Internet, which aims to connect businesses, governments, and civil society, to enhance Internet coverage and affordability provides a various number of good practice examples, including ICT centres for universal access in the Philippines or social Internet tariffs for vulnerable groups in Ecuador (Alliance for Affordable Internet 2008–2022). Another example is the Ajira Digital Program implemented by the government of Kenya (Mwauras, Ngene, and Wangila 2019). Internet centres, which operate in rural areas, offer Internet as well as training courses on how to be engaged in online platform work.

access, anti-trust, etc.[28]), data and consumer protection issues and regulations that directly concern labour markets, specifically the regulation of work on online and location-based labour platforms. Here, we briefly address some key aspects of these labour market regulations without implying that the former (business environment regulations and data and consumer protection issues) are less important. Regulatory issues around platform work are being discussed around the world in public debates, most prominently those related to location-based platforms because of their visibility. We have shown above the ambiguous effects of location-based platforms (often higher earnings, higher demand, higher competition, lower prices, etc.). These effects differ across sectors and differences in regulation – between sectors and countries – explain part of these differences. In ride-hailing markets, for example, digital platforms often meet a highly regulated taxi sector. Even in countries with very low administrative capacity, there is some regulation of taxi markets.[29] The rationale for regulating taxi markets is and was consumer protection rather than the working conditions of drivers. When ride-hailing platforms started to compete with traditional taxi services, their drivers did not comply with the requirements for licensed taxi drivers (although compliance was also likely to be partial among traditional taxi drivers in many countries). Thus, the emergence of platforms necessitates the establishment of a level-playing field for traditional and platform drivers in terms of (basic) regulation, such as for car safety. Such regulatory adjustments are happening. For example, in 2015, Mexico City became the first Latin America City to regulate e-hailing services. The elements of regulation include that (i) location-based taxi platforms must be registered with the secretary of mobility; (ii) drivers need to pay an annual fee; (iii) the cars used for the service need to fulfil some basic requirements such as four doors, air conditioning, airbags, and seat belts; and (iv) the location-based digital platforms need to pay a certain fee of each ride to the Taxi Mobility and Pedestrian Fund (Puche 2019). This regulation shares the responsibilities between the company and the drivers. This points to an important general question: How should the platform be (legally) seen and what responsibilities arise from this? The stance of platforms is often that they do see themselves as a technology service provider, for example of shared rides, with little responsibility for the transaction and delivery of goods and services, including the service providers; that is, their workers and drivers. Legislation is responding to this. In 2017 the Court of Justice of the European Union declared that Uber needs to be classified as "a service in the field of transport" and not as an information society service (Court of Justice of the European Union 2017); this means that Uber in general would be subjected to the rules of the transport market, which explains why Uber is not universally available in Europe.

28 An example of the regulatory challenges is the case of mobile money. M-Pesa, Kenya's most popular mobile payment service, was able to grow at a fast pace since the authorities regulated the system as a telecom product and not a banking product. While this was conducive to the fast growth of the mobile payment sector, it resulted in a monopoly market that required regulation (World Bank 2016).

29 See Gwilliam (2005) for a discussion of the specific regulatory issues of this sector and some studies on the effects of deregulation.

Policymakers will have to strike a balance. On the one hand, they should not stifle competition and innovation and forego the gains from a digital platform. On the other hand, there are other policy objectives, including decent working conditions for platform workers, that are not easily reconciled with support for innovation. To continue with the ride-hailing example, it is relatively straightforward to regulate taxi safety but it is less straightforward to ensure that the drivers work under decent conditions. An example of an attempt to balance different policy objectives comes from Rio de Janeiro, Brazil. The city developed its own taxi app meant for traditional taxi drivers who do not want to switch to Uber. The app maintains a fixed fee for every journey; however, taxi drivers can provide discounts to the passenger to allow them to compete with Uber via prices. Even though maintaining the application is costly for the city, its next plan is to create a similar app for food delivery applications (Abé 2022).

A key aspect of platform work – not only of location-based platforms – is whether platform workers should be seen as employees or independent contractors (Berg, Cherry, and Rani 2019). The employment status matters for the quality of work, as independent contractors or self-employment workers are typically not entitled to claim certain legal rights, including minimum wages, unemployment benefits, and paid leave. In many countries, employment status also matters for access to and coverage by social protection systems (ILO 2021).[30] What exactly defines an employee varies between jurisdictions and is far from settled, especially in the context of platform work.[31] Further, in many developing countries, most self-employed are informal; that is, they are not linked or are only partially linked to, registered with, or covered by formal systems and legislation, including labour regulation, tax systems, and social protection. Accordingly, many platform workers are informal as well, although platform participation may, in principle, offer an opportunity for formalisation. The mandatory registration of ride-hailing platform workers as small businesses with social security and the tax authority in Uruguay is not the only example that platform participation may formalise employment. In India, for example, social security benefits have been extended to platform workers through the *Code on Social Security, 2020*. The code defines platform and gig work and enables both online-l and location-based platform workers to receive social security coverage under the Employee State Insurance Scheme (ILO 2021). A Social Security Fund will be established that will receive contributions from aggregators and platforms (1–2 per cent of annual turnover), workers and the government (NITI Aayog 2022). While the code is seen as an important step in recognising platform workers, it has been criticised for being too vague. As of the first quarter of 2023, the law is still due for implementation and the formula for social security funds has not been de-

30 It has been argued that social protection – especially for a guaranteed minimum to mitigate large losses – should be decoupled from traditional wage-employment contracts with social protection directly provided to individuals and their families (Packard et al., 2019).

31 See Berg, Cherry, and Rani (2019) for a detailed discussion.

fined (Mohanty 2023). These first attempts to leverage digital platform for improving and formalising employment need to be watched carefully and evaluated to draw lessons that can be applied in other contexts.

Much of the work on online labour platforms is across borders, which adds another layer of complexity. In the case of location-based platforms, there may exist a local subsidiary, but headquarters are typically outside the country where workers operate. This raises further regulatory and accountability issues that have only been minimally addressed to date. Berg, Cherry, and Rani (2019) discuss the possibility of an international governance system for online platform work and point to the Maritime Labour Convention of 2006 as an interesting precedent for the governance of labour relations in an industry that operates across many jurisdictions.

