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Digitalization and Development Cooperation: an assessment of the debate and its implications for policy

Veronika Heimerl
Werner Raza

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Austrian Foundation for Development Research – ÖFSE
A Austria, 1090 Vienna, Sensengasse 3, **T** +43 1 3174010, **F** -150
E *office@oefse.at*, **I** *www.oefse.at*, *www.centrum3.at*

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List of Abbreviations

BD4D	big data for development
BMZ	Germany the Federal Ministry for Economic Cooperation and Development
D4D	data for development
DFID	UK's Department for International Development
DGD	Belgian Development Cooperation
GDP	Gross Domestic Product
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
ICT4D	ICTs for development
ICTs	Information and Communication Technologies
LDCs	Least Developed Countries
NGOs	Non-Governmental Organizations
OECD	Organisation for Economic Co-operation and Development
UNCTAD	United Nations Conference on Trade and Development
UNIDO	United Nations Industrial Development Organization

Abstract

In recent years, the discourse on a Digital Revolution of the economy has gained renewed interest, both in the academic sphere and among policy makers and the public. This interest has been sparked by the emergence of new technologies, such as different types of automation, robotization, Artificial Intelligence and Big Data. In public discourse, extreme outlooks on both sides of the spectrum are widespread. On the one hand, there is the claim that digital technologies will provide the solution to most contemporary economic and social problems. On the other hand, dystopian scenarios are prevailing, in which digital technologies will replace human labor, resulting in soaring unemployment rates with negative economic and social consequences.

Up until today, most of the new literature on the impact of digitalization has focused largely on the industrialized countries of the Global North, while the impacts on developing countries are under-researched. However, there is reason to believe that a separate analysis of the impact on developing countries is necessary, since the impacts of digitalization differ significantly according to the level of industrialization and income per capita. The fact that in many developing countries the Industrial Revolution and the Digital Revolution are taking place at the same time poses specific challenges.

Although the development policy literature has dealt with the effects of earlier ICTs (Information and Communication Technologies) – summarized in what has been termed the ICT4D literature, research on the impacts of digitalization on development and its implications for development cooperation, are still at an early stage. Against this backdrop, this briefing paper will provide a critical summary of the current state of the literature on the challenges and potentials arising from the process of digitalization for developing economies. A sober account of the historical evidence suggests that both euphoria and dystopian views are equally misplaced. The major policy challenge for development cooperation will lie in supporting LDC governments in their efforts to manage the effects of the economic and social transition process brought about by digitalization. This will involve both supply-side (labour market, education, research and innovation, infrastructure) as well as demand side (wage and social policies) policies. Last but not least, the social costs of the adjustment process must be regulated based upon an approach that respects the human rights of affected populations.

Keywords: digitalization, automation, robotization, technological revolution, development cooperation, developing countries

1. Introduction

In recent years, the discourse on a Digital Revolution of the economy has gained renewed interest, both in the academic sphere and among policy makers and the public. This interest has been sparked by the emergence of new technologies, such as different types of automation, robotization, Artificial Intelligence and Big Data. However, the process of a digitalization (also referred to as digitization) of the economy is not a new phenomenon. In fact, it started in the second half of the 20th century (between the late 1950s and 1970s, depending on the exact definition) with the emergence of modern digital computing and continued with the emergence of different types of Information and Communication Technologies (ICTs) throughout the past decades. The Digital Revolution is often perceived as the Third Industrial Revolution and believed to have an impact on economy and society as profound as the two industrial revolutions that came before. While the Agricultural Revolution marked the transition of human societies from gatherers and hunters to settled farmers, the (First) Industrial Revolution starting in the late 18th century marked the transition from manual production to industrialized production with the help of machinery (most importantly the steam engine) and the Second Industrial Revolution around the turn of the 20th century introduced new technologies such as electricity. Similarly, the Digital Revolution is perceived as the transition from mechanic technology to digital technology, offering a whole range of new technological possibilities, which are already profoundly impacting economies as a whole around the world (e.g. Faith 2017; Berger/Frey 2016). Some even argue that the changes brought about by digitalization will be of a "disruptive" nature and that there is a "possibility of entirely new development trajectories going forward" (Lütkenhorst 2018: 5). However, it is impossible to make exact predictions of the economic and social consequences of such a profound and unprecedented change (e.g. of the implications for jobs and employment, structural transformation, environmental impacts, etc.).

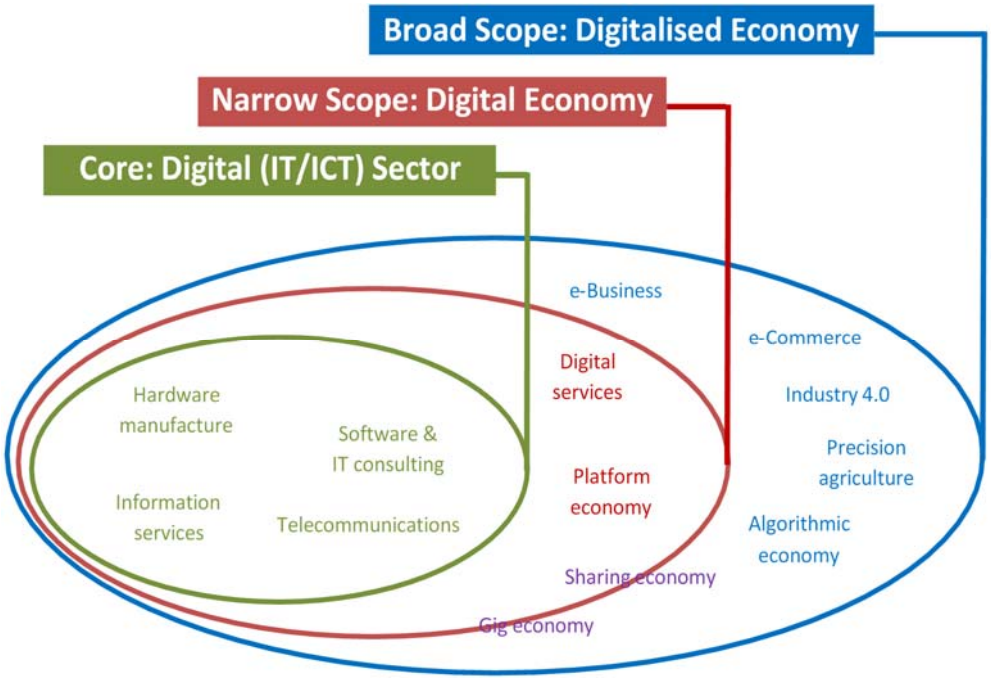
In the public discourse, extreme outlooks on both sides of the spectrum are widespread. On the one hand, there is the claim that digital technologies will provide the solution to most contemporary economic and social problems (e.g. Burt 2015). This is very evident e.g. in the recent discussion on the potential of block chain technology to eradicate poverty (e.g. Haahr 2017). On the other hand, dystopian scenarios are prevailing, in which digital technologies will replace human labor, resulting in soaring unemployment rates with negative economic and social consequences (e.g. Shewan 2017).

Up until today, most of the new literature on the impact of digitalization (i.e. the emergence of the last wave of digital technologies mentioned above) on the economy has focused largely on the industrialized countries of the Global North (e.g. Berger/Frey 2016; Bukht/Heeks 2017), while the impacts on developing countries are under-researched. However, there is reason to believe that a separate analysis of the impact on developing countries is necessary, since the impacts of digitalization differ significantly according to the level of industrialization and income per capita (Bukht/Heeks 2017; Lütkenhorst 2018). The fact that in many developing countries the Industrial Revolution and the Digital Revolution are taking place at the same time poses specific challenges. It has been argued that China might have been "one of the last countries to ride the wave of industrialization to prosperity" (Frey/Rahbari 2016: 14), since already industrialized countries have significant advantages in the exploitation of digital technologies. Although the newer literature focuses mainly on industrialized countries, there is a body of research on the effects of earlier ICTs on development (summarized in what has been termed the ICT4D (ICTs for development) literature) as well as a smaller, more recent body of literature on (big) data (termed the D4D (data for development) or BD4D (big data for development) literature).

Against this backdrop, this paper will aim at reviewing the current literature on the challenges and potentials arising from the process of digitalization for developing economies as well as development cooperation.

Box 1: What is the "digital economy"?

