SET SUPPORTING ECONOMIC TRANSFORMATION

DIGITALLY ENABLED ECONOMIC TRANSFORMATION AND POVERTY REDUCTION

Evidence from Kenya and Cambodia

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LIST OF ACRONYMS

ADB	Asian Development Bank
AfDB	African Development Bank
ASEAN	Association of Southeast Asian Nations
B2B	business-to-business
B2C	business-to-consumer
BPO	business process outsourcing
CDRI	Cambodia Development Resource Institute
CNC	computer numerical control
CTA	The Technical Centre for Agricultural and Rural Co-operation
DEET	digitally enabled economic transformation
EAB	Ease Doing Business in Agriculture
EAC	East African Community
ECIPE	European Centre for International Political Economy
EGDI	E-Government Development Index
EU	European Union
GDP	gross domestic product
GfA	growth from above
GfB	growth from below
GIS	geographic information system
GMAC	Garment Manufacturing Association in Cambodia
GPS	global positioning system
ICT	information and communication technology
ILO	International Labour Organization
IT	information technology
ITC	International Trade Centre
ITU	International Telecommunication Union
KAM	Kenya Association of Manufacturers
KAS	Konrad Adenauer Stiftung
KIHBS	Kenya Integrated Household Budget Survey
MIS	market information services
MM	mobile money
MSMEs	micro, small and medium enterprises
ODC	Open Development Cambodia
ODI	Overseas Development Institute UK United Kingdom
R&D	research and development
RGC	Royal Government of Cambodia
SCEA	Shippers Council of Eastern Africa
SET	Supporting Economic Transformation
STEM	science, technology, engineering and mathematics
UIDAI	Unique Identification Authority of India
UNCTAD	United Nations Conference on Trade and Development
UNDESA	United Nations Department of Economic and Social Affairs
UNECA	United Nations Economic Commission for Africa
UNIDO	United Nations Industrial Development Organization
US	United States
VAT	value-added tax
VRS	Vital Records System
WBES	World Bank Enterprise Survey
WDI	World Development Indicators

WEF	World Economic Forum
WITS	World Integrated Trade Solution
WTO	World Trade Organization

EXECUTIVE SUMMARY

Economic transformation is crucial to poverty reduction, through transforming production opportunities, lowering the costs and increasing the variety of consumption and enabling government services and other factors to provide better services. Digitalisation affects all of these channels in fundamental ways. This paper develops a framework to understand how. It argues that digitalisation can have positive and less positive or even negative effects in all of these channels but with likely overall net positive effects, sometimes large. It applies the framework to the cases of Kenya and Cambodia. It also argues that policy matters greatly for whether these positive effects materialise.

Digitally enabled economic transformation and poverty reduction: a framework

Economic transformation is brought about through productivity improvements by means of (i) structural changes – that is, movement of the labour force from less productive sectors of agriculture to manufacturing and services – or (ii) within-sector productivity shifts as a result of firms upgrading or firm entry/exit. It affects poverty reduction through three channels: production structures (the poor as producers), consumption of goods and services (the poor as consumers) and service delivery.

Digitally enabled economic transformation (DEET) affects poverty reduction under each of the channels. If managed well, DEET will reduce poverty, but digital technologies can also pose a threat and exacerbate existing inequalities and/or create new ones. How successfully these channels are able to reduce poverty will further depend on the enabling policy environment, comprising three sets of policies, related to building digital capabilities, fostering inclusive digital change and promoting competitiveness.

Under the **production** channel, DEET can lead to increased productivity and economic diversification, creating direct and indirect employment opportunities. There are examples of digital-led agricultural growth, digital-led labour-intensive manufacturing and IT and IT-enabled services. The poverty effects also depend on how formal activities link to the informal sector. There may also be digital exclusion of those without digital access, credit and lack of skills, as well as a hollowing-out of the middle-skilled workforce, fewer options for poorer countries to benefit from offshoring to less digitalised firms and rising precariousness of work on online platforms.

Under the **consumption** channel, digital technologies can lower the cost of exchange and transactions, reduce information asymmetry and expand access to cheaper and lower cost of goods and services. This is likely to lead to a reduction in prices, which may benefit low-income households, particularly in the case of price-inelastic essential goods, such as food, clothing, housing and energy. In low-income countries, an increase in agricultural productivity can have pro-poor benefits by reducing food prices, thereby increasing the disposable income of net food consumers. However, while the positive effects of internet dissemination grow exponentially with adoption levels, the digitally marginalised lose out. Predatory pricing on digital platforms can actually increase consumer prices.

Under the third channel, **government services**, digitalisation can lead to better monitoring and increases in tax collection, and GovTech, EdTech and HealthTech can increase public sector efficiency, transparency and performance. National digital identities can facilitate growth, job creation and poverty reduction, on both the production and the consumption side, but losses are possible if increased resources are poorly targeted and crowd out other effective investment. There could also be digital marginalisation of those that do not have digital IDs or have poor information and communication technology (ICT) access.

While digital technologies present new opportunities through the three channels discussed above, their **potential to reduce poverty will further depend on policy**, regulatory frameworks and institutions to manage the digital change in a sustainable and inclusive manner, including those on digital capabilities, managing inclusive digital change and fostering competitiveness. The table below presents the main

channels that these policies can affect, with subsequent sections discussing the poverty-reducing implications of these three sets of policies.

Digitalisation, economic transformation and poverty: The role of policies

	Production	Consumption	Government services and other context
Building digital capabilities			
Digital access, connectivity and adoption	x	x	X
Legal and regulatory framework for data and boosting e-commerce	x	x	X
Managing inclusive digital change			
Taxation and competition policies	x	x	
Social protection	x	x	
Skills development	x	x	X
Political economy of digital change			x
Fostering competitiveness			
Ease of doing business	x		
Climate change			x
Trade openness, transport, logistics	x	x	

Digitally enabled economic transformation and poverty reduction: Evidence from Kenya and Cambodia
We use the framework to discuss DEET in Kenya and Cambodia. While services are the biggest driver of economic growth in Kenya, accounting for 43% of gross domestic product (GDP), agriculture continues to be the largest employer, with 57.8% of the workforce employed in the sector. Growth in manufacturing – a key pillar in the government's Big 4 agenda – remains positive at low levels, with a falling share in sectoral employment. The share of both manufacturing and services has increased in the case of Cambodia, in terms of value-added in GDP and sectoral employment, indicating structural transformation post-2000. During this time, poverty rates (national definition) have fallen, from 52.5% in 2004, to 47.8% in 2007 and 13.5% in 2014 (ADB, 2014), although two thirds still live under $5.5 a day.

In terms of the share of the population that has access to the internet, both Kenya and Cambodia fare badly: less than 50% of the population has access to internet. However, Cambodia fares better in terms of active mobile broadband subscriptions: of every 100 inhabitants, roughly 67 have an active broadband subscription compared with 34 in Kenya. Both countries fare poorly in terms of fixed broadband subscriptions compared with comparator countries in the region.

Cambodia ranks ahead of Kenya on the overall Digital Readiness Index, with Kenya faring better on certain indicators, such as ease of doing business and start-up environment. Indeed, Kenya has significantly improved its Ease of Doing Business Rank, ranking 56th in 2020; Cambodia comes in at 144. Kenya ranks higher on the World Economic Forum Network Readiness Index, with lower individual ICT usage compared with Cambodia but higher government and business usage. On the ICT regulatory front, Kenya

ranks (45) significantly higher than Cambodia (132), with higher scores on all categories: regulatory authority, mandate, regime and competition framework.

On the **production** side, poverty reduction through digital-led agricultural growth holds promise in both countries. Currently, in terms of good ICT practices in agriculture, Kenya fares better than Cambodia. While manufacturing in Cambodia is of a much larger scale than that in Kenya, digitally led manufacturing growth, particularly in labour-intensive sectors, is more promising in Kenya: over 70% of manufacturing firms in Kenya have their own website compared with less than 15% of Cambodian manufacturing firms. There have been a few attempts to upgrade capabilities in Cambodian firms but few to no digital technologies have been installed. There has also been no attempt to upgrade and increase the competitiveness of the workforce, such as through installing sewbots. In Cambodia, services-led transformation is more prominent than other channels but opportunities for export-led services growth remain limited; the share of digitally deliverable services exports – such as insurance, financial services, intellectual property charges, telecommunications, computing and IT, other business services and audio-visual and related services – in total exports in Cambodia has remained below 5%, and has declined since 2014.

On the **consumption** side, poverty reduction through digital financial inclusion has been more successful in Kenya. For instance, M-Pesa has lifted 2% of households from extreme poverty. Kenya is doing significantly better than other East African countries in terms of women's access to finance, although a gendered digital divide still exists. While the banking and microfinance sectors have developed substantially in the past years in Cambodia also, financial inclusion remains low. Middle-class urban Cambodians have been the main beneficiaries of mobile money. Access to mobile money remains challenging for the poor, who are without a smartphone, reliable internet access and language and digital literacy skills to seize the full range of opportunities offered by new digital online platforms, including mobile payment systems and pseudo-banking services. Cambodia ranks lower than other comparator countries in terms of use of digital finance by the poorest 40%, potentially because of low levels of online consumer trust. In terms of gendered access to finance, women in Cambodia appear to have significantly lower access than those in comparator countries.

With regard to delivery of **e-government services**, progress in Cambodia has been limited. While its ranking on the E-Government Development Index has improved in the past 10 years, there remains scope for significant improvement, particularly on the provision of e-government services. Kenya has made good progress on e-governance, which plays an important role in building digital trust. This has been reflected in overall higher use of digitalisation in businesses and government in Kenya.

1. INTRODUCTION

COVID-19 has caused global disruption to production, supply chains and consumption at an unprecedented scale. According to recent estimates, the pandemic poses a real challenge to ending poverty by 2030; global poverty could actually increase for the first time since 1990. Under the most extreme scenario of a 20% income or consumption contraction, the number of people living in poverty could increase by 420–580 million, relative to the latest official recorded figures for 2018 (Sumner et al., 2020). Digitalisation presents a viable option of mitigating some economic losses from COVID-19 by facilitating economic transformation, ultimately contributing towards poverty reduction.

Digital transformation in sub-Saharan Africa, for instance, has been found to increase growth by nearly 2 percentage points per year and to reduce poverty by 1 percentage point per year (Calderon et al., 2019). This effect can be doubled if paired with stronger investments in human capital. However, there are important distributional effects; while application of new digital technologies can reduce poverty in certain groups, it can also exacerbate existing divides as well as create new divides within and between countries, and between rural and urban populations, men and women and rich and poor (UNCTAD, 2018). For instance, people in urban areas are more likely to be digitally connected than people in rural areas; even within urban areas, divides often exist between affluent centres and inner-city neighbourhoods (McKinsey Global Institute, 2014). Digital divides exist along dimensions of ethnicity, gender, education level, caste, disability and age (Goggin, 2017; May, 2012). In the same way that offline marginalisation is often experienced in multiple and overlapping ways, so are digital divides, with individuals with multiple marginalised identities even more likely to be offline (Robinson et al., 2015).

This report maps out how digitalisation is changing the relationship between economic transformation, growth and poverty through the three identified channels by means of which economic transformation affects poverty: production, consumption and service delivery, and the distributional effects (including winners and losers) of certain types of transformation to address current challenges (Section 2). It then applies this framework to Kenya and Cambodia – two economies hit hard by the pandemic.

In Cambodia, COVID-19 has adversely affected the main drivers of its economic growth: tourism, garment manufacturing exports and construction, which together account for 70% of the country's growth and almost 40% of paid employment. The country is set to witness its slowest growth since 1994, with a contraction of between 1% and 2.9% in 2020. Poverty among households involved in tourism, construction, trade, manufacturing and the garment industry is expected to increase by 3–11 percentage points compared with the baseline or in the absence of COVID-19 (World Bank, 2020a).

In Kenya, strong economic growth in recent years has led to a reduction in poverty, with the poverty headcount rate declining from 43.7% in 2006 to 36.8% in 2015 (latest data). However, with gross domestic product (GDP) growth plummeting to a projected 1.5% in 2020, (World Bank, 2020b), the ongoing COVID-19 crisis threatens to derail progress in reducing poverty and boosting shared prosperity. Kenya's main exports – horticulture and tourism – are very elastic in demand and vulnerable to adverse economic losses resulting from COVID-19. Shutdowns in China, the US and Europe, notably in the apparel, machinery and footwear subsectors, have also hit manufacturing in Kenya.

In terms of digital development, both countries have made significant advances (e.g. emerging apps in Cambodia), some with direct poverty-reducing implications (notably through M-Pesa in Kenya). But there are also differences, with Kenya at the start of generating manufacturing employment (300,000 formal jobs and 50,000 in garments) and Cambodia much more advanced (750,000 jobs in garments alone, mainly women). The two, therefore, present useful case studies for a comparative analysis.

The structure of this paper is as follows. Section 2 puts forward a conceptual framework for understanding how digitally enabled economic transformation (DEET) can affect poverty reduction. Sections 3 and 4 apply the framework to Kenya and Cambodia, respectively. Section 5 presents a comparative analysis and Section 6 concludes.

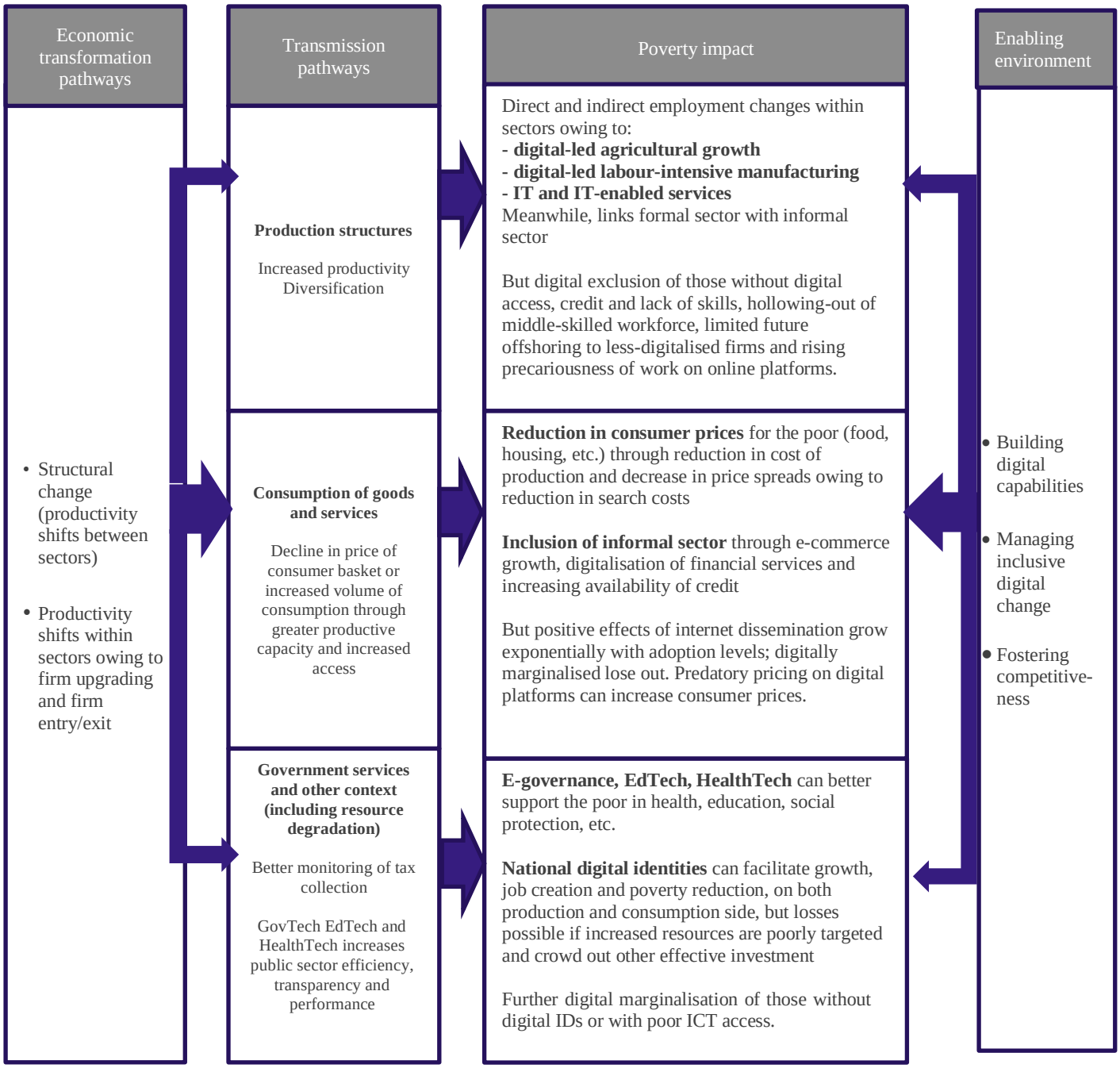
2. DIGITALLY ENABLED ECONOMIC TRANSFORMATION AND POVERTY REDUCTION: A CONCEPTUAL FRAMEWORK

Economic transformation is brought about through productivity improvements by means of (i) structural changes – that is, movement of the labour force from less productive sectors of agriculture to manufacturing and services – or (ii) within-sector productivity shifts as a result of firms upgrading or firm entry/exit. It can affect poverty reduction through three channels: production structures (poor as producers), consumption of goods and services (poor as consumers) and the broader context and service delivery (Diwakar et al., 2019). Within these channels, some people can escape poverty through 'growth from above' (GfA), which results from larger, more formal investments, for example in labour-intensive manufacturing; many escape extreme poverty directly through 'growth from below' (GfB), which is related to state support and private sector investment in smallholder agriculture and related sectors – transport, trade, information and financial services (Shepherd and Diwakar, 2019). Poverty reduction through GfA occurs mainly in industries such as garment manufacturing, where employment is accessible to poor, often-migrant, women and men. Poverty reduction through GfB requires building poor individuals' and households' assets and human capital, supporting the economic empowerment of poor women and facilitating or removing any blocks to migration.

Building on the frameworks by Diwakar et al. (2019) and Shepherd and Diwakar (2019), Figure 1 presents a conceptual framework for understanding the relationship between poverty reduction and economic transformation in a digital economy. In this framework, economic transformation, referring to productivity shifts within and across sectors, is enabled through the digital economy.[1] This DEET affects poverty reduction through three channels: (i) **production**, (ii) **consumption** and (iii) **GovTech and service delivery**. Under each channel, digital technologies have the potential to reduce poverty, if managed well, but also pose the threat of exacerbating existing inequalities and/or creating new ones. How successfully these channels are able to reduce poverty will further depend on the enabling policy environment, comprising three sets of policies, related to building digital capabilities, fostering inclusive digital change and promoting competitiveness. We examine this framework below in more detail, and apply it to the case of Kenya and Cambodia in subsequent sections.

[1] The digital economy contains a range of technologies with enormous potential to affect the organisation of production, as well as the efficiency of the production process. These include (i) mobile networks, (ii) cloud computing, (iii) machine learning, (iv) Internet of Things, (v) 'big data' and (vi) Artificial Intelligence, which facilitate the development of smart platforms and applications (e.g. e-commerce platforms, FinTech apps, etc.) as well as smart machines (e.g. robots and 3D printers).

Figure 1. Digitally enabled economic transformation and poverty: a framework



Source: Authors

2.1. The production channel

Under the production channel, DEET can lead to increased productivity and economic diversification, creating direct or indirect employment opportunities. Under *direct* employment effects, increased productivity and diversification lead to output growth and potential expansion in exports, creating new jobs linked to this expansion. *Indirect* employment effects of DEET refer to increased competitiveness of firms and resulting job increases, as a result of better access to goods in digital economy. Increasing use of digital technologies can lower the costs of exchange and transactions, increasing market access and offering firms new opportunities to source better-quality cheaper materials, overall reducing the cost of production.

Some existing evidence documents a positive and significant impact of *digitalisation on productivity and output growth*. Multi-country studies suggest that, on average, a 10% increase in broadband penetration increases GDP growth in the range of 0.9–3.19% (Quiang et al., 2009; Czernich et al., 2011; Scott, 2012; Zaballos and Lopez-Rivas, 2012). At the firm level, using a sample of 49,610 firms in 117 developing countries between 2006 and 2011, Paunov and Rollo (2015) confirm widespread productivity gains for firms adopting the internet. The McKinsey Global Institute (2011) further suggests that firms with online presence grow two times as fast and export twice as much as offline firms.

New employment opportunities can therefore be created as a result of DEET, either directly or indirectly. Cross-country studies documenting a positive employment impact of automation include Booz & Company (2012) and Muro and Andes (2015), as well as Gregory et al. (2016) for the EU. In contrast, some other studies report a labour-substituting effect of digital technologies and robotics, whereby digital technologies are displacing labour and affecting overall employment negatively (see, for instance, Frey and Osborne, 2013; Bowles, 2014; Acemoglu and Restrepo, 2017). Examining the impact of computerisation on employment, Frey and Osborne (2013) find that 47% of the jobs in US are at risk. Using the same methodology, the World Bank (2016) finds that 57% of jobs in Organisation for Economic Co-operation and Development countries, 69% in India, 77% in China and 85% in Ethiopia are at risk of being automated.

The World Trade Organization (WTO) (2017) further holds that labour being displaced by installing digital technologies in some sectors can be absorbed into sectors that are producing these technologies, as well as into tasks that are complementary to automation and robotics. Increasing deployment of robots in manufacturing, for instance, not only requires more skilled labour in manufacturing but also creates jobs in the service of automation tools and machinery. As digitalisation expands globally, it is becoming increasingly important to understand the sectoral composition of these new jobs being created, in addition to understanding changes in labour composition and future skill needs. There are likely to be job losses for those without the relevant skills, potentially leading to further marginalisation of vulnerable groups. Below we examine the potential of DEET to affect poverty reduction across different development models based on agriculture, manufacturing and services.

