

The Growth Effect of Disruptive Technology in Ethiopia: With a Case Study of Digitalization in the Financial Sector

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The Growth Effect of Disruptive Technology in Ethiopia: With a Case Study of Digitalization in the Financial Sector

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List of abbreviations and acronyms

API	Application Programming Interface
ARDL	Auto-Regressive Distributive Lag
ATM	Automated Teller Machine
BI	Business Intelligence
BPO	Business Process Outsourcing
CBE	Commercial Bank of Ethiopia
CBK	Commercial Bank of Kenya
CEO	Chief Executive Officer
DBE	Development Bank of Ethiopia
DTs	Disruptive Technologies
DW	Data Warehouse
ECM	Error Correction Model
EGDI	E-Government Development Index
EPRDF	Ethiopian People's Revolutionary Democratic Front
ERM	Enterprise Resource Management
ERP	Enterprise Resource Planning
FDRE	Federal Democratic Republic of Ethiopia
FSFM	Frankfurt School of Finance and Management
GB	GigaByte
GDP	Gross Domestic Product
HRD	Human Resource Development
ICT	Information and Communication Technology
IFC	International Finance Corporation
IMF	International Monetary Fund
IT	Information Technology
ITU	International Telecommunication Union

KI	Key-Informant
LDCs	Least Developing Countries
MFIs	Micro-Finance Institutions
MNPD	Ministry of National Planning and Development
NBE	National Bank of Ethiopia
NDS	National Digitalization Strategy
NDPS	National Digital Payments Strategy
OSI	Online Service Index
POS	Point of Sale
SMEs	Small and Medium Enterprises
SSA	Sub-Saharan Africa
TFP	Total Factor Productivity
UNCTAD	United Nations Conference on Trade and Development
WDI	World Development Indicators

Abstract

Focusing on digitalization as a major disruptive technology in Ethiopia, this study found that digitalization is at a very low level of development in Ethiopia, by regional standard. Yet, a 10% rate of digital penetration (digitalization) is found to increase GDP growth by 0.5%—this being as high as 0.8% in the service sector. Digitalization in the financial sector is growing very fast, but is still the lowest by regional standard. Major challenges for this are found to be the stifling regulatory environment from the central bank, the telecommunication infrastructure (though significantly improved lately) and the low level of digital literacy both at national level and within the financial sector. Low investment from the board of directors of banks so as to pay high dividend, failure of executives to take risk to creatively use the IT capacity in the country, the difficulty of measuring the impact of digitalization for use in board and executive decision-making, and coordination failure in collectively acquiring some digital technologies from global vendors at national level are some of the challenges identified in the sector. Based on these findings, the study derived various policy implications that include: strengthening the regulator body and improving its working modality; acquisition of some digital technology at national level; and improving the digital infrastructure, cost and reliability; among others.

Key words: Disruptive technology; Digitalization; Financial sector; Ethiopia; Africa.

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1.0 Introduction

Ethiopia has witnessed excellent economic growth in the last decade and half. However, poverty and unemployment are still major problems. This is partly because this growth was not accompanied by structural transformation and failed to create sufficient employment as a result (Alemayehu, 2022a). Thus, structural change and job creation is a key socioeconomic and political challenge that needs the attention of policy makers. Fast and transformational growth is required to address these challenges. Disruptive technologies (DTs, hence forth) such as digitalization are crucial in this respect. DTs can bring about structural transformation of the economy, lead to global level of competitiveness and transform the economy and its various sectors and sub-sectors through technological leapfrogging (Sabbagh, et al., 2012; UNCTAD, 2018; Ab.Aziz et al., 2021). This is in particular important in the financial sector in Ethiopia, which is at a very low level of development and, hence, the focus of this study.

Such potential positive effect of DTs could be a source of job creations. On the other hand, the effect of DTs on job creation could also be negative because DTs could also destroy jobs in economic agents' bid to use DTs for efficiency and competitiveness. The role of DTs, both in structural transformation as well as the employment creation and destruction is, thus, crucial to understand in a developing country like Ethiopia. In this study, I will focus on digitalization and digital transformation as one aspect of DTs.

DTs, such as digitalization, will generally be limited if they are studied or carried in an isolated manner. Thus, it is generally better to examine digitalization in the financial sector in the context of the national digital ecosystem and the overall effect of DTs in transforming the national economy where the financial sector is just one part of it. Notwithstanding such limitations, in this study, an attempt is made to only identify the impact of digitalization in the Ethiopian financial sector after a brief review of the national ecosystem. This is done by focusing on the Ethiopian banking sector which is the de facto financial sector of the country. To redress the limitation of focusing only on the financial sector alluded above, I will attempt to place the digitalization in the sector in the context of the national digital ecosystem in comparison with the East African region as bench mark.

There is a dramatically accelerating pace of development and adoption of new technologies in the world since the turn of this century. According to UNCTAD (2018), this is driven by: (a) the cumulative nature of technological change, (b) the exponential nature of technologies growth, (c) the convergence of technologies into new combinations, (d) dramatic reductions in costs as well as entry costs; and (e) the

emergence of digital “platforms” such as the internet. The literature groups these disruptive technologies (DTs) into five broad categories: (i) Artificial Intelligence, (ii) Digital Technology: Big data and the internet of things, (iii) 3D printing, (iv) Bio-technology, and (v) Material/Nano-technology. Of these categories, this study will focus on “digitalization” or what is called the “big-data and internet of things”. Although the latter could contribute a lot in various sectors of the national economy, and hence it is imperative to take the synergy associated with that, the focus of the study is on the financial sector. The study will, however, begin by looking at its general economic growth effect to redress some of such limitations.

Even the digitalization aspect of DTs, which is the focus of this study, could have different pillars. The World Bank (2017) uses the following as pillars of digital economy: digital connectivity, digital financial payment systems, digital platforms, digital entrepreneurship, and digital skills. In this study, I will focus on these pillars depending on the relative importance of each to the financial sector.

The issue of digitalization in the financial sector is particularly important for Ethiopia given the low-level development of digitalization in the country, compared to neighbouring countries such as Kenya and its potential disruptive effect if the Ethiopian financial sector is forced to compete with foreign banks, emerging FinTech firms and telecom companies (such as Safaricom of Kenya). Telecom companies are increasingly relying on their earning from mobile payment system, instead of voice and data, for their revenue. Such stiff competition is going to happen soon since the government is in the course of opening up the financial and the telecom (which is already in the pipeline) sector for foreign firms. For example, bench marking with Kenya (see below for details), internet users in Ethiopia constitute 21% of the population in 2021, while this was 40% in Kenya in the same year. Similarly, the number of mobile connections/subscribers in Ethiopia was 39% of the population (45 million) in 2020, while the comparable figure for Kenya in the same year was 110%. The innovative Kenyan mobile payment system (M-PESA) is incomparable to traditional branch-based banking system in Ethiopia. This underscores the challenge of digitalization in Ethiopia, even to reach the level attained by neighbouring countries in Eastern Africa region.

The future of the financial sector is a constant struggle between disruptive technologies and the move to adopt and explore them to remain ahead in the business. After an examination of 126 articles about digital banking and financial inclusion that are published from 2014 to 2020, Ab.Aziz et al. (2021) noted that, digital banking has developed enormously across countries in the world and this has improved efficiency by deploying cost-effective technology, shifted the managerial focus toward enhancing the efficiency of digital channel operation; affected many banks in downsizing their physical branch-based operations; and had turned bank clients to rely for their transaction outside bank branches. It also allowed bank clients new channels of funds, new ways of handling daily transactions, and provided more financial products and product information fast and less costly. It has also improved financial inclusion (Ab.Aziz et al., 2021; Nguyen et al, 2020; Varda and Singhania, 2020).

Thus, the analytical framework of the study needs to allow examining the impact of digitalization in Ethiopian banking sector in all these aspects where global banks are making a big headway.

With this general perspective, the rest of the study is organized as follows. In Section 2, the analytical approach of the study is briefly offered. Section 3 is devoted to the examination of the economic growth effect of digitalization in Ethiopia. Section 4 will focus on the case study of the financial sector. Section 5 concludes by offering the policy implications of the study by way of conclusion.

2.0 The Analytical Framework

The analytical framework of the study is based on Christensen et al. (2015) definition of “disruptive technologies” as ‘coming up with cheaper, simpler, more reliable and convenient product than existing products in the market’ (Christensen, 1997; Christensen et al., 2015). Since technology is not enough to define this phenomenon, Christensen incorporated cultural and leadership aspects of new entrants—what is now called the business model innovation in his latter definition. “Business model innovation” is defined (Markides, 2006) as the formation of a significantly different business model in an existing market or business. Studies on digitalization in the financial sector found that digital technologies enable new business models, cause (dis-)intermediation and customer centricity which becomes increasingly important for financial service providers in many countries (Cziesla, 2014; Nguyen et al, 2020; Varda and Singhania, 2020). Additionally, these studies also found that the interaction between users, technological changes and information is increasingly digitalized across countries (Cziesla, 2014 Ab.Aziz et al., 2021).

The issue of focusing on a new business model is imperative for the Ethiopian financial (banking) sector, where banks are currently pursuing the traditional branch banking model. The literature also shows that, among other innovations, the phenomenon of FinTech is shaking the established, traditional players; and according to many experts, is able to totally transform the financial business sector even further (Karagiannaki, et al., 2017; Cziesla, 2014; Nguyen et al, 2020; Varda and Singhania, 2020). This new business model also includes the idea of Christensen et al. (2015) that noted disruptive innovation originates in either low-end market or new-market foothold. In addition, DTs often do not target mainstream customers until the quality of the product has met their standards. Hence, the mainstream customers are unlikely to switch to low price companies immediately (Christensen et al., 2015). Today, since the new business models met the standard in the financial business, they already became part of the financial sector in digitally advanced countries. They are, thus, sure to be a threat to banks that are relying on the traditional branch-based banking model, such as those in Ethiopia.

DTs are also different from sustaining innovations which are based on enhancing the performance of technological products or services according to the mainstream customers’ evaluation (Christensen & Overdorf, 2000). “Sustaining innovation”

mostly comes from incumbents. However, what those companies cannot cope with or introduce is disruptive innovation due to lack of processes that can handle such innovation. It is sensible to consider the Ethiopian banking sector as characterized by “sustaining innovation” that is confronted with technology which is potentially disruptive as defined by Christensen et al. (2015). This is because Ethiopian banks are attempting to cope with challenge of digitalization and its disruptive effect by slowly improving the current business model. With this conceptualization, for the purpose of this study, I will use digitalization as proxy for disruptive technology both to examine its general picture at national and general level as well as its effect and challenge in the financial sector. This is done cognizant of the fact that “digitalization” is just one facet of DTs as noted above (see also UNCTAD, 2018; World Bank, 2017).

Analytically, the study is undertaken at two levels: at macro and micro (firm) levels. The macro level analysis is necessitated because it is crucial to consider the impact of digitalization on economic growth in a broader context. Having this macro level picture, I will resort to a case study (firm-level) approach to concretely examine the nature, effect and challenge of digitalization in the financial sector. The latter is aimed at informing the macro-level analysis which is too general for concretization of the issue. Both methods are preceded and, thus, informed, first by descriptive and data exploration analysis about the nature of digitalization in Ethiopian financial sector, by placing (benchmarking) the Ethiopian performance in the context of the African region in general and countries in the Eastern African region in particular.

In the first method, the macro-level growth impact of digitalization is examined using a standard Solow-growth model. A Cobb-Douglas production function, that also incorporated the effect of “disruptive technology” (D) as one of its arguments, is used for the purpose. Thus, growth of output (both GDP and sectoral GDP) is modelled as a function of labour (L), capital (K) and an indicator of digitalization (D) — which is assumed to affect the “productivity” indicator or the “Solow-residual” that is given by “A” in Equation 1. “A” is also referred as total factor productivity (TFP) indicator and normally derived as a residual in standard growth models such as Equation 1. “A” will be computed here, net of the digitalization effect from the estimation of Equation 2.

$$Y = AL^{\alpha}K^{\beta} \quad (1)$$

$$Y = A^*L^{\alpha}K^{\beta}D^{\gamma} \quad (2)$$

Where: Y, K, L, D, and A are, respectively, output (GDP), capital, labour, digitalization, and efficiency (total factor productivity, TFP) indicators; A* is TFP net of the “D” effect.

In relation to the effect of “D”, this model will also give us the direct effect of “D” on each sector (agriculture, industry, and services) when the dependent variable is changed to sectoral value-added. This is helpful to get more insight about the differential effect of disruptive technologies across sectors.

Having this general picture at macro and sectoral level in Section 3, I have pursued a case study approach in Section 4 to further enrich our understanding. The micro-level information is collected based on the case study approach using a semi-structured interview carried with key informants in the Ethiopian financial sector. The interview focused on the level and impact of digitalization as well as the coping mechanism employed to withstand the digitalization impact on the current business model of banks in the sector. Firm-level data is also collected from the case study banks to examine the quantifiable dimension of the study. The Ethiopian financial sector is selected in line with the hypothesis that digitalization has significant disruptive effect on service sector in general and the financial sector in particular in the Ethiopian context. It is also my interest area of study.