Figure 1: The Digital Economy



Source: Bukht/Heeks (2017: 13)

Digitalization is a very broad and encompassing concept; (almost) all economic processes are either directly or indirectly influenced by some digital technology. Bukth and Heeks (2017) offer a useful conceptualization of what comprises the "digital economy". They call the part of the economy most directly connected to digital technologies the "digital sector": the IT/ICT sector, which produces foundational digital goods and services. The "digital economy" comprises the "digital sector" plus digital services and platform services. It is defined as the "part of economic output derived solely or primarily from digital technologies with a business model based on digital goods or services" (Bukth/Heeks 2017: 13). The parts of the economy least directly, but still related to digital technologies are defined as the "digitalized economy". Many other definitions found in the literature refer to Bukht and Heeks' (2017) "digitalized economy" simply as "digital economy". The authors review measurements of what they define as "digital economy" (marked red in Figure 1) and estimate it to amount to around 5% of global GDP and 3% of global employment in recent years. This is roughly consistent with other studies, which find estimates of around 6.5% (UNCTAD 2017: xiii). There are estimates of the size of the whole "digitalized economy", which find it to amount to around 20% of the global economy (in 2015) (e.g. Knickrehm et al. 2016). However, due to difficulties in measurement, it is believed that the size of the "digital economy" is usually underestimated (Sheehy 2016). Furthermore, there are significant global disparities when it comes to the size of the digital economy; "GDP percentages for developing countries are likely to be around one-third to one-half of OECD/global figures." (Bukth/Heeks 2017: 16).

Given the high level of both complexity and uncertainty involved, the focus will be on a broad overview of the most important issues as well as on the relevance for and state of application in development cooperation. The paper departs from the premise that the digital revolution will continue to take place and shape our economies and societies. Therefore, the relevant question for policy makers is not whether digitalization *should* happen, but which *type* of digitalization is desirable and how to best deal with it. This entails answering the question how the potentials can be exploited and how the possible negative consequences can best be mitigated. The rest of the paper is organized as follows. Section 2 will focus on how digitalization transforms developing economies and thereby delineate the context development cooperation operates in. Understanding these changing circumstances and the possible regulatory framework to cope with them will be crucial for development cooperation in the future. Section 3 will focus on development cooperation policies with respect to digitalization. It will discuss the opportunities as well as challenges provided by the use of digital technologies for development cooperation programs and activities. In particular, it will focus on principles and guidelines which should be applied when promoting digital technologies in development cooperation. A final section concludes with main messages and policy recommendations.

2. The impact of digitalization on developing economies

Section 2 examines the broad economic changes brought about by digitalization in developing countries and therefore the framework conditions, in which development cooperation operates.

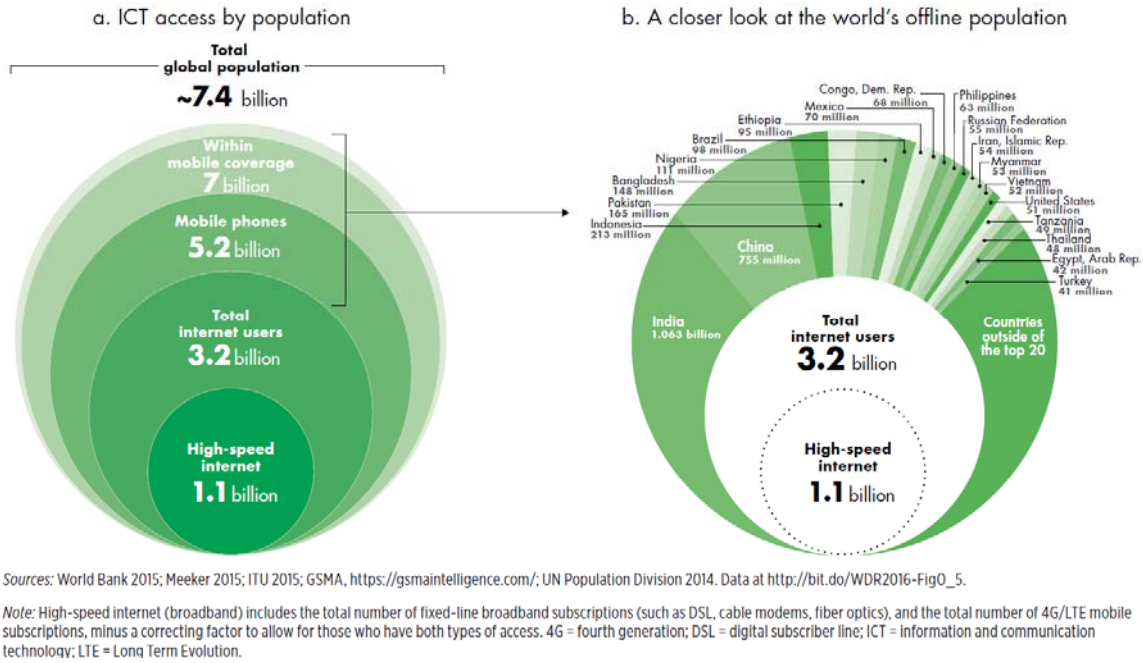
2.1. The Digital Divide

Most studies on the impacts of digitalization on developing countries stress that there is a considerable "digital divide" across multiple dimensions. The digital divide is manifested most importantly in terms of a discrepancy in firstly the use of digital technologies (due to availability of basic infrastructure, access, affordability, etc.), secondly the benefits obtained from digital technologies and thirdly the level of digital skills. The dimensions across which the digital divide exists include most importantly development status (i.e. a divide in the use of and return to technologies between industrialized and developing countries), but also urban vs. rural, individual income status, education, gender or age within a certain country (e.g. World Bank 2016: 5; Kleine/Unwin 2009; UNCTAD 2017). Such a digital divide exists for all digital technologies; in some dimensions it is self-reinforcing, therefore exhibiting a widening tendency.

Figure 2 shows that while much of the world's population has access to mobile phones (5.2. billion) and most can receive mobile signal (7 billion), more than half the world's population does not have access to the internet. This "offline" population is overwhelmingly located in the poor regions of the world.

An example for the digital divide by development status is mentioned in Box 1: the relative size of the digital economy is around two to three times higher in industrialized countries than in developing countries. This digital divide is visualized by Figure 3 and Figure 4. Figure 3 shows for several different technologies how the use in developing countries and least developed countries (LDCs) is lagging behind dramatically. Except for cellphone subscriptions – with a coverage of more than 70% of inhabitants/households in LDCs – all other technologies are used by at least four times as many inhabitants/households in "developed economies" as compared to LDCs.

Figure 2: The internet remains unavailable, inaccessible, and unaffordable to a majority of the world's population

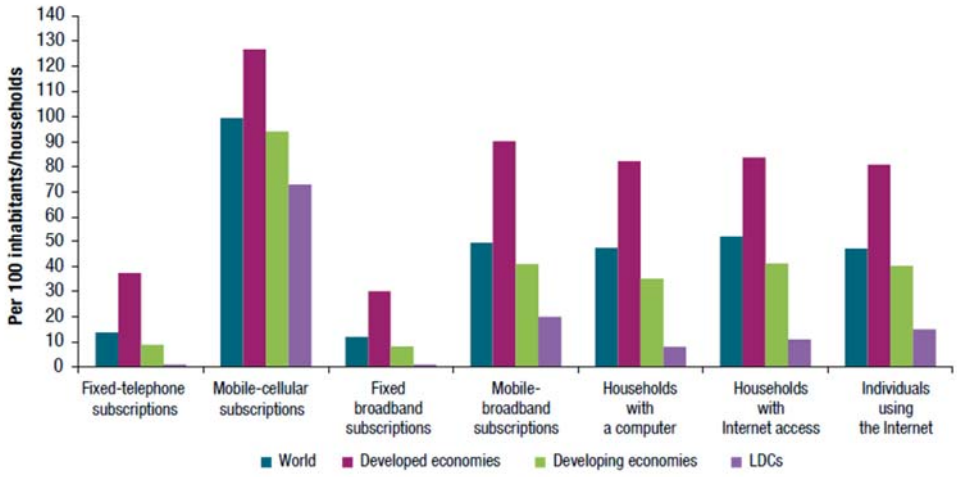


Sources: World Bank 2015; Meeker 2015; ITU 2015; GSMA, https://gsmaintelligence.com/; UN Population Division 2014. Data at http://bit.do/WDR2016-FigO_5.

Note: High-speed internet (broadband) includes the total number of fixed-line broadband subscriptions (such as DSL, cable modems, fiber optics), and the total number of 4G/LTE mobile subscriptions, minus a correcting factor to allow for those who have both types of access. 4G = fourth generation; DSL = digital subscriber line; ICT = information and communication technology; LTE = Long Term Evolution.