2.1.1. Digital-led agricultural growth and poverty-reduction

For low-income countries, increasing value from the informal sector, including by helping smallholder farmers, can be a key pathway towards poverty reduction. Digital technologies are shaping the relationship between economic transformation, especially GfB, and poverty reduction. Productivity can be enhanced through digital value chain management solutions such as business-to-business (B2B) services that help agribusinesses, cooperatives, nucleus farms and input agro-dealers connect with smallholder farmers. Digital apps lower costs through greater efficiency; improve value chain quality through better traceability and accountability; and ultimately increase smallholder farmer yields and incomes by making it easier for more commercial players to formally engage with large numbers of smallholder farmers (Wolfert et al., 2017; CTA, 2018; Tsan et al., 2019).

Krishnan et al. (2020) highlight different pathways through which AgriTech can affect economic transformation and jobs:

- Increased productivity and job creation through digital value chain management and reduction in information asymmetry. For instance, Mbiti and Weil (2011) find that M-Pesa, a mobile phone-based money transfer in Kenya, increases employment by 12 percentage points, with the impact driven by changes in farm employment. They suggest that the increased resource flows owing to M-Pesa are channelled towards farming, which boosts demand for labour and subsequently increases employment. Krishnan et al. (forthcoming) undertake a survey of over 800 farmers and find that farmers that use Ag-platforms are more productive than they not been using such platforms.

- Increased value addition and diversification of functions. For instance, using remote sensing and land mapping, farmers can begin to grow new products for new markets, thus making the most of the real-time data they obtain in relation to commodity prices, weather and land mapping. However, data provided to farmers may be inaccurate as a result of poor infrastructural support (bad-quality bottom-up and top-down enablers), leading to significant errors in decision-making by farmers and distrust within networks in the value chain.
- Increased regional trade and cohesion. Research shows that TradeMark East Africa's work in the East African Community (EAC) has resulted in the elimination of 87 of 112 identified nontariff barriers, in part because of digitalisation.[2] For instance, the introduction of single windows at intra-EAC customs ports and cross-border mobile telephone and financial services has facilitated intra-EAC trade (Gasiorek et al., 2016). Another success in the EAC is cross-border mobile telephone services through cuts in roaming charges and the use of mobile phones for cross-border financial transactions (ibid.). Other measures include automation of the application and issuance of certificates of origin in Kenya by the Kenya National Chamber of Commerce and Industry, and development of apps such as Sauti, which have improved cross-border trade by providing informal traders with information on regional laws, while an electronic cargo tracking system in the region has facilitated regional and global trade.
- Formalisation of jobs. As agriculture becomes more digitalised and formalised, technical skills such as the operation of drones, platforms and automated systems will be increasingly sought after.

To maximise large-scale employment gains from the production channels of DEET, fostering domestic integration can be key for low- and middle-income countries. This can be made to occur by using digital platforms to link the informal sector to productive sectors of the economy. The informal sector comprises many rural workers, smallholder farmers, casual labourers and petty enterprises – that is, those groups already facing the most social and economic disadvantage. In some regions, this accounts for over 80% of employment. Linking informal workers to potential markets and the formal economy will likely be highly inclusive, but these links will also provide a route for progression into more formal parts of the economy for previously excluded workers and entrepreneurs.

However, the potential of AgriTech for increasing agricultural productivity depends on constraints faced by farmers, such as access to credit, input shortages in local markets, lack of infrastructure and shortage of skills. Smartphones are required to receive messages but few smallholder farmers in the poorest countries currently have access to this technology.

2.1.2. Digital-led manufacturing growth and poverty reduction

Recent literature has increasingly documented the productivity- and diversification-enhancing effects of digital technologies in manufacturing. For instance, Banga (2019) finds that firm-level digital capability is significantly and positively affecting product upgrading of Indian manufacturing suppliers in global value chains. The author finds that the most digitally competent firms are producing 4–5% more sophisticated goods than the least digitally competent firms. In Bangladesh, online trade is found to be more diversified than offline trade (ITC, 2018); the country has diversified from apparels into other products online, including agricultural products, food and beverages, and consumer electronics. Cross-country analysis of export diversification on employment conducted over 1991–2010 reveals that employment expands with export diversification, while vulnerable employment declines with export diversification (UNCTAD, 2018). The employment rate of individuals over 15 years of age tends to increase with export diversification in developing countries (ibid.).

[2] https://www.trademarkea.com/news/elimination-of-non-tariff-barriers-advances-trade-within-eac/

A particularly important sector for poverty reduction in low- and middle-income countries has been **textile and garments manufacturing.** Digitalisation can have an important impact on GfA and the job-creating potential of labour-intensive industries, affecting future employment levels, occupational structures and skill requirements. Altenburg et el. (2020) highlight new digital technologies that are transforming the sector, including fabric cutting with laser technology and use of robotics in fabric pressing (Nayak and Padhye, 2018). Digital solutions are being deployed across the garments value chain, from design (digital design software, 3D printing, virtual sampling, etc.) to manufacturing (computer numerical control (CNC) machinery) to distribution (blockchain) and sales (cloud computing, social media, etc.). Expert opinion seems to converge around an early full automation of simple garment production within less than a decade. On the other hand, predictions for a full automation of the entire US garment industry cover a range from less than 10% to more than 70% by 2030 (Andersson et al., 2018). There appears to be a window of opportunity for low-cost countries to attract clothing investments and engage in export-oriented manufacturing. Increased focus needs to be given to the changing structure of occupations and skill levels of the workforce. Banga and te Velde (2018), for instance, provide the example of the A to Z garments factory in Tanzania, which shows how investment in the digital technologies of CNC cutting has created new employment opportunities through increases in overall productivity, and the related expansion in output and exports. Installing CNC lasers has led to some job losses in cutting tasks but increased overall jobs in the next task of stitching, which continues to require dexterity and ranks relatively lower on technical and economic feasibility of automation (Minian et al., 2016; Berg et al., 2017).

Low-income countries are, however, facing a two-pronged challenge in the digital age. It is not only the level of digitalisation that is lower in these countries but also the impact, as compared with more developed counterparts. The impact of doubling internet penetration on manufacturing labour productivity, for instance, is roughly 8 percentage points lower in low-income countries compared with middle-income countries, and lower in sub-Saharan Africa compared with other parts of the world (Banga and te Velde, 2018). In line with this, the World Economic Forum (WEF) 2018 report on measuring readiness for the future of production finds that only a handful of countries are positioned to capitalise on digital technologies for leapfrogging. Such uneven digital development across countries can create distinct and severe distributional consequences, contributing to existing inequalities as well as leading to new inequalities. Across countries, a persistent digital divide can lead to an increase in re-shoring of manufacturing jobs. While till now re-shoring has not occurred at a very large scale, it is important to note that some leading firms have already re-shored historically labour-intensive manufacturing closer to the end market, such as Philips shavers in the Netherlands and Adidas shoes in Germany (Bloomberg, 2012; The Economist, 2017).

There is also a threat of limited future offshoring of production, leading to the loss of ‘could-have-been’ jobs in lower-middle-income countries, which have traditionally been major offshoring hubs. Findings in De Backer et al. (2018), for instance, reveal that a 10% growth in robotics investment corresponded to a 0.54% drop in offshoring between 2010 and 2014, with a higher (negative) correlation for labour-intensive jobs. However, a slowdown in offshoring in lower-middle-income countries from developed countries can be offset to some extent by increased offshoring from China. As wages continue to rise in China, there is likely to be increased offshoring to lower-wage countries. Surveying over 600 light manufacturing Chinese firms, Xu et al. (2017) find that, while 28% of Chinese firms rank rising wages as a primary obstacle to firm operations, 31% prefer technology upgrading as a preferred response to rising wages, as opposed to offshoring to locations with cheaper labour. Even when they choose to offshore, it is to Asian rather than African economies (ibid.). To remain competitive, low- and middle-income countries may further reduce wages. In this regard, Kucera (forthcoming) finds that employers have already used the use of robots to reduce production costs in high-income countries as an argument for not increasing wages in least developed countries. The effects of digitalisation and automation are likely to be hardest felt among micro, small and medium enterprises (MSMEs) that have not embraced or are unable to access new technologies, and among workers in the lowest tiers of increasingly fragmented global supply chains, particularly in countries where international labour standards are not effectively implemented in law or in practice.

Manufacturing wages in developing countries face a two-pronged threat. First, the falling cost of capital and growing digitalisation in developed economies could have a back-stopping effect on wages, whereby manufacturing firms in developing economies lower wages to remain competitive. Second, when robots and human are highly substitutable, even a small increase in the level of robot productivity can increase output significantly, leading to higher returns on robots and traditional capital, destruction of jobs and lower wages in the short run (Berg et al., 2018). Even in the long run, the labour share declines substantially and inequality rises. For Kenya, Banga and te Velde (2018) find that the share of labour compensation in manufacturing value-added declined from 40% in 2000 to 27% in 2016 – a period that saw significant improvements in digitalisation. While it is widely held that higher-productivity manufacturing can offset the falling share of labour and reduced wages, Turner (2018) argues that rapid productivity growth can be driven by a very small number of highly skilled people. Instead of focusing only on 'skills', attention should be given to life-long education, learning and citizenship (ibid.).

Whether or not automation results in net job losses, some argue that, without complementary policies, it will amplify earning disparities between employees with high and low skill levels (Acemoglu and Restrepo, 2018). Within low- and middle-income countries, the sectors and firms that install digital technologies are likely to increasingly demand higher-skilled workers with digital and soft skills for performing non-routine cognitive tasks, leading to reduced employment opportunities for middle-skilled workers performing routine tasks, such as machine operators and technicians. Existing social and economic divides may also be exacerbated on the basis of access to digital technologies. For instance, women are less likely to access financial services than men, particularly through mobile technology (Hunt and Samman, 2016), which will exacerbate their exclusion. Similarly, in urban areas of Bangladesh, garments manufacturing led to poverty reduction (World Bank, 2019). However, the slowdown of job creation in manufacturing limited the share of families that could benefit.

Rodrik (2018) calls for increased focus on domestic integration, aiming to disseminate throughout the rest of the economy the capabilities already in place in the most advanced parts of the productive sector. Government–business collaborations need to target the connection between the highly productive global firms, potential local suppliers and the domestic labour force. In a similar vein, Krishnan et al. (2019) identify six ways in which manufacturing MSMEs can be integrated into global value chains:

1. backward linkages – supporting manufacturing of core parts required for intermediary products providing intermediary services
2. complementary linkages – facilitating services not directly linked to manufacture of the product
3. forward and logistical linkages – manufacturing part of the final product
4. producing the core product
5. offering finishing services
6. integrated linkages, where MSMEs have relatively integrated backward and forward linkages and compete with large firms.

If done and managed well, digitalisation can open up new pathways for digital-led manufacturing growth, including through increases in productivity, product sophistication and higher marker access, particularly lowering barriers to entry to export market for women, youth and MSMEs. However, a persistent digital divide implies that the gains from digitalisation are unevenly distributed, both between and within countries. Managing the digital change in an inclusive manner is crucial since the opportunities presented by the digital revolution could be outweighed by the risk that it exacerbates existing inequalities and/or creates new ones.

2.1.3. Digital services-led development and poverty reduction

As the potential for labour-intensive manufacturing industries to boost development and reduce poverty reduction comes into question, low- and middle-income countries may need to look towards alternative pathways for transformation. Baldwin (2019) argues that the age of 'globotics' is here, which will affect industries differently compared with before. Earlier, the 'gains and pains' from automation and technology were felt mostly in the manufacturing sector; this time around, it is the professional and services sector jobs that will be the most affected. However, since most services are under-priced in developing nations compared with developed nations, it is likely that this will mostly be an export opportunity for developing nations and an import opportunity for developed nations (ibid.). The basic point is that service jobs have been shielded by high face-to-face communication costs. As digital technology tears down those barriers, the differences between the wages of accountants in, say, the UK, and in, say, Kenya, will narrow.

The recent literature has examined the role of such 'smoke-stack-less industries' in promoting growth and economic development over manufacturing in the digital age, particularly in African countries (Newfarmer et al., 2018). These authors see technology as the key to opening up non-manufacturing avenues of value-added, particularly services trade, tourism, horticulture, business and trade services, and transport. On similar lines, Gollin (2018) views services as being just as good a pathway for development as manufacturing, with 'smart services' such as business, environmental services, tourism and finance offering better scope for employment and productivity. Such services-based transformation brought about through a reduction in exchange and transaction costs is GfB in Shepherd and Diwakar (2019).

Digital platforms in particular are key mechanisms for reducing the cost of exchange within the informal economy, boosting its productivity. These platforms offer employment opportunities to previously disconnected households; connect low-productivity segments with firms with higher productivity; and link people to more formal parts of the economy across sectors and geographies (Pathways for Prosperity, 2018). For example, transport platforms such as Rapido in India and GO-JEK in Indonesia provide platforms for connecting often highly segmented low-end taxi hailing services using motorcycles, offering efficiency gains for riders and consumers. GO-JEK has grown to link more than a million riders, and has expanded to include food delivery, courier services and cashless payments using its e-money service, GO-PAY. These benefits also surface in the analysis of Uber drivers in Mexico, where we find that the platform – while not perfect – almost universally provides a step up for drivers. Not only do they generally earn more but also they are safer and typically enjoy better conditions than they would working as taxi drivers (ibid.). In another field of work – online freelancing – Malaysia has embraced this model of connecting poor and informal workers to broader markets with its eRezeki initiative, specifically designed to help poorer people do relatively simple online work. These platforms can help broaden a country's tax base, creating potential for greater redistribution and investment for those who remain disconnected.

One challenge with a services-led development model is that highly productive and tradable services are skills-intensive, and non-tradable services (such as social care, personal services, etc.) are not (yet) highly value-adding and may not be sufficiently scalable. Rodrik (2016) points out that the essential problem with services-led development is that services tend to require relatively high skills, particularly IT services, which requires long-term, steady investment in education, infrastructure, institutions and governance. Developed country evidence suggests a 'hollowing-out' of the labour force, with a rise in demand for high- and low -skilled workers at the expense of middle-skilled workers (Goos and Manning, 2007). Jobs created in the services sectors are likely to be high-skill, requiring digital and soft skills, or very low-skill, in tasks such as nursing or health care; this is likely to exacerbate inequalities.

The development of digital applications has also created new forms of employment in the services sectors, leading to a rise in the 'gig-economy', characterised by short-term contracts and freelance work. The operating model of the gig-economy platforms can be divided into two categories: 'crowdwork' and 'on-demand economy'. Crowdwork refers to tasks commissioned and carried out virtually, via the internet,

while the on-demand economy refers to specified tasks that are carried out locally, with the service purchaser. While crowdworking platforms such as Upwork can create new employment opportunities in developing countries, the demand for digital labour comes mainly from wealthy economies, with workers across the globe competing (Graham and Anwar, 2019).

This distributed supply and concentrated demand implies significant increases in competition, and rising precariousness of work, with online work often being re-outsourced to African economies under worse conditions (Graham and Anwar, 2019). For instance, a recent survey by the International Labour Organization (ILO) (2019a) of 35,000 workers in 75 countries on five microtasks platforms reveals that crowd-workers are well educated but earn only $4.43 per hour of paid work, with workers in North America, Europe and Central Asia earning more than workers in Africa and Asia Pacific, where earning varies between $1.33 and $2.22 per hour of paid and unpaid work. On-demand platforms benefit domestic works in terms of choice over working times, tracking of hours worked and wages earned, and potentially better remuneration, but overall threaten domestic workers' access to decent work through low and insecure incomes, discrimination, further entrenchment of unequal power relations within the traditional domestic work sector and the erosion of established labour and social protections as key challenges (Hunt and Machingura, 2016).

Digital services-led development offers a promising pathway for poverty reduction in low- and middle-income countries but faces difficulties in terms of quick scale-up and generation of large-scale employment, thereby limiting its impact on poverty reduction.

2.2. The consumption channel

The second channel through which DEET can affect poverty reduction is consumption, which refers to the poor as consumers in the economy. Digital technologies can lower the cost of exchange and transactions, reduce information asymmetry and expand access to cheaper and lower cost of goods and services. This is likely to lead to a reduction in prices, which can benefit low-income households, particularly in the case of price-inelastic essential goods, such as food, clothing, housing and energy. In low-income countries, an increase in agricultural productivity can have pro-poor benefits by reducing consumer prices, thereby increasing disposable incomes of net food consumers (Ivanic and Martin, 2018). The pathways through which digital technologies can affect consumer prices are reviewed below.

2.2.1. DEET: reduction in consumer prices

As discussed in Section 2.1, increasing productivity and diversification as a result of digital technologies can increase the volume of products consumed or decrease the price of products in the consumers' baskets. Based on a randomised experiment in Gujarat, India, Cole and Fernando (2012), for instance, find statistically significant increase in usage of mobile-based information on agricultural decisions. Farmers with access to the digital platform had higher uptake of cotton fertilisers by 22% and cotton pesticides by 30%. These farmers also increased their purchase a more effective pesticide by 10% compared with the control group. Farmers engaged with the service also plant significantly more cumin and sow larger of quantity of cumin by 8% and 50%, respectively, compared with the control group. In northern Ghana, Al-Hassan et al. (2013) find that farmers that participated in a information and communication technology (ICT)-based market information services (MIS) project used improved seeds 13% more than non-participants. s

Asymmetric information leads to price dispersion among markets, especially so in remote rural and agricultural areas where market price information is not easily accessible. Mobile phones help improve market prices by reducing search costs, and speed up the access to better information (Aker, 2010), thus reducing price spreads in the market. Mobile phone coverage alone in Niger's grain market has reduced 10-16% in inter-market distortion, with stronger effect in market pairs where transportation costs are more

expensive (ibid.). The impact is higher in fisheries in Kerala, India, where the introduction of mobile phones led to a substantial reduction in price spread across markets from Rs 7–8/kg to Rs 5/kg, in coefficient of variation of prices by 38 percentage points, in incidence of waste[3] by 4.8 percentage points and in violations to the law of one price across markets from 50–70% to 1–5%. This is consistent with the findings of Labonne and Chase (2009), that mobile phone purchases have a robust and significant positive impact on the household-level growth rate of per capita consumption (11% to 17%) of farmers in rural areas of the Philippines. In northern Ghana, participation in ICT-based MIS projects was observed to have increased farmers' expenditure not only on pesticides but also on consumption (e.g. measured by households being able to meet the recommended daily allowance of calorie intake) (Al-Hassan et al., 2013). Technologies such as M-Pesa have also facilitated remittances, one of the largest sources of external financing for many low- and middle-income countries.

Better farmer–trader communications reduce the uncertainty associated with demand for certain goods and facilitate the provision of inputs to rural areas (Debo and Van Ryzin, 2013). Evidence suggests that, in rural Niger, mobile phones reduced search costs by 50%; in rural Peru, they increased household real consumption by 11% between 2004 and 2009 and reduced poverty by 8 percentage points (World Bank, 2016). In Kerala, for example, mobile phones have allowed fishers to determine the most profitable port to sell their fish; by equalising access to information, price variance in the market declined, boats' profits rose by 8% and consumer prices fell by 4% (Jensen, 2007). Additionally, pilot programmes have shown that technologies like blockchain can potentially increase access to export markets by small stakeholders, by increasing data transparency across the supply chain and replacing time-consuming paperwork with automatic digital verifications (World Bank, 2018). While most agricultural m-apps are still on pilot stages, Qiang et al. (2012) gather early quantitative estimates of m-apps' impact on farmers' income. In Kenya, the Agri Manager app has led to 9% or about $300 additional income of small tea growers, mainly as a result of more accurate recording of production volumes. Kenya Agricultural Commodity Exchange provided pricing information and supply chain services to farmers, which has led to higher incomes for 75% of farmers and 60% of commodity traders. In Sri Lanka, Tradenet users who are 10–15 km away from the nearest market have obtained an average premium of 23% on the price per kilogramme, as the m-app has allowed farmers to plan optimal market entry times and minimise sunk costs (e.g. transport costs).

However, it is important to note that a persistent digital divide across countries, across rural–urban areas and between sexes can have severe distributional consequences. Galperin and Fernanda Viecens's (2017) review of development impacts of internet technologies cautions that the positive effects of internet dissemination on market coordination and political institutions grow exponentially with adoption levels, suggesting that advanced economies are reaping significant benefits from internet investments; the returns for less advanced economies, and in particular for the fight against poverty in these regions, remain uncertain. For example, Pi Pay is an electronic payment system that is taking off in Cambodia but so far mainly caters to the urban population, benefiting middle-class consumers more than other groups (ODI-CDRI, 2020).

Moreover, rising market concentration of digital giants and e-commerce monopolies may sizably augment the financial power of a few leading firms in high-income countries and cause increased rent-seeking, anticompetitive practices and attempts to block actual or potential competitors. As a result, certain established competition and antitrust policies may no longer be adequate to address e-commerce giants' threat to market competition. These policies are based on the short-term interest of consumers, and they view low consumer pricing as existence of competition. But competition can no longer be measured primarily through pricing and output since this runs the risk of ignoring the adverse effects of 'predatory pricing' and how integration across business lines can be anticompetitive. For instance, Amazon

[3] Incidence of waste is measured as the percentage of fishing units that do not sell their catch (Jensen, 2007).

increasingly controls the infrastructure of online commerce through its massive Amazon Marketplace, which it uses as a laboratory to sell and test sales of new goods. The Marketplace allows it to force independent merchants to use its site, to both sell goods as a retailer and host sales by other retailers, and to gather massive amounts of data on other merchants, giving it a tremendous competitive advantage (Khan, 2017). Furthermore, it not only charges a hefty commission fee (which goes up to 40% on some products such as electronics) but also pushes its own products 75% of the time, decreasing the 'visibility' of products supplied by African firms listed on these platforms (The Guardian, 2016). Such practices can result in lower prices for consumers in the short to medium term, until the competitors exit the market, and then are likely to increase as choices for consumers decrease owing to less or no competition in the long run.