3.0 The growth effect of digitalization in Ethiopia

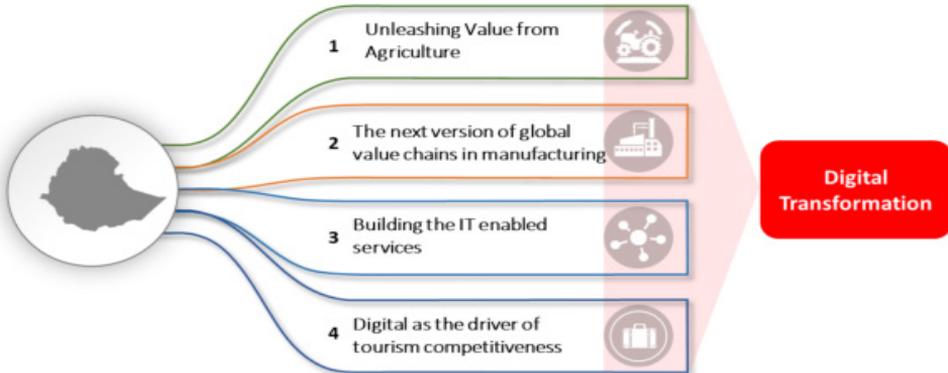
Examining the growth effect of digitalization is important from two perspectives. First, it will give us the general impression about the economic growth impact of digitalization/DTs at national level in quantifiable manner. Second, the impact of digitalization in the case study firms (the financial sector) is conditional on the state of national infrastructure that includes, in particular, access to information and communication technology (ICT) and related infrastructure such as access to electricity, as well as the general growth of the economy.

Before examining the growth impact of digitalization, I have first examined the national digital ecosystem for growth. This is important because the impact of DTs such as digitalization on economic growth (as well as the financial sector) is also conditional on the national digital ecosystem and related national digital strategy and policy.

The national ecosystem for digitalization: National strategy and IT infrastructure

The Government of Ethiopia has issued its National Digitalization Strategy (NDS) in 2020 (Federal Democratic Republic of Ethiopia [FDRE], Digital Strategy, 2020). This strategy is informed by the government's understanding of the drivers of the economy and its vision of the country. The NDS noted, the strategy is “based on current economic drivers (i.e., agriculture and manufacturing) and the national vision which is jobs creation, raising foreign exchange earnings, and bringing about inclusive prosperity. Based on this, four pathways were selected to analyse opportunities and frame Ethiopia's digital journey. This is summarized in Figure 1 taken from NDS. As summarized in Figure 1, the transformational effect of digitalization is envisaged to be realized through transforming the agriculture, manufacturing, and services (including tourism) sectors.

Figure 1: The four pathways of Ethiopian digitalization stage for digital transforming



Source: FDRE, Government of Ethiopia: Digital Ethiopia 2025 – A Digital Strategy for Ethiopia's Inclusive Prosperity, 2020.

Among the sectors identified in Figure 1, the NDS noted various small initiatives attempted in the agricultural sectors. This includes, among others, digitally aided extension services, resource mapping, such as soil and water (FDRE, Digital Strategy, 2020). However, the effect of digitalization and level of IT use in rural areas is limited as the rural internet penetration has been just 4% and most of the rural population are generally IT illiterate (except a simple mobile use). Most of the initiatives have also encountered various challenges that include connectivity, the lack of enabling regulations, appropriate finance, and skilled human capital (FDRE, Digital Strategy, 2020).

For similar reasons, the digitalization in the industrial sector has also been found to lag behind, confirming the findings of Alemayehu (2022a). Notwithstanding this, the government is attempting to set up “The Ethio ICT Village” which is envisaged to serve as a first prototype of experimentation with much more integrated “servisification” of manufacturing in its NDS. The aim is to exploit the benefits of industrial parks the country built recently by mixing the old forms of manufacturing with the new forms of ICT services exports (i.e., Pathway 3 in Figure 1). However, fast and reliable internet connectivity is a decisive factor for this. The new IT Park “Ethio ICT Village” could, if adequately connected to residential areas, are also believed in the government strategy to serve as an initial BPO (business process outsourcing) hubs. This will also contribute to the growing use of ICT in the service sectors that includes the tourism service sector (the fourth pathway shown in Figure 1), and goes very well with the vision of job creation.

In relation to tourism in particular, the strategy stresses the underexploited nature of the use of ICT to benefit from tourism potential of the country. Towards that end, the government envisages to learn from other African countries that made an advanced use of ICT for tourism. Digital tourism initiatives in countries such as South Africa and Kenya (as well as Thailand) are believed to offer valuable lessons for Ethiopia

in this strategy. Prior to digitalization, these countries had similar challenges in the tourism sector such as limited targeted marketing, poor management of tourism data, and inadequate capacity among tourism SMEs (FDRE, Digital Strategy, 2020). Digital initiatives have helped overcome these challenges and driven growth of the tourism industry from which Ethiopia aspires to learn.

The NDS (FDRE, 2020) noted that in all sectors, fast and reliable communication infrastructure, and hence, connectivity, is Ethiopia's most binding constraint to exploit the four pathways identified in the strategy. This is also the challenge of digitalization in the financial sector, which will be examined in detail below. Due to connectivity challenges, Ethiopia cannot reliably take on tasks that involve real-time communication, such as virtual assistance. Robust connectivity enables citizens and businesses to participate in the digital economy by having access to affordable and high-quality internet, through which they can engage in information sharing and online transactions. A direct outcome of improved core connectivity infrastructure (e.g., mobile towers, handsets etc.) and supporting infrastructure (e.g., power) further enables improved service access empowering both individuals and communities. Yet these are the challenges to make the best use of ICT in Ethiopia as recognized in this strategy (FDRE, Digital Strategy, 2020).

In addition to connectivity, reliable network cover, affordability and poor-quality telecom services is also found to be a major problem in the strategy (FDRE, Digital Strategy, 2020). The latter is partly emanated from the monopoly of internet service provision by Ethio Telecom which will be ending this year (2022). This is hoped to change for the better, with joining of the market by Safaricom in 2022. Average download speeds and the international bandwidth per user are both lower compared to Ethiopia's African peers. Ethiopians have access to internet of on average 2kb/s of international bandwidth per user, compared to the sub-Saharan African average of 11kb/s and the Kenyan average of 103kb/s (FDRE, 2020, National Digital Strategy). These are also the challenges the Ethiopian financial sector is facing, as will be analysed in detail in the next section.

The second related problem is the cost of service, which has implications for profit of firms in the financial sector. Internet and mobile data costs in Ethiopia are among the highest in the world. A 1 GB of monthly data in Ethiopia costs US\$51 (at purchasing power parity) compared to US\$25 in Rwanda, US\$18 in Ghana, and Nigeria, and US\$8 in Kenya (FDRE, 2020). Similarly, 1 GB data in Ethiopia costs 9.65% of the monthly gross national income per capita. The International Telecommunication Union (ITU) recommended benchmark being just 2%. Ethio Telecom has slashed tariffs by some 40% since 2019 and a bit more in 2021. There is also a significant improvement in accessibility and reliability since this tariff reduction. It is hoped that the ongoing telecommunication sector liberalization and the coming of the new entrants, including Safaricom, will reduce the cost of the service further and also expand the service.

The third constraint identified in the NDS is human capital. Ethiopia's urban population is fairly well educated with literacy rates of 80% in Addis Ababa. However, this is missing in rural areas, which are home to 80% of the population. Human capital

development (as indicated, for example, by enrolment figures), as well as digital literacy, are correlated with effective use of digitalization, and this is very limited in Ethiopia.

Fourth, as part of the national digital ecosystem, the status of E-governance is important. The Government of Ethiopia has progressed in its various E-governance efforts, despite difficult human capital and infrastructural conditions. The government's planned work on upgrading and modernizing the government WoredaNet (county level network) to create a fibre network backbone able to provide high-speed connectivity to public offices and institutions can lead to increased government efficiency. It will also deepen the digitalization drive. On the OSI (Online Service Index) 2018 scale that is set on the scale from 0 (lowest) to 1 (highest), Ethiopia scores 0.6, which is on par with Kenya, higher than Nigeria (0.5), and just below Rwanda (0.7) in this area. For the overall E-Government Development Index (EGDI) score, the country also ranked 151 among 180 economies in 2018. Despite improvements in recent years, there is still room to improve on this as Ethiopia remains behind the global average score (FDRE, Digital Strategy, 2020).

In line with the NDS, the National Bank of Ethiopia (NBE) has also set out a National Digital Payments Strategy (NDPS) for 2021–2024 which is important for the digitalization in the financial sector (NBE, 2021). The NDPS aims “to build a secure, competitive, efficient, innovative, and responsible payment ecosystem to support a cash-less and financially inclusive economy”. The NDPS is built along four pillars that are also identified as challenges of digitalization in Ethiopia: infrastructure, adoption, regulatory and oversight framework, and creating enabling environment for innovation. With this strategy, the NBE aims to transform Ethiopia's payment landscape, and it claims it has already started this journey through issuing digitalization related regulations (for agent banking and for payment instrument) recently. This is aimed at encouraging the adoption of non-traditional banking and embracing technology-enabled financial services as well as benefit from further access to global knowledge, resources, and funding. The NDPS is aligned both with the NBE's internal vision and the government's vision and reform agenda in other institutions (external) (such as the National ID programme of the Ministry of Peace and the “home grown reform policy” of the Ministry of Finance, the telecommunication reform of the government etc., according to the NBE (2021).

Finally, as it stands today, the responsibility of providing the communication backbone infrastructure and digital ecosystem in Ethiopia is left for the publicly owned and the only telecom company—Ethio telecom. This is identified in the NDS as a problem. Telecommunication service is introduced in Ethiopia in 1894, amazingly just after 18 years of its invention and the first patent given to the American Alexander Graham Bell. Since then, Telecom remained a public company and the only one to date. Beginning in 1991, the telecommunication sector was divided into two: The telecommunication authority (in charge of regulation) and the telecommunication corporation (in charge of infrastructure and service provision). The latter is renamed Ethio Telecom in 2010.

Since 1989, Ethio Telecom had a Digital Microwave and Fibre Cable Communication for its operation. Currently, Ethio Telecom has also over 20,000km of fibre optics line under its operation (FDRE, Digital Strategy, 2020). Mobile penetration resulted in an increase in internet coverage from 1.1% in 2011 to 18.6% in 2017. Mobile coverage has further grown to about 45% in 2021 and 60% in March 2022 (Table 1). However, compared to countries in the rest of Africa as well as all least developing countries (LDCs), its digital depth, as measured by tele density and given in Table 1, is found to be half the level in the rest of Africa. This is found relatively better for mobile, compared to Internet and broadband subscription as well a fixed line density. Active mobile broadband subscriptions in Ethiopia stand at 7.1%, compared to 23% in Uganda, 35% both in Rwanda and Kenya, and 24.8% (on average) in the SSA region (FDRE, Digital Strategy, 2020). While Internet adoption has increased, use in economically productive activities remains limited. Currently, much Internet activity is focused on social media rather than E-commerce, business or education (FDRE, Digital Strategy, 2020). Similarly, broadband penetration rate per 100 inhabitants in Ethiopia is one of the lowest in the region at 0.2% (Table 1). In addition, only 1% of the population uses Internet to carry out its transactions such as paying bills or buying online as well as to access its account using mobile phones in 2017, according to the 2020 Global Findex data base. This differential penetration rate of mobile and broadband is found to have a corresponding differential effect on growth (Alemayehu, 2022a). In sum, all the challenges outlined here at national level have strong bearing on digitalization in the financial sector. Thus, the financial sector will significantly benefit if these challenges, including national level cyber security, which is currently being handled by the federal government, are addressed very well at national level.

Table 1: Selected indicators of Tele and Internet density

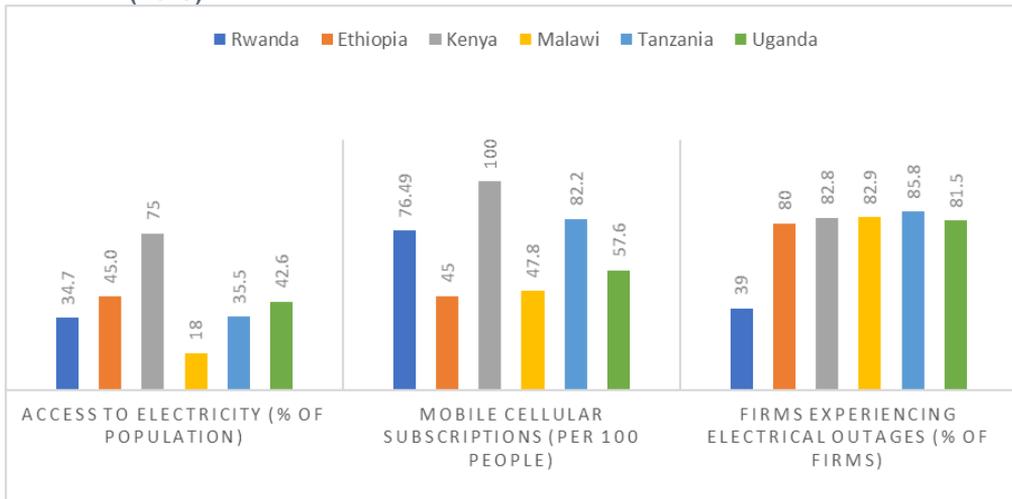
Tele Density (Per 100 inhabitants)	2015/16	2016/17	2017/18	2018/19	2019/20
Mobile (per 100 inhabitants)	43	61.6	39.8	41.9 [42]	44.9 [44.5]
Internet and data (density, per 100 inhabitants)	10	17.5	18.5	0.5 [0.502]	0.6 [0.660]
Fixed line (density, per 100 inhabitants)	1	1.2	1.2	1.2 [1.21]	1 [0.979]
Broadband & Internet subscribers (No., millions)				0.212	0.216
Broadband & Internet users (No., millions)				0.021794	0.02353
Memo*					
Mobile users/100 inhabitants					
Africa	86.6	87.5	86.7	89	88.7
Least Developing Countries (LDCs)	67.5	67.6	68.4	71	74.9
Individuals using Internet/100 inhabitants					
Africa	20.3	22.3	24.8	26.3	28.6
Least Developing Countries (LDCs)	12.4	14.3	16.1	17.6	19.5

Notes: Figures in the square bracket [] are number in millions. * is based on data from International Telecom Union (ITU) estimates, 2021.