Source: World Bank 2016:8

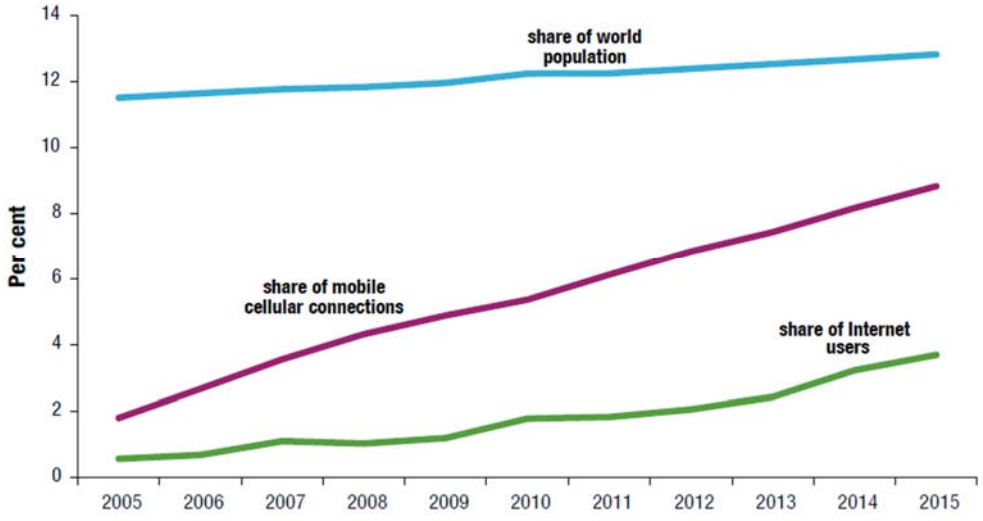
Figure 3: ICT penetration by level of development, 2016



Source: UNCTAD 2017: 17

Figure 4 shows that while around 13% of the global population live in LDCs, only around 3% of internet users do. However, the graph also shows a pronounced trend towards convergence since the beginning of the 2000s. What the aggregated graphs do not show however, is that especially within developing countries and LDCs there is a highly significant divide between the urban and rural population as well as one according to level of education, across the income distribution and between the genders (e.g. in developing countries, men are twice as likely to have access to the internet than women from the same age group and with similar levels of education and income (Faith 2017).

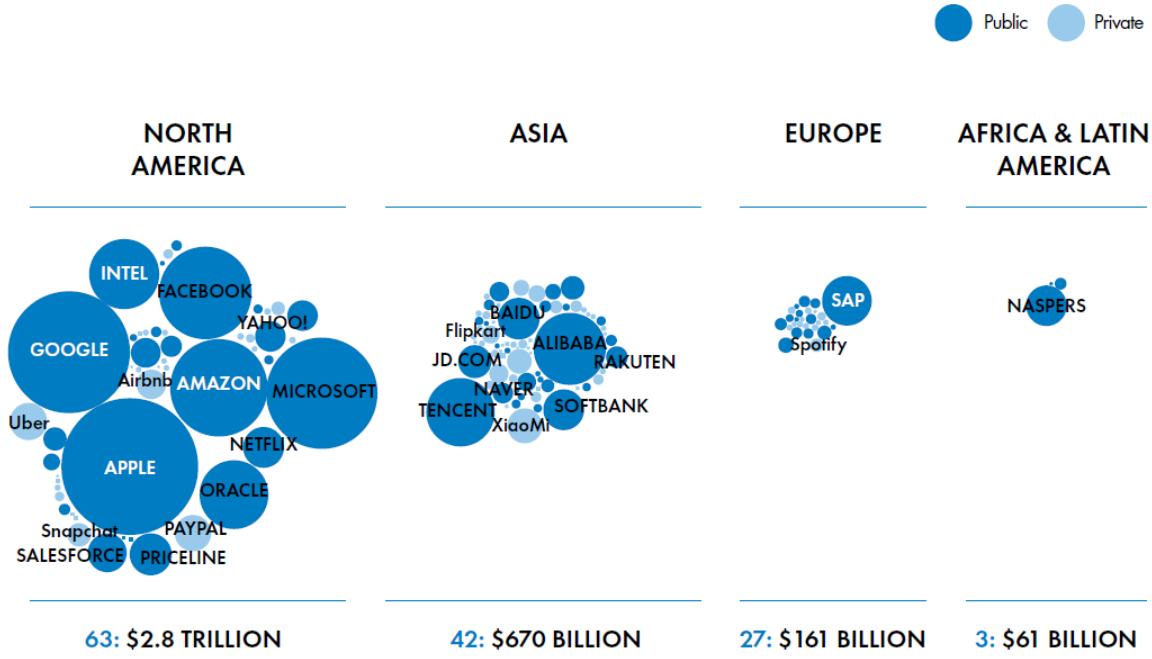
Figure 4: LDCs' shares of world population, cell-phone connections and Internet users, 2005-2015



Source: UNCTAD 2017: 18

Furthermore, there is a divide between industrialized and developing countries when it comes to the ownership of "digital" companies, with a vast majority of companies being located in industrialized countries. This is especially problematic for developing countries, since both profits and most of the value-added and employment are generated in the countries where the companies are located. This evidence combines with a concern for the increasing monopolization of "digital companies" through network effects and high economies of scale due to exceptionally low marginal costs in highly digitalized sectors (WBGU 2018; World Bank 2016: 13). Figure 5 shows the geographical concentration of most digital multinational corporations in the United States, which together amount to roughly 3-4% of global GDP (World Bank Open Data n.d.). For instance, in 2016 Google's revenues alone amounted to roughly the GDP of middle income countries like Slovakia or the Ukraine (World Bank Open Data n.d., Statista 2018).

Figure 5: Geographical concentration of headquarters of "digital MNEs" with a market capitalization of more than $1 billion, by region, 2016



Note: Public referfs to publicity listed companies. Pivate refers to privately owned companies.

Source: UNCTAD 2017: 10

The high concentration of market power has important policy implications (see e.g. Mann (2018) on the example of data ownership and governance). It is part of the reason, why in the community of development practitioners the importance of using open source solutions in digital projects is emphasized (more on this in Section 3).

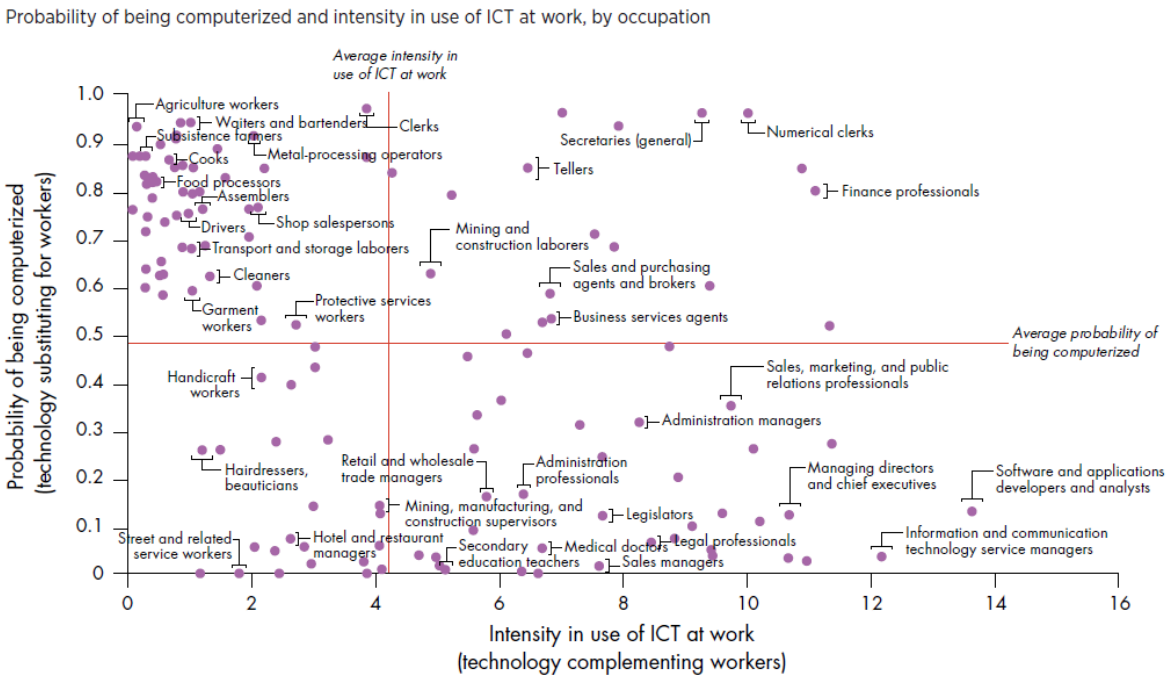
2.2. Industrialization, Structural Change and Employment

The emergence of the new wave of digital technologies has significant implications for industrial development as well as employment. It changes both the relative importance of specific sectors of the economy and has an impact on employment levels in these sectors as well as skill requirements.