2.2.2. DEET: inclusion of the informal sector

GfB on the consumption side includes removing constraints faced by the informal sector. Support takes the form of developing inclusive business development services, combined with financial inclusion; extension of physical and transport infrastructure, especially electricity; and skills development (Diwakar et al., 2019). Digitalisation of financial services can increase availability of credit and help alleviate poverty. Digital financial services can provide more cost-effective and secure methods of financial transactions in the agriculture sector, particularly for smallholder farms (Babcock, 2015). An interesting example is that of BlocRice, an Oxfam value chain in Cambodia that is using Big Data Analytics to connect importers, exporters, processors of rice and farmers, and generating data to gauge the creditworthiness of farmers. It is further using blockchain to develop smart contracts for transparency and traceability (te Velde et al., 2019). Kenyan farmers that avail themselves of the DrumNet (pilot) have reported an increase in income by 32%, as users have benefited from value chain support, increased bank creditworthiness and reduced transaction costs.

E-commerce growth is also lowering barriers to entry, creating new opportunities of growth for the informal sector. E-commerce platforms in China such as Tmall.com and JD.com have become available to use even in remote rural villages, and evidence shows that these platforms have led to lower consumer prices and higher wages in these areas (Fan et al., 2018). Combining this and other new pathways (such as linking the informal sector into the formal sector and capturing more value from agriculture) may help create a more spatially integrated, less segmented and more inclusive economy. Not all patterns of transformation will lead to lower prices, however. While digital platforms may improve market access and reduce information asymmetries, it is also key to consider longer-term effects of consumer pricing models in the platform age for developing economies. At present, the dominant approach in antitrust policies uses the consumer welfare standard, which is based on measuring benefits or harm to consumers in the form of lower or higher prices, respectively. However, this approach is not suited to assessing the impact on competition of some business models used by global digital platforms that provide services for free (Stucke and Grunes, 2016; Khan, 2017).

Contrary to many developed countries in both the earlier and current phases of digitalisation (Bauer et al., 2016), most developing countries lack policies regarding the control and use of data, increasing the risk of their data being controlled by whoever gathers and stores data and then has exclusive and unlimited rights on data. Using the power of Big Data, e-commerce giants have emerged as critical intermediaries integrating across business lines and slowing taking over essential infrastructure on which competitors depend. Amazon is again an example of this (Khan, 2017). Another difficulty with the consumer welfare standard is that it may not be easy to conduct price analysis of online platforms providing marketplace infrastructure, owing to rapid price fluctuations and personalised pricing facilitated by algorithms.

2.3. GovTech and service delivery channel

Under the GovTech and service delivery channel, digital technologies can expand access to public services and quality of provision through e-governance and online portals, and facilitate collection of taxes. The role of digital identities for poverty reduction is also important but is complex, requiring careful unpacking.

2.3.1. GovTech and expanding access to public services

GovTech has the potential to transform public sector efficiency, transparency and performance. The growth of digital data – through sensors, smartphones, social media and satellites – represents a new asset class for more efficient decision-making and public sector responsiveness. Successful GovTech initiatives will need to integrate these new sources of information with core public sector management systems data, such as on financial management and procurement. Growth in non-agricultural production capacity through digitalisation can also help build a more predictable and resilient tax base, the monitoring of which can also be further facilitated through digital technologies. For instance, e-government services can make it easier for consumers to pay their bills online and reduce tax evasion. This increased government revenue can be spent on various ways to support the poor, especially through human development, provided they spend it effectively.

Successful examples of GovTech include Malta and Estonia. In 2010, Malta's Information Technology Agency diverted its efforts towards ensuring that all government services were accessible online and to improving the quality and delivery of e-government services. It created a central platform to enable the rapid implementation of services, encompassing three important components: eForms, MyBills and eProcurement. **eForms** is a new platform that allows the creation of online forms, enabling the whole process – from the creation of forms by a department to the filling-in and sending process by citizens or businesses – to be done completely online in a secure environment. **myBills** is the Maltese government's online billing solution, supported by the Hosted Payment Page, which directs users to make electronic payments through a central PCI-certified environment. By the end of 2010, 93% of online transactions were taking place through the Hosted Payment Page. **eProcurement** enables the use of electronic communications and transaction processing by the public sector, in order to purchase supplies and services, or tender public works. Estonia has also made marked progress towards digital transformation, particularly in e-governance, over the past two decades. Key factors behind Estonia's success include (i) openness to change after independence, including through young leadership; (ii) privatisation and innovation; (iii) low costs of digitalisation; (iv) availability of ICT talent and closeness to digital leaders in Scandinavia; and (v) decentralisation and flexibility (ODI–CDRI, 2020).

India has also undertaken several initiatives, under the National e-Governance Plan (Government of India, 2018). This progressive plan promotes e-governance in a holistic manner. There are various policy initiatives and projects to develop core and supporting infrastructure, including state data centres, state-wide area networks, common services centres and middleware gateways – that is, the National e-Governance Service Delivery Gateway, the State e-Governance Service Delivery Gateway and the Mobile e-Governance Service Delivery Gateway. Important support components include core policies and guidelines on security, human resources, citizen engagement and social media, as well as standards in areas related to metadata and interoperability. New initiatives include G-I cloud, an initiative that will ensure the benefits of cloud computing for e-governance projects. These projects involve sustained efforts at multiple levels to improve the delivery of public services to citizens and simplify the process of accessing them.

EdTech and HealthTech will also shape the future of education and health care over the coming decades across the world. In low- and lower-middle-income countries, digital health has great potential to strengthen health care provision for the most vulnerable. Digital interventions, embedded in health and education systems, can improve service delivery in three ways – boosting productivity at the point of delivery, improving interconnectivity within the health or education system and allowing for more effective

organisational designs (Pathways for Prosperity Commission, 2019). For instance, in Uganda, the Mobile Vital Records System (VRS) helped raise birth registrations from 28% to 70%. It is a mobile web-based app that tracks and records births, a key aspect of health planning; without this, countries have only approximations of the size, health and longevity of populations. At $0.03 per registration, the cost is very low, and Mobile VRS is likely to become an integrated part of the forthcoming national ID system. On EdTech, Kenya has seen significant successes with the national literacy programme called Tusome, which uses digitised teaching materials and a tablet-enabled teacher feedback system. However, successfully scaling-up of such EdTech and HealthTech initiatives for poverty reduction will require access basic infrastructure needs to be met first, including access to reliable electricity, internet access and digital literacy skills.

2.3.2. DEET and digital identities

On the production side, digital identities can facilitate cross-border B2B and business-to-commerce (B2C) e-commerce, which can contribute to growth, job-creation and poverty reduction. On the consumption side, digital identities can increase financial access of the poor, enabling easier access, for example, to micro-payments, microcredit and micro-pensions. A digital identity can also ensure that benefits meant for women, such as conditional cash transfers, are actually accessible by women. However, Hernandez and Roberts (2018) point out that 'digital first' strategies run the risk of leaving behind the most marginalised. 'Digital first' and 'digital by default' strategies unconsciously repeat the Millennium Development Goal era error of reaching the 'low-hanging fruit' at the expense of those in most need. The United Nations (UN) (2018) also warns against emerging digital first and digital by default approaches that privilege the most connected and lock out the least connected. The report warns that, although digital IDs, for example, are providing more remote access to government services for those who have them, the already marginalised are least likely to obtain digital IDs and therefore risk falling further behind. The report concludes that, 'the public sector is inadvertently creating new digital divides by advancing e-government services at the expense of those who cannot take advantage of them' (38). Use of technology in this way amplifies existing divides, adding a new digital dimension to poverty.

The case of Aadhaar – India's pioneering digital identity system – throws some light onto the risks associated with such programmes. Aadhaar was launched in India in an effort to formalise the unorganised sector: informal employment, characterised by poverty, constitutes over 80% of total employment in India (ILO, 2013). In addition to challenges around data privacy, information leaks and data storage, there are increasing concerns over Aadhaar exacerbating inequalities between the poor and the rich. Although Aadhaar is a voluntary system, over a billion Indian residents are already enrolled. The costs of opting out at such high rates of penetration have made the scheme increasingly mandatory in practice, with increasing dependence on Aadhaar for benefits, pensions and subsidies (Dixon, 2017). While it was designed to allow previously undocumented citizens to participate in the formal economy by accepting 18 proof of identity documents, over 99.9% of all Aadhaar numbers were issued to people who already had at least two forms of identification, which has led to further exclusion of the poorest of the poor from accessing government services. Misra (2019) argues that the government's decision to put in place mandatory linking of Aadhaar to benefits under 252 welfare schemes in 2017, including for receiving private services such as a telephone connection or opening a bank account, has made the poor worse off. First, people are often unaware of how to link the Aadhaar number to the subsidy scheme, and the processes can take up to several months, during which no benefits can be claimed. Second, authentication failures have meant that the poor have not been able to gain access to the subsidies they are entitled to. The Unique Identification Authority of India (UIDAI) has officially said that Aadhaar authentication failure rates are at 12% for government services (Sachdev, 2018). This is quite a jump from the 0.04% statistic given in 2012. At a national level, the failure rate for iris scan authentication is at 8.54%; that for fingerprint scans is 6%. At the level of individual states in India, UIDAI was unable to provide data on authentication failure rates.

2.4. Enabling environment for poverty reduction through DEET

While digital technologies present new opportunities for poverty reduction through the three channels above, their potential to disrupt poverty will further depend on policy, regulatory frameworks and institutions to manage the digital change in a sustainable and inclusive manner, including those on digital capabilities, managing inclusive digital change and fostering competitiveness (Banga and te Velde, 2018). Table 1 presents the main policy issues that can affect poverty reduction in a digital economy, with subsequent sections discussing the poverty-reducing implications of these three sets of policies.

Table 1. Enabling environment: main pathways of impact

	Production	Consumption	Government services and other context
Building digital capabilities			
Digital access, connectivity and adoption	x	x	X
Legal and regulatory framework for data and boosting e-commerce	x	x	X
Managing inclusive digital change			
Taxation and competition policies	x	x	
Social protection	x	x	
Skills development	x	x	X
Political economy of digital change			x
Fostering competitiveness			
Ease of doing business	x		
Climate change			x
Trade openness, transport, logistics	x	x	

2.4.1. Building digital capabilities

Digital access, connectivity and adoption

Policies to close the digital divide can strengthen the poverty-reducing potential of DEET under all three channels of production, consumption and service delivery. On the production side, sector-level digitalisation policies need to target less-digitalised labour-intensive industries in a way that boosts productivity in these sectors and maximises employment gains. For instance, a key challenge for participation of MSMEs in the garments sector in Kenya is the lack of technology to carry out routine tasks such as cutting; limited local capacity and skills to perform higher value-added work; and an uneven playing field that supports the growth of large players while simultaneously disadvantaging MSME participation in garment manufacturing (Krishnan et al., 2019). Even in the agricultural sector, while smart agriculture and smart fisheries technologies are being used to boost green and blue economies, this remains concentrated among large-scale farmers who can make the required capital investment in high-end technologies (Commonwealth Secretariat, 2019). MSMEs tend to lack capital to adopt digital technologies, alongside a

lack of human capital and know-how and broadband connectivity, requiring targeted policies on digital infrastructure that expands digital access to these firms, in addition to facilitating domestic integration of the less-digitalised less productive firms with the 'superstar' digitalised global firms in the economy to realise the full job-creating potential of digital technologies.

On the consumption and service delivery side, it is important that policies on digital adoption and connectivity expand ICT access and affordability to marginalised sections of society, to ensure that digitalisation does not exacerbate existing social and economic inequalities or create new ones. Digital divides exist along dimensions of ethnicity, gender, education level, caste, disability and age (May, 2012; Goggin, 2017). For instance, average internet penetration in sub-Saharan Africa is just 25%– half the global average (ITU, 2018), whereas Africa's share in robots sold is just 0.02% – 15 times lower that its share in GDP (Banga and te Velde, 2018). Internet use is already biased towards males in developing countries such as Botswana, Cameroon, Malawi, Nigeria and Zambia, indicating that women are being further marginalised in the digital age (Commonwealth Secretariat, 2019). Women are also less likely to access financial services, particularly via mobile technology (Hunt and Samman, 2016).

Efforts to make internet more affordable could include free or subsidised access to public/open areas such as educational institutions and local and community centres, public Wi-Fi, etc.; closing of the digital urban–rural divide through a reduction in taxes on ICT services and equipment to rural areas; providing incentives to network operators to expand coverage to marginal areas; and a reduction in import duties of local content suppliers. One country that has significantly improved its internet affordability is Botswana through rules enabling technology and service neutrality, without restricting operators from holding several types of licenses such as network licence, services license etc (A4AI, 2017).

Legal and regulatory framework on data

Development of a legal, comprehensive and enforceable regulatory framework covering issues on data flows, data localisation, privacy, cyber-security, consumer protection and e-commerce can strengthen the poverty-reducing potential of DEET under all three channels of production, consumption and service delivery. While laws on online dispute resolution, e-transactions, consumer protection, privacy and cyber-crime can increase digital trust of consumers and boost use of e-commerce and e-governance services, laws on data localisation form a contentious issue, particularly on the production side. For foreign digital firms, the freedom to freely locate data allows them to build a global network of data by cheaply and quickly expanding into new markets and economies of scale (Meltzer, 2015). Placing requirements on data localisation may increase sunk costs, with only the more productive firms able to bear the additional costs. It has been estimated that economy-wide data localisation requirements could lead to GDP losses of 0.8% in Brazil, 1.1% in the EU, 0.8% in India, 0.7% in Indonesia and 1.1% in Korea. The impact on domestic investments is also sizeable in Brazil (-4.2%), China (1.8%), India (-1.4%), Indonesia (-2.3%) and Vietnam (-3.1%) (ECIPE, 2014). Moreover, the impact of data localisation varies across sectors, depending on the intensity of data use. As a result, sectors of communication, financial and other data-intensive sectors are more adversely affected, potentially leading to a change in the production structure of the economy, back towards agriculture, leading to a reverse in structural transformation (Bauer et al., 2016).

However, some authors argue for shifting the focus of development dimension of data localisation from GDP losses to implications for 'catch-up' of developing countries. Azmeh and Foster (2016), for instance, argue that absence of localisation requirements can slow-down convergence across developed and developing countries. Banga and Velde (2018) show that while manufacturing continues to exhibit 'unconditional convergence' (Rodrik, 2013), convergence slowed in sub-Saharan Africa in 2002–2013 as compared with 1991–2002. One plausible reason is the rise in digitalisation in the recent years; production in the digital economy is more likely to be based on a 'data thread' connecting different stages of production, suggesting production is likely to be more concentrated in developed economies with advanced capital centres, skilled labour and research and development (R&D) facilities. Castro and McQuinn (2015)

further hold that data localisation policies in developing countries will lead to developed countries setting up data centres locally, which can bring in foreign investment, skill development, improvements in tech capacity of countries through clustering and development of a national internet industry that could encourage catching up. Overall, many developing countries do not have policies regarding the control and use of their data, which increases the risks of data being controlled by whoever gathers and stores it. To leverage economic gains from data, it is therefore important for developing countries to develop national data policies addressing issues on data ownership, collection, and conditions of transfer.

2.4.2. Managing inclusive digital change

Taxation and competition policies

Policies on taxation and competition primarily affect poverty reduction through the production and the consumption channels. As discussed above, digital giants are increasingly exploiting their control of critical data infrastructure to maximise long-term gains. On the production side, traditional competition and taxation policies can lead to an increase in market concentration of digital giants and e-commerce monopolies, which can further focus financial power in the hands of a few leading firms in high-income countries and cause increased rent seeking, anti-competitive practices and attempts to block actual or potential competitors. Traditional competition policies are based on the short-term interests of consumers and view low consumer pricing as indicative of the existence of competition. However, competition in the digital age can no longer be measured primarily through pricing and output since this runs the risk of ignoring the adverse effects of 'predatory pricing' (Khan, 2017). On the consumption side therefore, lack of appropriate competition and taxation policies can lock-in consumers in the long-run, leading to a rise in consumer prices.

It is therefore important for countries to update and broaden taxation and competition policies to consider, for instance, consumer privacy, personal data protection, consumer choice, market structure, switching costs and lock-in effects (UNCTAD, 2019). The United Nations Conference on Trade and Development (UNCTAD) (2018) therefore calls for tighter regulation of restricted business practices: break-up of large firms responsible for market concentration; regulating digital platforms as a public utility with direct public provision of the digitised service; and strong monitoring and administration at the international level are some of the options to regulate super-platforms. Taxing these firms where their activities are based rather than where they declare their headquarters will help in redistributing their rents and increase government revenues. Data show that only 11 per cent of countries globally apply digital services and content taxes (ITU, 2018). In addition to this, it is important to support domestic e-commerce players and help local suppliers to link into domestic and regional platforms in low and middle-income economies. Banga and te Velde (2018) note that third-party platforms such as Amazon not only charge a hefty commission fee (which goes upto 40% on some products such as electronics) but also push their own products 75% of the times.

Extending social protection

As discussed under the production channel, digital technologies will create some jobs and destroy some, depending on the type of task being performed. Workers in middle-skilled occupations, performing routine non-cognitive work (e.g. machine operators), are more at risk from automation, compared to those performing high-skilled tasks or low-skilled non-routine tasks. To ensure that digitalisation doesn't exacerbate existing economic inequalities, it is important for countries to extend protection policies to cover digitally excluded workers, workers performing routine non-cognitive tasks and workers whose jobs have be de-skilled. For instance, the introduction of navigation and GPS systems and platforms such as Uber has lowered the barriers to entry into driving, allowing less-skilled workers to enter the occupation. In countries without a strong labour union in the taxi industry, this can result in falling wages for those in the taxi industry. But in countries such as Indonesia, the strong presence of a labour union has prevented taxi wages

from dropping, even with Uber. A large number of app-based rides in such countries can instead create secondary industries or help in shifting informal workers to the formal sector. Low- and middle-income countries need to promote freedom of association and the right to form unions that can function freely, through workers' collective bargaining power.

The gig economy- in which digital technologies connect consumers and workers- is also growing rapidly, particularly on-demand platform work such as domestic work, care services, beauty services etc, of which women form majority share of the workforce. Rising precarity of work on these platforms has led to digital labour being treated as a commodity. Thus, there is an urgent need to put in place labour regulations and social protection policies targeting digital labour, keeping in mind both efficiencies and distributional aspects (ILO, 2018). In some cases, dynamic labour markets, through deregulation, can benefit some workers, but others may face greater insecurity of employment and income. There is consensus that social protection of digital labour needs to be strengthened, along with increasing bargaining power through the formation of trade and labour unions. Policies on social insurance schemes are also useful. The decline in the traditional employment relationship and the emergence of work arrangements that do not permit the identification of an employer and employee pose a clear challenge to the allocation of social protection-related rights and responsibilities (Hunt et al., 2019). A shift from an employee to an independent contractor status generally implies a corrosion of the social protection rights and benefits for the worker. Similarly, the question of who is the employer, in the platform–provider–purchaser relationship, and the classification of platforms as brokers, poses a challenge (Harris and Krueger, 2015).

Overall, appropriate social protection policies in the digital age can boost worker productivity and labour market participation, and on the consumption side, it can lift credit constraints, encourage investments, and provide greater security. It is key to note that the relationship between digitalisation and social protection is dynamic; while social protection policies can help to manage the digital change in a more inclusive manner, digital transactions and mobile money play a crucial role in facilitating cash-less transactions and expansion of government-to-person protection transfers.

Targeted skills development

Skills development can facilitate poverty reduction through all three channels. On the production side, skills-development can contribute towards poverty-reduction by boosting productivity gains from digitalisation. For Commonwealth countries, it is found that a 1% increase in skills, measured using a human capital index, can increase the impact of internet penetration on manufacturing labour productivity by roughly 7.4%, on average (Commonwealth Secretariat- ODI, 2020). Similarly, Banga and te Velde (2018) find that skills-development can significantly increase the impact of internet penetration on manufacturing labour productivity, more so in low-income countries than middle-income countries. In the digital age, targeted skills-development is crucial; digital technologies and automation tend to replace labour performing routine tasks, which can be both cognitive tasks such as book-keeping and clerical (Marcolin et al., 2016) and non-cognitive tasks such as operating machinery and assembly. It is mainly the middle-skilled occupations (clerks, crafts and related workers, plant and machine operators) that are intensive in such routine tasks. In contrast, high-skilled occupations (legislators, technicians and professionals) are intensive in non-routine cognitive tasks, whereas low-skilled occupations (sales and services workers) are intensive in non-routine manual tasks. On an average, the demand for workers in high-skilled, non-routine jobs has increased in advanced economies, accompanied by some increase in the demand for workers in low-skilled, non-routine jobs such as caring and personal services; middle-skilled jobs have declined. In these countries, a decrease in middle-skilled jobs has led these workers towards less-skilled jobs, which has consequently increased competition and lowered wages.

On the consumption and service delivery side as well, lack of digital skills forms a key obstacle in the uptake of digitalisation. For instance, while more than 70% of the population in the UK and Australia use

the internet for purchasing goods and services, less than 12 per cent of population in Bangladesh, Botswana and Jamaica and do so (Commonwealth Secretariat-ODI, 2020). Similarly, over 50% of the population in the UK is using the internet to interact with government organisations but only 2% is doing so in Zimbabwe and Bangladesh (ibid).