In addition to regulating platform work, there are voluntary commitments and transparency initiatives that aim to improve working conditions for platform workers. An interesting example of such a voluntary approach is the so-called "Ombuds Office for the Crowdsourcing Code of Conduct", established in 2017 by the German trade union, IG Metall, the German Crowdsourcing Association, and eight digital labour platforms (from Europe but with global operations). Workers who feel that they have been treated unfairly by a signatory of the Code of Conduct can turn to this office, which would act as a mediator between platforms and crowdworkers (Berg, Cherry, and Rani 2019). However, a brief inspection of the website (accessed in April 2023) suggests that the number of signatories has not grown much since 2019 (to nine platforms, to be precise).

The Fairwork project is a transparency initiative that attempts to measure the "fairness" (pay, conditions, contracts, management, representation) of working conditions on digital labour platforms using desk research, worker interviews and surveys, and interviews with platform management (Fairwork Foundation 2020). The project rates numerous location-based as well as online labour platforms (>100) in 26 countries, including both high- and low/middle-income countries. The rating exercises reveal considerable variation in the working conditions on platforms both across and within countries. The impact of such initiatives is difficult to judge and evaluate. Occasionally, the ratings are taken up by the media, which increases awareness among the general public, particularly in India. Further, platforms that score well use their scores for marketing purposes. However, other platforms that consistently score very low, including Uber, appear to ignore such assessments without much impact on their business.

5 Digital Skills

Digital skills are key to being prepared for the future of work. A basic level of "digital literacy" is required to make effective use of the digital services, such as financial services, or engage on

location-based labour platforms. Only advanced digital skill levels will allow workers to successfully participate in digital industries or online labour platforms. Thus, the demand for digital skills is heterogeneous; it differs across sectors and occupations and countries with different initial technological conditions and skill endowments (Strietska-Ilina and Chun 2021). Foundational digital skills that enable individuals to access and engage with digital technologies are of primary importance in most (poorer) countries (World Bank and IFC 2021). Such foundational skills are entry-level skills required for the basic and effective use of digital devices and applications. In countries with important and growing tech industries, demand for higher-order skills to use technology for task-oriented purposes and specific ICT occupations and professions is increasing.

Empirical studies on the demand for digital skills show these patterns. In a case study of digital skills demand in Rwanda, Nigeria, Mozambique, Kenya, and Côte d'Ivoire, the World Bank and IFC (2021) point to a largely unmet demand for digital skills that differs between countries. The authors estimate that, by 2030, at least foundational digital skills will be required by 50–55 per cent of all jobs in Kenya, 35–45 per cent of all jobs in Côte d'Ivoire, Nigeria, and Rwanda, and 20–25 per cent of jobs in Mozambique. The demand for digital skills will originate from occupations outside ICT specialties and will result from adopting – not developing – digital technologies. Therefore, most of the demand (70 per cent) will be for foundational skills, followed by 23 per cent for non-ICT intermediate skills.

Another study by the Asian Development Bank and LinkedIn (Asian Development Bank and LinkedIn 2022) looks at digital skills and demand in selected Asian countries. The study relies on (a) the analysis of 38,000 standardised skills self-reported by LinkedIn members from India, Indonesia, Malaysia, and the Philippines benchmarked against data from Australia, Singapore, and the United States; and (b) a survey among employers (and digital training providers) in Bangladesh, India, Indonesia, and the Philippines, plus the United States. The latter survey indicates that individuals with intermediate digital ("deploying hardware and software to build tools, platforms, and applications that can be easily used by others with only basic digital skills") or advanced digital skills ("develop new technologies such as artificial intelligence (AI), robotics, and genetic engineering") are in high demand. Further, the LinkedIn data reveals that digital jobs are more in demand in developing countries, while business and management professionals are (more) sought after in the more advanced economies. For example, in Indonesia and the Philippines, the fast-growing job profiles include managing online content and social media. Accordingly, the application of Microsoft Office, Adobe Photoshop and Adobe Illustrator are specific skills in high demand. Specific software knowledge, for example, Java and SQL, are demanded in every country studied.

Such studies indicate a growing demand for digital skills. They also diagnose that this demand is not met. Specifically, the report by the ABD and LinkedIn (Asian Development Bank and LinkedIn 2022) notes that 48 per cent of employers state that even though candidates

meet degree requirements, they might not have the necessary skills for the job. Below, we assess the digital skills gap by examining the scarce comparable data on digital skills – at least when it comes to low-income countries. Digital skills will have to be taught much more effectively in schools. Although this is an important issue, we only address it superficially. Instead, we focus on digital re- and upskilling through training as part of active labour policies. We review selected approaches and interventions, including by German development cooperation, and the scarce evidence on their effectiveness.

5.1 Where do we Stand? Huge Digital Skill Gaps

Measuring "digital skills" is not a trivial exercise. Based on an extensive literature review, Strietska-Ilina and Chun (2021) highlight that digital skills are an important component of foundational (basic digital literacy), meta-cognitive (transversal ICT skills, such as the use of software), and technical/hard skills (intermediate/advanced digital skills, such as programming). Socio-emotional skills influence how these skills can be effectively applied and may gain importance as some technical tasks are increasingly performed by machines. Thus, it is a set of skills that matters in a "digitalised labour market". This skill set is constantly changing. For example, the recent rise of highly potent AI chatbots probably implies that some hard technical skills, such as programming, will be less relevant than some people assumed quite recently.

With these complexities in mind, the subsequent review of selected indicators still reveals some important patterns regarding digital skills worldwide and in the developing world. In general, the availability of comparable data on digital skills is biased toward higher-income countries. We present data from three different sources: from the UN reporting in the context of the Sustainable Development Goals (SDGs); from a World Bank report based on data from the world's most widely used professional network app, LinkedIn; and from the OECD on digital skills in schools.