In the past decades, many developing countries followed "latecomer industrialization strategies", at times successfully, as exemplified by the rapid industrialization of China and other Asian economies. However, there is increasing evidence of a phenomenon labelled "premature deindustrialization" (Rodrik 2016), which has been linked to digitalization. Empirical evidence shows that the process of deindustrialization, which has been observed in industrialized countries for decades, takes place at increasingly earlier stages of industrial development for newly industrializing countries. This means, that the process starts at lower shares of industrial output of GDP as well as at lower income levels. Rodrik (2016: 2) suggests that it might be possible for the economies of developing countries to become "service economies without having gone through a proper experience of industrialization", not least due to the increasing "servicification" of industrial processes facilitated by new digital technologies (Lütkenhorst 2018). At the same time this means that the strategy of "latecomer industrialization", which was successful for many countries in the recent past, might not be a viable development strategy for countries in the future.

Additionally, the question of employment and its substitutability by technology is of major concern. While digitalization leads to the displacement of some workers by technology, it also creates jobs in new fields. Both of these dimensions need to be taken into account in order to assess the overall changes of employment levels. The World Bank provides a framework to assess the likelihood of automation by occupation (see Figure 6). Many of the occupations at high risk of automation are simultaneously occupations, which do not require a high level of technology use (e.g. workers in agriculture). This means that there is a tendency that it is less likely for a worker to be replaced by technology if he/she is complementing technology. However, there are also several occupations (mainly in the service sector), which do not require a high level of technology use and are simultaneously at low risk of automation (e.g. hairdresser).

Figure 6: The interaction between technology and jobs varies by occupation

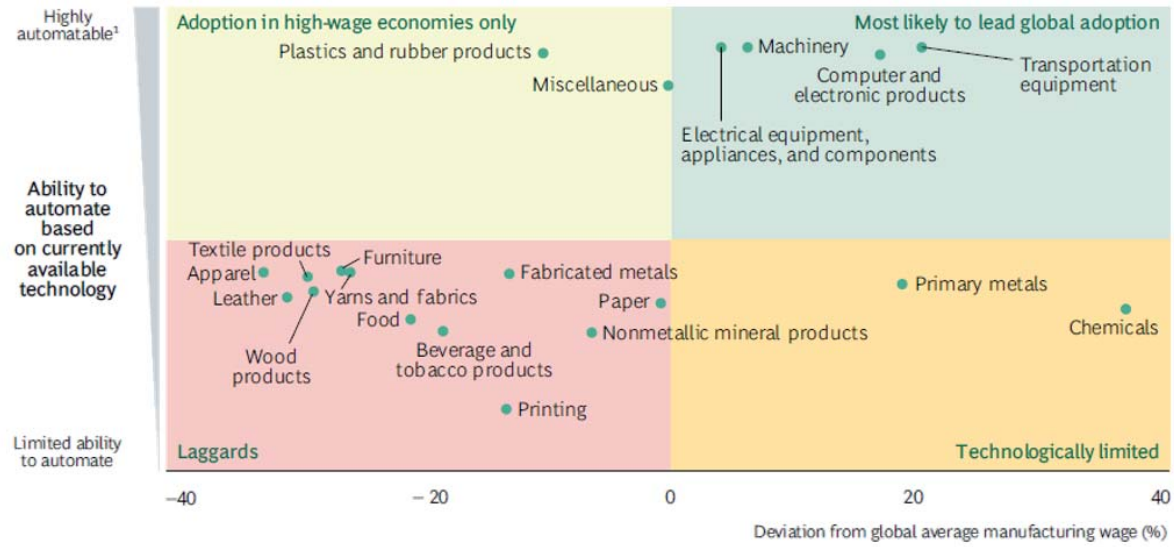


Note: The probability of being computerized is obtained from Frey and Osborne (2013). ICT intensity is an index between 0 (no use of technology) and 19 (most use of technology). ICT = information and communication technology. The red lines represent the average values of ICT intensity (x-axis) and of computerization (y-axis) across the pooled sample of 10 developing countries with STEP household surveys.

Source: World Bank 2016: 131

As to the susceptibility to automation on the country level according to development status, the findings are very mixed. The World Bank (2016) suggest that industrialized countries are more susceptible to a loss of employment due to digitalization than developing countries, due to the high level of technology use (World Bank 2016: 131). An analysis provided by the Boston Consulting Group (Sirkin et al. 2015) focusing on the potential of automation according to income (by industry) suggests a similar picture (see Figure 7). Most of the highly automatable industries are relatively high-income and most of the least automatable industries relatively low-income, suggesting that industries in high (and middle) income countries will suffer more from automation than industries in low-income countries.

Figure 7: Ability to automate and wage level by industry

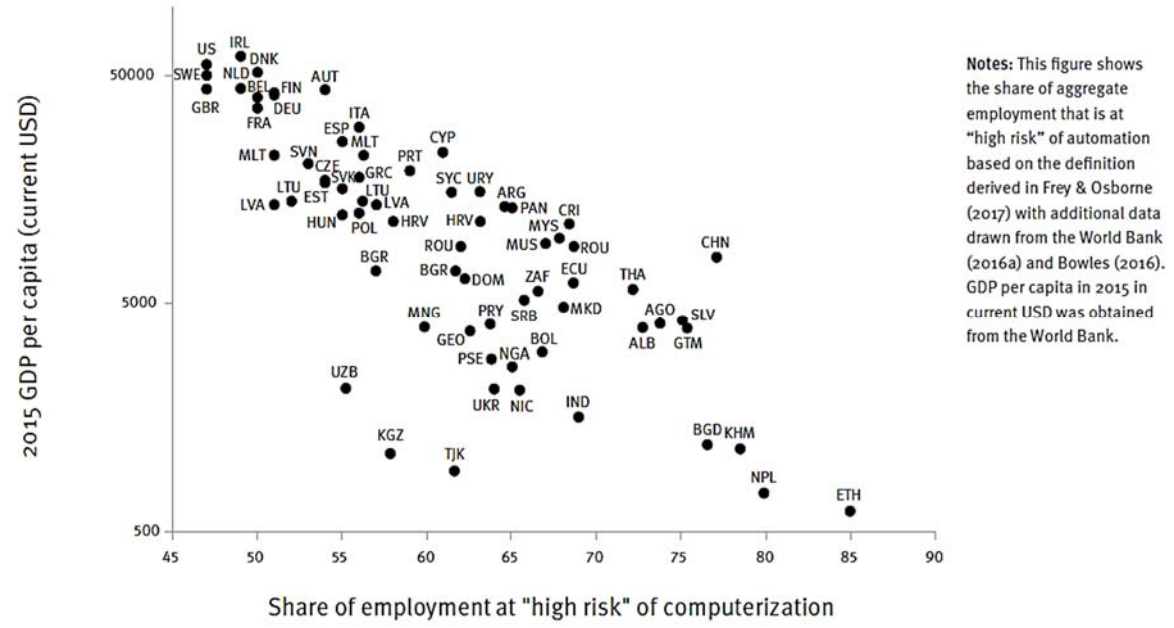


Sources: U.S. Bureau of Labor Statistics, "International Labor Comparison of Hourly Compensation Costs in Manufacturing Industries, 2012"; BCG analysis.
Note: Petroleum and coal manufacturing are not depicted because of a high and variable wage premium, consistent with immovable, resource-intensive industries.
¹These are defined as occupational tasks that have the potential to be replaced with advanced robotics.

Source: Sirkin et al. 2015: 13

However, there is also contrasting evidence. A UNIDO report from 2017 suggests a negative correlation between per capita income and the share of employment at high risk of automation: the lower per capita income, the higher the risk of automation for the countries workforce (UNIDO 2017).