Banga and te Velde (2019) highlight the importance of three types of skills for being competitive in the digital age (i) basic to intermediate job-neutral digital skills such as accessing the internet, digital advertising and data analysis; (ii) job-specific digital skills such as computer programming and web-app development; and (iii) soft skills such as communication, management and critical thinking. A well-functioning national innovation system is important for effectively building these skills in the economy through boosting the supply of technology and skills (through formal education, technical and vocational education and training, non-formal education and private on-the-job training); demand for technology and skills (through fostering innovation, R&D subsidies and incentives for firms to acquire tech.); and intermediaries to link the supply and demand, including industry associations, technology hubs and digital platforms.

Managing the political economy of DEET

Historical evidence suggests that social and technical change go hand in hand; a more progressive society with effective state–business relations and cohesive civil society is more likely to accept change and make it work. DEET for poverty reduction can be facilitated by putting in place policies that target increasing flexibility of institutions, ability to work effectively as an ecosystem and clear division of responsibilities. Within the domestic economy, better and targeted dialogue is needed among the government, private sector players and educational institutions, to make it possible to understand the challenges facing industrialisation and to find innovative solutions to address these. Important lessons in improving regulatory practices can be drawn from Rwanda; since 2006, government efforts have been directed towards privatisation of state-owned enterprises to reduce government's non-controlling share in private firms and to attract foreign direct investment, particularly in ICT services.[4] In 2016, the Rwandan government adopted the ICT Act, which applies to all electronic communications, the information society, broadcasting and the postal sector. It aims to create a comprehensive legal framework for regulating ICT activities, with a regulatory ICT authority responsible for implementing the country's international obligations in ICT as well as promoting fair competition in the sector.

At the international level, negotiations are currently exploring reduction or removal of tariffs on digital products. In the case of Africa, the United Nations Economic Commission for Africa (UNECA) et al. (2019) holds that African governments do not face a lack of information/knowledge on data protection issues but rather other hurdles. The absence of a regulator, even in countries with data protection laws, points to insufficient resources as one of the causes of the sub-optimal regulatory landscape (ibid.). A particular challenge in cross-border e-commerce is the absence of references to the international aspects of e-commerce, such as choice of law, in the majority of e-transactions laws. To address this, the EAC, for instance, has developed an Electronic Transaction Bill (2014) to promote electronic transactions. In addition to this, EAC states have adopted e-transactions policy recommendations to be domesticated by EAC countries through the development of regulatory frameworks (ITC, 2015). Only 14 out of 55 AU member states to date have signed and ratified the African Union cyber-security and personal data protection convention (SAIIA, 2020), owing partly to limited awareness among policy-makers and legislators in member states; lack of broad consultation of key stakeholder to drive legislative change; and poor capacity in terms of expert personnel for the development of national cyber-security governance frameworks (Orji, 2018).

[4] US Department of State 2017 Investment Climate Statements

2.4.3. Fostering competitiveness

Improving ease of doing business

Policies to improve the ease of doing business continue to be important for fostering competitiveness of firms in the digital age and facilitating poverty-reduction through the production side. This includes policies on reducing the cost of financing digital technologies; improving access to credit; securing a reliable power supply through better governance and investment in renewable energy; and improving trade logistics, postal competence and transport infrastructure. Digital technologies can address some of these challenges. Lowering the cost of electricity and increasing the reliability of the power supply can, for example, be achieved through digitalising energy services. Across the world, utility firms are investing in smart meters that can (i) collect accurate and timely data on electricity usage and electrical outages and monitor electricity bills; (ii) integrate data across territories, which can improve productivity; (iii) forecast demand and keep track of consumer usage patterns, preventing outages and managing peak demand; and (iv) optimise unit pricing of electricity. Kenya Power has already made some effort for commercial users: 6,000 smart meters have been installed at the premises of large power consumers. Deployment of smart meters is a key point of convergence for utilities and telecom providers, such as Liquid Telecom in Kenya, which can offer good networking capability for installation and effective use of such mechanisms.

Similarly, digitalisation of customs; electronic tracking and communication systems in industrial trucks; digital inventory and stock-taking; digital excise stamps, etc. can reduce non-tariff barriers to trade and strengthen regional trade. Recently, the Government of Rwanda announced plans to fully automate the clearance of exports and imports in an effort to boost revenue, reduce international trade costs through reductions in time taken to clear cargo and increase the flow of taxable goods (The East African, 2018).

Managing climate change in the digital economy

Deployment of digital technologies across sectors can have important implications for the environment; for instance, the rapid expansion of output in the apparel industry can have important implications for carbon emissions, which already account for 10% of global emissions (World Bank, 2019). On the other hand, digitalised material processing technologies can contribute to reducing waste in garment production and thus enhance resource efficiency. An interesting case in point is the treatment of fashion jeans (‘vintage look’), which normally creates an exceedingly high ecological footprint. By relying on advanced digital laser technology, the Spanish company Jeanologia has designed an automated process that does not rely on toxic chemicals and reduces water consumption (Altenberg et al., 2016). Similarly, Big Data, combined with automation in production, technology innovation and recycling technologies, have the potential to make manufacturing more precise, reducing wastage. Potential benefits include higher speed, faster delivery times and lower costs. Potential re-shoring and localisation of production nearer to consumers can also reduce the carbon footprint of the apparel industry. However, using technologies to make the garments supply chain more sustainable will require extensive financial investment and collaboration across stakeholders.

Policies for leveraging digital technologies to manage climate change are becoming increasingly important. Currently, carbon emissions from the digital ecosystem are significant, with global data centres accounting for 2% of global emissions.[5]

Trade openness and trade facilitation

There is a large literature documenting a positive impact of trade on economic growth through learning by exporting to international markets and learning by importing better quality intermediate inputs. As per the 2020 World Development Report (World Bank, 2020c), 50% of global trade today takes place in global

[5] https://www.greenpeace.org/archive-international/en/news/features/New-Greenpeace-report-digs-up-the-dirt-on-Internet-data-centres/

value chains, which can, in particular, offer sustainable and inclusive growth, create better jobs and reduce poverty, under the correct conditions and reforms. A 1% increase in global value chain participation is estimated to boost per capita income levels by more than 1% – about twice as much as conventional trade (ibid.).

There is a need to address formal and informal barriers facing low- and middle-income countries in trading, including poorer trade logistics and transport infrastructure. Digitalisation can help here. For instance, as we have seen, the Government of Rwanda plans to fully automate the clearance of exports and imports. It is also important to note that, while goods can be ordered using e-platforms, they still need to be delivered using traditional systems (as long as drones are not mainstream), highlighting the need to also develop and strengthen postal competence and reliability to increase market access. Poor postal and logistical competence is likely to restrict e-commerce growth in low- and middle-income economies.

3. DEET AND POVERTY REDUCTION: KENYA CASE STUDY

3.1. Economic transformation and poverty reduction in Kenya

Since 2006/07, agricultural value-added as a share in GDP has been on an increasing trend in Kenya, rising from 20.5% to 34% in 2018 (Figure 2). Services account for 43% of GDP and are the biggest driver of GDP growth in Kenya, with labour productivity steadily increasing in the transport, storage and communications sectors in Kenya (Figure 3). Growth in the manufacturing sector, a key pillar in the government's Big 4 agenda and in jobs creation, remains positive; under the Big 4 agenda, the share of manufacturing to GDP is expected to increase from about 9.6% to 15% in 2022 (KAM, 2018) but has declined in the recent years. Agriculture continues to be the largest employer in Kenya, employing 57.8% of the workforce.

The poorest inhabitants by income in Kenya live in rural areas, where poverty rates are higher (40%, compared with 28–29% in peri- or core urban areas) and per capita expenditures are lower. Even so, across rural and urban areas, the share of near poor is consistent (Diwakar and Shepherd, 2019). Even though per capita incomes may have been increasing in absolute terms, inequality remains high in Kenya, with a Gini coefficient of 39.1 in 2015/16 according to analysis of the Kenya Integrated Household Budget Survey (KIHBS), and with high regional variations. The majority of the Kenya poor remains engaged in the agriculture sector to meet subsistence needs. Additionally, the agriculture sector, which employs the majority of the income poor, has not grown at a pace adequate to meet the needs of job-seekers. Most jobs created are in low-productivity services, primarily in the informal economy (World Bank, 2016).

Figure 2. Sectoral value-added in Kenya

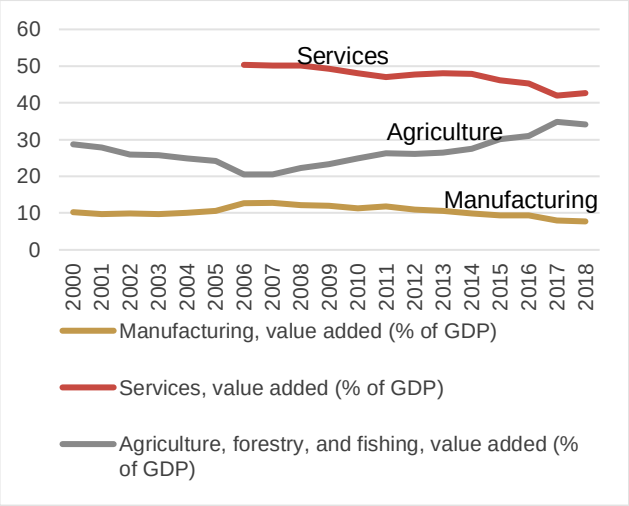
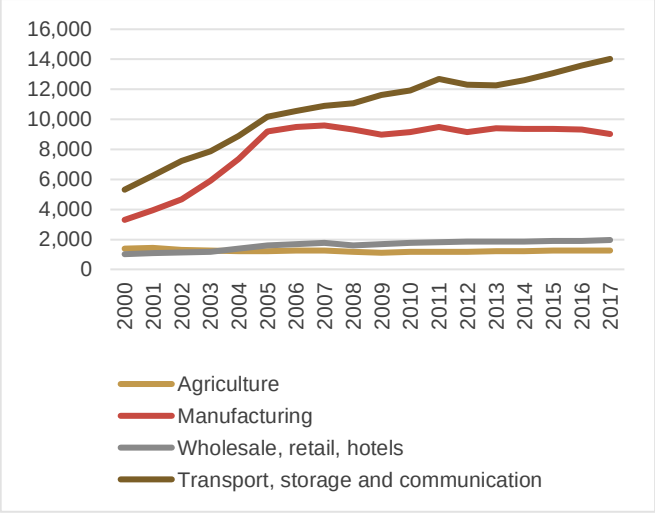


Figure 3. Sectoral labour productivity in Kenya

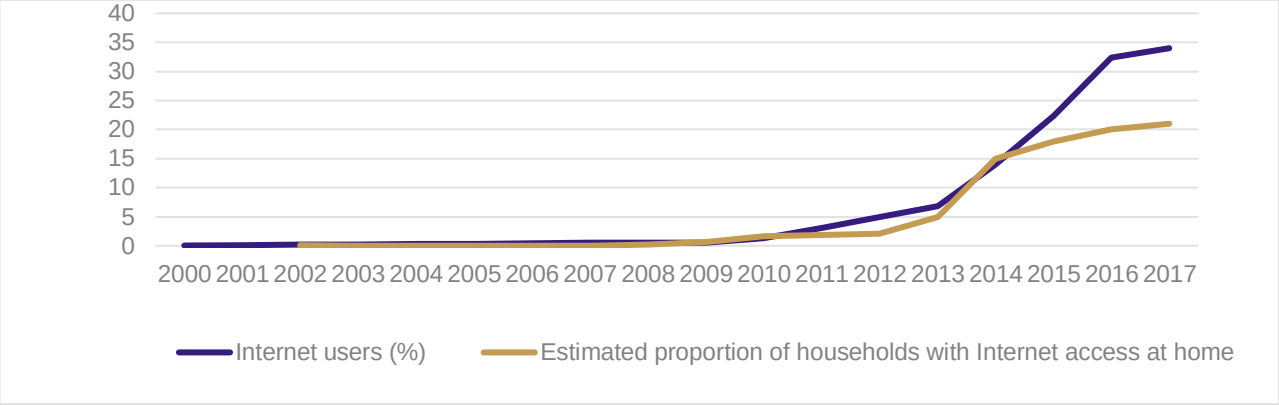


Source: WDI, SET dataset combining ILO/UN data

Notes: Labour productivity is calculated as (output (in constant 2010 US dollars)/employment))

In terms of internet penetration, the percentage of population with access to internet has almost doubled every five years since 2007, and the estimated proportion of households with access to the internet has also witnessed a steep increase, particularly since 2009 (Figure 4).

Figure 4. Internet penetration in Kenya (% of population)



Notes: Internet users are individuals who have used the Internet (from any location) in the past three months. The internet can be used via a computer, mobile phone, personal digital assistant, games machine, digital TV, etc. Internet access is defined as the percentage of households that reported that they had access to the internet. In almost all cases, this access is via a personal computer either using a dial-up, ADSL or cable broadband access. This indicator is measured in percentage of all households.

Source: WDI

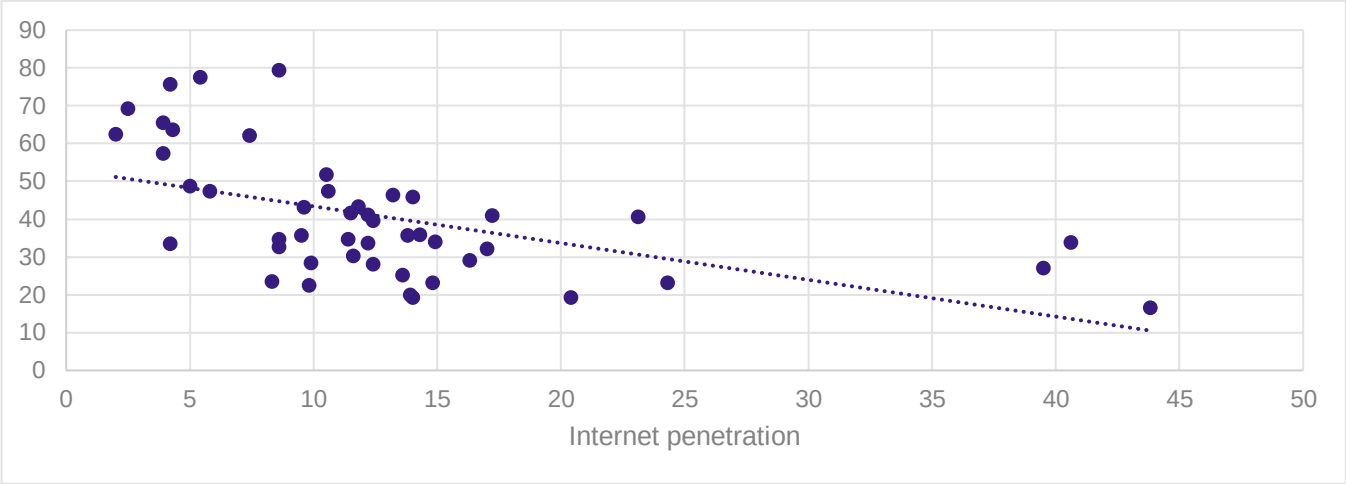
Kenya has emerged as a leader of digitalisation in sub-Saharan Africa, owing to continued and combined efforts by both the public and the private sector. Table 2 compares Kenya with other selected East African countries on a range of ICT indicators. It is observes that Kenya ranks ahead of countries across most indicators; 33% of households in Kenya have access to the internet, with 85% of the population being covered by at least a 3G mobile network. It also scores significantly better than other East African countries in terms of international bandwidth. Within Kenya, there appears to be an inverse relationship between digitalisation and poverty headcount (see Figure 5); Kenyan counties with higher internet penetration tend to have a lower poverty headcount.

Table 2. Digital readiness of Kenya and comparator countries

	Estimated proportion of households with internet access at home	Percentage of the population covered by at least a 3G mobile network	International Internet bandwidth; in Mbit/s	Active mobile-broadband subscriptions per 100 inhabitants	Fixed broadband subscriptions per 100 inhabitants	Internet users (%)
Kenya	33.65	85.00	916287.00	34.06	0.58	17.83
Ethiopia	17.98	66.00	40000.00	14.09	0.05	18.62
Uganda	10.77	65.00	75880.00	23.40	0.34	23.71
Rwanda	9.30	93.37	23080.00	35.01	0.18	21.77
Tanzania	14.40	85.00	12700.00	8.66	3.22	16.00

Source: ITU data. Note: Data are for 2017/18

Figure 5. Poverty headcount (%), vertical access, vs. internet penetration, across Kenyan counties



Source: Kenyan counties data using the 2015/16 KIHBS.

In the next section, we apply the framework presented in Figure 1 to the case of Kenya and understand how digital transformation is affecting poverty reduction in the country through the different channels, and the associated opportunities and challenges.

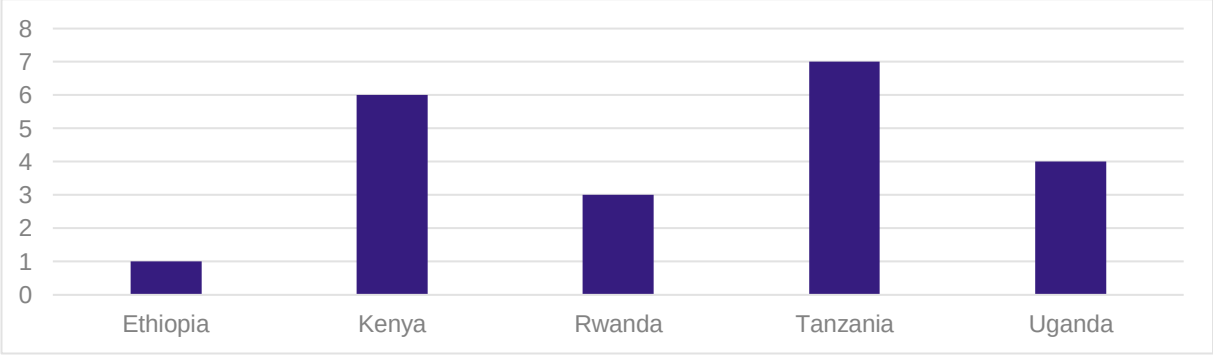
3.2. DEET and production structure in Kenya

3.2.1. Digital-led agricultural growth and poverty-reduction in Kenya

The Kenyan economy is reliant on agriculture, and smallholder farmers undertake a large proportion of agricultural activities. Smallholder production, generally on plots of less than 2 hectares, is characterised by low yields, low quality, poor market linkages and little access to finance. The majority of smallholder farm households live below the poverty line. The proliferation of new technologies in Kenya could boost the productivity of the sector, which currently accounts for around 26% of GDP directly and another 27% indirectly though linkages with other sectors.

World Bank's Ease Doing Business in Agriculture (EAB) (2019) scores countries on good practices across a number of indicators in agriculture, such as registering fertilisers, supply plants seed, ICT, transport, protecting plant health, accessing finance, etc. Kenya's overall score is 64.80, which is above the average for sub-Saharan Africa and the average of lower-middle-income countries. Its count of good ICT practices is 6 – 2 points above both the regional and income group averages (see Figure 6).

Figure 6. ICT score of the agriculture sector in East African countries (2019)



Source: World Bank EAB 2019

With growing use of digital technologies – such as cloud computing and open-source software – barriers to entry into farming technologies have reduced, enabling a number of Kenyan entrepreneurs to develop yield-improving solutions at affordable cost models. For example, ULima is an all-in-one app for pre- to postharvest farming, providing tailored and step-by-step assistance to farmers. With increased climate variability, farmers can now use Agrobase for information on the optimum pest management strategy. A number of urban farming apps have also helped maximise crop yield and soil quality. Expert information on good farming practices and livestock-rearing can now be simply accessed through SMS alerts from ICow. Some of the most critical detail on a herd is identification of reproductive problems, now made possible through the Breeding Wheel app. There are also popular downstream apps such as MFarm, which connects farmers with local buyers and provides a real-time virtual marketplace. Rapid diffusion of digital financial services is increasingly being used for input supply financing and output payment, thus enhancing market linkages and subsequently the livelihoods of smallholder farmers.

Some examples of how digital technologies are contributing to poverty reduction in Kenya through various channels are given below:

- Sending SMS messages with agricultural advice to smallholder sugar cane farmers in Kenya has increased yields by 11.5% (PAD, 2019).
- Twiga Foods is a platform that connects fresh fruit farmers with roadside vendors in urban and peri-urban areas (Twiga, n.d.). The platform sources fresh fruits and vegetables (FFV) from rural farmers and delivers these to urban and peri-urban vendors who have registered on the platform. This has helped reduce the number of intermediaries between rural farmers and vendors on the FFV value chain; reduced transaction costs incurred by both farmers and vendors in coordinating sales; and ensured that quality FFV are able to reach the final consumers in good time (GSMA, 2018). By on-boarding farmers and vendors on its platform, Twiga is transforming interactions between farmers and vendors by improving trust and transiency in FFV value chains in Kenya.
- iProcure is the largest agricultural supply chain platform in rural Africa (iProcure, n.d.). In addition to complete procurement and last-mile distribution services, the Kenyan company provides business intelligence and data-driven stock management across the supply chains.
- AgroCare has developed a mobile app that provides tailored fertiliser recommendations to farmers using soil data collected using a portable scanner. This ensures farmers apply fertilisers more economically, focusing on problem areas, thereby reducing waste and increasing outputs (Price, 2018).
- Tulaa offers digital credit, which is integrated into a digital end-to-end market linkage model, connecting farmers to buyers, and digital loans from Apollo Agriculture. Together, these are bundled into a digital advisory product for farmers. Many of these players rely on digitally enabled credit-scoring algorithms to suss out farmer creditworthiness. Tulaa relies on commissions from farmer market linkages and related transactions (Tsan et al., 2019; Krishnan et al., 2020).
- The Eastern Africa Farmers Federation is running the e-Granary mobile platform to increase access to market information and e-extension services for farmers to mitigate the lack of access to conventional extension services in Kenya.