Target 4.4 of the SDGs reads: "By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship". This target is, inter alia, operationalised through Indicators 4.4.1, the "Proportion of youth and adults with information and communications technology (ICT) skills" and 4.4.2, "Percentage of youth/adults who have achieved at least a minimum level of proficiency in digital literacy skills" (United Nations Statistical Commission 2021).[32]

Indicator 4.4.1 is disaggregated by age, sex and nine[33] sub-skills, including the "proportion of youth and adults who have copied or moved a file or folder" and the "proportion of youth

32 4.4.2 is an additional official SDG4 indicator collected by UNESCO (see https://tcg.uis.unesco.org/wp-content/uploads/sites/4/2020/09/SDG4_indicator_list.pdf).

33 In Geneva in 2018, the 6th Expert Group meeting on ICT Household Indicators (EGH) decided to modify the sub-skills by making them independent of the devices used. From 2020 onwards, Member States will collect data on the new 11 sub-skills.

Figure 7. Proportion of Youth and Adults who have Copied or moved a File or Folder (Latest Year Available)

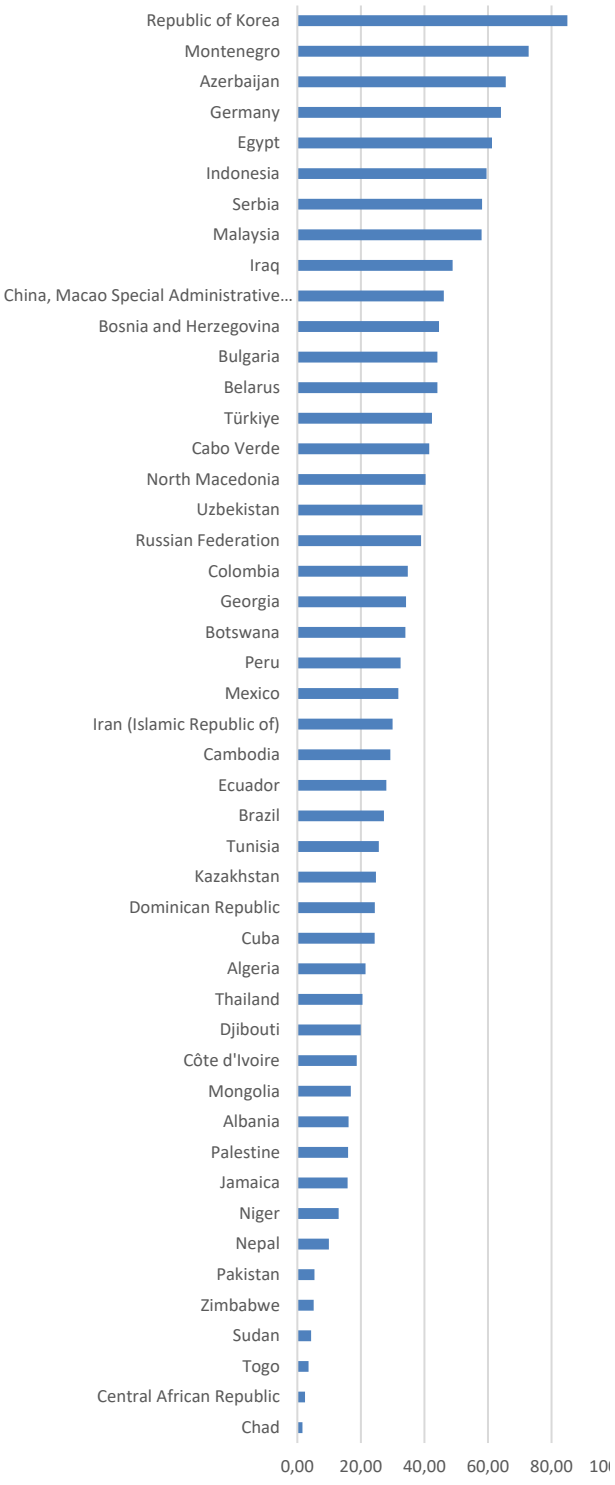
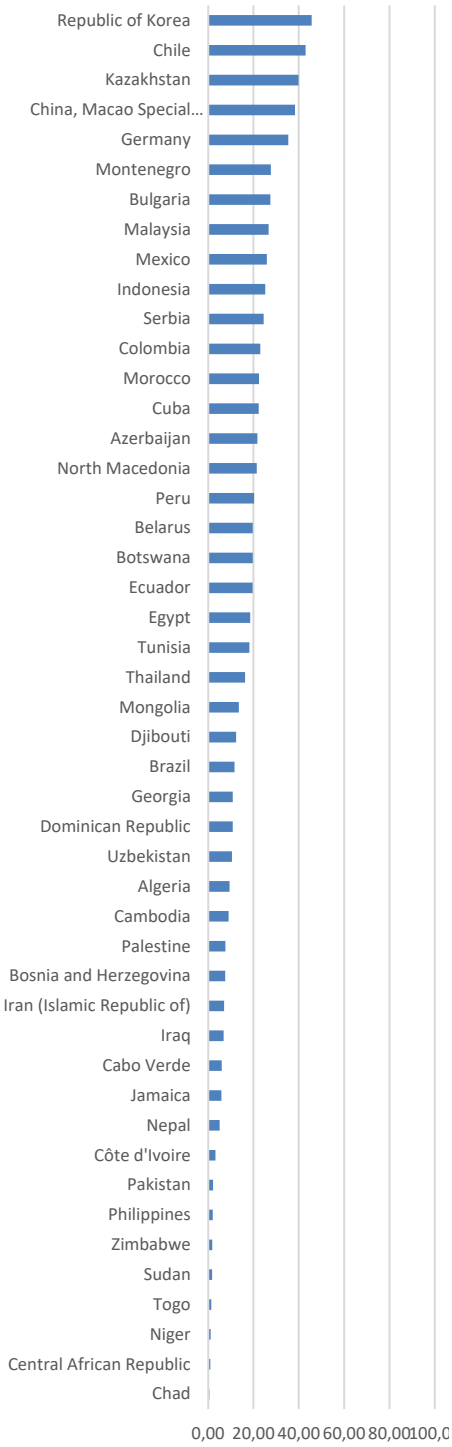


Figure 8. Proportion of Youth and Adults who have used a Basic Arithmetic Formula in a Spreadsheet (Latest Year Available)