Figure 8: Jobs at "high risk" of Automation



Notes: This figure shows the share of aggregate employment that is at "high risk" of automation based on the definition derived in Frey & Osborne (2017) with additional data drawn from the World Bank (2016a) and Bowles (2016). GDP per capita in 2015 in current USD was obtained from the World Bank.

Source: UNIDO 2017: 21

Results vary widely, since findings in this area are highly sensitive to the specific methodology applied in assessing the automatibility of specific occupations or industries. Therefore, further research is needed to finally assess the susceptibility to automation in different countries across the spectrum of industrial development. The assessment of the possibilities for the creation of new jobs through digitalization are of an even more speculative nature. However, it seems certain that there will be significant opportunities in “innovative IT-enabled services” (Lütkenhorst 2018: 60), requiring a high level of digital skills (clusters around such services are already emerging in e.g. Kenya and Rwanda).

A directly related issue is the future change in the international division of labor and the organization of global production networks due to digitalization. Since the 1970s there has been a continuous process of “offshoring” economic activities, in particular manufacturing, from industrialized to developing countries. There is now growing attention to the phenomenon of “reshoring” or “back-shoring”, which refers to relocating economic operations, which were previously offshored, back to high-income countries. Lütkenhorst (2018) points out that the phenomenon is highly under-researched to date. Most evidence is based on anecdotal accounts, while there is a lack of systematic studies.

Digitalization might contribute to reshoring by changing cost structures and by reducing the importance of economies of scale (de Backer et al. 2016). While today most manufacturing products are highly standardized and produced in large quantities, often far from the location of final demand, new technological possibilities will likely allow for production closer to final demand and in smaller quantities. The most crucial technological possibilities in this regard have been summarized under the term “additive manufacturing”. This refers to a development that can be understood as a reversal of specialization: new technologies enable a single worker or machine to produce parts, components or even whole products, which are made up of different materials, in an efficient way. The most prominent example of “additive manufacturing” is 3D printing, where a machine can produce a whole product from primary material. Such technologies allow for decentralized production in small quantities or even singular, personalized products for individual wants and needs (de Backer et al. 2016). The speed and scope of reshoring will depend on “how fast additive manufacturing will move from its current focus on prototyping and product development towards the decentralised batch production of final goods from multiple materials” (Lütkenhorst 2018: 29). This in turn will depend on how fast costs of additive manufacturing such as 3D printing will fall. Between 2009 and 2014 the prices for 3D printers have fallen by a factor of 40, mostly due to the expiration of patents. The process of printing is likewise exhibiting falling costs due to an increase in the speed of printing and increased energy-efficiency of the printers (ibid.).

Overall, Lütkenhorst (2018) finds a tendency in expert opinion towards the conclusion that in the medium-run development countries will be seriously affected by reshoring activities. In the likely emerging new international division of labor, many low-income countries, particularly those with small domestic markets, will be disadvantaged by the positioning of production close to the location of final demand.

2.3. Environmental Impacts

The increasing diffusion of digital technologies has important environmental impacts on several levels (Berkhout/Hertin 2004; Higón et al. 2017). Similarly to the discussion on the impacts of digital technologies on development, the discussion of the impacts of digital technologies on the environment is “characterized by a stark contrast between optimistic and pessimistic assessments” (Berkhout/Hertin 2004: 904). The topic of environmental impacts of ICTs is highly under-researched, especially with a specific focus on developing countries. Most of the research is based on isolated case studies, therefore lacking a representative account of overall impacts (Berkhout/Hertin 2004; Lütkenhorst 2018). However, while there are

negative as well as positive impacts for the environment, many of the former are disproportionately borne by developing countries.

Berkhout and Hertin (2004) differentiate among three types of environmental impacts of ICTs, which are summarized in Table 1. Direct impacts are generated by the production and use of ICTs. They include resource use (sensitive resources, such as rare-earth minerals for the production of electronics, are predominantly sourced in developing countries), energy consumption and pollution generated by the production of infrastructure and devices, the electricity consumption from the use of devices as well as the disposal of electronic waste (which takes place predominantly in developing countries). Indirect impacts arise from the effects that ICTs have on production processes, products and distribution systems and include the dematerialization and the substitution effect (i.e. the substitution of material goods for information goods as well as travel for communication technologies). The third category is termed “structural and behavioral impacts” and comprises effects generated by structural change and growth of the economy as well as the change of life styles and value systems through ICTs. The overall environmental impact of ICTs is determined by the impacts in all three categories.

Table 1: ICT impacts on the environment

	Positive impacts	Negative impacts
Direct effects of ICT		Environmental impacts of production, use and disposal of ICTs (e.g. electronic waste)
Indirect effects of ICT	Improved efficiency, de-materialisation and virtualisation, detection and, monitoring of environmental change (e.g. intelligent logistics, electronic directories, environmental sensors)	Falling prices for resource inputs, proliferation of ‘intelligent’ devices, partial substitution (e.g. e-shopping as well as private shopping trips)
Structural and behavioural effects of ICT	Structural and life style transitions (e.g. growth of ‘light’ industries, green consumerism)	Stimulating growth and re-materialisation (e.g. growth of long-distance travel)

Source: Berkhout/Hertin 2004: 906

Therefore, it is close to impossible to assess whether digital technologies will exhibit an overall negative or positive impact on the environment. However, their environmental impact is significant and should be considered, since both minerals’ extraction and waste management are pressing issues for developing countries.

Other authors have stressed the positive effects by which technology contributes to increased efficiency and new possibilities for e.g. renewable energy generation. There is a high degree of agreement that an energy transition towards a low-carbon energy system cannot be achieved without a comprehensive use of digital technologies (e.g. UNIDO 2017). These potentials should be assessed particularly for developing countries, where new infrastructure needs will have to be catered for, and path dependencies through infrastructure for fossil fuels are less pronounced.

3. Digitalization in Development Cooperation

3.1. The debate on ICT4D and D4D

The interest in the digitalization topic from the perspective of (economic) development and development cooperation is underlined by the recent wave of publications and policy initiatives concerned with digitalization. For example, UN-agencies, development cooperation agencies, the World Bank and others collaborated to define the „Principles for Digital Development“ (see Box 3). Several different development agencies have elaborated specific strategies and dedicated projects to the opportunities provided by digital technologies for development cooperation (see Section 3.2.). Furthermore, research institutes and international organizations have dedicated special issues of their publications to the topic. The World Bank e.g. devoted its annual “World Development Report” to the topic in 2016 (World Bank 2016) and the UN issued an UNCTAD-report on “Digitalization, Trade and Development” in 2017 (UNCTAD 2017).

Several scholars have pointed out similarities between the reception of the impacts of ICTs on developing countries in the ICT4D literature (in the end of the 1990s and the beginning of the 2000s) and that of the newer wave of digital technologies today (Pawelke 2017; Kleine/Unwin 2009). The observation is that in both periods, digital technologies have received a very positive treatment in the literature, when it comes to their potential for developing countries. Similarly, in both periods technologies sparked a pronounced interest of development cooperation agencies and other projects to pick them up and invest into them. As Kleine and Unwin (2009) put it: “If the rhetoric was to be believed, […] new ICTs […] [would] bring about revolutionary changes in countries’ development. […] The cycle of invention of technology, hype around its development impacts, communal learning through failed and successful project implementation and, finally, more measured steps to integrating a new technology into development efforts has been gone through before.” (Kleine/Unwin 2009: 1045) On the other hand, other authors have made the argument that this new wave of digitalization differs significantly from the last one in several dimensions. Lütkenhorst (2018: 6) e.g. makes the case that the new digital technologies are in their general impact “*transformational* in nature, *cross-cutting and pervasive* in their innovative application across the various sectors of industry, and leading towards a *growing homogeneity* of industrial processes in functions ranging from design all the way to monitoring and control.”

However, there now seems to be a consensus that in the past, ICTs have not lead to the expected benefits for developing countries, both on a macro level and in specific projects applying them. Furthermore, the “digital divide” between developing and industrialized countries widened across different dimensions (Kleine/Unwin 2009). In 1998, a UN-report on the potential of ICTs for development found ICTs had “barely touched” many people’s lives in the poorest countries, and that some were even negatively affected either through their exclusion from the “global information society” or through social and economic “dislocations” brought about by technological change (Mansell/Wehn 1998). Similarly, in 2011, the independent evaluation group of the World Bank found that between the years 2003 and 2010 only 30% of the funded projects with the goal of increasing access to ICTs actually reached that goal (IEG 2011). The 2016 World Development Report entitled “Digital Dividends” made a similar point, when stating that “Although there are many individual success stories, the effect of technology on global productivity, expansion of opportunity for the poor and the middle class, and the spread of accountable governance has so far been less than expected“ (World Bank 2016: 2).