Source: Author's own computation based on NBE data.

In addition to IT related infrastructure, additional supporting infrastructure, especially access to electricity is also crucial for effective use of digitalization. Generally, frequent power outage is also highly correlated with network interruption and 80% of Ethiopian firms encounter that (Figure 2). As shown in Figure 2, generally, access to electricity and digital penetration in Ethiopia is one the lowest in the region. This has detrimental impact on digital penetration in the country. In particular, access to electricity service in the country is only 44%. This, however, has a major difference between urban (96%) and rural areas (31%) (FDRE, 2020; Figure 2). In addition, access to mobile apparatus, digital ID and cyber security are also important for digital penetration. Ethiopia has lagged behind in all these fronts. There is no national ID in Ethiopia yet (although it is under preparation in 2022). All these infrastructure deficit and lack of national ID are some of the other major reasons that limits the expansion and wider use of digitalization in the Ethiopian financial sector.

Figure 2: Infrastructure (access to electricity and mobile subscription) indicators (2019)



In sum, in relation to the national digital ecosystem and the IT infrastructure which is the backbone of digitalization in the country in general and the financial sector in particular, we generally state that the condition in Ethiopia is very poor by regional standard. This is the case in terms of network capacity, speed, and reliability that hinder the best use of digitalization both in the financial sector and the country at large. In addition, it is also found to be costly both for institutions as well as citizen that further hinders its wide use. The national digital strategy, though visionary, lacks specificity and prioritization for implementation and quick result. I will examine the impact of this in the financial sector at firm-level after examining the general growth effect of digitalization at macro-level in the next section.

The effect of digitalization on growth: A growth model

A study for “The Global Information Technology Report 2012” (Sabbagh et al., 2012), that was based on 150 nations that includes Ethiopia for the period of six years from 2006 to 2010 categorized these countries into four categories: “Digitally Constrained”, “Emerging”, “Transitional” and “Advanced”. This categorization is found to correspond, inter alia, to the contribution of digitization to economic growth, job creation, innovation, and welfare of the society (Khan et al., 2015; Sabbagh et al., 2012). In this classification scheme, Ethiopia is found in the category of “digitally constrained economies”, which are countries with a digitization score below 25% and, hence, have barely begun to develop affordable Internet connections. In such countries, Internet services remain expensive and limited in reach. By contrast, “advanced economies” are those with a score of 40% and higher that are in the most mature stage of digitization. These countries have a talent base that can take advantage of digital services, and such services are affordable and reliable (Khan et al., 2015; Sabbagh et al., 2012).

This study also attempted to quantify the growth effect of digitization (an index made up of ubiquity, affordability, reliability, speed, usability, and skill indicators is used) using a classical production function-based growth model, controlling for a number of variables. They found that an increase in digitization by 10-percentage points triggers 0.50% to 0.62% gain in per capita GDP growth. By contrast, previous studies that focused mainly on broadband penetration established that a 10-percentage point increase in broadband penetration contributes a gain in per capita GDP growth of just 0.16% to 0.25% (Sabbagh et al., 2012). The same study also noted that digitization also has a significant impact on job creation in the overall economy: an increase of 10% in digitization reduces a nation's unemployment rate by 0.84% (Sabbagh et al., 2012). Similarly, Katz's (2012) study showed that a 10% increase in internet (broadband) penetration can increase a country's GDP by 0.2% to 1.4%. Below, I have estimated similar standard growth model specified in the previous section to gauge quantitatively the impact of digitalization on GDP growth in Ethiopia. Since the effect of digitalization on growth could vary significantly across sectors, I have also estimated the growth effect of digitalization on sectoral GDP too.

The Ethiopian GDP is recently being dominated by the services sector. The services sector's contribution to GDP was about 40% in the last five years (2015/16–2019/20). Its contribution to GDP growth also ranged from 29% to 46% in the same period. The services sector contribution to urban employment was also about 67% in 2019/20. This further justifies our focus on the services sector using the financial sector as a case study. Agriculture follows the services sector in its contribution to GDP at 33% to 36% in the same time and 33% in 2019/20. Given the subsistence and traditional nature of agriculture, as well as the low level of industrial development to deploy DTs such as digitalization, the impact of DTs is expected to be strong in the services sector. Within the non-agricultural sectors, although the industrials sector's contribution to GDP has recently increased from 10% a decade ago to 24-29% in the last five years (201/16–2019/20), this is dominated by the construction sector that is contributing about 70% to the industrial sector's output. Manufacturing, considered the dynamic sub-sector necessary for structural transformation remained very small, being on average about 5% of GDP for the past four decades (NBE, 2019/20; Alemayehu, 2008; Alemayehu et al., 2017). Thus, given the small share in GDP and less sophisticated nature of the Ethiopian manufacturing sector (dominated by food and metal firms) (see Alemayehu 2021, for example), significant impact of digitalization in the growth of this sector may not be expected.

The econometric model

An Auto-Regressive Distributive Lag (ARDL) based error correction model (ECM) formulation of Equations 1b is given as Equation 3 below. This econometric approach is chosen for the following two reasons: (i) it is a simple and straight forward approach that can easily be implemented in a single equation framework, even if the variables in the model are $I(0)$ and $I(1)$, as long as they are co-integrated. It also has excellent

small sample properties suitable to our case (Pesaran & Shin, 1999; Pesaran et al., 2001; Pesaran., 1997; Alemayehu et al., 2015). (ii) since it is formulated in a dynamic ECM form, it handles both short-term dynamics as well as long-term equilibrium relationships suggested by theory and specified as equations 3 in a single equation (variables as defined in Equation 1).

$$\Delta Y_t = \gamma_0 + \sum_{j=1}^m \gamma_{1j} \Delta Y_{t-j} + \sum_{j=0}^m \gamma_{2j} \Delta L_{t-j} + \sum_{j=0}^m \gamma_{3j} \Delta K_{t-j} + \sum_{j=0}^m \gamma_{4j} \Delta D_{t-j} + \alpha_1 [\beta_1 Y_{t-1} - \beta_2 L_{t-1} - \beta_3 K_{t-1} - \beta_4 D_{t-1}] + \varepsilon_t \quad (3)$$

Data and estimated results

Both national and international sources of data are used. Real level of GDP and sectoral GDP is taken from the Ministry of National Planning and Development (MNPD) and the National Bank of Ethiopia (NBE) for the period 1992–2012 Ethiopian calendar (1999/2000–2018/2019 European calendar). I have used labour and capital stock data from Groningen University Structural Change database. Two indicators of digitalization are used: number of “mobile subscribers” and “broadband subscribers”. The latter data is available since 2000, given that digitalization in Ethiopia began around this period. This data is obtained from International Telecommunication Union (ITU) World Telecommunication/ICT Indicators database. However, this data is incomplete and inconsistent in some of the years with the data from the national telecom operator, especially since 2015/17. Thus, starting from this date, the data from Ethio Telecom as reported in NBE Annual Report, various years, is used. Since the ITU data is also based on European calendar year, for the years before 2015/16, it is converted to Ethiopian calendar years by averaging the data for two consecutive years that correspond to the Ethiopian calendar year (the Ethiopian fiscal year runs from July to June). The final database has 20 years data. Twenty years data point is very limiting for time-series analysis, and the country doesn't have a quarterly GDP data. Thus, I have used standard software-based generation of quarterly data from the annual data—obtaining about 80 data points. I have used the natural logarithm of all variables for estimation. Hence, the estimated results, reported in Table 2a and Table 2b, are elasticities. The model passed all diagnostic tests as reported in Table 2a. The digitalization indicators are also found to be co-integrated with all the variables of the model, as can be read from the “bound test” result reported in Table 2a.

As can be read from the long-run estimated results of the models given in Table 2a, a 10% increase in the number of mobile subscribers leads to 0.5% growth in GDP. This becomes nearly 1% in the services sector. However, this effect is found to be relatively limited in the agricultural sector, at 0.3%, with no effect in the industrial sector as the value become statistically insignificant (not reported). Given the very small and traditional nature of the industrial sector, dominated by the construction sector, this result is reasonable.

The same growth model is also estimated using the number of broadband subscribers (in natural log) as a proxy for digitalization instead. As can be read from the second half part of Table 2a, the effect of broadband penetration on growth is still found to be positive and statistically significant. However, the potency of the digitalization effect is reduced nearly by half (40%) for GDP growth and by 33% for the services sector GDP growth. The effect of broadband expansion is found to have no effect in the agriculture and the industrial sectors (statistically insignificant in both; not reported).

Table 2a: Growth effect of digitalization in Ethiopia: Long-run estimated coefficient/elasticities (n=86, 2000Q1 to 2019Q4)^

All, in natural logarithm Long run Coefficients Using Mobile Subscribers	GDP (n=68)		Service GDP (n=71)		Agriculture GDP(n=72)	
	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
Capital stock	0.24	2.09**	0.06	1.24	-0.03	-0.35
Labour	1.61	12.15*	1.69*	30.8	1.86*	20.3
Mobile Subscription Using Broad band Subscribers	0.05	3.62*	0.09*	11.24	0.033*	2.59
Capital stock	0.15*	2.27	0.02	0.25	-0.18*	-3.12
Labour	1.77*	23.4	1.79*	18.13	2.1*	30.42
Fixed Broadband Subscription	0.03*	3.53	0.06*	4.9	-0.01	-1.36
Diagnostic Tests						
Bound Test (Co-integration test)	F(9.91)*	[3.4L&3.8U]	F(21.8)*	[3.4L&3.8U]	F(33.8)*	[3.4L&3.8U]
Adjusted R-Squared		0.99		0.99		0.99
Jarque-Berra (Residual normality)		0.52(0.77)		0.81(0.66)		2.7(0.26)
Heteroscedasticity ARCH	F(1,58)	1.31(0.26)	F(1,66)	1.97(0.16)	F(48,37)	0.11 (0.74)
Ramsey RESET	F(1,55)	0.00 (0.98)	F(1, 62)	1.41(0.24)	F(1,6)	0..11 (0.91)

Notes: *, **, *** indicate the coefficient significance at 1%, 5%, and 10% level of significance, respectively; ^All models are found to have a serial correction problem (which gives biased results in the ARDL approach used) hence the estimation is done using the New-West HAC correction method which corrects for both auto correction and heteroscedasticity.

The short-run elasticity values of the model extracted from the estimated error-correction model of Equation 3 is also given in Table 2b. The result shows that the short-run effect of digitalization is mixed. The short-run elasticity of GDP growth with digitalization (mobile subscription rate) is found to be 0.04. This value is found to be

0.02 with three and four quarters lag for the services sector. The contemporaneous effect in the agriculture sector in the short run is also found to be positive and statistically significant at elasticity value of 0.06, while this becomes negative 0.03 and 0.02 for the 3rd and 4th quarter lag period. In general, the nearly “zero” nature of the short-run elasticity values for all shows that the benefits of digitalization generally come in the long run.

In all the three models, the adjustment coefficient (the error correction term) is found to have the correct sign that is statistically significant. However, the speed of adjustment is generally found to be very low. Thus, only 6% to 9% of the deviation from equilibrium is found to be corrected in one quarter—showing the relatively sluggish nature of adjustment of growth to a deviation from its equilibrium level in these models with regard to digitalization. The latter also in a way shows that, if you missed the opportunity of digitalization it takes a while to adjust it.

Table 2b: The short-run estimated coefficients/elasticities: Growth effect of digitalization

Variable (all, in natural logarithm)	GDP (n=68)		Service GDP (n=71)		Agriculture GDP(n=72)	
	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
Short-run Coefficients						
Δ GDP						
Lagged 1 periods (-1)	0.33*	3.12	0.38*	8.68	0.25*	12.8
Lagged 2 periods (-2)	0.08*	2.35	0.20*	4.96	0.09*	7.17
Lagged 3 periods (-3)			0.04*	2.84		
Lagged 4 periods (-4)					0.17*	3.11
Δ Capital stock I	-0.04*	2.92			-0.61*	-4.92
Lagged 1 periods (-1)	0.02**	2.15	-0.02***	-1.72	-1.76*	-2.72
Lagged 2 periods (-2)	0.05*	2.4				
Lagged 3 periods (-3)	-0.11*	-2.6				3.32
Lagged 4 periods (-4)			-0.63*	-6.12		
Δ Labour	1.80**	2.0	0.74	1.56	2.7*	3.0
Δ Mobile Subscriber	0.04*	3.97			0.06*	4.7
Lagged 3 periods (-3)			0.02**	2.0	-0.03*	-2.97
Lagged 4 periods (-4)			-0.02*	2.7	0.02*	3.13
The Error Correction Term (ECM)	-0.06*	-3.57	-0.08*	-6.83	-0.09*	-6.13

Note: Diagnostic test are the same with Table 2a.