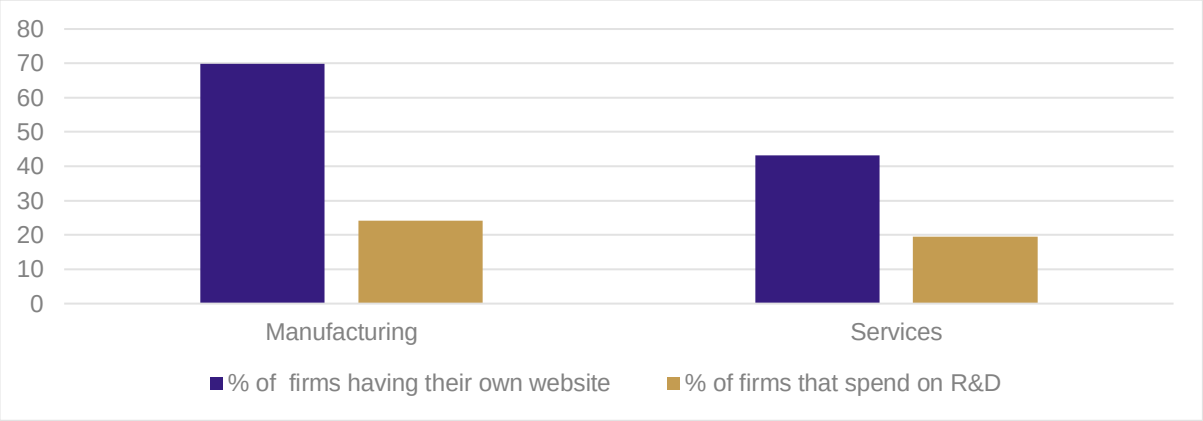
While digital agricultural technologies have demonstrated early signs of creating an impact, adoption still lags, with the reach of the leading platforms and technologies ranging from 1,000 farmers to over 600,000. This suggests reasonable uptake but also significant scope to expand (World Bank, 2019).

3.2.2. Digital-led manufacturing growth and poverty reduction in Kenya

Overall, the manufacturing sector is more digitally ready than the services sector in Kenya. Data from the World Bank Enterprise Survey (WBES) show that, while 70% of manufacturing firms in Kenya have their own website and roughly 25% conduct R&D, less than 50% of services firms have their own website and

less than 20% are spending on R&D (see Figure 7). Digital-led manufacturing growth, particularly in labour-intensive industries, can facilitate large-scale job creation. In Kenya, the textile–garments–leather sectors fare well in terms of using internet and email, but firms engaged in this sector are less likely to engage in online purchases, undertake R&D, use mobile money (MM) and have their own websites (Banga and te Velde, 2018). Comparatively, a higher proportion of firms in the machinery–electronics–transport sectors and the chemicals–plastics–rubber sectors use the internet, email clients, engage in e-commerce and online marketing, have a web presence, use MM and undertake R&D. Taking a deep dive into manufacturing sectors, Kenya Association of Manufacturers (KAM) (2018) confirms that there is limited access to technology/ICT among Kenyan manufacturing industries, particularly in the textiles and apparel industry, where the cost of financing manufacturing investments and trade financing is very high as compared with global rates. This highlights the need for competitive credit in the sector to facilitate investment, reinvestments and trade expansions.

Figure 7. Digital readiness of firms in Kenya, 2018



Source: WBES

However, some Kenyan garments firms that have installed digital technologies report impressive growth outcomes (prior to COVID-19). For instance, Banga and te Velde (2018) use the case of New Wide Garments in Kenya to highlight the productivity-enhancing potential of digital technologies in garments. Based in the Athi River Export Processing Zone, this is a garments subsidiary of the New Wide Group, a Taiwanese-owned textile and garments manufacturer, employing about 7,500 people. Over the past 10 years, the firm has been bringing in new machines and digital technologies in order to reduce the cost of production. New technologies have been installed for automated packing of garments. While stitching is mostly carried out by workers, some tasks – such as stitching pockets on shirts – are being done by CNC sewing machines. Overall, technology has not only lowered the average cost of production but also helped in meeting international standards. Net employment has not been negatively affected; workers replaced in some tasks are retrained and employed in other tasks and operations, but new product lines have also generated jobs. Another firm – Megh Industries – has invested heavily in modern technologies and moved from manufacturing of transport equipment and parts to full transport seating and van conversions, which is more sophisticated and value-added in nature.

MSMEs are a crucial component of the Kenyan economy. They constitute approximately 80% of Kenyan businesses and together employ close to 14.9 million (78% of the labour force). Approximately 7.4 million MSMEs in Kenya collectively contribute about a third of the country's GDP, and yet over 85% of them are unlicensed enterprises. Around 400,000 MSMEs fail annually, with almost 90% of start-ups operating for less than two years. To maximise the job-creating potential of digital technologies, it is becoming increasingly important to facilitate domestic integration of less digitalised less productive firms with the 'superstar' global firms within the economy (Rodrik, 2018).

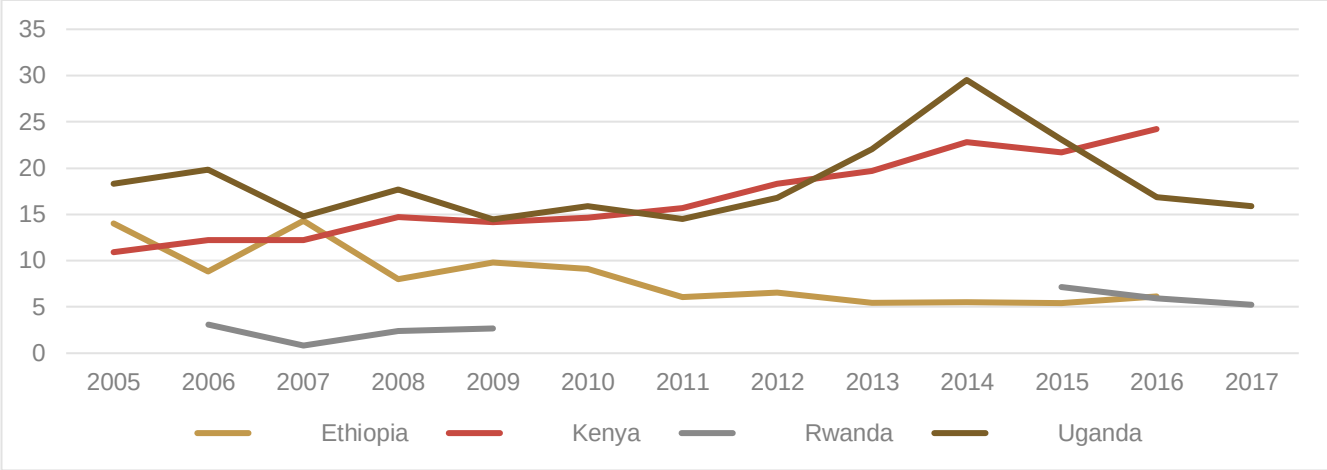
Specifically, the manufacturing sector needs to clearly articulate its needs to the domestic technology sector in Kenya so that companies can actively develop solutions for local challenges (Banga and te Velde, 2018). As per Were (2016), there is a lack of efficient collaboration between the two sectors as a result of a general lack of awareness in the manufacturing sector on how advanced the local technology scene is; a stubborn perception that local tech firms are not as sophisticated as foreign firms and cannot develop effective solutions to local problems in manufacturing; and limited awareness in the tech community regarding the types of problems facing Kenyan manufacturers.

Krishnan et al. (2019) review labour-intensive value chains and find that, in the case of leather, MSMEs participate mainly in low value-addition less complex tasks, requiring low- and semiskilled technical capabilities and low levels of mechanisation. Similarly, MSMEs in textile value chains perform only peripheral tasks, as they have either old or none of the machinery required for high value-added tasks. MSMEs have greater opportunities to grow in garment value chains, as they perform tasks such as design, and to some extent branding or market services, which increase the value capture of the product, and often subcontracting. However, a key challenge for participation of MSMEs in the garments sector is the lack of technology to carry out routine tasks such as cutting; limited local capacity and skills to perform higher value-added work; and an uneven playing field that supports the growth of large players while simultaneously disadvantaging MSME participation in garment manufacturing.

3.2.3. Digital services-led development and poverty-reduction in Kenya

As discussed previously, the recent literature highlights the role of ‘smoke-stack-less industries’ such as IT, tourism and business services in driving growth in African countries (Newfarmer et al., 2018). Technology can be the key to opening up non-manufacturing avenues of value-added, particularly in digitally deliverable services such as insurance and financial services; intellectual property charges; telecommunication, computer and information services; other business services; and audio-visual and related services. Figure 8 shows that the share of digitally deliverable exports in Kenya’s total services exports has steadily increased, from about 11% in 2005 to 24% in 2017, and the country fares better than other East African countries. Kenya is particularly a hub for global digital business process outsourcing (BPO), through government promotion schemes like Ajira. At present, 7,000 Kenyans work in BPO jobs, with an estimated 286,000 employed by digital services platforms in transport, logistics and e-commerce. Examining the role of services in economic transformation in Kenya, Khanna et al. (2016) conclude that Kenya has achieved considerable success in IT (particularly in areas associated with mobile telecommunications) as well as in business and professional services. A range of digital start-ups has risen in Kenya – particularly in software innovation (R&D and product development including apps). Moreover, e-commerce, including its hybrid variants, is growing rapidly as well, which brings into focus a segment that may be termed ‘connectivity enhancers’ (Mann et al., 2015). However, Banga (2020) shows that, while 80% of IT companies surveyed have a website, this falls to less than 50% in most other services subsectors. Across subsectors, the share of exporters is also less than 30% (ibid).

Figure 8. Share of digitally deliverable exports in total services exports (%)



Notes: Digitally deliverable export services are identified as insurance and financial services; intellectual property charges; telecommunications, computer and information services; other business services and audio-visual and related services, following UNCTAD's (2019) classification.

Source: UN and World Bank data

New forms of employment opportunities are also arising from growth of digital platforms in Kenya. Over the past decade, IT-enabled services exports have undergone a transformation from classical BPO towards individualised online platform work (Lehdonvirta et al., 2019). Growing services liberalisation, combined with IT, can allow online 'gig' work to emerge as a new export-led development strategy (Baldwin, 2016). Melia (2020) holds that a minimum of 25,000, mostly tertiary-educated, lower-middle class Nairobians now earn on average KES 30,000 (approximately $300) per month conducting some form of online labour. Roughly half of all online workers in Kenya are ghostwriters, with transcriptions forming the next largest subsector for online work. However, as with tasks being increasingly automated, many Kenyan transcribers may soon need to find a different task.

3.3. DEET and consumption in Kenya

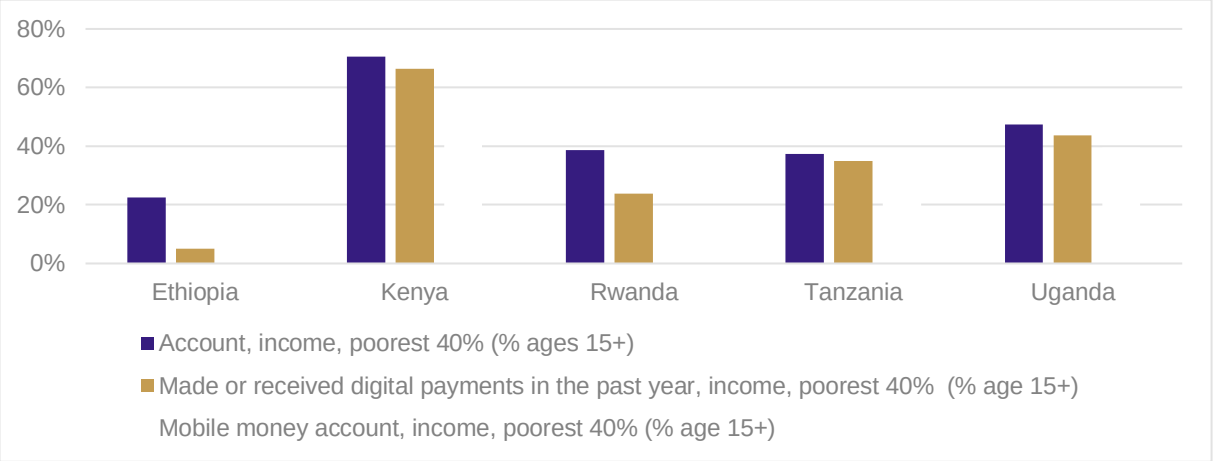
3.3.1. Reduction in consumer prices in Kenya

Evidence from Kenya (Ellis et al., 2010) shows that increased access to formal sources of finance can help poor households invest in activities that are more likely to contribute to increased incomes and poverty reduction. Delivering financial services through technological innovations, including via mobile money, can be a catalyst for the provision and use of a diverse set of other financial services – including credit, insurance, savings and financial education. A study based on a survey of households across Kenya, for instance, finds that M-Pesa lifted 2% of households out of extreme poverty (Suri and Jack, 2016), by providing a convenient platform for sending and receiving money and short-term credit. Overall, Kenya ranks ahead of other East African countries in terms of access of the poorest 40% to banks, MM and digital payments (Figure 9).

A good example of digital technologies affecting consumption is the One Acre Fund, operating in East Africa. This has created a loan product that fits the needs of these farmers by procuring high-quality farm inputs (including improved seeds and fertiliser), ensuring timely and convenient distribution of those inputs, training smallholder farmers on the inputs to maximise returns on their investment and assisting in market facilitation to maximise profits. Since 2014, One Acre Fund has enabled farmers in Kenya to make loan repayments digitally using M-Pesa instead of cash. The loan product offers farmers flexible repayments with no repayment schedule on the M-Pesa platform; borrowers can pay as little or as much as they want at any time and can complete repayment by the final deadline. This flexibility allows farmers to closely match repayments to cash flow and reduce pressure on household finances. The results from One Acre Fund show that a combination of farm inputs (including improved seeds and fertilizer) and convenient and

timely delivery has enhanced productivity, increased income per acre by 50% and generated a dollar impact of roughly $135 per farmer (Ndung'u, 2018).

Figure 9. Access to finance for the poor in East Africa, 2015/16



Source: WITS e-commerce indicators

3.3.2. Inclusion of vulnerable groups in Kenya

The value of MM transfers in Kenya increased by 9.5% from KES 3,638 billion in 2017 to KES 3,984 billion, or 44.7% of annual GDP in 2018 (World Bank, 2019). A study in Kenya established that digital finance supports efforts to reduce poverty and manage risks in low-income households. Significantly low-income households and vulnerable groups have created their own social networks that have enabled them to diversify risk within their social pools, and thereby also enhanced their resilience to unexpected negative shocks (Suri, 2015). MM appears to increase the number of active participants and effective size of risk-sharing networks, without increasing information, monitoring and commitment costs. Another study has correlated improved access to mobile phones with living standards, which in turn is one of the dimensions of poverty (OPHI, 2016).

The World Bank (2014) observes that digital payments can promote women's economic empowerment by facilitating greater account ownership and asset accumulation and increasing women's economic participation. Digital payment, including by governments and employers, facilitates the confidentiality and convenience that women require in financial services and payments. They provide an on-ramp to financial inclusion and, in many cases, the first account that a woman has in her own name and under her own control.

MM has helped about 185,000 women in Kenya move from farming to business (Suri and Jack, 2016). In areas with a high density of agent outlets, 3% of women in both female- and male-headed households have taken up business or retail occupations over farming (ibid). Examining gender-disaggregated data on digitalisation of finance, Table 3 finds that Kenya is doing significantly better than the other East African countries considered in terms of women's access to finance but a gender divide persists: 20% of women over the age of 15 use the internet in Kenya to pay bills or buy something online, 75% women make or receive digital payments, compared with below 50% in other East African countries, and 69% women have an MM account in Kenya, compared with below 45% in comparator countries.

Table 3. Digitalisation of finance in Kenya, by gender, 2016/17

	Used internet to pay bills or buy something online, male (% age 15+)	Used internet to pay bills or buy something online, female (% age 15+)	Made or received digital payments in past year, male (% age 15+)	Made or received digital payments in past year, female (% age 15+)	Mobile money account, male (% age 15+)	Mobile money account, female (% age 15+)
Ethiopia	1%	0%	16%	8%	1%	0%
Kenya	33%	20%	84%	75%	77%	69%
Rwanda	6%	3%	45%	33%	37%	26%
Tanzania	15%	8%	48%	38%	44%	33%
Uganda	13%	6%	62%	48%	59%	43%

Source: WITS e-trade indicators

3.4. GovTech and service delivery in Kenya

E-governance has also played an important role in building digital trust in Kenya. In 2007, the Kenyan government embarked on a connectivity and e-services delivery project supported by the World Bank under the Kenya Transparency Communications and Infrastructure Project. The goal was to boost ICT connectivity in Kenya, improve service delivery to citizens, increase the type and quality of information and enhance the government's ability to ensure transparency and support anti-corruption efforts. The targeted areas include support to pension administration, drivers' licence registration, land information and registration systems, a high court registrar, public servants' wealth declaration, company registration and improvements in e-procurement. To make the government a leader in ICT applications, e-applications and e-content development, as well as aggressive promotion of the use of the internet in learning, social and government institutions in all levels of service delivery, has been initiated.

Table 4 shows Kenya's E-Government Development Index (EGDI) ranking, which assesses progress on e-government based on three components: online service provision, telecommunication infrastructure and human capital. It is observed that Kenya's EGDI improved between 2008 and 2018, with increases in components of online service telecommunication infrastructure. Kenya's flagship government-to-citizen (G2C) platform is the e-Citizen (https://www.e-Citizen.go.ke/). This portal provides services including business name search and registration, notice of marriage, registration of marriage, driving licences, land searches and clearances and passport and visa applications. The system allows citizens to sign up and apply for government services and pay conveniently using MM, credit cards, debit cards and online banking. The system also allows foreign residents to apply for services. Users receive an email and SMS notification every time their application has progressed. In addition to e-Citizen, Kenya has adopted a one-stop-shop model for various government services (or Huduma Centre) (Republic of Kenya, 2019).

Table 4. E-Government Development Index, Kenya, 2008–2018

Component	2008	2010	2012	2014	2016	2018
Rank	122	124	119	119	119	122
Index	0.35	0.33	0.42	0.38	0.42	0.45
Component 1: Online Service	0.30	0.08	0.43	0.43	0.56	0.63
Component 2: Telecommunication Infrastructure	0.05	0.02	0.12	0.16	0.18	0.19
Component 3: Human Capital	0.69	0.23	0.71	0.56	0.52	0.55

Source: UNDESA

3.5. DEET and the enabling policy environment in Kenya

This section examines how Kenya is faring on the three sets of policies described in Section 2 under the enabling policy environment for DEET and poverty reduction.

3.5.1. Building digital capabilities

The first significant development for Kenya's digital economy was in 2007, with the introduction of MM through Safaricom's M-Pesa. Then, in 2008, ICT was incorporated as a key development pillar in the government's 2030 vision. Since then, significant efforts by the Ministry of ICT have been directed towards increasing the level of digitalisation in Kenya or creating a digitally enabling environment, including announcement of the Konza Technological City ('Silicon Savannah') as the vision's flagship project for BPO and IT-enabled services. High-speed internet was brought into the country in 2010 through SEACOM, TEAMS, EASSY and LION undersea fibre-optic cables, followed by the launch of the Kenya Open Data Initiative in 2011, making key government data freely available through a single online portal. In 2012, Kenya spent $3,178 million on ICT services, with a special focus on computer-related services in the budget, and in 2013 it launched the National Broadband Strategy, with the aim of transforming Kenya through a nationwide high-capacity broadband network. Subsidised broadband was thus made available for all universities and technological hubs. Further efforts by the government saw the introduction of the National Cybersecurity Strategy (2014) to provide a secure online environment to conduct business, accompanied by the rolling out of 4G internet coverage by telecom providers. Since 2016, efforts have also been focused on preparing the Kenyan workforce for the digital economy. The Ministry of ICT's ongoing Digital Literacy project aims to bring about systemic change in basic and higher education through integrating technology in the learning programme.

In terms of readiness on the legal and regulatory front, Table 5 compares progress on ICT regulations using the International Telecommunication Union (ITU) ICT Regulatory Tracker, which identifies trends in ICT legal and regulatory frameworks. While it does not measure the quality or the level of implementation or performance of regulatory frameworks, it helps identify gaps in **national regulatory frameworks** using four dimensions: **regulatory authority, regulatory mandate, regulatory regime and competition framework**. The regulatory authority dimension includes indicators measuring, for example, presence of a separate ICT regulator; autonomy of the regulator in decision-making; accountability; enforcement power; dispute resolution; and presence of a competition authority. Regulatory mandate examines who has control in the country for regulating the following: licensing; quality of service obligation measures; radio

frequency allocation; universal accesses; broadcasting; and internet content. In turn, regulatory regime captures the existence of regulations in major areas, including types of licensing; use of Voice over Internet Protocol services; mandated infrastructure-sharing and co-location; and presence of a national plan that involves broadband. Lastly, competition framework measures the level of competition in the main market segments within the ICT sector: existence of competition in local and long distance fixed-line services; 3G, 4G and other services, as well as foreign ownership or participation in facilities-based operators; spectrum-based operators; local/long distance service operators; international service operators; and Internet Service Providers.