Therefore, claims that groundbreaking benefits for developing countries will be triggered by digital technologies should be met with skepticism. However, digital technologies will substantially change the global economy and understanding these changes will be vital for development policy and development cooperation. The experience with the ICT4D and D4D debates thus suggests to carefully scrutinize, which projects actually benefit from the introduction of digital technologies. Implementation in turn, should be guided by a systemic account of potential effects and explicitly cater for appropriate mitigating policies.

3.2. Recent digital initiatives in European development cooperation

In the following, we will discuss specific strategies of a set of European development cooperation agencies with regard to digitalization. We will then proceed with providing a list of illustrations on the application of specific technologies in actual development cooperation projects, before discussing important principles when working with digital technologies in development cooperation.

Interest in the use of digital technologies in development projects has grown recently, both by international organizations and development cooperation agencies as well as private providers and NGOs. Several development agencies have elaborated specific "digital strategies". Box 2 provides an overview of the strategies of four leading European development cooperation agencies.

While Box 2 lays out the overall strategies of European development cooperation agencies, practical applications of digital technologies in development projects have become widespread in recent years. The Appendix to this briefing paper contains a list of specific technologies and examples of projects, where those technologies have been applied.[1] The Appendix is not exhaustive in nature, but provides an overview of practical examples, how technologies have been used in and for development cooperation projects. It is noteworthy that the listed technologies can be potentially applied in a large number of sectors, in which development cooperation typically operates, e.g. agriculture, trade, health care, private sector development, etc.

In the literature on digitalization for development practitioners a number of principles for the implementation of digital technologies in projects have been proposed. The most important initiative has emanated from a collaboration between several UN-agencies, the World Bank, development cooperation agencies and others for defining the „Principles for Digital Development". The nine principles are guidelines to be followed by development projects in the implementation of digital technologies and are officially endorsed by over 50 organizations, including major development cooperation agencies like USAID, large NGOs like Oxfam and international organizations (see Box 3).

[1] The website https://www.trendradar.org/en/cases/ offers a database of close to 700 project examples making use of digital technologies. It includes descriptions of the projects and further information.

Box 2: Digital strategies of European development cooperation agencies

Belgium: The Belgian Development Cooperation (DGD) has elaborated a "Strategic Policy Note" on the topic of digitalization (Achten 2016). The DGD states three priorities in the implementation of digital technologies: 'better use of (big) data', 'digital for inclusive societies' and 'digital for inclusive and sustainable economic growth' (ibid.). In working on these issues, "digitalization can play an important role in all of the sectors where the Belgian development cooperation is active" (Achten 2016: 17). Therefore the DGD sees digitalization as a crosscutting issue and proposes to integrate digitalization in "everything we do when it can contribute to [our] vision" (ibid.: 17). This means that digital technologies will be included in projects concerned with health, education, agriculture and food security, basic infrastructure, water and sanitation, governance, social protection, financial services and others (Achten 2016: 17). However, the DGD stresses that there are certain basic conditions for a successful "digital approach", which need close attention and include "the availability of ICT infrastructure and electricity, the presence of human skills to use and manage the technology, sound leadership and a favorable regulatory framework" (ibid.: 9). In the Belgian strategy it is empathized that local ownership and knowledge transfer as well as environmental issues (most importantly managing e-waste) are key to the sustainability of digital projects.

Germany: In Germany the Federal Ministry for Economic Cooperation and Development (BMZ) and the German Corporation for International Cooperation (GIZ) cooperated for several publications on the topic of digitalization. They developed a glossary, which gives a brief overview of important terms and concepts in the realm of digitalization, with the aim of familiarizing development cooperation practitioners with them (BMZ 2016a). The glossary is part of a larger "toolkit", comprising most importantly a collection of project examples using digital technologies as well as practical tips for their implementation and usage (BMZ 2016b). Furthermore, the BMZ has published a "Digital Agenda" (BMZ 2017). 350 of BMZ's projects explicitly deal with digitalization issues, 199 of which are realized by GIZ. There is a focus on African and to a lesser extent Asian countries, with 117 of these projects being based in Africa and 79 in Asia. For the initiative "Digital Africa" the BMZ has increased the funds to 100 million Euros in 2017. The focus lies on supporting the provision of digital infrastructure (such as broad band internet cables), e-learning projects, good governance and anti-corruption projects, public health projects, IT-sector development projects, the fostering of democratic processes as well as refugee projects (ibid.: 5). The German agenda states changes in the labor market, the digital divide, data security and human rights as well as electronic waste as the major challenges with regards to digitalization (ibid.: 9).

Denmark: The website of Denmark's DANIDA states that "digitalization and technology is a strategic priority in Danish foreign- and development policy and an area where Denmark - based on our values, principles and experiences with a highly digitalized public sector - can help set the global foreign and development policy agenda in the coming years" (DANIDA n.d.). It states closing the digital divide in terms of cell-phone and Internet access as its major concern. There is one DANIDA publication on technology and development with the title "Hack the future of Development Aid" (Haahr 2017). It contains a very optimistic account of the use of blockchain technology in the context of development cooperation and proposes using it for various purposes, such as financial transfers, record keeping (e.g. for land titles, health records, etc.), the conclusion of contracts, e-voting, e-learning, etc.

United Kingdom: The UK's Department for International Development (DFID) has issued a "Digital Strategy 2018-2020" (DFID 2018), which aims at establishing "DFID as a global leader in digital technology and development" (ibid.: 4). The strategy is twofold: on the one hand it lays out the plan for implementing digital technologies in development cooperation projects, on the other hand it proposes to transform DFID into a "digital department" by using digital technologies in internal processes (DFID 2018: 6). The strategy is mainly aimed at tackling global poverty, "[promoting] common principles and standards for digital development throughout the aid system", providing "affordable, secure access to the internet" (ibid.: 4) as well as using data for decision making in the organization and for increasing accountability (DFID 2018: 5).

Furthermore, several authors stress that the digital technology itself should never be the starting point of considerations for implementing it in a project context. Instead, the starting point should always be a specific problem or challenge in need of a solution, which might entail the use of a digital technology, if useful in the specific context (Schwaab 2016; Achten 2016). There is also the concern that the hype around digital technologies might divert limited development funds from the satisfaction of more fundamental and pressing needs (such as food, clean water and sanitation, electricity) towards digital technologies (Kleine/Unwin 2009).

It is important to keep in mind that worldwide more than 850 million people are living in informal settlements without sufficient access to essential infrastructures (WBGU 2018). Furthermore, for the use of most digital technologies, there is a need for constant maintenance and support, which requires the long-term commitment of people with the necessary skills. Some authors have voiced their concern over the potential that "in essence, digital technologies employed to solve an identified problem will create a host of new problems that, in turn, will be in need of renewed solutions." (Ndemo/Weiss 2017: 342).

Box 3: The Nine Principles for Digital Development

1. "Design with the User", which refers to the idea that the specific targeted users of the technology should be taken into account, with their interests and skills.
2. „Understand the Existing Ecosystem": the technology should be compatible with local context and existing policies.
3. „Design for Scale": it should be ensured that the technology is used beyond the pilot phase.
4. „Build for Sustainability": the aim should be to reach a certain level of institutionalization of the technology use, so that it keeps being used in the future.
5. "Be Data Driven": projects should be designed so that data for decision making and monitoring can be collected. The collected data should then be used for these purposes.
6. "Use Open Standards, Open Data, Open Source, and Open Innovation": Whenever possible, open source technologies should be used in order to avoid spending scarce development cooperation funds on expensive licenses as well as reduce the dependence on a specific provider.
7. „Reuse and Improve": it might be possible to adapt technologies that are already used in a certain context instead of implementing something entirely new.
8. "Address Privacy & Security": a "careful consideration of which data are collected and how data are acquired, used, stored and shared" (Principles for Digital Development n.d.) is required.
9. „Be Collaborative": experiences should be shared with other practitioners, users, experts, etc.

Source: https://digitalprinciples.org/principles/

Schwaab (2016: 16) therefore suggests to conduct rigorous impact assessments before implementing a technology. In the assessment, the following aspects should receive particular attention (i) avoiding the abuse by authoritarian governments, or by corporations with high market power and criminal forces; (ii) inequalities and the digital divide are decreasing, never increasing; (iii) economic development that creates employment is supported; and (iv) the capacity of partners to conduct such assessments themselves is fostered.