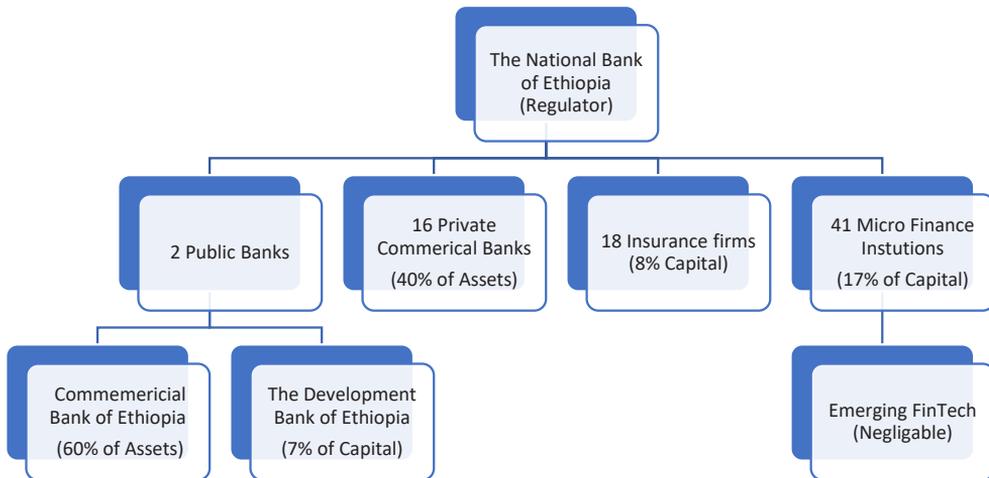
4.0 A case study: Digitalization in the financial sector

In this section, we have selected the financial sector as case study to examine the nature and impact of disruptive technology in one of the sub-sectors of the services sector at micro-level. The focus on the financial sector is justified for it is one of the most exposed sub-sectors to the disruptive technology of digitalization.

Digitalization in the Ethiopian financial sector in regional context

International Finance Corporation (IFC) identified more than 50 factors that influence the growth of digitalization and digital payment system in the financial sector such as mobile money. Of these, three are especially important (IFC, 2011): “regulation, competition with other instruments of financial access, and user perceptions and skills” (Donovan, 2012). Thus, our understanding of digitalization in the Ethiopian financial sector is as a process that allows a full use of the ICT to modernize and enhance the provision of financial services easily and efficiently in the context of the three factors noted. Before going to this discussion at firm-level, it is imperative to briefly describe the Ethiopian financial sector by benchmarking it with the sector's performance in the Eastern Africa and African region at large.

The Ethiopian financial sector is dominated by the banking sector due to its low level of development (Figure 3). The non-banking financial sector is generally missing—thus understanding the banking sector in Ethiopia is tantamount to understanding the financial sector in the country. The sector is composed of one dominant public bank, one public policy bank, 16 private banks, 18 insurance companies (16 private and two public) and 41 micro-finance institutions (MFIs) (11 public, 13 private, and 17 NGO-owned). The banking sector itself is also dominated by one publicly owned bank—the Commercial Bank of Ethiopia (CBE). The CBE accounts for about 60% of the national deposit and lending in the last three years. This share was much higher in the past (see Alemayehu, 2008; Alemayehu et al., 2017; Getenet, 2021). The insurance companies are very small with a combined capital of 9.65 billion birr in 2020, which is just 8.5% of the total capital of the banking sector (NBE, 2020). The 41 MFIs fare better than insurance companies, as they had a combined capital of 19.4 billion birr, which is about 17% of the total capital of the banking sector in the same year, 2019/2020. Thus, it makes sense to talk about the Ethiopian banking sector as Ethiopian financial sector.

Figure 3: The profile of the Ethiopian financial sector

Note: Assets and capital refers to assets and capital in all banking sector in 2019/20.

Source: Author's own computation based on NBE data (2019/20).

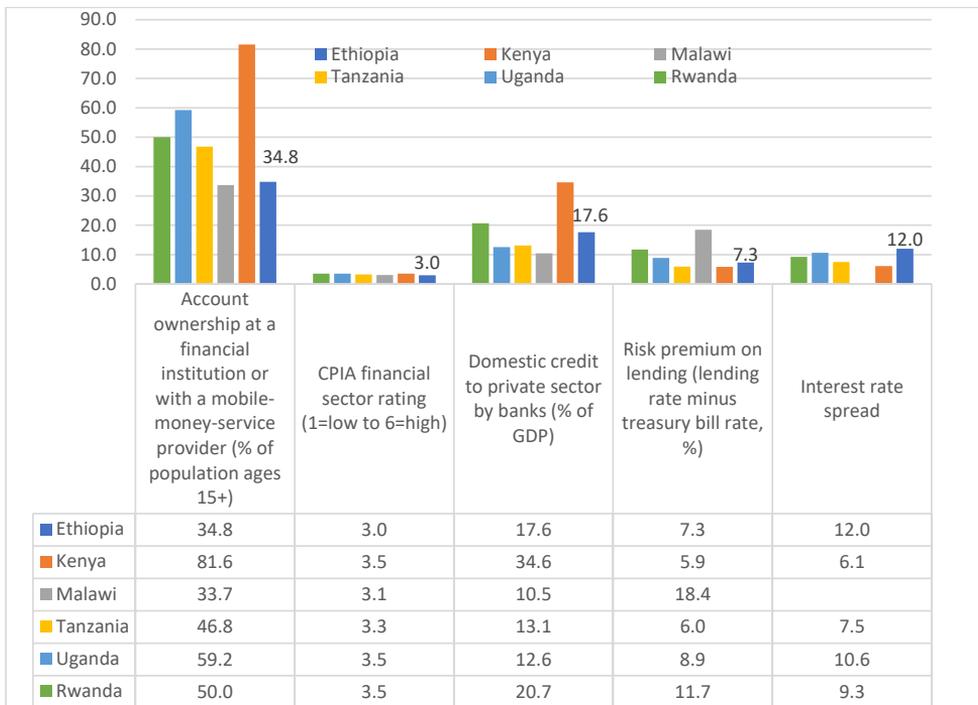
Recent years saw the emergence of new FinTech (financial technology) based firms which are both foreign and domestically owned but are generally very small and at nascent stage. Most of them are attempting to engage in mobile payment systems and E-commerce, but their impact is still to be seen. In addition, the country also witnessed an emerging public mobile payment system, Tele-Birr, which is owned by Ethio Telecom—the national telecom monopoly. The latter claimed to register about 9.5 million customers since its establishment four months ago, in May, 2021. It has signed an agreement with 26,000 agents, eight banks, and a number of merchants (it also works with phones that are not smart using the USSD technology). With 55 million customer base it has, Ethio Telecom has a great potential to dominate this market like that of Kenya's MPESA in the coming years.

With the joining of the telecom market by the first private telecom company—the Kenyan Safaricom, in 2021, we expect a strong growth in digitalization and related services that may disrupt the current digital-based ecosystem. Given the early stage of the Tele-Birr development and the general picture offered about the Ethiopian financial sector above, the focus of this case study is on the banking sector.

It is worth contextualizing the Ethiopian financial sector in the trend of the sub-Saharan Africa (SSA) financial sector and its recent growth. The depth and coverage of financial systems in SSA expanded steadily over the past decade—helped by reform efforts (Kasekende, 2010; IMF, 2015) and digital development (EIB, 2018b). Access has also improved significantly in recent years. Account penetration in SSA countries has recorded a remarkable increase of almost 20% between 2011 and 2014; and this has further increased to 33% in 2018. If we include other types of accounts which are not necessary opened in the financial institution, such as mobile money account, the

account penetration rate (i.e., the share of account holders among the population aged 15+) rises from its low level of 23% in 2011 to 43% in 2017 (EIB, 2018a). This is a 100% growth though still low compared to other developing countries level of 63% in 2017. Ethiopia's performance on this front in the region, which is below 35%, is one the lowest in the continent although better than Sudan and Burundi (Figure 4). Low access to financial services and lack of awareness of existing digital financial services limit Ethiopians' use of digital payment systems. The country generally relies on cash-based transactions and people trust that. As a result, accessing a physical cashier is the main withdrawal method (83%), even compared to ATMs (1%). Online payments are negligible and interoperability for financial transactions is in a nascent stage (FDRE, Digital Strategy, 2020).

Figure 4: Accounts at banks or other financial institutions (population age 15+)



Source: Author's own computation based on WDI data, The World Bank.

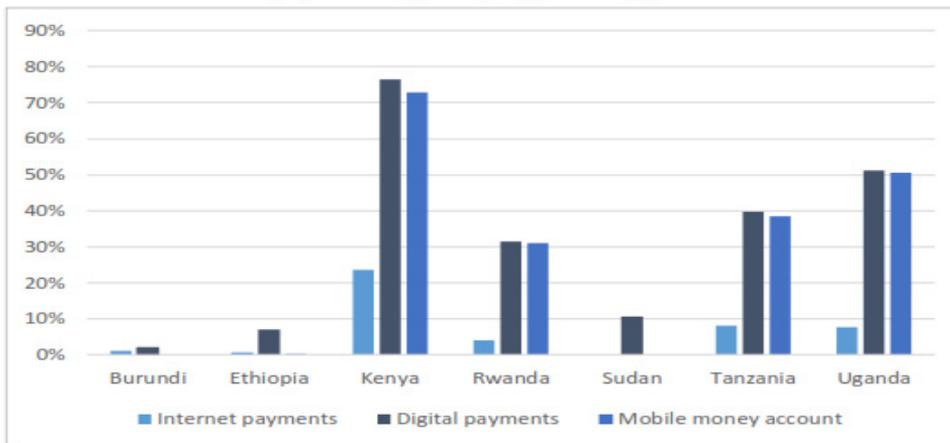
For developing countries such as Ethiopia with lower rate of financial development, EIB (2016; 2018) advised developing their customer base and engage in their own digitalization development. However, this development is also dependent on the private sector development, noted EIB (2016; 2018). The latter will require technical assistance and knowledge transfers, not just financing, to the private sector. This is a long-term investment that banking groups need to do for it will be in their economic and financial advantage as they groom tomorrow's larger and stronger clients—but the

work needs to begin now (EBI, 2016, 2018). This could be done, EBI (2018) suggested by offering innovative financial and policy instruments, including FinTech, portfolio guarantees and the like (EIB, 2018).

The continent also saw significant development in the use of IT in its banking sector in general and on mobile banking and FinTech in particular. Thus, according to EIB survey, half of the banking groups in SSA reported being fully deployed in terms of general IT infrastructure but the majority of them are in deployment and planning deployment stage in terms of internet-banking technology, mobile banking, and FinTech in 2018. As a result, in the relatively advanced countries such as Kenya, financial inclusiveness through mobile banking has reached unprecedented level. Ethiopia's performance in this respect is also one of the lowest in the region where the Internet payment system being almost non-existent while digital payment generally being better—yet in all payment channels, its level is the lowest in the East African region (Figure 4 and Figure 5).

Figure 5: Mobile accounts (population age 15+, as percentage)

Source: EBI (2018).

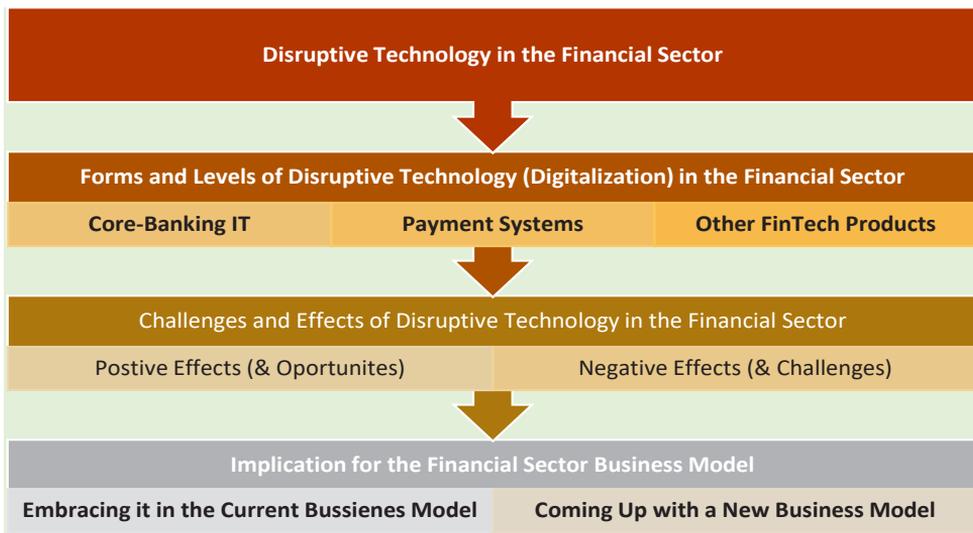


Partly because of the country's poor performance in all indicators as given in Figure 4 except in “risk-premium on lending”, in the East African region, the Ethiopian financial sector is the least efficient in the region making the cost of doing business for firms expensive. Having this general understanding about the country's lowest position in the regional context, I will now turn to an in-depth look of a sample of banks as a case study. This is carried to identify factors behind the challenge of digitalization in the sector, beginning with the dominant bank, the CBE.