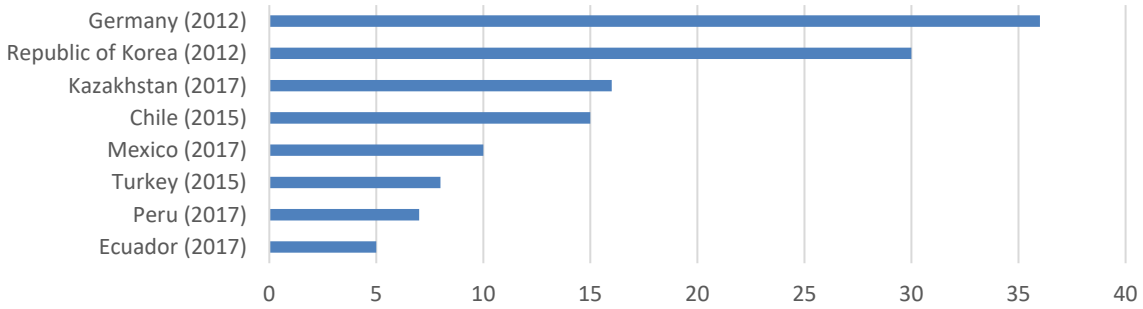


Source: ITU 2022

and adults who have used basic arithmetic formulas in a spreadsheet".[34] As of 2020, 94 countries have ever reported data on any sub-skill under Indicator 4.4.1. For example, by 2020, 90 countries (including high-income countries) had provided information on the proportion of individuals who have copied or moved a file or folder. With 93 countries reporting, slightly more information is available on the proportion of individuals that used specialised programming language.

Thus, data on digital skills are scarce, particularly for developing countries. Among those countries with any data on Indicator 4.4.1, only a few are low-income countries (see Figure 7 and Figure 8). The low amount of available data illustrates the huge discrepancies in digital skills across countries. In Chad or the Central African Republic, for example, only a very small fraction of adults (1.6 and 2.4 per cent, respectively) have copied or moved a folder, and for several countries this share is not much higher than 40 per cent or below (Figure 7). The share of people who have used basic arithmetic formulas in a spreadsheet is also very low for most low- and middle-income countries. In poor African countries, including Chad, the Central African Republic, Niger, and Togo, fewer than 1.5 per cent of individuals are equipped with those skills. Most countries do not even reach 25 per cent on this metric (Figure 8) compared to about 50 per cent in high-skilled Korea.

Figure 9. Percentage of Youth/Adults who have Achieved at least a Minimum Level of Proficiency in Digital Literacy Skills



Source: UNESCO Institute for Statistics 2022.

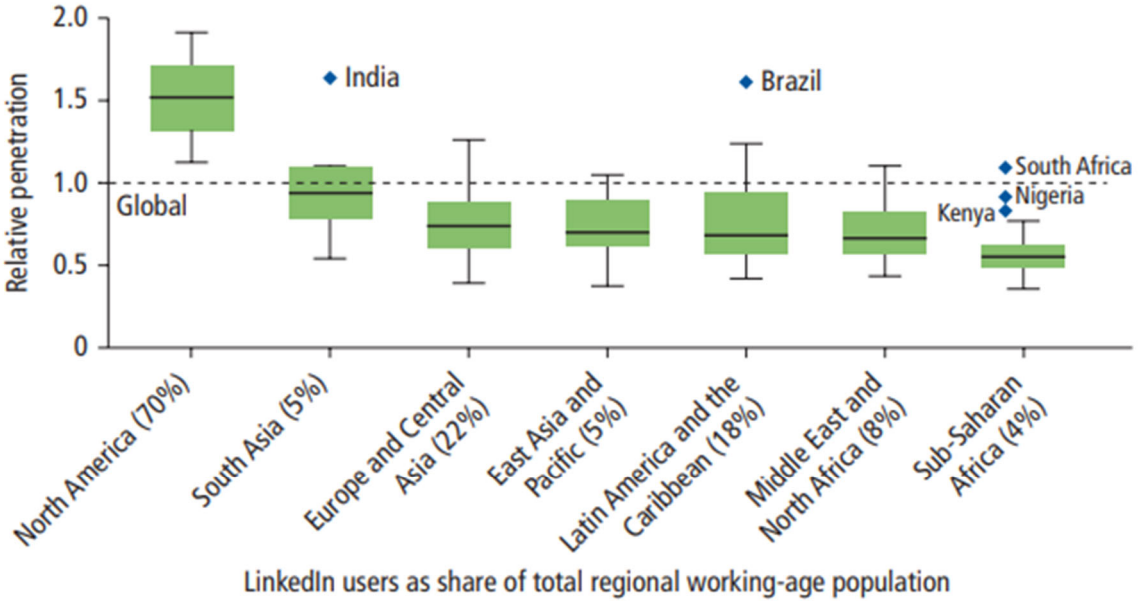
UNESCO's Indicator 4.4.2 measures digital literacy using a specific module of the Programme for the International Assessment of Adult Competencies (PIAAC), which is available only for 31 countries, including only six low- and middle-income countries and no African countries. UNESCO defines digital literacy as "the confident and critical use of a full range of digital technologies for information, communication, and basic problem-solving in all aspects of life". Using PIAAC data, UNESCO defines a digital literacy threshold beyond which individuals are, for example, likely to "Figure out how to send an email message to a number of contacts

34 Data are collected via household surveys, which received a manual for measuring ICT access and use by households and individuals by the data compiler (the International Telecommunication Union).

using an unfamiliar bulk email function", or (ii) "use a sorting tool to make it easier to locate sales numbers for a specific product in a company spreadsheet" (or tasks of similar difficulty). Measured in this way, digital literacy is very low in countries like Ecuador (5 per cent digital literacy) or Peru (7 per cent). However, to put this into perspective: Even in the high-income Republic of Korea, the share of individuals with a minimum level of digital skills is only 30–35 per cent (Figure 9).