4. Conclusions

Digitalization will transform economies both in the Global North and South. The specific scope and scale of these changes however remains to be seen, and will be influenced both by technological developments and political regulation. Historical experience would seem to suggest that technological euphoria as well as overly pessimistic accounts of the transformative impact are equally misplaced.

With that in mind, a first observation on likely impacts is that the large net labor-substituting effects of digitalization are not corroborated by the available historical evidence. The introduction of new technologies has a dual effect on employment. Though some jobs are shed, new jobs are created as a consequence of the emergence of new business activities and new products and services, respectively, that become possible thanks to new technologies. To the extent that history provides some guidance for the future, the last 200

years suggest that the overall job effect of this dual movement need not be negative (Perez 2016). The real policy challenge then is twofold: (i) to manage the inevitable reshuffling of jobs from old to new sectors and industries; and (ii) to incentivize the emergence and expansion of new economic sectors that make use of and expand upon novel technologies in a way that delivers a net social benefit to society.

The first challenge particularly requires governmental capacities in the fields of education and training as well as active labor market policies. The second challenge calls for pro-active industrial policies, with a focus on research and innovation, tax and financial policies, infrastructure policies as well as social and regulatory policies that safeguard key societal objectives such as social equity and inclusion. Arguably, such policy capacities are better developed in OECD countries than in most LDCs. Development cooperation can support such capacity-building in LDCs, and it will arguably be one of the former's principal challenges in the near future.

Policy challenges for LDCs as well as for development cooperation will likely relate to three key issues:

(1) Regulating the socio-ecological impacts of commodity extraction: digitalization rests upon the availability of a number of key minerals, in particular rare earths. Major deposits of the latter reside in LDCs. The governance of commodity extraction will thus be extremely important, both in terms of promoting domestic economic development by e.g. wisely managing resource rents, and by safeguarding the interests of local populations affected by the social and environmental impacts of mining.

(2) Keeping up with the infrastructural needs of the digital economy: the proliferation of digital technologies depends on the affordable and reliable supply of electricity, as well as on state of the art telecommunication technologies, e.g. broadband internet, both of which are often lacking in LDCs. Massive infrastructure investment will thus be required. The funding of such investment will depend on a well-designed mix of public and private monies, and in the case of many LDCs will call for the establishment of new financing vehicles like infrastructure development banks. Prudent financial management should avoid excessive foreign indebtedness and focus on the availability of affordable long-term funds. Similarly, access to infrastructure services should be provided at reasonable rates.

(3) Managing the economic potentials and challenges of the digital economy: as outlined above, the digital transformation will involve both management of structural economic change and exploiting the potentials for new production and employment. In the context of LDCs, two processes merit particular attention:

    (i) Managing changing skills demands in traditional labor-intensive light manufacturing industries, such as apparel, leather, agro-food production etc., in light of automation and robotization (Industry 4.0): though at the end of the day, it is not technical but economic feasibility that will be decisive, automation and robotization will eventually diminish the employment creation potential of typical labor-intensive industries. Instead, the demand for employment will shift to higher qualified, though fewer workers. Thus, the competitiveness of such industries will in future depend on the supply of skilled labor. LDC policy makers will thus have to scale up investment in vocational training and education, in order to equip the workforce with the skills requisite to modern industrial production. This must not only involve the requisite technical skills, but particularly those skills that are complementary to the kind of tasks that will be increasingly taken over by machines. The emergence of new employment-generating economic activities will thus particularly depend on the creative and innovative capacities of the future workforce. Development cooperation should

support such efforts for skills upgrading in industrial sectors, particularly among the young working population.

(ii) Promoting domestic production of high value-added products: technologies such as 3D printing allow LDCs to produce high-value added customized products domestically (e.g. medicinal products such as prostheses), thus avoiding the need for expensive imports of such products. LDC policy-makers should promote companies that use digital technologies for the domestic production of products that substitute for expensive imports.

Last but not least, digital technologies also offer new potentials for making development cooperation itself more efficient by rationalizing bureaucratic routines as well as by improving on the evidence base for the design and evaluation of development projects. Digital technologies may also be conducive to increasing the transparency of development cooperation.

At the end of the day, the economic, social and political impacts of digitalization will however depend on political governance, which will define the strategic trajectories of the digital revolution in the future. It must be emphasized that this process should be guided by a commitment to democratic decision-making and, as far as development cooperation is concerned, by the objective to foster socially inclusive and environmentally sustainable development.

References

Achten, Dirk (Ed.) (2016): Strategic Policy Note. 'Digital for Development' (D4D) for the Belgian development cooperation. Brussels.

Berger, Thor/Frey, Carl Benedikt (2016): Structural Transformation in the OECD: Digitalisation, Deindustrialisation and the Future of Work. OECD Social, Employment and Migration Working Papers No. 193. Paris.

Berkhout, Frans/Hertin, Julia (2004): De-materialising and re-materialising: digital technologies and the environment. In: Futures, 36(8), 903-920.

BMZ (2017): Die digitale Revolution für nachhaltige Entwicklung nutzen. Die Digitale Agenda des BMZ. Berlin/Bonn.

BMZ (2016a): Glossary – Digitalisation and Sustainable Development – Terminology from the Digital World for Development Cooperation and International Cooperation in Education, Culture and Media. Berlin/Bonn.

BMZ (2016b): Toolkit – Digitalisation in Development Cooperation and International Cooperation in Education, Culture and Media. Berlin/Bonn.

Bukht, Rumana/Heeks, Richard (2017): Defining, Conceptualising and Measuring the Digital Economy. Development Informatics Working Paper Series No. 68. Manchester.

Burt, Martin (2015): How technology can help us eliminate, not alleviate, poverty. World Economic Forum. https://www.weforum.org/agenda/2015/09/how-technology-can-help-us-eliminate-not-alleviate-poverty/ (June 15, 2018).

DANIDA (n.d.): Denmark at the digital forefront. http://um.dk/en/danida-en/strategies%20and%20priorities/techvelopment/ (April 25, 2018).

De Backer, Koen/Menoni, Carlo/Desnoyers-Jamesi, Isabelle/Moussiegti, Laurent (2016): Reshoring: Myth or reality? OECD Science, Technology and Industry Policy Papers No. 27. Paris.

DFID (2018): Digital Strategy 2018-2020: Doing Development in a Digital World. London/Glasgow.

Faith, Becky (2017): Decent Work in a digital world. IDS Digital and Technology Briefing, September 2017. Brighton.

Frey, Carl Benedikt/Rahbari, Ebrahim (2016): Do labor-saving technologies spell the death of jobs in the developing world? In: Chandy, Laurence (Ed.): The future of work in the developing world. Brookings Blum Roundtable 2016 Post-Conference Report. Washington D.C.

Haahr, Mariannne (2017): Hack the future of Development Aid. Sustainia/The Danish Ministry of Foreign Affairs/Coinify. Copenhagen.

Hernandez, Kevin/Ramalingam, Ben (2017): Blockchain for Development – Hope or Hype? IDS. Rapid Response Briefing No. 17. Brighton.

Higón, Dolores A./Gholami, Roya/Shirazi, Farid (2017): ICT and environmental sustainability: A global perspective. In: Telematics and Informatics, 34(4), 85-95.

IEG (Independent Evaluation Group) (2011): IEG Annual Report 2011: Results and Performance of the World Bank Group. Independent Evaluation Group, the World Bank Group. Washington D.C.

Kleine, Dorothea/Unwin, Tim (2009): Technological Revolution, Evolution and New Dependencies: what's new about ict4d? In: Third World Quarterly, 30(5), 1045-1067.

Knickrehm, Mark/Berthon, Bruno/Daugherty, Paul (2016): Digital Disruption: The Growth Multiplier. Optimizing digital investments to realize higher productivity and growth. Dublin.

Lütkenhorst, Wilfried (2018): Creating wealth without labour? Emerging contours of a new techno-economic landscape. German Development Institute Discussion Paper 11/2018.

Mann, Laura (2018): Left to other peoples' devices? A political economy perspective on the big data revolution in development. In: Development and Change, 49(1), 3-36.

Mansell, Robin/Wehn, Uta (Eds.) (1998): Knowledge societies: Information technology for sustainable development. Published for the United Nations Commission on Science and Technology for Development. Oxford.

Ndemo, Bitange/Weiss, Tim (2017): Making Sense of Africa's Emerging Digital Transformation and its Many Futures. In: Africa Journal of Management, 3(3-4), 328-347.