The case studies: The financial/banking sector

The case study includes the dominant bank, CBE, that accounts for 60% of total deposit and outstanding loan of the banking sector in the period 2018/19—2020/21. The case study also includes three private banks, out of 16 private banks in the country. The three banks are among the top five biggest private banks with a combined deposit and lending share of 30% in the total deposit and lending portfolio of the private banks in the country during the same period. The selection of the three private banks is also informed by the variation in their deployment of digitalization in their respective banks. Thus, while Dashen Bank prefers partnership with private FinTech foreign firms, United Bank prefers to do that in-house. Abyssinia Bank is more devoted to have advanced digital products such as virtual banking, which is missing on the others. The analytical approach used in conducting the case studies is summarized in Figure 6.

Figure 6: The analytical approach of the case studies



Source: Author's own computation from the literature review.

The public bank: Commercial Bank of Ethiopia

The last two decades saw a significant expansion of the banking sector in Ethiopia (Alemayehu et al., 2017). The last five years in particular witnessed significant expansion of the banking sector in terms of branch network and capital expansion, the use of IT in banking (digital channels), as well as significant growth in domestic resource mobilization and lending.

There are two publicly owned banks in Ethiopia. However, one of these banks, the Development Bank of Ethiopia (DBE) is a policy bank that is difficult to characterize as commercial bank (Alemayehu et al., 2017). In addition, its size is also relatively small,

accounting only for about 7% of the total assets of the banking sector and 1% of the total bank branches in 2019/20. Thus, our focus is on the other bank, the Commercial Bank of Ethiopia (CBE). The CBE dates back to the establishment of the State Bank of Ethiopia in 1942. The CBE was legally established as a share company in 1963. In 1974, the CBE merged with the nationalized privately owned Addis Ababa Bank and became the public bank since then (see Alemayehu, 2008).

The CBE has more than 32 million account holders and 6.5 million mobile bank users as of September, 2021 (Table 3). Active ATM card holders reached more than 11.5 million by 2021. With more than 40,000 permanent employees and more than 22,000 outsourced jobs as of 30 June 2021, it is the biggest bank in the country—with a market share of about 60% in terms of assets, deposit mobilization, and lending. It is also the dominant bank, both by number of branches and capital (Table 3). By 2019/20, the number of bank branches in the country reached a total of 6,511 up from 4,257 in 2016/17. Private banks in aggregate increased their branch network, from 681 in 2009/10 to 2,837 in 2017, and to 4,593 (a share of 70.5%) today. The CBE has also significantly increased its branches, from 1,310 branches in 2017 to 1,825 in 2021, accounting for 28% of the total. Branch expansion, which apparently is against the impact of digitalization (see below), is taken by Ethiopian banks as a means to their aggressive deposit mobilization endeavours with excellent success—it was also a policy direction given by the previous (EPRDF) government. The total capital of CBE has reached 49.6 billion birr, which is 44% of the total assets of the banking sector in 2019/20 (Table 3). This has been 54.6% in 2017, however (NBE, 2020). During the last three years (2019 to 2021) CBE accounted for 60% of total outstanding loans as well as 57.3% of total deposits in the banking sector (NBE, 2020). Thus, given its dominance, we have devoted more space to CBE's digitalization effort in this section.

Table 3: Capital and number of branches of the banking sector (in millions of birr)

	22011/12	2012/13	2013/14	2015/16	22016/17	22017/18	22018/19	2019/20
Capital (in millions of Birr)								
Total (all banks)	18,010	23,346.0	26,437.3	13557.5	42579.6	85751	101498	112898
Public banks	9134	12,046.0	11,821.9	21058.3	50174.7	51,528	57494	57332
[CBE share of National, %]	34.6	38.7	34.2	31.5	54.6	51.1	49.1	44
Private banks total	8,876	11,300.0	14,615.4	22002.2	27788.1	34.223	44004	55575
Branch Network (numbers)								
Total (all banks)	1289	1728	2,208.0	3,301	4,257	4757	5564	6511
Public banks	675	869	1,003.0	1260	1420	1482	1685	1918
[CBE share of National, %[#]]	43.4 [559]	42.4 [732]	39 [856]	34.8 [1,150]	30.8 [1,310]	28.9 [1375]	28 [1578]	28 [1825]
Private banks total	614	859.0	1,205.0	2041	2,837	3275	3879	4593

Source: Author's own computation based on NBE, Annual Report (various years).

CBE has the leading role in modernizing the payment system in the country

With 85% of its 120 million people leaving in rural areas engaging in subsistence agriculture, cash, understandably, is the main payment system in Ethiopia. Despite this, CBE is a pioneer in digitalization that also threatened many privately owned banks and hence forced them to engage in digitalization, playing a leading role in modernizing the payment system in the country in the process. Table 4 shows this development in which the CBE has a market share of about 50% in the national ATM and Internet banking while its market share in the use of POS and mobile banking reached a staggering 77.6% and 80%, respectively, in 2017. Although we couldn't manage to get the data for its current market share, all indicators show it has still a leading role as that of 2017 in terms of market share (see Table 4 and Table 5).

Table 4: Modern Payment Systems and the Market Share of CBE

Digital Channel	March 2016/17		2020/2021 (2013)
Payment Systems	Numbers (of CBE)	Market Share (in %)	Numbers
ATM networks	1,501	50	3,138
POS networks	7,382	77.6	4,412 (active)
Mobile banking users	1.9 million	85	6.6 million
Internet banking users	35,208	48	154,469

Source: CBE (2017; and 75 Years Anniversary Magazine) and CBE, 2021 data.

Table 4 further shows the significant number of transactions that are carried using these digitalized payment systems. On average, CBE's ATMs channel handled 4.67 million transactions with a value of four billion birr per month in 2016/17. Similarly, the POS channel handled about 260,000 transactions worth half a billion birr per month in the same period. Similarly, 221,000 transactions worth nearly a billion birr per month were handled through mobile banking during the same period (2016/17). Internet banking performed relatively poor, handling only 4,500 transactions worth 125 million birr per month. This has significantly improved in 2021 (Table 4 and Table 5). In 2019/20, for example, all digital channels except POS expanded. As a result, about 163 million transactions worth about 200 billion birr were carried out through digital channels, mainly ATMs in 2019/20. This represented 37% of the bank's total transactions volume that could have been mediated with teller service—which is a significant development (Annual Report, 2019/20). Thus, the transactions per month more than doubled and the value of these transactions grew about three times, compared to 2016/17 (Table 5)

Table 5: Modern payment systems at CBE (2016/17 & 2019/20)

Digital Chanel	Based on Annual 2016/17 Data		2019/20 (Annual Report)	
	Average Numbers of transaction per month	Average amount of transaction per month (in billions of birr)	Average Numbers of transaction per month	Total amount Average amount of transaction per month (in billions of birr These transactions worth 198.5 billion birr per year)
ATM	4.67 million	4.040	163 million	transactions per year, these are mainly ATM
POS	0.258 million	0.466		
Mobile Banking	0.221 million	0.901		
Internet Banking	4,508	0.125	This is about 13.6 million transactions per month	This comes to average monthly value of about 16.6 billion birr
Sub-total (digital channels)	5.15 million	5.53 billion		

Source: Author's own computation based on CBE 75 Years Anniversary Magazine; and CBE Annual Repot, 2019.

The bank IT and human resource (HR) Development

The birrs use of digitalized payment system at CBE is also accompanied by the upgrading of its core banking software that networked all the branches that was carried in the last three years, 2019–2021. The CBE has also began using its enterprise resource management (ERM) system that it has been developing in the last three years. The use of ERM aims: (a) to standardize and align business processes of the bank with industry best practices; (b) to streamline and derive synergy among the closely related roles in the bank so as to bring operational excellence; (c) to reduce paper work, duplication of data entries and manual entries that is aimed at improving the efficiency and effectiveness of the bank; (d) to establish self-service environment and improve internal communications; and (e) support sophisticated data analysis to enhance strategic decision-making and planning. The ERM aims to develop a "Human Resource Modules", a "Finance Modules", a "Supply Chain Management Modules" (for procurement, warehouse & maintenance management), and "Hyperion Planning Modules" such as Business Intelligence (BI) and Data Warehouse Management (DW) which are part of CBE's digitalization and IT development strategy. The latter two are not yet deployed.

The CBE has also already completed and operationalized the CBE-Birr (Mobile Money) and Agent Banking system. The CBE-Birr has reached 11 million users in 2021. It has also established the CBE's contact centre and disaster recovery data centre which are part of the CBE's IT development endeavour. It has invested significantly on its data management and data storage system, with the plan to expand the latter to a significant level that is comparable to “cloud system” in a few years' time. Despite the fact that it is now comfortable with its infrastructure internally, the CBE has been,

and still is, generally challenged by the national communication/Internet system as well as lack of National ID. For example, at the beginning of 2018 (end of 2017), ATM's uptime is about 70%, 17%% of the reasons for down time being due to network/commination problems and about 6.5% being due to hardware failure (cash out of run and host/ATM fault).

IT development, deployment and its efficient use is closely related to human resource development. Thus, CBE's advance in IT development needs to go hand in hand with its human resource development or skill formation. It also needs continuous skill upgrading of its staff to tackle the high turnover of such skilled personnel. With this recognition, the CBE has drawn a comprehensive human resource development (HRD) strategy in collaboration with Frankfurt School of Finance and Management (FSFM). It has thus begun offering various on-job training on a continuous basis at a dedicated training centre built in Addis. Still, the professional staff it has a long way to go, given the high turnover of staff for greener pastures as well as CBE's loss of its invaluable IT personnel due to mismanagement and (ethnic) politicization of the bank by the CEO before the current CEO/president of the bank. In general, to make best use of its IT investment, monitoring the twining-up of the IT development and in-house skill formation on a continuous basis needs to be done.

In sum, CBE is the leading bank in modernization (digitalization) of the payment system in the country. Its future trajectory seems also excellent as could be read from the figures given in here and my discussion with key-informants. Given the significant number of unbanked populations in Ethiopia, the CBE has to go a long way, especially in mobile banking, by learning from the world class leading role and example of Kenya and its M-PESA. The coming of Safaricom to Ethiopian market needs also a strategic direction at CBE to withstand the upcoming competition with the world class provider of mobile payment system. The time-consuming nature of procurement rules at public firms also hinders digitalization because it takes more than a year to procure and use technology at CBE as it is a public bank. By the time it is ready to use the technology it acquired, the technology could be challenged by obsolesces—showing the importance of negotiating with the government for more autonomy to deal with such time-sensitive issues. Digitalization in the country (including CBE) is also generally vender-driven for lack of expertize in all areas, especially the business side of digitalization within CBE as well as the management's risk aversion stand in investing on in-house capacity that could replace vendors (see below the successful story of United Bank on this). The emerging Tele-Birr (the national mobile payment system) and the coming of new telecom operators in 2022 will be a major challenge for CBE that needs a strategic direction on digitalization and its implications for the CBE's current business model.

CBE doesn't seem to take the disruptive and transformative effect of digitalization and the impact of the incoming new actors on its business model in its strategic business plan. This could only be handled by aligning its IT and digital infrastructure with digital business development in a strategic manner. The digital business is significantly lagging behind the IT infrastructure development at the CBE. Important

services such as trade services, credit provision, E-commerce and deploying compatible payment system in the national digital ecosystem (such as Application Programming Interface, API) and similar developments in the industry are not yet developed. Thus, the alignment of the two and effective use of digitalization requires, among other things, in-house human resource development and deepening digitalization. More than anything, it needs a digital strategic direction to handle all these challenges mentioned and their implications for its current business model.

In addition, as a leading bank in the country, CBE needs to measure the trend of its IT and HR development, digitalization and digital transformation, not with local banks, but rather with regional (in particular Kenya, North African, South African banks, for example) as well as global banks so as to continuously upgrade itself and play a leading role. This is beneficial, not only for itself, but also for the whole banking system in the country (which also accords well with its mandates as a public bank). For example, its planned data management and storage investment (to be carried in a town 100km north of Addis Abeba) should have envisaged providing such big data storage, management and related services, not only for itself, but also for the entire banking system, with the aim of selling that service, which is comparable to a “cloud service” provision, to private banks—the majority of which are small to engage in such significant investment by themselves cost effectively. Such vision is also more appealing from national security and national sovereignty perspective—but the CBE is not doing that, and it is still a worth considering task.

Private banks: Dashen, Abyssinia and United banks

I have selected three of the biggest private banks among the 16 private banks in the country for this analysis. The three banks account for about 30% of the total capital, deposit, as well as lending of the total private sector banking in 2017/18. This is nearly half the level of deposit and lending at CBE (which has a share of about 64% during the same time, 2017/18).

Instead of discussing each bank separately, I have organized the information from my key-informant (KI) interview in all banks and data obtained from each of the banks along thematic areas: level of digital penetration, challenges encountered in digitalization, and impact of digitalization on their current business model. A unique feature of each of the banks relative to the disruptive effect of digitalization is discussed at the end, following the thematic discussion. I begin this analysis by looking at the motivation for digitalization in these banks (that is based on KI interview).