These data suggest that levels of digital literacy and, specifically, foundational digital skill levels are relatively low in developing countries. However, the above statistics are partial and, at times, outdated. Further, as we have seen above, there is a non-negligible digital workforce in low- and middle-income countries – for example, on online labour platforms – that possesses some intermediate or advanced digital skills. Assessing the prevalence of such more advanced digital skills and their quality is important because a digitally well-trained workforce is required in order to develop "home-grown" digital technologies and to provide and improve digital infrastructures. One way to collect data on the "digital workforce" is through professional network platforms. A World Bank report (Choi, Dutz, and Usman 2020) on "The Future of Work in Africa" uses data on "business-related digital skills" from LinkedIn; that is, from individuals who must have some basic digital skills to register with the platform. We have reproduced a figure on digital skills in Sub-Saharan Africa relative to other world regions (Figure 10).

Figure 10. Digital Skills in Sub-Saharan Africa Relative to Other Regions



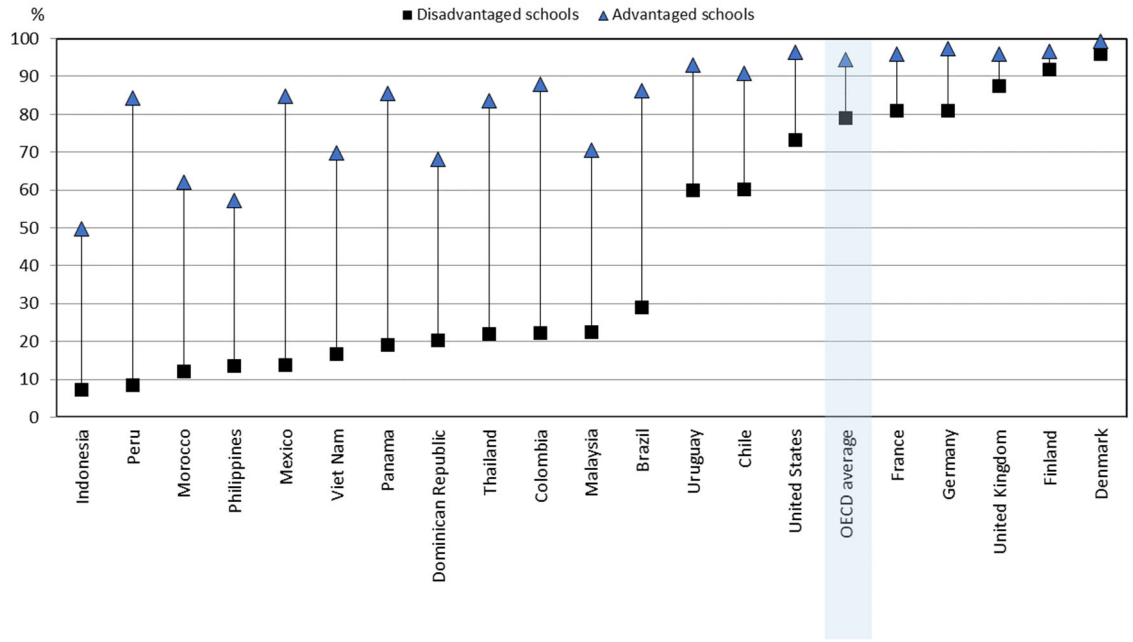
Source: World Bank calculations using LinkedIn data.
Note: Parentheses show the share of LinkedIn users in the total working-age population of each World Bank region.

Source: Figure 1.6. in Choi et al. 2019.

These data must be interpreted with caution (for a detailed discussion, see Choi et al., 2020). LinkedIn users may not be representative of the "digital workforce", and the composition of users may differ systematically between regions. The data are all self-reported with the related problems of over- and underreporting, as well as different interpretations of skills. Further, the figures are from 2019, which means they are relatively outdated by digital-age standards. With these caveats in mind, the LinkedIn data suggest that Sub-Saharan African workers have a lower level of digital skills than workers in other regions, even among the 4 per cent of the African labour force that uses LinkedIn (among 27 Sub-Saharan African countries with LinkedIn data). In the Figure skills are judged against the global average "skill penetration"; that is, the adoption of a series of specific skills. In North America, the 70 per cent of the labour force that uses the platform exhibits a digital skill penetration of about 1.5, whereas in Sub-Saharan Africa, the 4 per cent of users exhibit a digital skill penetration of -0.5 (with 1 as the global average digital skill penetration). The availability of digital skills varies significantly across the developing world. In South Africa, 17 per cent of the labour force are LinkedIn members with digital skills equivalent to the global average. Kenya and Nigeria also score much higher than the rest of Africa in terms of digital skills but fall well behind Brazil and India, where reported skill penetration is close to the US. This may suggest that at least some digital skills can be acquired through training and practice.

However, the foundations for digital skills are laid at school. All over the world, educational systems are struggling to adapt to digital technologies and develop and implement appropriate curricula. Any detailed discussion of the many challenges and issues involved goes beyond the scope of this review. However, we want to stress the importance of early digital skill development and flag some issues that are particularly relevant for developing countries. An obvious issue is that access to digital technologies for children (in school and out of school) is as unequal – between and within countries – as access to these technologies for the population at large. For example, data from PISA 2018, which is mainly from OECD countries, shows that 88 per cent of students had an Internet connection at home and a computer they could access for schoolwork; this represents an increase of 28 percentage points compared to PISA 2003 (OECD 2021). In low- and middle-income countries, this share was substantially lower. In countries such as the Dominican Republic, Indonesia, Malaysia, Mexico, Morocco, Peru, the Philippines, Thailand, and Vietnam, only half or less of the students had access to the Internet and computer at home. Further, as illustrated in Figure 11, there are huge inequalities in these access rates between children in "advantaged" (top 25 per cent according to PISA average score at school level) vs. "disadvantaged" (bottom 25 per cent) schools. In Peru, the country where this discrepancy is largest, almost 90 per cent of students in advantaged schools have access to the Internet and a computer at home, compared to fewer than 10 per cent in disadvantaged schools.

Figure 11. Access to a Computer Linked to the Internet at Home for Doing Schoolwork, by School's Socio-Economic Status (Percentage of Students in Advantaged and Disadvantaged Schools)



Note: A socio-economically disadvantaged (advantaged) school is one whose socio-economic profile (that is, the average socio-economic status of the students in the school) is in the bottom (top) quarter of the PISA index of economic, social, and cultural status amongst all schools in the relevant country/economy.
Source: Own elaboration based on OECD stats (https://doi.org/10.1787/888934239401).