Using this ICT Regulatory Tracker, Table 5 compares Kenya with other selected African across the four different dimensions. It is observed that, within the EAC, Kenya ranks highest, followed by Uganda and Tanzania. However, in e-commerce legislation, Rwanda is doing better than Kenya (Table 6). It has an active legal framework across all four dimensions considered: electronic transactions, data protection, consumer protection and cyber-crime prevention. In Kenya, acts on electronic transactions include the Kenya Communications (Amendment) Act 2008 and the Information Communications (Electronic Transactions) Regulations 2016.

While Kenya has made efforts to improve its regulatory system, regulations in the ICT services sector remain spread out between the central government and state entities in Kenyan counties, leading to unclear division of responsibilities and overlap of roles (Waema and N'dungu, 2012), and consequently to higher transaction (compliance) costs for private players. Fragmentation makes it more difficult for regulatory institutions to prosecute cybercrime such as software piracy, which deters foreign investment and also makes it increasingly difficult to fully align regulations with international standards. Firm interviews and existing evidence further suggest that high costs of permits, lack of harmonisation in customs rules and regulations, and time and cost to register a company continue to be important challenges facing Kenyan firms (Banga and te Velde, 2018).

Table 5. ICT regulatory readiness in selected African countries

Name	Regulatory authority	Regulatory mandate	Regulatory regime	Competition framework	Rank
Kenya	18	21.5	21	27	45
Uganda	17	20	22	27	52
Tanzania	20	21	19	25	62
Rwanda	20	20	18	24.33	73
Nigeria	17	20	20	21.33	91
South Africa	17	17	24	13.33	112

Source; ITU ICT Tracker 2019

Table 6. E-commerce regulatory readiness

	Electronic transactions/e-signature	Data protection/ privacy online?	Consumer protection when purchasing online?	Cybercrime prevention?
Kenya	Yes	Draft	Yes	Yes
Rwanda	Yes	Yes	Yes	Yes
Uganda	Yes	Draft	Yes	Yes
Tanzania	Yes	Draft	Draft	Draft

Source: UNCTAD e-commerce indicator

3.5.2. Managing digital change inclusively

Kenya needs to develop appropriate and effective regulatory frameworks around competition, taxation, social protection and skills development to manage the digital change more inclusively. Some advances have been made on this front. For instance, Kenya's new Finance Bill 2020 proposes to introduce a 1.5% tax on the gross transaction value of digital services provided through a digital marketplace as well as levying VAT at 14% on a number of goods that are currently exempt. This is in efforts to boost tax revenue in the country, particularly during the COVID-19 pandemic, when transactions concluded via online marketplaces have increased. Laws and policies around social protection need to account for rising informal employment and independent contract work in the digital age (Ndemo and Weiss, 2017). Flexibility enjoyed by workers differs across type of online work; worker-led flexibility is lower in household services but comparatively higher than in services such as ride-hailing (Hunt et al., 2019). Social protection programmes should recognise the diverse livelihoods of many gig workers, which are often characterised by multiple forms of employment and portable benefits (ibid.).

On the issue of labour and skills, Were (2016) notes that the Kenyan labour force is well educated but not well skilled. While the mismatch between education and skills is not as large as that in most of Africa, it still constrains the growth of the sector. Banga and te Velde (2018a) find that, although, on average, there is no significant difference in employment growth in the period 2007–2013 between digitalised Kenyan manufacturing firms (those that have internet) and those that are not digitalised, the average share of skilled employees is significantly higher (by 13 percentage points) in Kenyan digitalised firms. Lack of familiarity and training is often cited as a key barrier to tech adoption; lack of digital skills was cited as the main reason for not going online by 37% of those surveyed in Kenya in a recent GSMA survey.[6]

3.5.3. Fostering competitiveness, including through digitalisation

The World Bank Group's Doing Business shows Kenya has significantly improved on the ease of doing business; in 2018, it ranked 61 out of 190 countries, up from 80 in the year 2017. In the past five to six years, important reforms have been made in the following areas: starting a business, access to electricity, registration of property, protecting minority investors, paying taxes and resolving insolvency. The Kenyan Investment Authority (KenInvest) and the Business Environment Delivery Unit continue to make progress in reducing bureaucracy and simplifying the process of registering a business in Kenya, while recent laws such as the Bribery Act (2016) and the Access to Information Act (2016) are targeted at fighting corruption and improving transparency in doing business.

[6] https://www.gsmaintelligence.com/

Digitalisation can help address some of the traditional challenges facing Kenyan manufacturers. For instance, digitalising the electricity sector can solve important challenges in Kenya pertaining to cost of electricity, access and distribution, as well as reliability of power supply. Currently meter readers are tasked with making a monthly round to collect data from individual meters, which not only is time-consuming but also has resulted in increased data inconsistencies. There is a lack of accurate and timely data on electricity use in Kenya, leading to overcharged bills and consumer outrage.

Kenya Power has already installed around 6,000 smart meters at the premises of large power consumers that use above 15,000 units of power on a monthly basis, and in total more than 15,000 smart meters have been installed for large and small power consumers (NairobiGarage, 2018). Similarly, digitalisation of customs and border procedures can help facilitate trade by enabling greater efficiencies and reducing delays, as noted in the Logistic Performance Survey in Nairobi by the Shippers Council of Eastern Africa. It is also important to note that, while goods can be ordered using e-platforms, they still need to be delivered using traditional systems (as long as drones are not mainstream), highlighting the need to also develop and strengthen postal competence and reliability for increasing market access. Kenya as yet ranks lower on postal reliability than other East African countries, such as Tanzania, Uganda and Ethiopia (see Table 7). Kenya also has poorer logistics and customs; it takes roughly 10 days to clear exports through customs, compared with 7 days in Ethiopia (Table 7). Poor postal and logistical competence is likely to restrict e-commerce growth in Kenya

Table 7. Trade facilitation indices, 2016/17

	% of income linked to parcels and logistics services – Universal Postal Union Database	Postal reliability index – Universal Postal Union Database	Logistics Performance Index international shipments score	Days to clear direct exports through customs – WBES	Burden of customs procedures – WEF
Ethiopia	36.7	62.6	2.6	7.7	3.2
Kenya	16.0	53.7	3.2	10.3	3.6
Rwanda	26.0	24.7	3.1	10.2	5.3
Tanzania	10.0	64.5	3.0	12.4	3.2
Uganda	38.2	64.4	2.9	10.0	4.0

Source: WITS e-trade indicators

Overall, Kenya has emerged as a leader of digitalisation in sub-Saharan Africa, owing to continued and combined efforts by both the public and the private sector. There is important scope for DEET and poverty reduction, particularly through the production channel (manufacturing and services) and the consumption channel. Policies have been supportive towards digital transformation but need to speed up and target *inclusive* digital change, which considers the poorest. Adopting a more active approach towards digitalisation has become particularly important for Kenya in order to leverage the digital economy to mitigate economic losses from COVID-19. With social distancing policies and businesses shifting online, there has been an increase in demand for digital and digitally enabled services and ecommerce in Kenya (See Box 1). Digital solutions are also in turn increasing the efficacy of government policies through Telehealth, EdTech, digital tracking, etc. The COVID-19 crisis is therefore likely to be a step-change for digital transformation but will require targeted efforts in development of digital infrastructure and

comprehensive regulatory frameworks for data protection and cyber-security, in addition to improving postal competency and viable delivery networks.

Box 1: Emerging digital response to COVID-19 in Kenya

Some sectors in Kenya have been hard-hit by supply-side disruptions caused by the pandemic, including traditional sectors such of cut-flowers, tea and garments. The services sector, which is the biggest contributor to economic growth in Kenya, has also been directly affected in terms of reduced income and employment, particularly in sectors of tourism, travel and hospitality. The ICT sector, however, has emerged as playing a critical role in Kenya's fight against the pandemic, with new opportunities rising in the digital services (e.g. cloud computing, data storage, Internet of Things, Artificial Intelligence), digitally deliverable services (e.g. legal, financial, business) and e-commerce by manufacturing and services companies.

- ***Digital services***: Lockdowns are generating larger demand for communications, computer and information services; Safaricom, for instance, has seen a 70% surge in data usage. As businesses shift online, the demand for cloud computing – online on-demand delivery of IT resources with pay-as-you-go pricing – is also on the rise. In February 2020, Safaricom announced a partnership with Amazon Web Services (AWS) to sell AWS services, primarily cloud, to East Africans. It is also offering doubled internet speed for home fibre packages at no extra cost to users, while Telkom Kenya is rolling out Google Loon to boost 4G coverage. However, MSMEs are lagging in the use of cloud computing; less than 25% of them use it, against over 40% of large firms.
- ***Digitally deliverable services***: The ICT sector also plays a crucial role as an enabler of other services. Kenya is particularly a hub for global digital BPO, through government promotion schemes like Ajira. At present, 7,000 Kenyans work in BPO jobs, with an estimated 286,000 employed by digital services platforms in transport, logistics and e-commerce. However, while 80% of IT companies have a website, this falls to less than 50% in most other services subsectors. Across subsectors, the share of exporters is less than 30%.
- ***E-commerce in manufacturing firms:*** As a response to the crisis, 30% of KAM members surveyed are aiming to increase online capabilities. Jumia has partnered with the Kenya Private Sector Alliance to enable local businesses to set up their e-shop on the Jumia platform at no start-up costs, with Jumia halving its commission on vendors for locally manufactured goods to 1%. KAM has also launched a digital directory for locally manufactured goods to help customers shop online.
- ***E-commerce platforms***: E-commerce platforms, such as Jumia Kenya, Sky.Garden, Kilimall, Pigiame and Copia, with e-payments or mobile payments and last mile delivery capabilities, are uniquely positioned to be part of Knwya's response strategy to this pandemic. Local platform GoBeba reported that its gross merchandise value tripled in the three weeks following the first reported COVID-19 case in Kenya on 13 March, driven by sales of household essentials. Sky.Garden has seen an increase in demand for Fast-Moving Consumer Goods, productivity tools (computing products and accessories), entertainment electronics (TVs, home theatre, decoders), educational material and toys. However, large Kenyan supplier firms are better placed to leverage these platforms; the membership fees is a prominent challenge for MSMEs, in addition to hefty commission fees charged by these platforms. Moreover, e-commerce uptake is closely related to consumer online trust; while 70% of large Kenyan firms have an ICT security policy, less than 40% of MSMEs have such a policy in place. To encourage the use of digital payments by MSMEs, Safaricom has increased their daily M-Pesa transaction limit from approximately $700 to $1500 during the pandemic.

Source: Banga (2020)

4. DEET AND POVERTY REDUCTION: CAMBODIA CASE STUDY

4.1. Economic transformation and poverty reduction in Cambodia

The share of manufacturing and services value-added in GDP has increased in the case of Cambodia (Figure 10). Labour productivity has risen significantly since 2009 across all sectors considered (Figure 11). CPAN (2018) records a fall in poverty rates (national definition) from 52.5% in 2004, to 47.8% in 2007 and 13.5% in 2014 (ADB, 2014), although two thirds remain living under $5.50 a day. While poverty dynamics are complex (CPAN, 2018), a large number of poor people are in rural areas, where small-scale farmers practise agriculture at the subsistence level, using traditional methods with low productivity. In terms of sectoral employment, Cambodia has undergone some structural transformation; employment has shifted away from lower-productivity agricultural sectors towards manufacturing and services sectors.

Figure 10. Sectoral value-added (% of GDP)

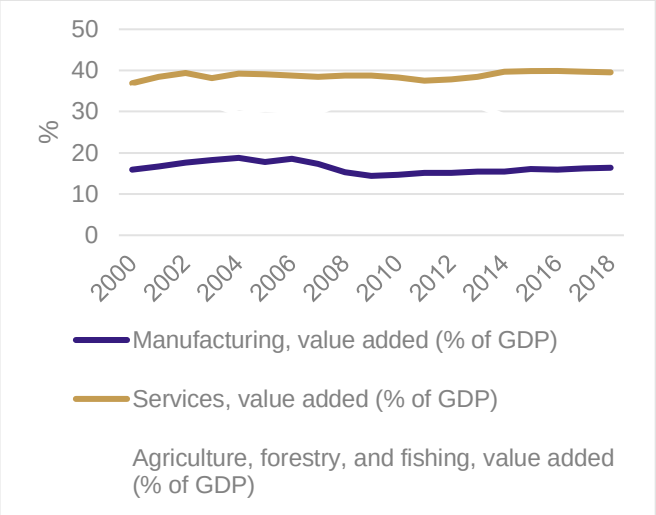
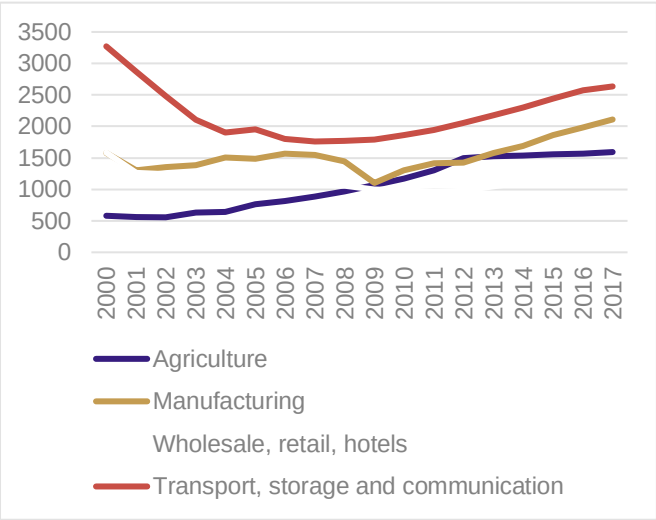


Figure 11. Sectoral labour productivity

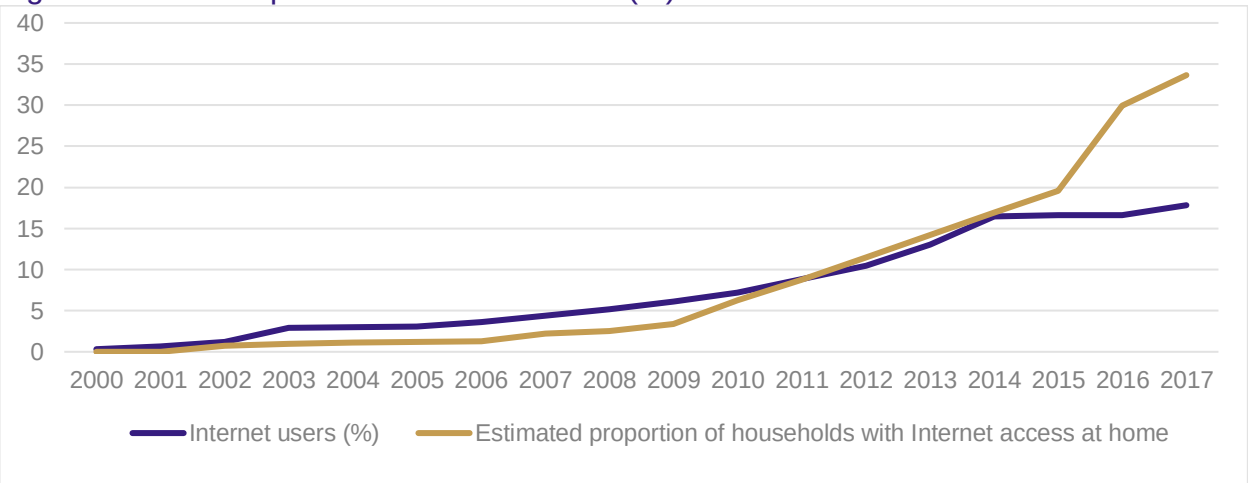


Notes: Labour productivity is calculated as absolute gross value-added (in 2010 US$) divided by employment.

Source: SET database, combining UN and ILO data

In terms of internet penetration, the percentage of population with access to internet has been on a rising trend since 2000, with significant improvements 2009 onwards (Figure 12). Significant policy initiatives undertaken by the Royal Government of Cambodia (RGC) include establishment of the ICT Policy 2009–2015, the Masterplan for ICT in Education 2009–2015 and the start of a fibre-optic cable project between Cambodia and China.

Figure 12. Internet penetration in Cambodia (%)



Source: WDI

World Bank (2018) points out that, while mobile penetration has surged in Cambodia in recent years, internet subscriptions remain low; in 2017, less than 35% of the population has access to the internet (Table 8). Only 21% of households in Cambodia have access to the internet compared with over 50% households in countries of Indonesia, Malaysia and Thailand. Cambodia fares particularly badly on fixed broadband subscriptions.

Table 8. ICT indicators in Cambodia, 2017 (latest year available)

	Internet users (%)	Estimated proportion of households with internet access at home	% of population covered by at least a 3G mobile network	International internet bandwidth; in Mbit/s	Active mobile broadband subscriptions per 100 inhabitants	Fixed broadband subscriptions per 100 inhabitants
Cambodia	34.00	21.00	83.90	173452.00	66.87	0.83
Indonesia	32.29	57.33	93.78	1809053.00	98.30	2.35
Malaysia	80.14	85.65	96.20	1424900.00	111.49	8.50
Thailand	52.89	64.38	98.00	4362000.00	99.01	11.89
Vietnam	49.57	27.27	98.00	6500965.00	46.95	11.80

Source: ITU

4.2. DEET and production structure in Cambodia

4.2.1. Digital-led agricultural growth and poverty reduction in Cambodia

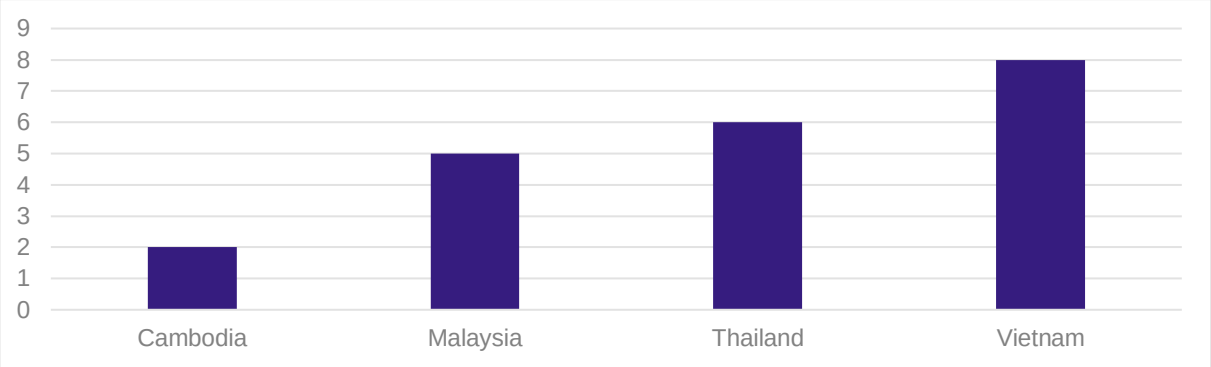
The RGC has identified agriculture as one of the key sectors for development since it first released its Rectangular Strategy. Version III of the Strategy aims to push agricultural investment beyond strengthening rural incomes, into improved technology, R&D, crop diversification and promotion of commercial production and agro-industries (RGC, 2013). The evidence suggests that Cambodia has begun to introduce digital technologies to connect farmers to international markets; enable transactions; improve information; reduce transaction costs; and increase agricultural production itself. This is likely to support and transform Cambodian agriculture. However, there may also be losers, and early adopters may displace some 'middlemen', for example.

Some AgTech initiatives are already being used in agriculture (ODI and CDRI, 2020):

- Oxfam works with small-scale rice farmers in Preah Vihear province, in the central north of Cambodia, who are empowered with information about their supply chain and by electronic verification of the terms of their contract. This project provides transparency and information to the value chain actor. The smart contract will be developed using blockchain technology in the organic rice value chain, by registering all chain actors with unique identification codes.
- International Fund for Agricultural Development is targeting the use of Synthetic Aperture Radar sensors and data used for crop-mapping in Cambodian rice. This uses GPS and optical sensors to monitor changes in surface roughness, soil tillage and/or crop-specific field activities, thereby making it possible to detect where targeted crop practice interventions need to take place.
- Precision agriculture using digital soil-testing for small-scale farmers has been pushed by Intel's Grameen Social Business. The E-Agro suite farming app is to be rolled out in 210 locations in Cambodia. The digital test characterises soil samples, GPS data and environmental data to provide real-time recommendations. The atom processor technology enables Cambodian shippers to automate tracking and increase shipment visibility, by sending automatic alters to packagers' locations.
- CGIAR-funded Nuru is using a mobile Artificial Intelligence assistant to detect cassava diseases. This application works without the use of internet and offers value-added as it is linked to real-time experts, through PlantVillage, which provides on-demand information on particular aspects of cassava diseases.

Leveraging digital technologies to increase value from agriculture will also depend on the enabling environment. Cambodia's overall score of ease of doing business in agriculture on EAB 2019 is 39.95, below the regional average and the average of the income group. The ICT score in agriculture is lower than in the comparator countries of Malaysia, Thailand and Vietnam (Figure 13).