In all banks, the importance of digitalization is understood because there is a recognition that the future as well as the global trend is in that direction. The pioneer CBE engagement has also impacted on digitalization drive of private banks, since the majority of the staff in the private sector are those that migrated from the CBE when the sector is opened for private operators. In addition, Ethiopia is populated by a young population to whom the traditional branch banking is no longer appealing by the day.

The banks also recognized the importance of digitalization in their future competition when the banking sector is opened for foreign competition (currently foreign owned banks are not allowed to operate in Ethiopia). Thus, there is recognition today by all banks that they will not survive the competition with foreign banks, FinTech's, and telecom companies without investing on digitalization now. Because of this recognition, Dashen bank, for example, stopped branch expansion, although branch expansion is a business model all banks pursue in Ethiopia and is strongly associated with significant deposit mobilization. In fact, before it was scrapped recently, the central bank (NBE) was demanding all banks to expand their branch number by 25% each year in a bid to increase deposit mobilization, which it believed can be done mainly through branch expansion.¹

In addition, the challenge of the pioneer digitalization activity of the CBE, the costly and error-prone nature of storing and managing non-digital information, the impossibility of generating timely and accurate financial statements, the costly nature of opening branches, especially in regional towns, customer demand for digital services, and the ability to withdraw (and deposit, transact) their money at any branch (hence the need to connect branches) have also been the major pushing factors for digitalization. Notwithstanding this motivating factor for digitalization and the success attained in digitalization so far, the strategic importance of digitalization in changing the current business model of banks is not recognized across banks in the sector. Some banks are just doing it motivated primarily by the desire to get foreign exchange by visitors (by having POS machines) or because other banks are doing it or connecting branch banks is becoming a must to serve customers in all branches and in all ATMs in any geographic area, or all of these factors.

a) Digital penetration: The general picture about the extent of digitalization in the CBE and three of the private banks in this study are given in Table 4. Table 6 shows that CBE dominated the banking sector in all forms of digital payment systems. In all the banks, all channels of digital payment system have grown significantly. This is generally led by the growth of card-holder (and hence ATM and POS users), followed by mobile banking users. In all banks (except United), the number of mobile bank users has more than doubled. In all, banks the number of Internet bank users is found to be relatively the lowest. In ATM transactions and value of transaction per year, CBE, Dashen, and Abyssinia saw tremendous growth in the last three years, while this growth is relatively slow in the United Bank.

In all banks, the mobile and Internet bank users are generally a small proportion of their customer base and are, thus, negligible relative to the rest of the digital channels. The number of mobile bank users is, however, better although is still very small. For

¹ This interference in the working of the commercial banks by the central bank (NBE) is so pervasive that one of the banks that was established with a strategy of no physical branch, Zemen Bank, was forced by the government (National Bank of Ethiopia) to open 60 branch banks in a five-year period to operate in the country.

example, in Abyssinia Bank, it was just 13% in 2018/19 (99% of which being mobile banking users) and increased only marginally to 14% in 2020/21 despite the doubling of mobile banking users in the latter period. In United Bank, too, the growth was modest. In the dominant bank, CBE, the number of users of this channel, however, nearly doubled from 11% to 20% during the same period (Table 6). Great performance in this channel is registered only in Dashen Bank, where the share of its mobile users which was also significant even in 2018/19 at 43% has jumped to the impressive rate of 65%. The latter is the result of a conscious decision of the management to go digital and reduce other channels (such as ATM). Dashen Bank management is generally relatively actively conscious of the incoming competition from foreign actors in the digital front and the implication of that for its current business model and, hence, acting accordingly.

In all the banks, except Dashen, the relatively small role of mobile banking and the dominance of the ATM/card-holders' channel and its growth show the shallow penetration of digitalization in the Ethiopian financial sector, especially compared to leading regional countries in this frontier such as Kenya that is demonstrated in Figure 7 and Figure 8.

Table 6: Digitalized payment systems channels in Ethiopian banks

	June 2018/2019 [2011 Eth Calendar]				June 2020/2021 [2013 Eth Calendar]			
	Abyssinia 2011	Dashen 2011	United 2011	CBE 2011	Abyssinia 2013	Dashen 2013	United 2013	CBE 2013
ATM (Numbers)	173	355	69	2,505	1078	403	119	3,138
POS (Numbers)	363	1,397	223	3,399	281	1,382	323	4,412
Mobile Banking users	336,659	916,000	144,154	2.3 Mln	708,945	2.08Mln	272,265	6.6 Mln
Internet Banking users	4,655	Same as above	16,845	95,000^^		Same as above	23,584	154,469
Number of Card-holder	365,390	872,511	187,546	2.9 Mln	910,567	1.29 Mln	271,995	11.56 Mln
ATM transitions (Number/yr)		929,315	1.795 Mln	163Mln^		2.15 Mln	1.98 Mln	664,840*
ATM transition (Value, Br/yr)		4.33 bln	1.64 Bln	198.5 Bln^		6.26 Bln	1.846 Bln	
Customers (Numbers)	2,6 Mln	2.14 Mln		21.6Mln	5 Mln	3.2 Mln	1 Mln	32.1 Mln
Mobile Transitions Number/year			47,842				565,324	445,384*
Internet transaction, Number/ year			2,775				3,950	479*
Branch, Number	353	413	223	1,444 [28%]	625	441	345	1825 [28%]

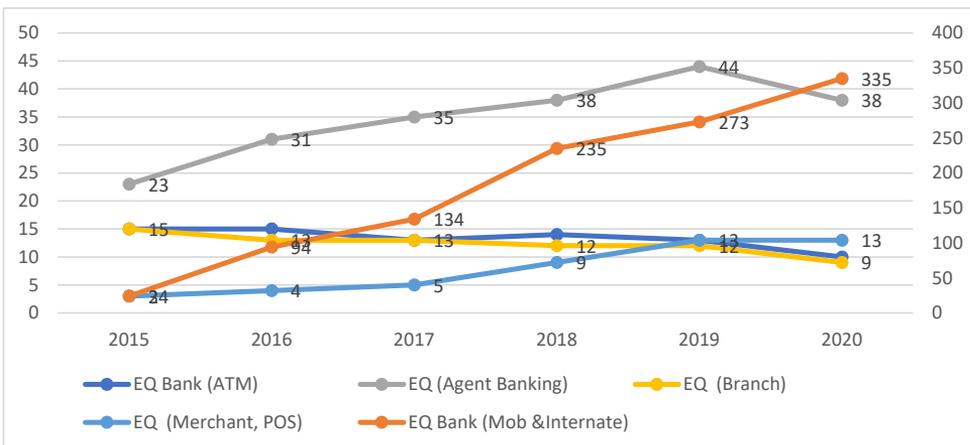
Notes: *For CBE, these figures are per business day. CBE has also a CBE-Birr with 100,666 transactions per business day, and 11.32 million users in 2020/21. ^2012 Eth calendar; ^^ estimates.

Source: Annual Report of Banks, various years and each bank.

In general, both in the private and public banks, the number of digital customers is growing fast, but accounts for a very small part of the bank's total transactions (both in number and value). Notwithstanding this fast growth, the level today is still small compared to the potential, given about 120 million population of the country, with 70% under 30 years of age, and 60 million mobile subscribers, about 20 million of them estimated to be smart phone users. This later demography shows digital banking is extremely small in Ethiopia. This is especially true in comparison to the financial sectors in digitally advanced countries such as Kenya where such channels account for over 80% of the total transactions in some of the major banks. In the later banks, the traditional channels (such as branch banking, ATM, POS, and even agent banking) are declining fast (see Figure 7).

Moreover, according to key informants, it appears that the top management owns the digitalization strategy but this is not internalized both within the bank staff (most don't have the drive, consider it risky and hence feel insecure to use digital channels and resist to leave past habit) and also at the society (customers) level at large. Thus, digital illiteracy is one of the major problems expressed by the banks for the low growth of digitalization. In addition, there is also a short-sighted view at the board and share holders' level, where high dividend level is usually perceived as an indicator of bank performance (and, hence, the basis for competition among private banks) instead of investing on sustainable and digitalized banking system which is crucial in the medium to long run. This is also another explanation for low level of digitalization in the sector. This has become a tradition in the sector from which getting out is still a major problem and, hence, hindering investing on digital banking and its effective use.

Figure 7: Trends of digital channels in Kenyan banks: Equity Bank (Number of transactions in millions, Internet & mobile banking in right axis)



Source: Equity Bank (2020).

b) Challenges encountered in digitalization: Four major challenges are encountered in digitalization of the financial sector in Ethiopia. The first set of

challenges is related to the deficiency of the national IT infrastructure. The second set of challenges relate to digital activities that are difficult and/or costly to be addressed by individual banks but can be handled less costly collectively—that is, the inability of the banking sector to exploit economies of scale due to national level “coordination failure”. The third challenge relates to the relationship of banks with the regulatory institution—the central bank, National Bank of Ethiopia (NBE). Finally, the fourth challenge relates to local IT human resource capacity building and its effective use.

All the interviewees in this study noted the challenge of getting a stable, reliable, and efficient telecom network and communication system. In fact, about a quarter of the operation of the biggest bank (CBE) services are interrupted due to national communication/network related problems. This level goes as high as 35% of the service down time of CBE branches in regional towns (towns located outside of the capital). This problem is also the same across private banks. Notwithstanding that, Ethio Telecom, which is the sole provider of this service, has significantly improved its service in the last three years and this problem is significantly reduced recently, as noted by all banks. In addition, the cost of the Ethio Telecom service provided to banks (such as network communication backbone) is about six times expensive compared to similar cost to their peers in East Asian countries. The banking sector expects this to improve with the coming of the new competitor, Safaricom in 2022. In addition to network communication problem and cost, frequent power outage is disrupting their activities; which is also costly to cope with as they have to use diesel generators for that purpose.

The second challenge relates to the problem of “coordination failure” which is making the banking service costly and inefficient. One of these challenges is that banks face significant license fees for operating system and potentially will also face in the future for cloud service vendors (such as Oracle, IBM, Microsoft, etc.). These costs and the monopoly position of vendors as well as their ability to segment the market/the product and charge very high price for individual banks (and also non-banking firms such as Ethiopian Airline, Ethiopia Shipping Line, and some ministries that use such services) would have been significantly reduced if license and related agreements are made at national, rather than firm-level, as is done in some neighbouring countries—this is what I referred as “coordination failure” above. Lack of a national framework for cooperation among banks for a win-win approach (instead of a competition only that is akin to a race to the bottom) by collectively investing in some indivisible assets that are costly for a single, especially small banks, but could be cheaper collectively is a major problem facing the sector. Such digital activities that are suffering from “coordination failure” include, inter alia, joint data storage and management, AI-based data analysis, data security, license agreement and potentially cloud service. Such collective efficiency consideration, which also touches upon national security and sovereignty issues should have been factors for government (the NBE) to take action, that includes coordinating banks, as this is primarily the government's (NBE) responsibility and the country is losing scarce resources for foreign firms as a result.

A related problem that some of the key informants mentioned is the ethnicization, as well as the trend for religion-based banking that is eroding their customer base which the government may address collectively. They are, however, optimistic the competitive threat from incoming digitalized payment (and banking) system and the need for merger to withstand such incoming competition could be used (assisted) by government to tackle such emerging concerns.

A related “coordination failure” challenge for the banking sector is lack of national identity document (National ID) that uniquely identify an individual. Such ID is a must for any advance in digitalization of the financial sector. This is a difficult and costly project for the individual banks to carry. Thus, provision of this at national level is important, yet the country is still working on it with no end in sight. A short-run solution is needed to make full use of digitalization in the coming few years, if the Nation ID is not forthcoming soon. One possible short-term solution is to share the customer database of Ethio Telecom with banks. Ethio telecom already has such information that is acquired when mobile lines are sold.