Overcoming the international gaps and national inequalities will require huge efforts, but it will be difficult to compensate through later training efforts. Evidence on how foundational digital skills can best be taught in school is accumulating, including from hardware distribution programmes line "one laptop per child" (Beuermann et al. 2015; de Melo, Machado, and Miranda 2014; OECD, Economic Commission for Latin America and the Caribbean, and CAF Development Bank of Latin America and European Commission 2020). Some of the key findings from the literature on the "digitalisation" of teaching are not overly surprising. Instead of teaching separate computer classes, the use of technologies should be applied in all subjects (Kandri 2019), and teachers also need to be equipped with the right skills to be able to transmit digital skills (World Bank 2016). Simply distributing laptops does not provide a lot of help. Evidence from the "One Laptop per Child programme" in several Latin American countries often shows little effect. In Uruguay, where the programme was implemented on a national scale, it did not affect school performance indicators in the first two years. In Peru, the programme did not lead to improvements in mathematics and reading; however, computer literacy did improve. Yet, when the use of ICT is well integrated into curricula by well-instructed teachers, it can have a positive impact on learning outcomes, at the same time as digital skills are transmitted. A meta-analysis of randomised experiments (McEwan, 2015) shows that in-

terventions were less effective when laptops were only distributed without guidance by a parent or teacher. Similarly, evidence from another randomised controlled trial from China indicates that an ICT programme, which used laptops and learning-assisted software to complement the English curriculum, is effective in increasing learning outcomes only when it is integrated into the teaching (Bai et al., 2016). Notwithstanding the efforts to effectively transfer foundational digital skills at schools, improving adults' digital skills at various levels will have to be a main policy priority.

5.2 Digital Skills Training as Active Labour Market Policy

The above accounts of the supply and demand for digital skills suggest that there is a strong rationale for advancing the digital skills of the global workforce, particularly in developing countries. Digital skill training for adults is ubiquitous. Digital training needs are highly heterogeneous, context-specific, and dependent on initial conditions. These needs range from foundational digital skills training, focusing on such matters as applying simple digital tools for participating in locational labour platforms or improving individual, business or farm productivity, to intermediate or advanced digital skill courses that prepare participants for jobs on online labour platforms and other jobs in ICT occupations.

Worldwide, millions of adults have been or are participating in various kinds of such training. "Big tech" plays a key role in organising and implementing that training, much of which is offered for free, but there are also many smaller-scale programmes. The public sector, including national governments, international organisations, and development cooperation, supports some of these private-sector programmes (ILO 2021) but also engages in various own initiatives. The scale of some of these programmes is impressive. For example, Microsoft's global skill initiative, which provides free access to training in LinkedIn Learning, Microsoft Learn, and GitHub Learning, was taken up by 30.7 million people in 249 countries within only eight months of its launch (during the COVID-19 pandemic). After the United States, the countries with the most learners were India and Brazil, followed by the United Kingdom and Mexico (Smith 2020). Amazon Web Services announced that it intends to provide free cloud computing training to 29 million people by 2025 (Amazon 2023). In India, Google collaborates with the Indian School of Business and the Ministry of Electronics and Information Technology in a digital skills initiative that aims to bring 41 million small and medium enterprises online. The programme consists of 5,000 in-classroom training sessions across India (Banga and te Velde 2019; Bharat 2017). The Indo-Pacific Economic Framework for Prosperity (IPEF) Upskilling Initiative (by the Asia Foundation and the US administration) plans to set up "7 million or more training and education opportunities that use digital tools to women and girls in the IPEF emerging economies and middle-income partners", including inter alia India, Indonesia, Malaysia, the Philippines, Thailand, and Vietnam. (Asia Foundation 2022). Atinigi, a learning platform – not only for digital skills – supported by the BMZ, has more than 400,000 registered

users and has counted 170,000 completed courses. In 2020/21, Go Digital ASEAN trained more than 200,000 individuals across the region in digital skills (The Asian Foundation 2023), and the Digital Transformation Centres (DTC) Initiative by ITU and Cisco has reportedly reached more than 100,000 people in the Americas, Asia-Pacific, and Africa (ITU 2022).

These impressive figures on training participants, documented in various reports, websites, and press releases, suggest that the programmes are successful – at least in terms of take-up. In light of the proliferation of these programmes, it is surprising that – according to our assessment of the empirical literature and very few project evaluation reports – evidence on their effectiveness in terms of transmitting digital skills, raising productivity, and/or improving labour market outcomes is very limited. We could only find two rigorous impact evaluations of digital skills training programmes – both implemented in Africa – which we present below. Before that, we briefly summarise the wealth of evidence that is available for training programmes in general and that, in our view, holds some lessons to be learned for training programmes with digital content.

The rich evidence on the efficacy of job training interventions, reviewed by Beber et al. (2021) and Kluve et al. (2017; 2019), among others, is mixed. Some interventions are successful at increasing earnings or the probability of employment, but many are not, for example, pure soft skills training. There is a tendency for integrated, multipronged interventions that combine vocational training with a capital infusion to be more effective. The same holds for high-quality and high-intensity interventions that involve private firms. Results cannot be easily generalised, as the impacts of those programmes are context- and beneficiary-specific. Context-specificity is partly due to the importance of market demand for the acquired skills. Without such demand, even an effective transfer of skills will not impact labour market outcomes. This explains why the involvement of the private sector typically raises the programme's effectiveness, as market needs are better anticipated. Further, McKenzie (2017) points out that although studies indicate small positive effects of training programmes, their costs may render them inefficient.