Figure 13: ICT score in agriculture, 2019

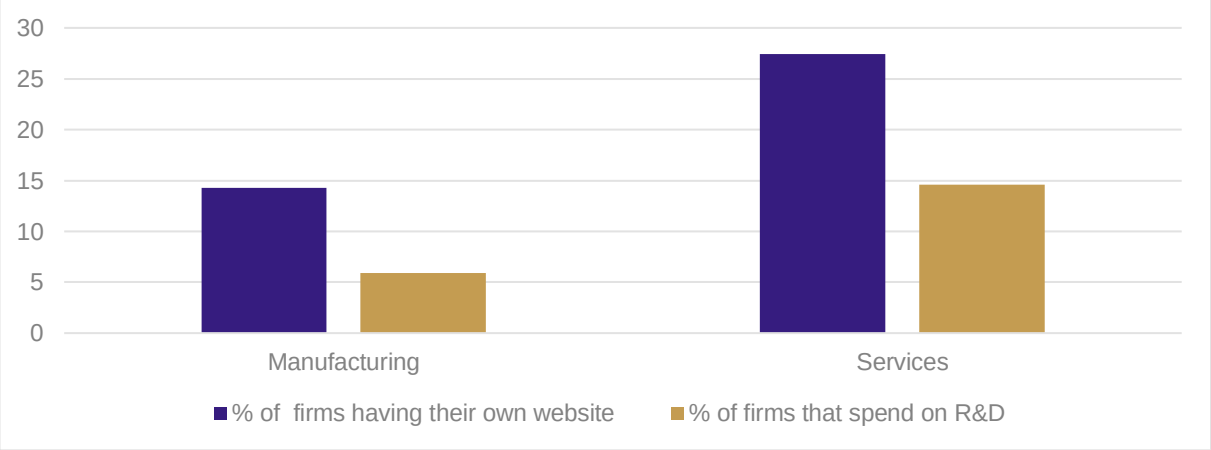


Source: World Bank EAB

4.2.2. Digital-led manufacturing growth and poverty reduction in Cambodia

Overall, the services sector is more digitally ready than the manufacturing sector in Cambodia. Data from WBES show that, while 27.5% of service firms in Cambodia have their own website and roughly 14.6% conduct R&D, less than 15% of manufacturing firms have their own website and less than 6% are spending on R&D (Figure 14). ILO (2019) points out that the implications of technologically induced upheaval are particularly profound for the textile, clothing and footwear sector in the region, given that this sector contributes significantly to manufacturing employment in countries like Cambodia (around 60%). Cambodia has relied heavily on the manufacturing sector, and especially garment exports, during its recent growth. The garments sector currently employs some 750,000 people (80% of them women, mostly under the age of 35) according to the Garment Manufacturing Association in Cambodia (GMAC) and supports many livelihoods (GMAC estimates this to be 20% of all livelihoods). Garments are characterised by relatively standard products in a wider global value chain; firms often headquartered in China manufacture (or assemble) in Cambodia at low cost and export to Europe or the US. Wages are low, although the minimum wage has risen considerably in recent years (ODI-CDRI, 2020).

Figure 14: Digital readiness of Cambodian firms, 2016



Source: WBES

Compared with Kenya, garments manufacturing in Cambodia seems to be less digitalised. One Chinese-owned garments firm in Sihanoukville Special Economic Zone employs around 1,000 people in one shift (ODI and CDRI, 2020). There have been few attempts to upgrade capabilities in the firm and few to no

digital technologies have been installed. There has been no attempt to upgrade and increase the competitiveness of the workforce, such as through installing sewbots. Another garment factory near Phnom Penh, employing 2,600 workers and supplying the US, has introduced more modern sewing machines, increasing efficiency by 40%. However, it is currently not planning to upgrade further, arguing that the costs are high and it has no provision for maintenance. At the same time, the profit margin is falling as wages are increasing (even though these are not the main sources of costs any longer), with production expanding more rapidly in Myanmar at times of rapid increases in wages.

Hung Wah Garment Manufacturing (Cambodia) reported that its automated garment machines had eliminated manual labour from the cutting process. In addition to increasing productivity through reduced time and labour input, automated cutting 'deskills' the task, as manual cutters – who are considered relatively higher-skilled workers at factories – are no longer needed. With automated cutting, only non-trained operators are required. This is likely to disproportionally affect female workers, who currently serve as the backbone of the textile, clothing and footwear sector in Cambodia. Cambodian women remain considerably disadvantaged in comparison with men, with a lower labour force participation rate; occupational concentration in low-value and low-skill sectors; less access to managerial roles; and lower wage and salary levels for work of equal value than men (ODI and CDRI, 2020). ODI-CDRI (2020) examine the future of manufacturing-led development in Cambodia and conclude that the picture is quite concerning; there is stiff global competition and pressures to reduce costs at a time when minimum wages have increased rapidly.

4.2.3. Digital services-led development and poverty reduction in Cambodia

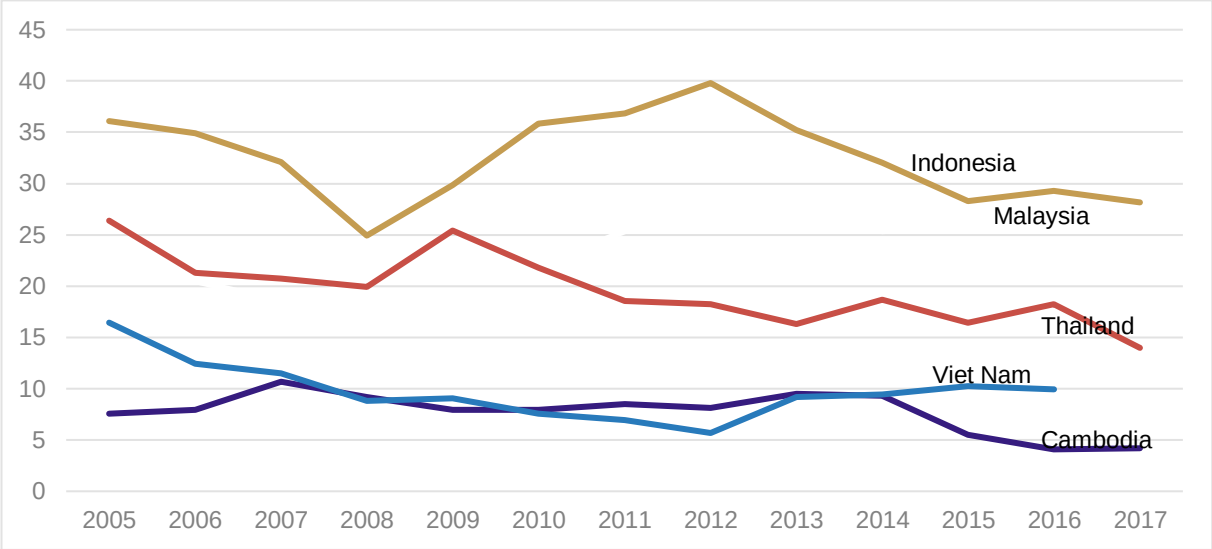
Cambodia is experiencing gradual digitalisation of its services sector, but there seems to be limited potential for exports. Overall, the share of digitally deliverable services exports – such as insurance and financial services; intellectual property charges; telecommunication, computer and information services; other business services; and audio-visual and related services – in total exports has remained below 5% in Cambodia and has declined since 2014 (Figure 15). While digital capabilities are still low and many of its companies are in an early stage of development, the sector holds great potential. By subsectors, the following list highlights some of the most prominent cases (ODI and CDRI, 2020):

- Financial services: Several digital payment platforms are in place in Cambodia, serving different purposes. One platform, Pi Pay, provides an electronic payment system, using European technology and partnering with a growing number of retail partners. There are many other payment systems in place, such as mobile phone-based systems that are used for salary payments; these have taken off, including in some of the manufacturing firms discussed above. But platforms such as Pi Pay have also taken off, as they combine ease of paying with retail opportunities. Pi Pay is operating in Phnom Penh and some other urban locations, hence the emphasis on serving urban consumers. It is important that Pi Pay enables transactions and reduces the cost of buying and selling but its effect on new and more efficient production is perhaps more limited. Benefits are likely to be targeted and involve reduced transaction costs.
- Transport services: Urban transport by bus was until recently based on paper reservations, with tickets sold by middlemen. However, progress has been made with regard to inter-urban transport as well as taxi services. Two of the most widely used platforms are BookMeBus and PassApp.
- Digital start-ups: The emergence of digital start-ups and co-working spaces is a noticeable change in recent years in cities such as Phnom Penh and Siem Reap. These spaces enable individuals or small teams to come together, design and innovate.
- E-commerce: There is much potential here, because half of the population is below 25 years and there is 120% mobile penetration, cheap data access, more than 7 million Facebook users and lack of financial inclusion (78% unbanked). Some 50,000 tech talents are employed, mostly in large companies, but there is huge potential for talents starting small-scale firms. Some 96% of Cambodians aged 18–35 have the desire to start their own company. Incubators such as Impact Hub

organise competitions, aimed at fostering entrepreneurial and digital growth across the tourism, agriculture and urban landscapes.

- Business services: Ink Animation is a very promising example of the new opportunities in a services-led economic transformation. The firm is involved in animation of films and distributes animated films internationally through online means, using its good contacts abroad, including through a Netflix series. It employs some 60 staff, with plans to expand to 200–300 in coming years, and starting salaries are much higher than the minimum wage. Before COVID-19, it was a very good example of a promising digitally based services exporter in a lower-income country. Unfortunately, this activity is still low in scale, compared with that reached in Japan and India, among other countries.

Figure 15. Share of digitally deliverable exports in total services exports (%)



Source: UNCTAD, World Bank data

4.3. DEET and consumption in Cambodia

4.3.1. Reduction in consumer prices in Cambodia

The spread of digital technologies in Cambodia has set the stage for the emergence of mobile payment systems and a greater use of financial services. The banking and microfinance sectors have developed substantially in the past years (Seng and Lay, 2018). Yet, as mentioned in previous sections, financial inclusion in the country remains low, with 22% of the population having a bank account and only 10% having a bank card (UNCTAD, 2017).

Within this context, and similarly to other developing countries, the emergence of mobile payment systems has promoted financial inclusion by complementing the traditional banking system. Wing was established in 2009 as the first MM transfer company, and since then other companies have followed suit. This includes companies such as TrueMoney, eMoney, PayGo, Pi Pay, Banhji or Smary Luy, mainly used to send, transfer and receive money, although some of them offer other services, including paying bills and tuition fees, and B2B FinTech solutions among others. Partly, the emergence of such companies has been supported by the establishment of the Cambodia Fintech Association in 2018. This aims at promoting the emergence of FinTech startups, hubs, and accelerators and has thus far fuelled the emergence of some FinTech startups, such as TosFUND, Karprak and Bima.

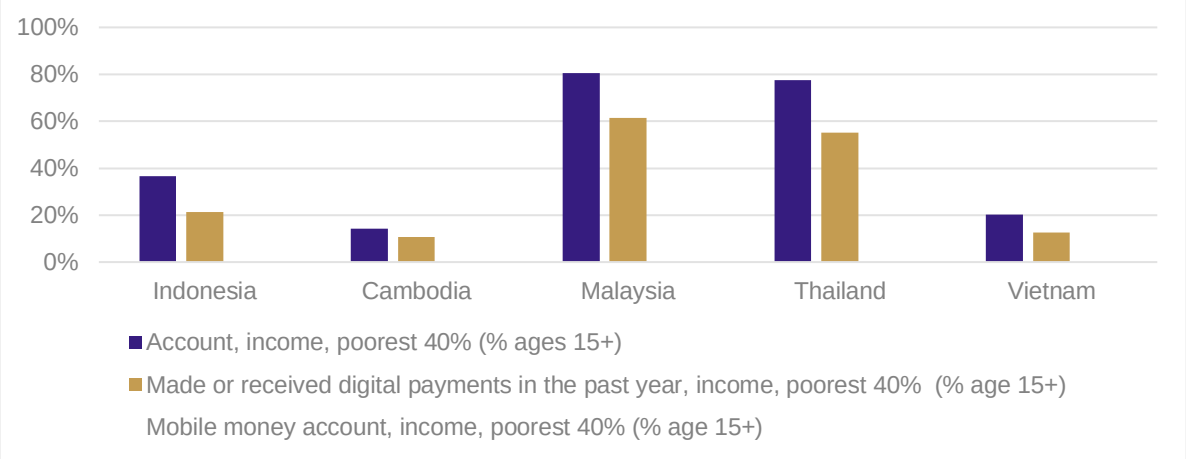
In line with the benefits displayed in the Kenya case study, the introduction and greater use of mobile payment systems in Cambodia has enhanced financial inclusion and reached under-served populations, particularly in rural communities. For instance, Wing is present in all Cambodian districts through a

network of over 7,000 Wing Cash Xpress outlets. Moreover, mobile payment systems have helped reduce transaction costs and increased the efficiency of the financial sector (RiskFrontier, 2014; Seng and Lay, 2018). Other recently introduced e-commerce platforms have most likely had similar impacts – through the reduction of transaction costs and increased output and income of those engaged in that market. This has the potential to foster demand-led growth in already mature sectors such as travel and hospitality, which have in place important employment multipliers with other economic sectors.

The deployment of digital technologies has offered opportunities for the development of online booking and trading services. Some of the most widely known digital platforms in this sector are Khmer25, LittleFashion, My All in One Mall and BookMeBus. While the sector seems to be gathering pace, penetration is still low, and online shopping is performed by only 8% of internet users (UNCTAD, 2017; KAS, 2018). At a larger level, e-commerce is also used for cross-border trade. Based on data from Alibaba, ITC (2018) reports Cambodia exporting machinery, beauty and personal care, agriculture and food and beverage products, which together account for almost 80% of total e-commerce exports.

While it is challenging to gather robust evidence on the reach of such measures and their impact on poverty levels, it is likely that middle-class urban Cambodians are the main beneficiaries (ODI-CDRI-2020). While MM is helping expand the financial system beyond previous levels, it remains challenging for those without a smartphone, reliable internet access and language and digital literacy skills to seize the full range of opportunities offered by new digital online platforms, including mobile payment systems and pseudo-banking services. Figure 16 shows that Cambodia ranks lower than other comparator countries in terms of use of digital finance by the poorest 40%. The demand for mobile banking is still limited, partly because of low trust levels in online transfers (KAS, 2018). Other reasons cited for Cambodians still being reluctant to use mobile banking services are lack of knowledge related to these services and the opportunities they offer and finding their use overcomplicated (Seng and Lay, 2018).

Figure 16. Access to finance for the poor, 2015/16



Source: WITS e-commerce indicators

4.3.2. Inclusion of vulnerable groups in Cambodia

Digital structural transformation has showed potential for reducing poverty in Cambodia via different DEET channels. In order to take advantage of such potential, vulnerable groups should receive special attention. In this regard, DEET has the potential to promote women's job opportunities, yet they still are a minority in Cambodia's IT industry's workforce (ADB, 2015; Markova and Wray, 2016). Cambodian women still face three barriers when engaging with the ICT sector (KAS, 2018). First are barriers to developing an interest in ICT, which result in fewer women studying ICT subjects compared with men, as well as less interest in working in economic activities related to ICT. Figures 17 and 18, based on ILO's

survey of enterprises and students in Association of Southeast Asian Nations (ASEAN) countries on the future of work, help illustrate this point. Second are barriers to acquiring ICT skills. Third are barriers to entering the workforce. Ensuring a gender perspective on the path towards the digital economic transformation in Cambodia by overcoming these barriers can greatly enhance women's job opportunities and income.

Figure 17. Student's main field of study

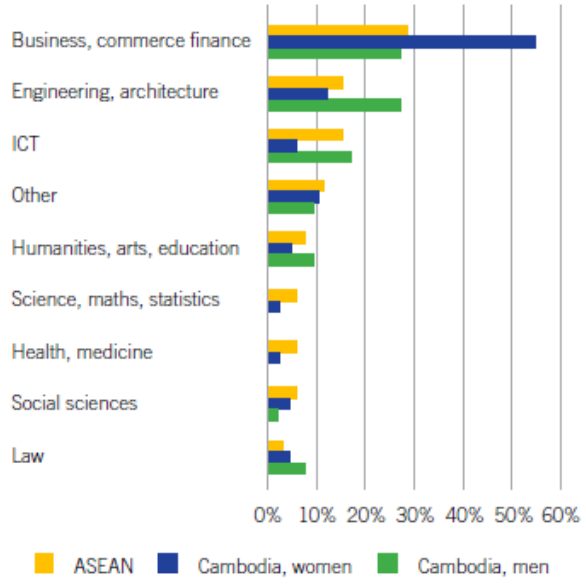
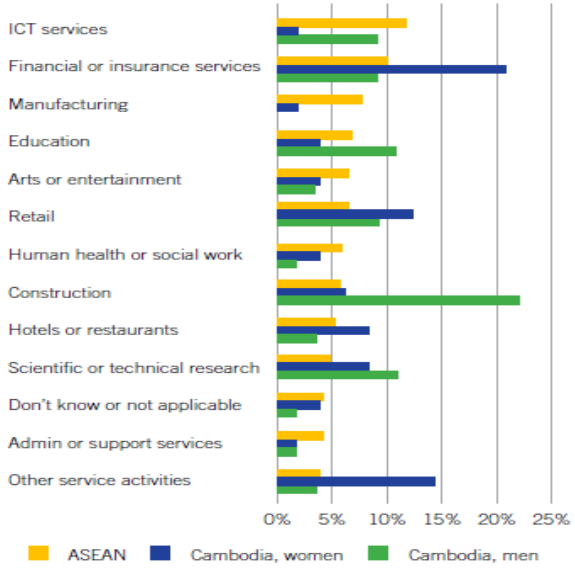


Figure 18. Student's ideal choice of economic sector after graduation



Source: ILO (2017)

In addition, ICT-based solutions, and in particular the use of smartphones and internet connection, can help Cambodian women migrant workers access information about risks and working conditions abroad, expand their network, call and message friends and relatives and be used as a reporting mechanism for seeking help when they face abuse by their employers. In addition, they can help relevant government agencies and non-governmental organisations better disseminate information and advice on the migration process and improve their outreach capacity. In Cambodia, while the use of online platforms by women migrant workers is limited to social connectivity, there exists potential, fostered by improved digital literacy and access to smartphones and internet, to make migration safer (ILO, 2019b). Table 9 finds that, in terms of access to finance, in Cambodia both men and women appear to have significantly lower access than men and women in comparator countries; gender gaps appear to be low in Cambodia. But only 4% of women in Cambodia are using the internet to pay bills or to buy something online, as compared with over 15% of women in Malaysia, Thailand and Vietnam; similarly, only 15% have made or received digital payments in Cambodia, as compared with over 60% in Malaysia and Thailand.

Finally, there have been initiatives that have used GIS technologies to support indigenous peoples' land title claims. Around 24 different indigenous groups live in Cambodia, divided into more than 450 indigenous communities, and estimated to manage nearly 4 million hectares. The lack of legal land titles has often led to private companies and government projects taking over land. Since 2001, laws have been passed with the goal of establishing the regulatory procedures to be followed to file land title claims, yet only a small proportion of the indigenous community has received such titles. The non-governmental organisation Open Development Cambodia (ODC) is supporting indigenous peoples file land ownership claims by mapping their land using GIS technology and digitalising the data to ensure its security and accessibility (ODC, 2017).

Table 9. Digitalisation and access to finance, by gender

	Used internet to pay bills or to buy something online in past year, male (% age 15+)	Used internet to pay bills or to buy something online in past year, female (% age 15+)	Made or received digital payments in past year, male (% age 15+)	Made or received digital payments in past year, female (% age 15+)	Mobile money account, male (% age 15+)	Mobile money account, female (% age 15+)
Indonesia	9%	13%	34%	35%	4%	3%
Cambodia	3%	4%	16%	15%	6%	5%
Malaysia	38%	39%	76%	64%	13%	9%
Thailand	19%	19%	62%	62%	11%	6%
Vietnam	20%	21%	22%	23%	3%	4%

Source; WITS e-trade indicators

4.4. GovTech and service delivery in Cambodia

The RGC has gradually increased the number and scale of policies aimed at addressing the challenges and opportunities posed by DEET. With regard to e-government service provision, the World Bank (2018) argues that progress has been limited. As of 2018, only a few online services were provided to citizens and businesses. Business registrations were available on the Ministry of Commerce website. Another available service was the issuance of single-entry visas to foreign tourists. Tax registration and payment was to some extent available; registration could be completed partially online but tax payment required visiting the General Department of Taxation. Despite these improvements, e-government remained fragmented. For instance, the RGC still lacked a unified national portal, with around 60 websites developed independently without a common template or standards for website security.

Regarding ID systems, the RGC developed the Cambodia National Strategic Plan of Identification 2017–2026, with the goal of accelerating and achieving universal identification by building a modern Civil Registration and Vital Statistic system. To this aim, the RGC plans to deploy ICT-based solutions focused on digitalising the information, computerising the data entry and storage process, promoting electronic authentication and developing ICT operational systems that can manage ID, passport, residential, citizenship and civil registration information. Taking these tenets into account, the EGDI can help evaluate the current state and progress of e-government in Cambodia (Table 10). Table 10 shows how Cambodia's EGDI score increased from 0.30 to 0.38 from 2008 to 2018 but is still at a low level. When it comes to the online provision of government services, the score increased from 0.20 to 0.25, showing some progress but far from that experienced in building the appropriate telecommunications infrastructure. This may align with the World Bank's (2018) claim of the RGC having been able to enhance e-government service provision but still with high potential for improvement.

It is expected that the Cambodia e-Government Master Plan 2018–2023 (draft) and the comprehensive long-term strategy for the digital economy (for 2020–2035), currently being drafted, will help the RGC upgrade its digital capabilities. The design of the policy ought to be aligned with previous strategies, including the Cambodia National Strategic Plan of Identification, and implementation will require the fruitful collaboration of different government ministries, with the Ministry of Posts and Telecommunications and the Ministry of Information assigned important roles.