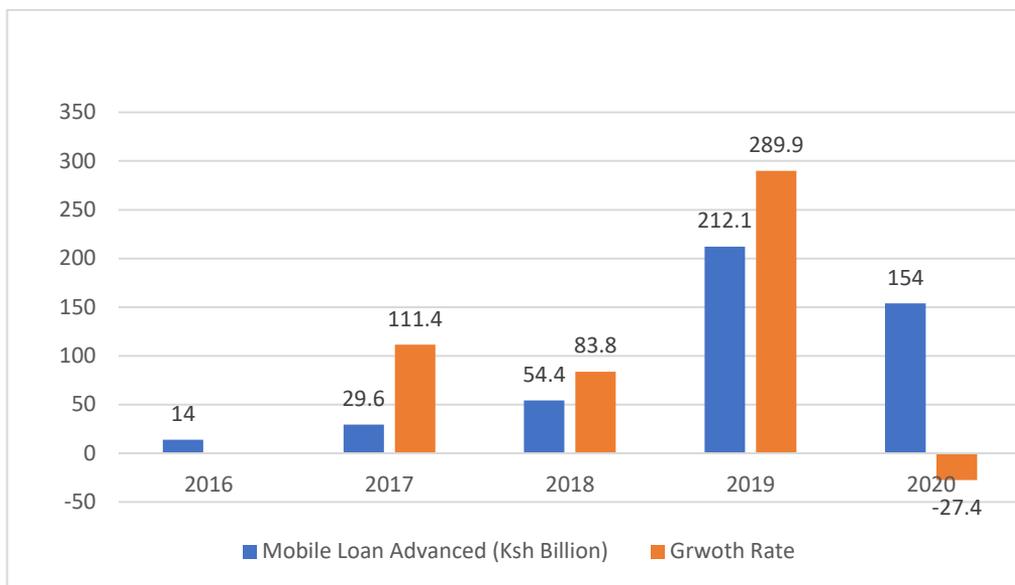
The third challenge is related to the banks' relation with regulatory body, the NBE regarding digitalization. Due to lack of well-trained and capable experts on digitalization issues at NBE, the conservative and controlling mind-set stance of its staff as well as lack of strategic thinking by understanding the current state of global (and regional) trend of digitalization and its trajectory, digital innovation and its use has faced a major hurdle in the banking sector. First, getting an approval both for standard and new financial product is very bureaucratic and time consuming. This at times leads to obsolescence of the technology/innovation at the time of approval. Second, as a defensive action to its lack of regulatory capacity, the NBE follows a rule which de facto says any innovation that is not in its permissible list as well as all new innovation about which no regulation exist are illegal with significant penalty. This rule is easy for control and minimizes risk for the regulator, especially when capacity at NBE is limited. However, it kills innovation at banks, especially in a fast-changing technology such as IT that includes digitalization. Thus, it appears digitalization advance in Ethiopian banking sector is bank-led (not nationally/NBE-led through clear and all-encompassing rules). Instead of facilitating digitalization, the regulator is a constraint for this bank-led IT-based innovations and realization of related financial products. The NBE is not accountable when it fails in this duty either. Sometimes it could retaliate to those who confronted it or complain about its activities related to approval of digitalization systems or products. It is high time to change this practice in favour of an approach that encourages new innovation and innovative financial products (see the final policy recommendation section) at NBE which is found as one of the major challenges in relation to digitalization.

Finally, the fourth challenge relates to IT human resource capacity in the sector and its effective use. This is not a major challenge as those outlined above as most banks have excellent IT personnel at their IT department. But still, it is important. In most banks, there is significant dependence on vendors for technology supply (the only exception being United Bank that has built impressive in-house capacity). There

is also lack of confidence on the part of bank management to take the risk of relying on (and building) local talent for their major digitalization tasks. Such talent is, however, widely available in banks and throughout the country (i.e., young bright IT savvy are many). Limiting the potential digitalization role of the small FinTech companies through government regulations and the restriction of the financial sector to citizens only (although has its own merits) has also a limiting effect on technological transfer and quick upgrading of banks' digitalization level to the global standard.

c) Impact on current business model: One of the major and significant effects of disruptive technology is to change the current business model of firms as noted in Section 2. From my discussion with key-informants and the various strategic documents of the banks, digitalization is appreciated by the industry and all banks have an IT department in charge of digitalization (both the business and technical aspect). However, despite its high growth in most aspects, it didn't lead to a change in their branch-based dominant business model in any meaningful way in any bank and it is difficult to see that happening in the very short run. In this sense, IT and digitalization cannot be considered a disruptive technology in Ethiopian financial sector yet. Still, the bulk of the banks' business is conducted physically being in branches and focusing on big-customers. This can also be inferred from the contrasting trend of digital and non-digital (such as branch) channels of the Ethiopian banking sector with that of Kenyan banks, which are well advanced in this area. This is shown in Figure 7 and Figure 8.

Figure 8: Mobile bank loan advances at Commercial Bank of Kenya (in billions of Ksh)



Source: CBK, Annual Report, 2020.

The trend of digitalization as can be inferred from the digital financial channels in two of the Kenya's banks is given in Figure 7 (for Equity Bank) and Figure 8 (for Commercial Bank of Kenya, CBK). Kenya has one of the very advanced financial sectors in Africa, which is comparable to the level in emerging economies. Thus, a comparison with Kenya offers how far the Ethiopian financial sector is in terms of digitalization. Although Figure 7 is based on one of the dynamic banks in Kenya and the region, Equity bank, the trend is similar across banks in Kenya. For example, in the CBK, one of the largest banks in Kenya, exhibited the same trend of a decline in transactions that are based on branch while registering a phenomenal growth in digital transactions, including even lending, as can be read from Figure 8.

Comparing the trend of some of the digitalization indicators in these Kenyan banks with the trend among the Ethiopian banks shows quite a contrasting trend. For example, in Equity Bank, the use of branch tellers has declined by 38% in 2020 (compared to 2019), and it is closing most of its branches in 2022. Similarly, ATM transactions have declined by 21% in 2020. On the other hand, transactions using mobile and Internet banking have increased by 28% and 82%, respectively. Agent banking growth also stagnated in Equity Bank in 2019 and grew only by 2% in 2020 (CBK, 2020, Figure 7). In contrast to this trend, the trend of branch and ATM expansion in Ethiopian banks is increasing very fast and significantly so (Table 6). What is interesting in the case of CBK is also the spectacular growth in mobile bank-based loan advances—an excellent indicator of fast changing business model (Figure 8)—whereas there is no digital lending in Ethiopian banks. This contrasting pattern shows at what very early stage the Ethiopian banking sector is found in relation to digitalization and new business model in banking that is flourishing in Kenya.

In terms of linking digitalization and current banking practice, our interviewees noted that “process-based thinking” is missing in most banks. To think of digitalization of a particular activity or product from the start to the end and institutionalizing that as a procedure to be followed by operational staff is an important strategic direction worth pursuing but missing in the banking sector. This is important to cut “ad hoc” procedures and replace them with systemic (and digitalized) approach. The lack of a digital ecosystem for E-commerce (both in legal and technical framework) is also a major constraint to change the current business model.

Regarding challenges expected in the coming years, significant digital disruption is expected starting in the year 2022 because Ethiopia is admitting a new telecom company (Safaricom) for the first time in its over 100 years history of telecom monopoly. The outlook among our interviewees, however, is optimistic in some of the private banks and a concern in some of both private and public banks. Most expect significant improvement on quality, reliability and cost of digital services that they are currently getting from Ethio Telecom. Some of them also believe that they have a local knowledge and can work in partnership (joint venture) with foreign FinTech, even foreign banks. In fact, for some of the banks, such foreign competition may lead to merger and acquisition with a positive effect on capitalization and deescalating the ethnic and religion-based segmentation of the market, which is eroding the customer

base of multi-ethnic and multi-religious banks. The later trend is also a potentially worrisome for the political stability of the country as a whole, which requires the immediate attention of policy makers.

d) Some special activities in the case study banks: Apart from the similar pattern of digitalization and challenges encountered as discussed above, there are also bank-specific digitalization features observed in the case study banks.

Dashen Bank: One unique approach in Dashen Bank is the deployment of its mobile and Internet banking platform and a digital wallet called Amole in July 2018 in an integrated and holistic approach with a spectacular success. Prior to this, the bank accounts were not integrated with wallet. The Amole works via USSD, mobile app and Internet channels. By December 2020, over two million customers had been registered on the platform, up from 50,000 two years back when the project started—which is a significant growth. Thus, this digital payment platform already surpassed the number of card transactions in retail environment (African Business, 2021). What is unique, and perhaps explains partly its success, is its ability to correctly identify the gap in the market and engage in collaboration with its key FinTech partners, Moneta Technologies, according to African Business (2021). Officials at Dashen, attributed the success primarily to their unique vision of digitalization and corresponding significant investment in IT (to the tune of 1.3 billion birr per annum—one of the highest in the industry). Regarding their vision, they take digitalization in a holistic manner with a view to have an open omni channel platform that will be compatible with any partners, customers' preference, and ready to exploit uncharted territories by adding value (e.g., includes plan to engaging in wholesale and distribution channels, mobile lending, exploit cloud cost advantage, incentivise money senders instead of focusing on receivers only, etc.). In this endeavour, it has encountered business model related challenges such as the push by Ethio Telecom to use Dashen's resources for its new mobile payment system (Tele-Birr) without sharing the benefit the later generates or get compensated for their service to Tele-Birr. The push by the regulator to generate uniquely identified customers, without having a national ID system, as well as digital illiteracy both at regulator, its own staff and the public at large are challenges that the bank has encountered. Despite this, it has a determined vision and strategy for digitalization which could also be inferred from the growth trend of its different channels: it has stopped branch expansion, significantly reduced new employment and re-directed those displaced by digitalization to marketing tasks, for example.

Abyssinia Bank: A unique aspect of digitalization at Abyssinia Bank is its strong drive to use digitalization extensively, relative to other bank, as well as its significant growth in the last three years. This is illustrated by its recent launching of virtual banking in selected locations of the capital and its current plan to launch digital lending, which is not seen in all other banks. It has also partnered with a renowned global payment gateway solution provider, VISA Cyber source. This has enabled the bank to offer online shopping and online payment services to its customers.

Hibret/United Bank: In Hibret/United Bank, its effort to carry most digital activities in-house using own capacity (human capital) is one of its distinguishing features. By doing this it, not only managed to save millions of birr and foreign currency, but also developed its staff confidence and managed to tailor best the technology to Ethiopian condition. It has also implemented key software in the business such as ERP (Enterprise Resource Planning). United Bank is the only bank to develop its core banking system in-house, not only in Ethiopia but also in Africa as a whole. It has also a unique in-house developed digital ecosystem called “CEO chat room” where the CEO can chat with every staff in the bank across the country (the bank has over 4,000 personnel) unanimously to find out ethical problems, banking problems, leadership problems (including confessions that is akin to a Catholic priest function of the same), etc. This has helped in identifying problems in the bank's operation that includes ethical problems of some authorities within the bank. It is also the first bank to implement the first mobile and Internet banking in the country. The interesting question is why United Bank did this while others are not? The fundamental reason relates to whether the CEO's in Ethiopian banks believe in the capacity of the young IT talent available, both at the bank and across the country, and willing to take the risk to engage them in major tasks. The youth have the capacity, but do not have the confidence and, hence, not willing and able to take a risk; and so are most CEOs in taking the risk and engage the local talent on major digital tasks of the bank. The United Bank CEO took that calculated risk, with outstanding success.² Yet, if he had failed, he could have been condemned for this adventure. The lesson is, innovative approach and creativity needs taking a calculate risk. Perhaps the United Bank CEO's background as an IT expert and head of the IT and System management of the bank before his current position has helped that too. In other situations, risks such as this need to be understood and covered by board of banks and national level relevant institutions to spur innovation. If other banks also secure some of their software from local innovation (such as from the United Bank) it would have benefited the innovator, themselves (is less costly, in local currency and found next to them in the country, compared to their current foreign vendors), and the country at large.

² Interview with the CEO of United Bank.

4.0 Conclusion and policy implications

The study attempted to examine the nature, impact, and future direction of disruptive technology, in the form of digitalization, on Ethiopia economy in general and its financial sector in particular. From the study, the level of ICT expansion, as well as the related digital transformation in the financial sector is found to be one of the lowest in the region. The level is found to be at extremely low level, especially, when compared with neighbouring Kenya which has significantly advanced and digitalized financial sector.

Notwithstanding the low level of digitalization, even this low level is found to be key driver of economic growth in Ethiopia. Thus, the study noted that, a 10% increase in digitalization, measured by growth of mobile subscriptions, could lead to 0.5% growth in GDP. This is found to be about 1% in the services sector, and about 0.3% in the agricultural sector. It is found to have no effect on the industrial sector, however. The effect of broadband penetration is also found to have similar positive effect, but nearly half in terms of potency compared to mobile penetration.

Having this macro picture, I have also attempted to look at the effect of digitalization in-depth at micro-level by taking the Ethiopian financial/banking sector as case study. From the analysis of the digitalization activity in the banking sector, I have identified a number of challenges in the sector, with implications for policy. The major challenges identified are the following.

First, apart from the necessity of networking banking branches and digital documentation of customer's information, most banks do not seem to take digitalization as the main strategy for transforming their current business model. Their current business model is based on branch expansion and targeting big customers and foreign exchange generators. All banks carry the bulk of their business physically in-branch too. In this sense, the digitalization technology in the financial sector is not that disruptive yet. Most banks seem also to pursue newer aspects of digitalization because other banks, especially the pioneer CBE, are engaging in it before them. Thus, digitalization is not taken as threat to their current business model that needs immediate strategical actions yet. Notwithstanding, all banks have an IT department and some of them have also digital business department. They are also investing a lot on digitalization, especially on digital in-house infrastructure and payment system.

Second, one of the major problems for advancement of digitalization in the banking sector is lack of methods or tools that measure the impact of investing on digitalization. In general, if it is difficult to measure an activity and its impact, it is difficult to pay serious attention to it by management. In other words, we care about bank profit because we accurately measure it and we know the consequences of its change and so is business expenditure. The Lack of similar measurement possibility about the impact of digitalization, and using that as an input for management (including board) decision, is hindering the management to strategize extended development of digitalization and use, as well as realizing its potential. The tradition and expectation of significant dividend each year by the board and shareholders in the Ethiopian banking sector accentuated this problem by limiting heavily investing in digitalization.