The only rigorous impact evaluation of a "digital skills training program" is the unpublished study by Atkin, Schoar, and Wahnscha (2021). Over multiple years the authors evaluate the impact of the Artificial Intelligence 101 training programme by Sama in Nairobi, Kenya. The programme is relatively short, lasting five hours a day for 10 days, and teaches basic digital skills, occupational skills relevant to digital and the business outsourcing industry, and job search preparation. It targets low-income youth with little experience and no formal training. After programme completion, participants can apply to Sama's Delivery Centres to work on projects for clients such as Walmart and Google. Tasks include image tagging, image annotation, data classification, or dataset creation for machine learning algorithms. The authors randomly allocated individuals who passed an initial eligibility check to three groups to evaluate programme impacts: (1) Control group: eligible but not randomly selected; (2) training only: eligible and selected into the training programme but no job referrals to Sama at

the end of the programme (they were free to apply at SAMA partner centres or for other jobs); (3) training and job referral: eligible and selected into training plus detailed information on how to apply at SAMA Delivery Centres. Results show that individuals participating in training and job referral have 37 per cent higher earnings, are 10 percentage points less likely to be unemployed and work 22 per cent more hours a week than the control group. These effects are particularly strong for women. Looking at the group that only received training, the authors find that after 16 months of training completion, individuals had worse employment outcomes than the control group, which indicates that people were struggling to find work. These negative effects disappear 2.5 years after training completion, and employment rates and hours worked are slightly (but not significantly) higher than in the control group. After training completion, people who received training only were waiting for jobs in the ICT sector and finally switched to other sectors.

These findings are instructive, but one must be careful not to overgeneralise from one study. It is surprising to see a relatively large and sustained impact of a relatively light-touch intervention, a 10-day training. This contradicts the findings from other studies on skills training, which suggest that training needs to be intensive and long in order to be effective. However, the fact that it only works with referrals casts doubt on the effectiveness of the training. Instead, it suggests that the second component of the programme, the job referrals, is what really matters. This, in turn, implies that, at least in the Kenyan context where the programme was implemented, there is an important role for labour market frictions that inhibit efficient matching of job seekers with vacant jobs.

Here, another digital skill – namely, the effective use of online professional networking platforms – comes into play. Such platforms, including online job search, networking, and hiring platforms, may reduce information frictions on labour markets and improve the efficiency of matching individuals with specific skills to jobs. They can provide information about employers and the jobs they offer, as well as job seekers and their profiles; they provide access to the network on both the demand and supply sides of the market and thus lower the costs of matching significantly. As we have shown above, a significant part of the workforce is already engaged on such platforms. Evidence on the effects of participating in such platforms is scarce. Wheeler et al. (2022) was the first rigorous study on the labour market effects of participating in a professional networking platform. That study is relevant here since the participants are trained to open a LinkedIn account. The study is situated in South Africa and relies on a sample of participants of the Harambee Youth Employment Accelerator programme. This six-to-eight-week programme works with disadvantaged youth and covers workplace simulation, team building, and non-cognitive skill development. The intervention provides a randomly selected sub-sample of Harambee participants with additional training on how to open a LinkedIn account, construct a profile, join groups, make connections, and ask for recommendations. LinkedIn training replaced approximately four hours of the normal course materials. This light-touch intervention produced major results: Participants receiving the extra training on LinkedIn were approximately 10 per cent more likely to be employed by the end

of the overall training course (and six months later) than the control group that did not receive the extra training.

Box 3: Digital Skills in German Development Cooperation

The German development cooperation is engaged in numerous initiatives (600 projects in 90 countries) that use digital technologies (BMZ 2022), including a considerable number of digital skills projects – in line with the strategic priorities of the Ministry. In 2020, the BMZ published a "digital toolkit" (BMZ 2020a) that highlights many of those projects (32 to be precise). The project examples offer a wealth of practical lessons, some of which are summarised in practical recommendations for the development and implementation of digital education and skill measures. However, with a few exceptions and in line with our above assessment, the toolkit says very little about the (relative) effectiveness of different (types) of interventions. Probably acknowledging the fragmented project landscape, the toolkit suggests ways to better connect projects, for example through initiatives such as atingi, a free digital learning platform. The development and implementation of digital skills projects are organised under more comprehensive "umbrella" initiatives, such as the eSkills4Girls initiative or digital skills accelerator Africa (DSAA). The main goal of eSkills4Girls, which was initiated during the German G20 presidency in 2017, is to "close the digital gender gap and to invest more in digital skills for women and girls", including through women-targeted projects (for example, "We Code, Rwanda", a software training academy; Ghana Code Club, trainers travel to communities across Ghana to host coding workshops for women and girls), supporting female role models, and strategic business partnerships (for example, the African Code, which offered several events and workshops on basic concepts of programming). The initiative also comprises the multi-stakeholder initiative EQUALS (BMZ 2020b). The DSAA is an association of private companies supported by the Special Initiative "Decent Work for a Just Transition" with a focus on improving digital skills in line with private sector needs. In Rwanda, for example, Think-it GmbH and Kulimi e.V. offer learning camps on applied data analytics and machine learning to emerging graduates (DSAA 2021). Many other diverse projects, including for digital industrial skills ("Digital Skills for an Innovative East African Industry (dSkills@EA)") (GIZ 2021) exist. While it is still early days in terms of implementing "digital (skill) projects" and hence experimentation with various approaches and interventions needed, the accumulating wealth of experiences is – in our view – not used systematically enough to enhance the evidence base for even better and more impactful interventions.

These two impact evaluations forcefully illustrate that such evidence is needed for designing digital skill interventions that work. However, their external validity – that is, whether the results can be generalised to other contexts – is certainly limited. The scarcity of evidence on the effectiveness of digital skills trainings may be partly since the programmes are still relatively young. We can only speculate about other reasons, but the frequent involvement of the private sector probably makes the implementation of impacts evaluations somewhat more difficult (this is at least our personal experience). To our knowledge, none of the large-scale digital skills trainings mentioned in the introduction to this section have been rigorously evaluated. Overall, there is a tremendous potential for systematic learning in this policy field, including through rigorous evaluations and in German development cooperation (see Box 3).

6 Conclusions and Future Research Areas

Digitalisation will continue to have major impacts on labour markets in developing countries and governments; the private sectors and individuals will have to adjust to and prepare for the associated changes. While digital platforms become part of everyday life in some parts and some countries become increasingly involved in the division of labour in a "global digital economy", access to digital technologies remains far from universal in important parts of the developing world, despite the considerable expansion of mobile phone coverage. The scope and speed of digitalisation vary considerably in the Global South. Therefore, "context matters" and it is against this background that this study has reviewed the evidence on the effects of selected key aspects of digitalisation on labour markets in developing economies.