Table 10. E-Government Development Index, Cambodia, 2008–2018

Component	2008	2010	2012	2014	2016	2018
Rank	139	140	155	139	158	145
Index	0.30	0.29	0.29	0.30	0.26	0.38
Component 1: Online Service	0.20	0.05	0.19	0.17	0.05	0.25
Component 2: Telecommunication Infrastructure	0.01	0.01	0.08	0.21	0.25	0.31
Component 3: Human Capital	0.69	0.23	0.60	0.52	0.48	0.56

Source: UNDESA

4.5. DEET and enabling policy environment

This section examines how Cambodia is faring on the three sets of policies described in Section 2 under the enabling policy environment for DEET and poverty reduction.

4.5.1. Building digital capabilities

Beyond e-government capabilities, the country's innovation ecosystem must keep pace with the challenges and opportunities posed by digital technologies. The RGC is in the process of developing a long-term strategic framework to support an inclusive digital economy. This centres on the following areas: digital infrastructure; digital human resources, including technical, cognitive and soft skills; business ecosystems; e-government; and digital trustworthiness (ODI and CDRI, 2020). Two major national policies have also been designed in recent years: the Cambodian ICT Masterplan 2020 (following ASEAN's ICT Masterplan, published in 2015) and the Telecom–ICT Development Policy 2020. In addition to these, and regarding the regulatory framework, the Consumer Protection and e-Transaction Laws were approved in 2019, and the country has drafted a Cybercrime Law. A Data Protection and Privacy Law has not yet been developed, which hinders digital trade.

Beyond the abovementioned laws, and looking at the overall regulatory environment, the ICT Regulatory Tracker is used below to compare Cambodia with its regional counterparts (Table 11). The country ranks higher than Laos but falls behind all other nations. Malaysia and Thailand lead the ranking. Despite a seemingly poor performance, Cambodia ranks relatively high compared with its neighbours on Pillars 2 (regulatory mandate) and 4 (competition framework).

Table 11: ICT regulatory readiness, selected ASEAN countries, 2020

Name	Regulatory authority	Regulatory mandate	Regulatory regime	Competition framework	Rank
Cambodia	13	17	14	21.3	132
Laos	0	12	17	7.7	175
Indonesia	16	13.5	18	25	107

Malaysia	18	22	24	23	49
Philippines	16	12	17	22	128
Thailand	20	19.5	22	19.8	79.5
Vietnam	10	19	24	13	131

Source: ITU ICT Tracker

4.5.2. Managing digital change inclusively

Managing the differential impacts of digitalisation on different sectors and groups will be crucial to maintain inclusiveness while safeguarding political stability along the digital transformation path. Promoting inclusive development should be a central component of the new digital economy framework that the RGC is expected to roll out after mid-2020. One key element of this should be development of national skills policies. Research has shown there exists a shortage of ICT skills in Cambodia, whereby two thirds of businesses in the IT sector are unable to hire staff with adequate IT skills (World Bank, 2018), less than 3% of the population has intermediate digital skills in connecting and installing new devices and less than 1% has advanced digital skills in finding, downloading and configuring software (ODI and CDRI, 2019). Furthermore, not only digital skills are needed to create a productive digital workforce, but also complementary skills such as STEM-related skills. As a result, and as mentioned in Section 2.4.2, lack of comprehensive skills training policies may hamper the potential benefits of ICT and other digital-based solutions, which in turn may disproportionately affect vulnerable groups.

While some Startup Hubs (e.g. Impact Hub, Emerald Hub, Smallworld Venture) are filling this gap by providing mentoring, training and networking, further guidance is needed from the RGC. The RGC developed the Master Plan for ICT in Education 2009–2013, and in 2016 the first university degree on e-commerce was launched by the National Institute of Posts, Telecommunications and ICT (KAS, 2018). Yet research suggests there is still need for a bold nation-wide digital skills strategy that is aligned with the current efforts to promote the digital economic transformation in the country (ILO, 2018; World Bank, 2018).

In addition to the establishment of digital-oriented training programmes, social protection and smart labour market policies will need to be in place to cope with the potential challenges brought about by automation and other digital production technologies. In this regard, recent research shows cases whereby the automation of certain stages of textile production has created jobs in subsequent production stages (Banga and te Velde, 2018). Moreover, it is argued that the incorporation of new technologies into existing production systems will take some time, partly because the decision of upgrading technological capabilities and potentially automating production processes is not as straightforward as it may seem, and several factors are at play (UNIDO, 2020). Within this context, policy action will be needed to ensure an inclusive transition to a digital economy, not least in Cambodia's manufacturing sector.

Social protection mechanisms in Cambodia need to be urgently revised and extended to vulnerable groups to deal with the transformational changes that the economy is likely to see over the next couple of decades. Social protection needs to be extended to workers who are most risk of losing their jobs to automation – digitally excluded workers, those performing non-cognitive tasks and workers whose jobs have been de-skilled – as well as digital labour. According to ILO (2017), 57% of Cambodia's workers face a high risk of automation. Workers in construction, retail and manufacturing face the highest risk (87%, 81% and 86%, respectively). Risks are also different across gender and skill categories. Cambodian women are 50% more likely to be employed in high-risk occupations than men, and the figure stands at 20% for primary school graduates compared with post-secondary graduates. Main driving technologies are additive manufacturing,

body scanners, computer-aided design, smart apparel, nanotechnology, automatic sewing machines and automation.

The current National Social Protection Policy Framework (2016–2025) in Cambodia provides overarching guidance ON contributory and non-contributory (tax-funded) social security, covering both social assistance and social security (ILO, 2019). Overall, the social protection provision suffers from important challenges; it is highly fragmented and biased toward workers in the formal economy; it lacks financial capacity development and capacity for existing mechanisms; and programmes are not yet sufficient for dealing with potential crises (ibid.). It is key to note that digital technologies can help in improving the viability and efficacy of policy solutions, including those facilitating extension of social protection. For instance, as part of future goals, the National Social Protection Policy Framework is exploring the potential of developing a comprehensive database management system for correctly identifying poor and vulnerable people by linking the system to the IDPoor system. This can be facilitated by digital technologies and be particularly important in extending social protection to the poor, especially to deal with the on-going COVID-19 crisis. See Box 2 for a seven-point plan for inclusive digital transformation in Cambodia for economic recovery from COVID.

4.5.3. Fostering competitiveness, including through digitalisation

Cambodia ranked 144 out of 190 countries on the 2020 World Bank Ease of Doing Business Index, falling from 137 in 2014. However, recently some progress has been made in digitalising business procedures; on 15 June 2020, the RGC launched its latest online business registration system, also known as the Single Portal, which aims to approve applications within eight working days. There are six ministries integrated into the system: the Ministry of the Interior; the Ministry of Economy and Finance; the Ministry of Commerce; the Ministry of Labour and Vocational Training; the General Department of Taxation; and the Council for the Development of Cambodia. This means investors can register their business and taxes on one platform, with all fees paid online through various e-payment channels.

Related to e-commerce and digital technology adoption by Cambodian enterprises, it is argued that there still exist logistical difficulties that hinder international trade. In this area, Cambodia ranks below Malaysia, Thailand, Laos and Vietnam (World Bank, 2020). UNCTAD (2017) cites poor logistics as one of the main impediments to cross-border e-commerce promotion in Cambodia. Poor logistics also affects local e-trading, as delivery is considered inefficient and expensive (KAS, 2018). Table 12 shows that Cambodia ranks lower than other comparator countries in terms of postal reliability and logistics but fares better in terms of days taken to clear customs. Finally, and as part of this DEET channel, it is worth highlighting how digital technologies can help alleviate economic pressures on the environment. In Cambodia, some tech start-ups, such as SmartBin and LumaSystem, are already piloting projects aimed at using digital technologies to improve waste management systems in urban areas. For instance, SmartBin uses sensors in rubbish bins that inform on how full bins are and what materials they contain. This way, rubbish trucks can optimise their route and waste management costs can be reduced. While these companies are yet in their early stages of development, prospects for spillovers and crowd-in effects are indeed encouraging.

Box 2: Cambodia, COVID-19 and a seven-point inclusive digital transformation plan

Garment manufacturing and tourism – two important sectors for Cambodia's development – have been hard hit by the pandemic. The digital economy and e-commerce offer alternative pathways to mitigate some of these economic losses. However, there is a significant digital divide, which the pandemic may exacerbate. The government is already preparing a long-term strategy for the digital economy (for 2020–2035), which needs to target closing the digital divide by:

1. Leveraging technology to radically transform innovation in the manufacturing sector in response to the crisis. The government needs to support manufacturers in moving towards production of essential goods during the pandemic through new incentives package that encourages use of digital technology.
2. Providing appropriate and good quality skills by bringing new dynamism into the sector skills councils to embrace a digital economy. This can be done through supply-side policies on education and skills, demand-side policies on innovation and research and development, and facilitate linkages between the two, including through technology.
3. Nurturing the digital start-up economy for an inclusive economy through new incentives for collective action by start-ups that can redirect efforts to develop apps with relevant applications for the poorest.
4. Facilitating digital infrastructure development to enable the most vulnerable groups to take part in the digital economy. Cambodia has very low fixed-broadband penetration and low mobile broadband penetration compared with other Asian economies.
5. Ensuring that the public sector leads by example and manages the new framework for digitalisation in a coordinated way, including through progress on e-governance and electronic services, which can lead to increased government revenue during the pandemic.
6. Digitalising trade facilitation and boost e-commerce. For instance, the certificate of origin for exporting goods to ASEAN can be filled online 1st June 2020. Legal and regulatory frameworks for electronic transactions and signatures and use of data can facilitate e-commerce growth, in addition to uptake of digital payments and improvements in transport, logistics and delivery.
7. Revising and extending social protection mechanisms to the most vulnerable, who are most at risk of losing their jobs owing to the pandemic, including through digital technologies. In the longer term, digital technologies can support a harmonised social protection system, which can facilitate better coordination across IDPoor system, NSSF and other cash transfer and social assistance programmes.

Source: Banga and te Velde (2020)

Table 12. Trade facilitation indicators in Cambodia and comparator countries

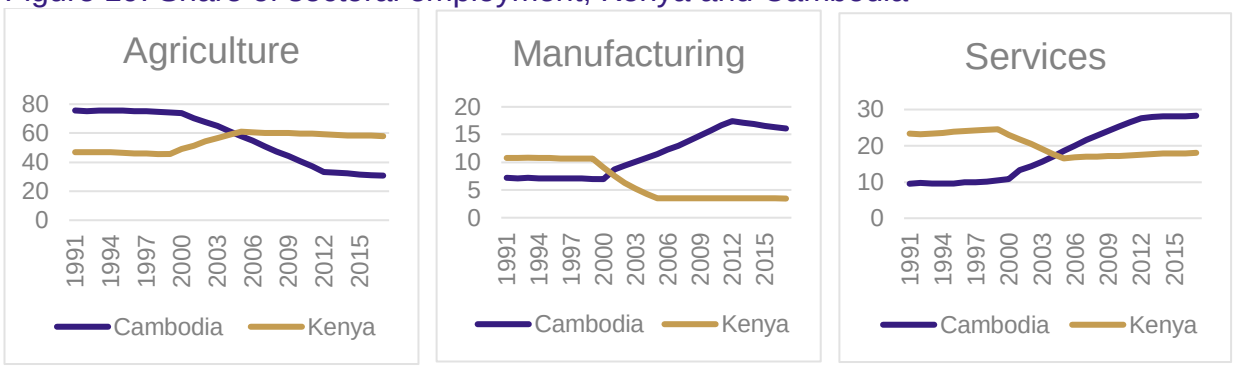
	% of income linked to parcels and logistics services – Universal Postal Union Database	Postal reliability index – Universal Postal Union Database	Logistics Performance Index international shipments score	Days to clear direct exports through customs – WBES	Burden of customs procedures – WEF
Indonesia	23.2	65.6	3.5	8.3	3.9
Malaysia	42.0	84.3	3.7	6.3	5.2
Thailand	48.9	90.0	3.6	1.9	3.7
Vietnam	16.1	70.3	3.5	6.9	3.6
Cambodia	73.0	25.2	3.3	4.9	3.1

Source: WITS e-trade indicators

5. COMPARATIVE ANALYSIS

The share of both manufacturing and services has increased in the case of Cambodia, in terms of value-added in GDP and sectoral employment, indicating structural transformation post-2000. During this time, poverty rates (national definition) have fallen from 52.5% in 2004, to 47.8% in 2007 and 13.5% in 2014 (ADB, 2014), although two thirds remain living under $5.50 a day. While services are the biggest driver of economic growth in Kenya, accounting for 43% of GDP, agriculture continues to be the largest employer, with 57.8% of the workforce employed in the sector. Growth in the manufacturing sector – a key pillar in the government's Big 4 agenda – remains positive at low levels, with a falling share in sectoral employment.

Figure 19. Share of sectoral employment, Kenya and Cambodia



Source: SET database, combining UN and ILO data

In terms of share of population that has access to internet, both Cambodia and Kenya fare badly; less than 50% of the population in each case has access to the internet. Cambodia fares better in terms of active mobile broadband subscriptions; of every 100 inhabitants, roughly 67 have an active broadband subscription, compared with 34 in Kenya. Both countries fare poorly in terms of fixed broadband subscriptions compared with comparator countries in the region.

Figure 20 looks more broadly at digital readiness and compares Kenya and Cambodia on Cisco's Digital Readiness Index, which measures a country's digital readiness along seven components: (i) technology infrastructure (fixed telephone subscriptions, fixed broadband subscriptions, internet services, networking services); (ii) technology adoption (mobile device penetration, internet usage, cloud services); (iii) human capital (quality of math and science education, adult literacy rate, years of schooling, population aged less than 14 years); (iv) basic needs (life expectancy, mortality rate for those under five years, sanitation, access to electricity); (v) ease of doing business (overall ranking, rule of law, logistics performance, time to get electricity); (vi) business and government investment (foreign direct investment, high-technology exports, government success in ICT promotion); and (vii) start-up (strength of legal rights, time to start a business, availability of venture capital).

Cambodia ranks ahead of Kenya on the overall score, with Kenya faring better on certain indicators, such as ease of doing business and start-up environment. It has significantly improved its Ease of Doing Business rank, which is at 56 in 2020; Cambodia comes in at number 144. Kenya ranks higher on WEF's Network Readiness Index, with lower individual ICT usage compared with Cambodia but higher government and business usage (Figure 21). On the ICT regulatory front, we have seen from the previous sections that Kenya ranks, at 45, significantly higher than Cambodia (132), with higher scores on all categories: regulatory authority, mandate, regime and competition framework.

Figure 20. Digital Readiness Index

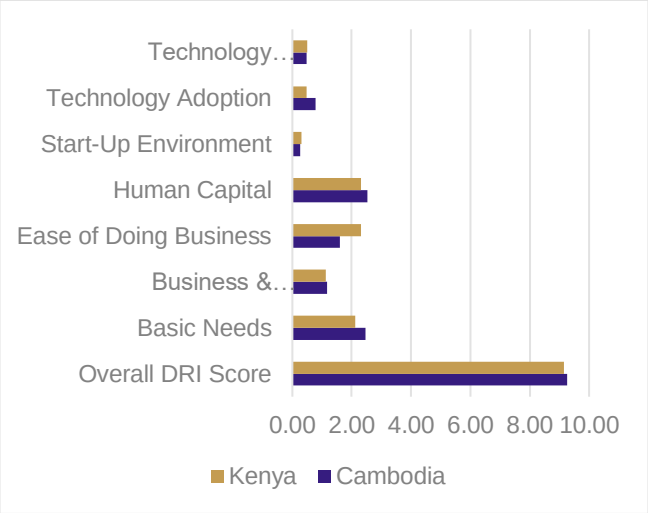
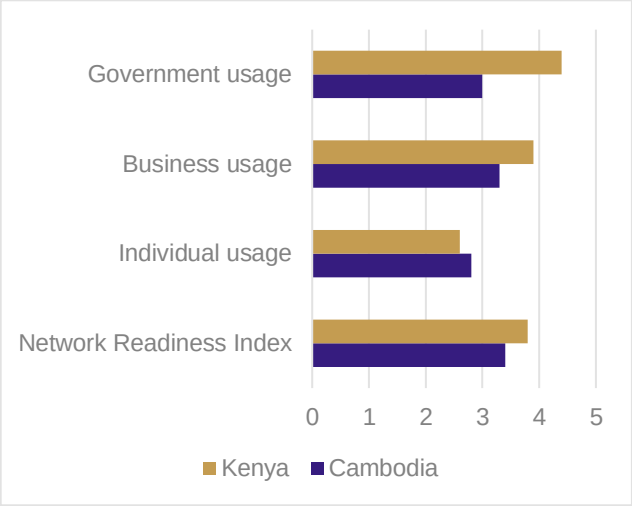


Figure 21. WEF Network Readiness Index



Source: Cisco, WEF

On the production side, poverty reduction through digital-led agricultural growth holds promise in both countries. Currently, in terms of good ICT practices in agriculture, Kenya fares better than Cambodia. Its count of good ICT practices is 6 – 2 points above both regional and income group averages and 4 points above Cambodia. In Cambodia, ICT renewal is not clearly stated in law, mobile virtual network operators are not allowed to operate and the licensing framework is tech- but not service-neutral. Digital-led manufacturing growth, particularly in labour-intensive sectors, is more promising in Kenya: over 70% of manufacturing firms have their own website compared with less than 15% in Cambodia. There have been a few attempts to upgrade capabilities in Cambodian firms but few to no digital technologies have been installed. There have also been no attempts to upgrade and increase the competitiveness of the workforce, such as through installing sewbots. In Cambodia, services-led transformation is more prominent than other channels but opportunities for export-led services growth remain limited; the share of digitally deliverable services exports in total exports in Cambodia has remained below 5%, and has declined since 2014. Targeted policies are needed to support IT and IT-enabled services, particularly financial, business, digital animation and e-commerce services. Currently, Cambodia has active legislation on electronic transactions and consumer protection and draft legislation on cybercrime but nothing on data protection and privacy.

On the consumption side, poverty reduction through digital financial inclusion has been more successful in Kenya. For instance, M-Pesa has lifted 2% of households from extreme poverty. Kenya is doing significantly better than other East African countries in terms of women's access to finance, though a gendered digital divide still exists. While the banking and microfinance sectors have developed substantially in recent years in Cambodia also, financial inclusion remains low. Middle-class urban Cambodians have been the main beneficiaries of MM (ODI and CDRI, 2019). Access to MM remains challenging for the poor, who are without a smartphone, reliable internet access and language and digital literacy skills to seize the full range of opportunities offered by new digital online platforms, including mobile payment systems and pseudo-banking services. Cambodia ranks lower than other comparator countries in terms of use of digital finance by the poorest 40%, potentially because of low levels of online consumer trust. In terms of gendered access to finance, women appear to have significantly lower access in Cambodia than in comparator countries

With regard to delivery of e-government services, progress in Cambodia has been limited. Its ranking on the EGDI has improved in the past 10 years but there remains scope for significant improvement, particularly on the provision of e-government services. Kenya has made good progress on e-governance, which plays an important role in building digital trust. This has been reflected in overall higher use of digitalisation in businesses and government in Kenya, as Figure 21 shows.

6. CONCLUSIONS

Economic transformation is crucial for poverty reduction, but there are many transmission mechanisms through which this can be achieved. These mechanisms can be broadly grouped under three channels: production, consumption and service delivery and broader context. We have developed a framework for understanding how digitalisation affects poverty through these three channels, and the enabling policy environment needed, in terms of building capabilities, managing the digital change more inclusively and increasing competitiveness.

Under the production channel, DEET can lead to increased productivity and economic diversification, creating direct and indirect employment opportunities. Under the consumption channel, digital technologies can lower the cost of exchange and transactions, reduce information asymmetry and expand access to cheaper and lower cost of goods and services. Under the third channel, government services, digitalisation can lead to better monitoring and increases in tax collection, and GovTech, EdTech and HealthTech can increase public sector efficiency, transparency and performance.

We then apply framework to understand DEET and poverty reduction in Cambodia and Kenya. Both countries fare poorly in terms of key digitalisation indicators but there is significant government support and interest in boosting digital transformation. Kenya has emerged as a leader of digitalisation in sub-Saharan Africa, owing to continued and combined efforts by both the public and the private sector. In the case of Cambodia, important policy initiatives have been made in recent years to leverage digitalisation for economic transformation. The RGC is currently preparing its long-term strategic framework for digitalisation.

In the case of Kenya, there is good scope for DEET and poverty reduction, particularly through the production channel (manufacturing and services) and the consumption channel. Policies have been supportive towards digital transformation but need to speed up and target inclusive digital change that considers the poorest. It is doing significantly better than the other East African countries in terms of women's access to finance, though a gendered digital divide still exists. Kenya has made good progress on e-governance, reflected in its performance on ICT usage by the government.

Manufacturing in Cambodia is of a much larger scale than in Kenya, but holds lower potential for poverty reduction. While the banking and microfinance sectors have developed substantially in recent years in Cambodia, financial inclusion remains low. In terms of gendered access to finance, women appear to have significantly lower access in Cambodia than in comparator countries. Services-led transformation is more prominent than other channels in Cambodia but opportunities for export-led services growth remain limited; the share of digitally deliverable services exports in total exports has remained below 5%, and declined since 2014. While the RGC has embarked on several digital initiatives and strategies, there is a risk that the RGC itself lacks sufficient capacity to play such a role effectively, indicated by a rather slow move towards e-government.

It is key to note that the role played by each channel in poverty reduction is dynamic, changing across countries and over time. For instance, the COVID-19 pandemic seems to have strengthened the role of e-governance for poverty reduction in Cambodia; by the end of May 2020, 50,000 households were added to the IDPoor system in a mere 10 days. Overall, digitalisation has much promise to reduce poverty, but these gains are neither inevitable nor uniform across countries, and crucially depend on a supporting policy and regulatory framework.

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