Nessel, Sebastian (2017): Geld für alle! In: trendradar_2030. betterplace lab. Berlin.

Pawelke, Andreas (2017): Gute Daten mit bösen Nebenwirkungen. In: trendradar_2030. betterplace lab. Berlin.

Perez, Carlota (2016): Capitalism, Technology and a Green Global Golden Age: The Role of History in Helping to Shape the Future. In: Jacobs, Michael/Mazzucato, Mariana (eds.): Rethinking Capitalism. Economics and Policy for Sustainable and Inclusive Growth. Chichester, 191-218.

Peters, Stephan (2017): Making History. In: trendradar_2030. betterplace lab. Berlin.

Principles for Digital Development (n.d.): https://digitalprinciples.org/principles/ (April 13, 2018).

Rodrik, Dani (2016): Premature deindustrialization. In: Journal of Economic Growth, 21(1), 1-33.

Schwaab, Jan (2016): Fragenkatalog für das Fachgespräch zum Thema „Digitalisierung und Entwicklungszusammenarbeit" des Ausschusses Digitale Agenda/ Deutscher Bundestag am 9. November 2016. Berlin.

Sheehy, Andrew (2016): GDP cannot explain the digital economy. Forbes. https://www.forbes.com/sites/andrewsheehy/2016/06/06/gdp-cannot-explain-the-digital-economy (August 31, 2018).

Shewan, Dan (2017): Robots will destroy our jobs – and we're not ready for it. In: The Guardian. https://www.theguardian.com/technology/2017/jan/11/robots-jobs-employees-artificial-intelligence (June 15, 2018).

Sirkin, Harold L./Zinser, Michael/Rose, Justin R. (2015): The Robotics Revolution. The next great Leap in Manufacturing. Boston Consulting Group (BCG). Boston.

Statista (2018): Google's revenue worldwide from 2002 to 2017 (in billion U.S. dollars). https://www.statista.com/statistics/266206/googles-annual-global-revenue/ (April 26, 2018).

UNCTAD (2017): Information Economy Report 2017: Digitalization, Trade and Development.

UNIDO (2017): Accelerating clean energy through Industry 4.0: Manufacturing the next revolution. Vienna.

WBGU (German Advisory Council on Global Change) (2018): Digitalization: What we need to talk about. Berlin.

World Bank (2016): Digital dividends. World Development Report 2016. Washington D.C.

World Bank Open Data (n.d.): https://data.worldbank.org/ (April 26, 2018).

Appendix

Digital technologies and their application in development cooperation projects

Technology	Description/Examples	Potential Use in Development Cooperation	Project Examples
ICTs	"ICTs [...] include any communication device or application, encompassing radio, television, mobile phones, computers and network hardware and software, and satellite systems, as well as the various services and applications associated with them, such as videoconferencing and distance learning." (Kleine/Unwin 2009: 1045)	access to information, knowledge and communication	The Soko e-commerce platform enables producers of handicrafts goods to sell worldwide online. "Those with no access to the internet can run their virtual shop over a standard mobile phone, sending customers photos of their products and then negotiating sales by text message. The proceeds of sales are paid out to the seller at specified kiosks, rendering bank accounts unnecessary. Over 1,000 artisans – of both genders, though 74% of them are women – are currently selling their wares on Soko. Their average household income has quadrupled." (BMZ 2016b: 2.4g)
Cellphones/ Smartphones		access to information, knowledge and communication	"Farmers in Uganda receive personalized commercial or technical advice on their smartphone in function of the crop on their field. This leads to a higher productivity of the farmers and allows them to get a fair price for their crop." (Achten 2016: 7)
SMS (Short Message Services)		sharing of information, communication	"In Tanzania it recently became possible to register the birth of children by SMS. Parents no longer have to undertake a two-day walk to the nearest village to do so." (Achten 2016: 6)

e-Finance/ e-Payments/ mobile banking	The use of digital technologies in the financial sector, e.g. for transferring money or offering credit, savings or insurance products.	access to finance (accounts, simple transactions, loans, …) without the need for conventional banking infrastructure, which has a special potential for rural areas.	The world's biggest mobile money transfer system is M-Pesa, which is used by 70% of the Kenyan population. 30% of the Kenyan GDP are processed via M-Pesa. Similar services are available in 20 other developing countries. (Nessel 2017)
			"Mobisol offers off-grid solar systems with capacities ranging from 30 to 200 Watts. In an innovative payment scheme, users pay in small monthly instalments instead of covering the full cost up front. Since a mobile payment system is integrated into the scheme, these small amounts can be settled simply by text message, freeing up access to the power system." (BMZ 2016b: 2.5a)
GIS (Geographic Information System)	“A system that geographically pinpoints information, linking data to points on digital maps.” (BMZ 2016a: 58)		Ushahidi is running a crowdmapping platform, which was used to collect and publish eyewitness reports on "anomalies and civil disturbances during the country’s 2007 presidential elections." (BMZ 2016a: 104)
			Trade Route Incident Mapping System (TRIMS): TRIMS is an app, which aims at fighting corruption in Nigeria. Affected people can send an a geo-coded SMS when they experience corrruption. The messages are collected anonymously on a crowdsourcing plattform and displayed on an interactive map. (Schwaab 2016: 3-4)
Customized Software Solutions			The „District Health Information System“ (DHIS2) in Bangladesh was implemented with the help of German development cooperation. It is the first digitalized, centralized administration system of the health care system in Bangladesh, which combines the records of 7,000 health care facilities. The software solution is open source. (Schwaab 2016: 3)

Apps	Add-on programme or piece of software for smartphones, tablets or desktop computers		"Sem Dengue": in Brazil people can send pictures of stganant waters (where mosquitos infected with dengue usually breed) to city officials via the app "Sem Dengue" (English: Without Dengue). The app has 100,000 registered users in 30 cities.
			The project "m-developers" of the German development cooperation trains and certifies 8,000 app-developers in Tunesia within six months via an online learning platform. The aim is the development of 1,000 apps. (Schwaab 2016: 4)
Blockchain	“Blockchain is a technology for keeping and maintaining records. It is a chain of transactions, which is" distributed, verified and monitored by multiple sources simultaneously." (Hernandez/ Ramalingam 2017) It is decentralized, every participant has a complete copy of the whole record chain and does not depend on the trust in other participants or a central authority.	Micro-finance, voting, registry of land titles/property rights, Supply-Chain tracking, tracking aid funds, etc.	The Swiss company Agora has the goal of automating "the entire electoral process with citizens voting electronically using biometric data and personalized cryptographic keys and the votes in turn validated by blockchain". It has already been tested in Sierra Leone.
			The company "bext360" uses the technology to track the supply chain of products such as coffee or timber to provide transparency of labor and environmental standards.
			The pilot project "Building Blocks" by the World Food Program uses the blockchain technology for a cash transfer program in Jordan.

3D Printing	Decentralized printing of solid material into spare parts and components to be assembled or whole small products (e.g. protheses, cannnulas, parts of a vehicle, furniture, …). There are currently more than 32,000 3D-printers in more than 150 countries, the majority of which are located in industrialized nations. (Peters 2017: 73)	Traditional production processes exhibit highly increasing returns to scale: producing a singular piece is very expensive. With 3D printing there are almost no returns to scale and singular pieces might get affordable. It is easy and inexpensive to adjust products to individual needs.	"Zaatari is going to be the first refugee camp in the world to have a FabLab: an open workshop equipped with modern technology. Here, refugees can gain the technical skills they need to produce items on site that they need. So the FabLab's 3D-printer will even enable them to make complex items, like prostheses, which would otherwise be virtually impossible to obtain due to their high cost and the lack of access to providers of medical supplies." (BMZ 2016a: 2.7d)
Big Data	Digitalization and automation lead to the collection of a vast amount of data via digital devices and censors.	monitoring, decision making and evaluation	"In Guinea 'Big Data' analyses of mobile phone records were used in the fight against ebola. Based on the analyses of these records they were able to determine the moving patterns of the people and thus predict where the disease would spread to next." (Achten 2016: 6)

Authors

Veronika Heimerl (BSc), is a research intern at ÖFSE, a student of the master programme „Socio-Ecological Economics and Policy“ and a teaching assistant at the Vienna University of Economics and Business. Her research interests lie at the interface between political economy, social and ecological issues.

Werner Raza is Director of ÖFSE – Austrian Foundation for Development Research. His work areas are international trade, development economics and policy.