The rapid expansion of Internet access and mobile phone network coverage makes some places interesting "laboratories" to study the broad labour market impacts of the effects of digitalisation on labour markets. Overall, however, the evidence on the employment impacts of digital infrastructures is relatively patchy, although several studies find that expanding Internet access has had considerable employment effects. Even less is known about the productivity and wage effects of digitalisation, which is partly since these are very difficult to disentangle from other sources of change. The direct employment effects of a growing ICT sector are relatively small in low- and middle-income countries, but there is significant potential. The ICT sector accounts for 2.1 per cent of total employment in high-income countries, much more than the 0.1–0.6 per cent in low- and middle-income countries. Firms have an important role to play in employment creation through digital technologies. Our review shows that many firms in developing countries have not yet adopted digital technologies, another indication of the vast dormant potential of digitalisation.

Digitalisation directly affects employment and work through the emergence of digital labour platforms, including location-based and online labour platforms. Our review of the literature on the characteristics and implications of platform work reveals that quite some empirical knowledge has been accumulated on online labour platforms, while somewhat less evidence is available on the effects of location-based platforms. This is partly because empirical work on online labour platforms has been able to analyse data from the platforms – that is, transaction data – as well as data from surveys of platform workers. Unfortunately, the firms that run location-based platforms appear to be reluctant to share transaction data. As we have shown, it is even difficult to assess the extent of location-based platform work. In contrast, transaction data from online labour platforms have been used to generate knowledge about patterns of demand and supply of platform work (Stephany, Kässi, Rani, and Lehdonvirta, 2021). This cited work has shown, for example, that demand for online and remote tasks comes from the Global North, while supply comes from South Asia, mainly India, Eastern Europe, and (English-speaking) Africa. Surveys among workers on these platforms have shown that workers appreciate (ILO, 2021) the ability to work from home and job flexibility, income opportunity (to complement earnings), independence, and skill upgrading possibilities. These

positive aspects may explain why online workers tend to be satisfied with their work, although surveys have also highlighted the downsides of online work. These platform markets are perceived as "buyer's markets", with excess supply and low bargaining power of and fierce competition among suppliers, which exerts downward pressure on wages and working conditions. Workers also mention volatile income, lack of employment benefits, social isolation, stress, and discrimination. Many of these perceptions are similar to those of workers on location-based platforms. However, these workers emphasise the lack of alternative employment opportunities as the main motivation for participating in platform work, followed by job flexibility and better pay. While there is some indication that platform work does better than conventional work, rigorous evidence on the effects on pay and wages is lacking. Although workers have long working hours, most would like to work more and feel constrained by the lack of demand (ILO 2021). Social protection coverage is rare among both location-based and online platform workers, although social protection rates are unlikely to be much lower among platform workers than for similar non-platform workers.

The emergence of platform work illustrates the need for regulatory action or adjustment. However, as our brief review of various digitalisation strategies shows most countries or regions tend to emphasise digital skills – rightly so – and the provision of digital infrastructure and affordable access. Many countries still have some way to go in terms of expanding digital infrastructure, bringing down data costs and providing "complementary infrastructure" (ID systems, e-government, postal delivery). Digitalisation raises very important regulatory challenges (market access, anti-trust, data and consumer protection issues, etc.), some of which directly concern labour markets. For example, the regulation of work on location-based labour platforms is an issue of public debate in many parts of the world. Developments in the ride-hailing sector, where platforms often meet a heavily regulated market, are worthwhile watching and they (as the cases of Brazil, Mexico, and the European Union show) illustrate how regulations need to adjust in order to establish a regulatory level-playing field that protects workers and consumers without foregoing the potential gains of advanced technology. It may be that previous conventions, such as those regarding employment status and how this translates into access to and coverage by social protection, will need reconsideration. The international dimension of platforms – location-based platforms being foreign-owned and transactions on online platforms being international – also necessitates international collaboration or governance structures. As in many other sectors, voluntary commitments and transparency initiatives – as laudable as they are – will only take us so far.

For good reasons, most governments around the world prioritise digital skills in their digital agendas. Our brief assessment of digital skills and related policies highlights the heterogeneity of the demand for digital skills from basic digital literacy that enables people to effectively use (simple) digital tools to advanced digital skills that allow for participating in the "global division of digital labour". How to support digital skill development and what to prioritise are far from trivial questions. Of course, the answers depend on initial conditions, and

we were surprised to see that empirical knowledge on these initial conditions in terms of digital skills is very limited outside the OECD. The little available data suggest that levels of digital literacy are relatively low in developing countries. Low-income countries exhibit extremely low levels of digital literacy, while the gaps between middle-income and high-income countries are also considerable. The evidence from the OECD's PISA studies on the use of digital technologies in schools suggests that most middle-income countries lag far behind (particularly in disadvantaged schools), which may cause these gaps to persist or even grow. Digital skills training as an active labour market policy, an important instrument of (German) development cooperation, will not be able to compensate for failures in earlier digital education. Digital training programmes proliferate and, in our view, do so without having proven their effectiveness in terms of enhancing digital skills and improving employment prospects and wages. Interestingly, the few rigorous studies that do exist indicate that improving matching (through job referrals or teaching the effective use of professional online platforms) may be more important than (just) the training itself for getting employment.

The lack of an evidence base for informed policy decisions runs through our entire study. We know too little about (1) the employment and productivity effects of expanding digital infrastructure and the associated transmission channels, (2) the labour market impacts of digital platforms, particularly those of location-based platforms and those coming from indirect channels (improved productivity of certain service sectors, such as transport and logistics), (3) the effects of policy choices (for example, regulatory changes) and development policy instruments (for example, digital skills training), and (4) the extent of the digital skills gaps. There are also some important elements of empirical knowledge required to identify (1) the right policies to expand digital infrastructures and affordable access, (2) appropriate regulatory frameworks and governance structures, and (3) effective institutions, policies, and programmes to enhance digital skills.

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