Third, the current business model of Ethiopian banks is to focus on big customers and corporate entities that are handled in-branch. This is the opposite of the trend in the banking sectors in the rest of Africa which are focusing on micro and small firms and the unbanked population using digitalization. Such digital transformation strategy (digital banking) as a business model is not getting the utmost attention it deserves by Ethiopian banks. Had they had their focus on the latter group of customers, as that of the rest of Africa such as Kenya, they would have focused on digitalization of finance and its indispensable role in changing their current business model.

Fourth, adapting to the advances in global level of financial digitalization and venturing on digital transformation of banking as a strategy is not observed in a substantive manner in all the banks of the country. This is, partly, because the Ethiopian banks are comfortable with their current business model, customer base, and current profitability. This is further strengthened by lack of a competitive threat from global players in the sector because the sector and the telecom sector have been restricted to citizens only to date. The telecom sector is now opened and sure to have effect on the current business model banks through digitalization—this indicates that the Ethiopian banks need to be ready for such competition ahead of time so as to survive in the business.

Finally, one of the major challenges to digitalization and financial innovation in the financial sector is the existence of technically very weak, conservative, and uninformed regulatory body, the National Bank of Ethiopia (NBE). Because of these features, the NBE doesn't give a leeway to banks to innovate and deploy new financial products and new business model. It doesn't answer to the banks' requests on time either. Neither is it accountable when it fails to do the latter. As a result, fearing reprisal from the NBE as part of its defensive position, which is not uncommon, and discouraged by the bureaucratic hurdle for approval of new digital products and systems, banks are being forced to stick to already known and approved financial products instead of working on a new and better one. This needs a fundamental policy change from the regulator side (see below). The digitalization problem is accentuated further by the lack of national ID which should have been done at national level, spearheaded, among others, by the NBE. Such problems of “coordination failure” has been also observed on various aspects that includes, acquisition of foreign licenses, cloud service, data management, and data storage service, cyber security, etc.

Given these major challenges and more specific ones documented in the study, some of the major policy implications of the study are the following.

First, the NBE needs to allow innovative financial products to flourish, requiring only notification from firms when they develop new products or systems, instead of prohibiting everything that is not in its list of permissible products as illegal, as is currently the practice *de facto*. It also needs to learn from neighbouring Kenya that, had it not been for such an enabling environment and without the smart decision of the then central bank governor Njuguna Ndung'u in 2007, Kenya wouldn't have developed M-PESA that has become a global success story of Kenya. For this to happen, the NBE staff needs to be literate in digital finance and its regulation ahead of time, staffed by high calibre and well-paid experts that could design regulatory frameworks following a notification by banks about their new financial products and systems. If possible, the NBE needs to do this ahead of such notification guided by clear strategic direction for digitalization. The NBE has to be accountable and transparent when it fails in these functions too—which is against its current posture of authoritative and vindictive nature. A possible short-term recommendation until NBE is staffed with such experts—plan B—is at least to regulate the “channels” (e.g., mobile banking) and leave detailed products within the channels for banks' creativity. Currently, the NBE, however, would like to give permission for each conceivable detailed product within a channel on a product-by-product basis. As a result, it takes time, at times, a year and half to get approval after going through an agonizing process of defending the product by commercial banks in front of the NBE officials, which might have no idea about the technology in question. By the time of approval, if this happens, the product could be obsolete in this fast-changing digital world. The NBE can learn a lot on how to handle such issues, on a continuous basis, from Kenya and the state bank of India, to just name a few.

Second, there are a number of areas that enhance digitalization in the financial sector but need to be taken collectively by all banks or by the government (NBE for example) for various reasons. These reasons include advantage of cost sharing, economies of scale, national sovereignty concerns, national security concerns, etc., that usually emerge from coordination failure. These challenges include, having a national ID, data storage and management system, data security, cloud service, and national level licensing of financial products from global vendors with monopoly power such as Oracle, IBM, Microsoft, etc. It is imperative for the government (NBE included) to ensure that these activities are carried in a coordinated manner at national level as a matter of urgency.

Third, in all banks, except in a few, the disruptive technology nature of digitalization with implication for transforming their current business model in a fundamental way is not recognized by the management and board of banks. With the inevitability of foreign competition that is on the horizon, and the trend of growing digital business models in neighbouring countries such as Kenya, the Ethiopian financial sector management needs to strategically plan to digitally transform their business model. One strategic direction on this is to optimize on partnering (including through API

[Application Programming Interface]) with potential competitors that most likely be better than Ethiopian banks, including FinTech firms and “Tele-Birr”, by capitalizing on their local knowledge, in-house capacity, and customer base.

Finally, disruptive technology, such as digital transformation in the financial sector, could be important (and could be used by the government) to de-ethnicize the banking sector through disrupting the ethnic (and also becoming religious, lately) business model most banks in Ethiopia are increasingly employing. Digitalization in tandem with incoming exposure of the sector to foreign competition could also contribute to this by making it necessity for Ethiopian banks to go through merger, acquisition and joint-venture so as to be a strong competitive bank. This de-ethnicization is important (in fact the government needs to do it deliberately and quickly) for multi-ethnic banks because the ethnic and religion-based banks are dislodging them of their customers with detrimental effect on their business. The ethnic and religious business models are also segmenting the market in the process. In addition, this is an emerging national threat, especially when these banks began financing influential ethnic cadres/leaders, ethnic parties, ethnic businesses, ethnic and religious extremists selectively as their priority customer. When the latter happens, it is highly probable that such banks will be captured by ethnic (religious) extremists that enhance ethnic (and religious) identity at the expense of national identity—from which Ethiopia is already suffering in the last three decades that culminated in a devastating war since last year.

References

- Aziz, M.R.A., M.Z. Jali, M.N.M. Noor, S. Sulaiman, M.S. Harun and M.Z.I. Mustafa. 2021. "Bibliometric analysis of literatures on digital banking and financial inclusion between 2014-2020". *Library Philosophy and Practice* (e-journal), 5322. <https://digitalcommons.unl.edu/libphilprac/5322>
- Abyssinia Bank. Various Years. Annual Report, Addis Abeba.
- African Business. 2021. "Amole driving a cashless society in Ethiopia". At <https://african.business/2021/07/finance-services/amole-driving-a-cashless-society-in-ethiopia/>
- Alemayehu, G. 2008. "The structure and performance of Ethiopia's financial sector in the pre- and post-reform periods, with a special focus on banking: In G. Mavrotas, ed., *Domestic Resource Mobilization and Financial Development*. Studies in Development Economics and Policy. London: Palgrave Macmillan. https://doi.org/10.1057/9780230594012_8
- Alemayehu, G. 2021. "Crony capitalism in a 'Developmental State' model of an African poor country: Ethiopia during the TPLF/EPRDF regime. Unprocessed/forthcoming, Economic Research Forum, Cairo and Dubai.
- Alemayehu, G. 2022a. "The challenge of unemployment and youth unemployment amidst fast economic growth in Ethiopia". AERC-ODI-ERF-INCLUDE Collaborative Research Project, Nairobi. At www.aercafrica.org
- Alemayehu, G., T. Addison and G. Alemu. 2017. "The current state of Ethiopian financial sector and its regulation: What is new after a decade and half strategy of gradualism in reform, 2001–2017. Unpublished, Department of Economics, AAU.
- Alemayehu Geda., Njuguna Ndung'u and Daniel Zerfu,. (2015). *Applied Time Series Econometrics: A Practical Guide for Macroeconomic Researchers in Africa*, Nairobi, University of Nairobi Press.
- Christensen, C.M. 1997. *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*. Harvard Business Press.
- Christensen, C.M. and M. Overdorf. 2000. "Meeting the challenge of disruptive change". *Harvard Business Review*, 78(2): 66–76.
- Christensen, C.M., M.E. Raynor and R. McDonald. 2015. "What is disruptive innovation?" *Harvard Business Review*, December 2015.
- Commercial Bank of Kenya (CBK). 2020. Integrated Report and Financial Statement, 2020. Commercial Bank of Kenya, CBK, Nairobi, Kenya.

- Commercial Bank of Ethiopia (CBE). 2018. Special Magazine for 75 Years Anniversary. Addis Abeba.
- Commercial Bank of Ethiopia (CBE). Various Years. Annual Report, Addis Abeba.
- Cziesla, T. 2014. "A literature review on digital transformation in the financial service industry". Bled eConference. At <https://aisel.aisnet.org/bled2014/18/014>
- Dashen Bank. Various Years. Annual Report, Addis Abeba.
- Donovan, K. 2012. "Mobile money for financial inclusion". *Information and Communications for Development*. Washington, D.C.: The World Bank. <http://hdl.handle.net/11427/19272>
- European Investment Bank (EIB). 2016. *Banking in sub-Saharan*. Luxembourg: European Investment Bank.
- European Investment Bank (EIB). 2018. *Africa: Recent Trends and Digital Financial Inclusion*. Regional Studies and Roundtables. Luxembourg: European Investment Bank.
- Equity Bank. 2020. Equity Group Holdings Plc Investor Briefing 2020. Equity Group Holdings Plc, Nairobi, Kenya.
- Federal Democratic Republic of Ethiopia (FDRE). 2019. Digital Ethiopia 2025: A Strategy for Ethiopia Inclusive Prosperity.
- Getnet, A., ed. 2021. *The Genesis, Evolution and Prospects of the Commercial Bank of Ethiopia: 1942/43–2017/18*. Addis Abeba: Addis Abeba University Press.
- IFC, International Finance Corporation. 2011. *Mobile Money Study 2011*. Washington, DC. <http://www.ifc.org/ifcext/globalfm.nsf/Content/Mobile+Money+Study+2011>.
- International Monetary Fund (IMF). 2015. *FinTech in sub-Saharan African Countries: A Game Changer?* Washington, D.C.: International Monetary Fund.
- International Telecom Union (ITU). www.itu.int
- Karagiannaki, A., G. Vergados and K. Fouskas. 2017. "The impact of digital transformation in the financial services industry: Insights from an open innovation initiative in FinTech in Greece". MCIS 2017 Proceedings. <http://aisel.aisnet.org/mcis2017/2>
- Kasekende, L. 2010. "Developing a sound banking system in sub-Saharan African countries". In Quintyn and Verdier, eds., *African Finance in the 21st Century*. Washington, D.C.: International Monetary Fund.
- Katz, R. 2012. "Impact of broadband on the economy". International Telecommunication Union. https://www.itu.int/ITU-D/treg/broadband/ITU-BB-Reports_Impact-of-Broadband-on-the-Economy.pdf
- Khan, S., S. Khan and M. Aftab. 2015. "Digitalization and its impact on the economy". *International Journal of Digital Library Services*, 5(2): 138–48.
- Markides, C. 2006. "Disruptive innovation: In need of better theory". *Journal of Product Innovation Management*, 23(1): 19–25.
- NBE, National Bank of Ethiopia (2020. Annual Report. Addis Abeba, Ethiopia.
- NBE, National Bank of Ethiopia . 2019/20. Annual Report. Addis Abeba, Ethiopia.
- NBE, National Bank of Ethiopia (NBE). 2021. *National Digital Payment Strategy, 2021–2024*. Addis Abeba: National Bank of Ethiopia.

- Pesaran, M.H. and Shin, Y. (1999). An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis, in Strøm, S. (Ed.), *Econometrics and Economic Theory in the 20th Century*, Cambridge: Cambridge University Press.
- Pesaran, M.H., Shin, Y. and Smith, R.J. (2001). Bounds Testing Approaches to the Analysis of Level Relationships. *Journal of Applied Econometrics*, 16:289–326.
- Pesaran, M. H (1997), ‘The Role of Economic Theory in Modelling the Long Run, *Economic Journal*, 107(440): 178-91
- Sabbagh, K.R.F., B. El-Darwiche, M. Singh, S. Ganediwalla and R. Katz. 2012. “Maximizing the impact of digitization”. *The Global Information Technology Report 2012*.
- Nguyen, T.T., H.T. Nguyen, H.T. Mai and T.T.M. Trâm. 2020. “Determinants of digital banking services in Vietnam: Applying UTAUT2 Model”.. *Asian Economic and Financial Review*, 10(6): 680–97.
- United Nations Conference on Trade and Development (UNCTAD). 2018. Technology and Innovation Report 2018: *Harnessing Frontier Technologies for Sustainable Development*. Geneva: United Nations Conference on Trade and Development.
- United Bank. Various Years. Annual Report, Addis Abeba.
- Varda, S. and S. Singhania. 2020. “Digital technology in the realm of banking: A review of literature”. *International Journal of Research in Finance and Management*, 1(2): 28–32.
- World Bank. 2017. *The Global Findex Database*. Washington, D.C.: The World Bank.

Appendix

Key Informants Consulted and Discussion Held With

Ato(Mr) Asfaw Alemu, President, Dashen Bank Sc.

Ato(Mr) Shimelis Legsse, Chief Information Officer, Dashen Bank.

Ato (Mr) Kasaye Eshetu, Director, Alternative Channels Department, Dashen Bank.

Ato (Mr) Daniel, Hailu, Chief Information Office, Abyssinia Bank, and also former Chief IT Project Leader at Commercial Bank of Ethiopia.

Ato (Mr) Yitbark Tesfaye, Director, IT Projects at Commercial Bank of Ethiopia.

Ato (Mr)Melaku Kebede, President, United Bank Sc.

Note: Names of other key-informants in the banking sector that remain to be anonymous are not listed here. The information used in the study has used their views, however.



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