Development of the Digital Financial Ecosystem in Rwanda: Drivers, Lessons and Way Forward

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Development of the Digital Financial Ecosystem in Rwanda: Drivers, Lessons and Way Forward

By

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Contents

List of tables

List of figures

Abstract

Digital financial services (DFS) have the potential to promote payments' efficiency and boost financial inclusion even in remote areas with minimal traditional financial infrastructure such as bank branches. In Rwanda, the digitization of payments is a key policy strategy in a bid to transform the country towards a more cashless and knowledge-based economy. Since the establishment of the Rwanda Integrated Payments Processing System (RIPPS), various policy and product innovations have been put in place to increase the share of transactions done electronically. This study examines the development path of digital financial services in Rwanda over the decade 2011-2021 using a mixed-methods approach. The quantitative part entails descriptive and regression analysis to ascertain the trend, patterns and determinants of uptake for key DFS products in the country while the qualitative key informant interviews with key stakeholders are used to ascertain the opportunities and challenges for further promoting DFS in the country. The findings indicate that between 2011 and 2021, the number of people using Internet and mobile banking increased quite substantially. The number of active mobile money subscribers increased from 1.6 million in 2012 to 5.1 million in 2021, while credit cards increased from 115,200 in 2011 to 686,309 in 2021. The transactional volume and value also increased remarkably, partly fueled by COVID-19 and innovative use of mobile money, including electronic tax payment. The study recommends improving Internet connectivity and quality, promoting digital literacy, improving interoperability and enhancing cyber security to further boost DFS in Rwanda.

Keywords: *Digital financial services; Financial inclusion; Mixed methods; Cashless economy; Rwanda*

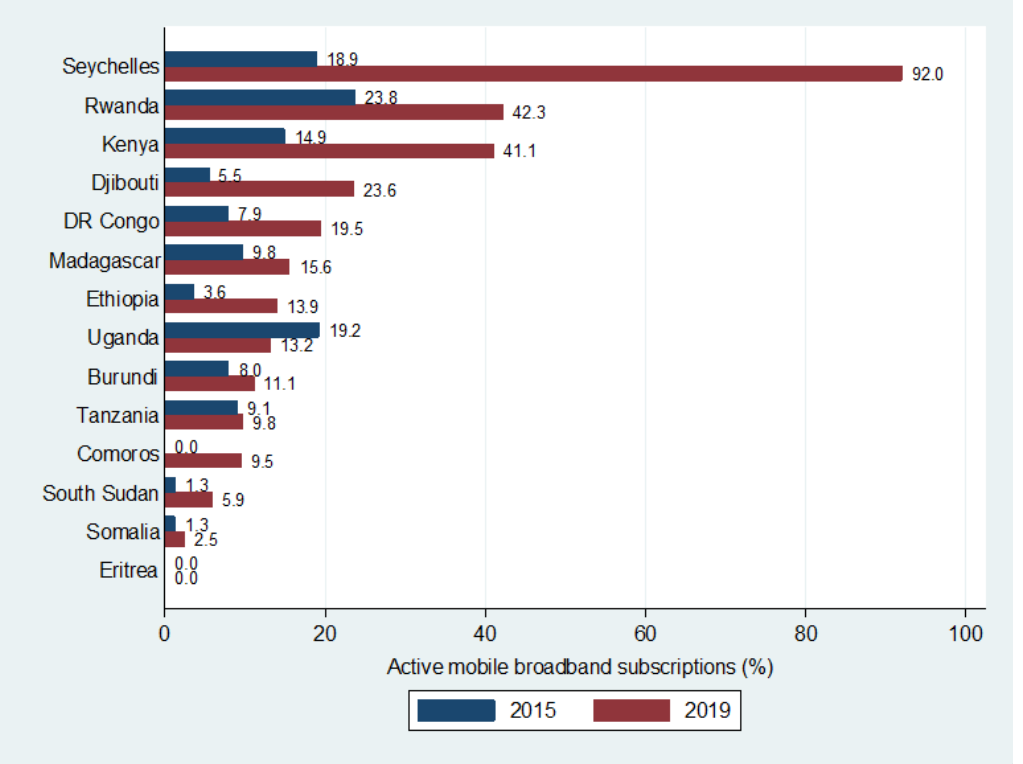
1. Introduction

Background

Sub-Saharan Africa has among the lowest levels of financial inclusion, with only 43% of Africans having an account at a financial institution in 2017 (Bille et al., 2018). This compares unfavourably with the corresponding rates in low- and middle-income countries (63%), high-income countries (94%) and at the global level (69%). The continent's disproportionately lower levels of account ownership and financial inclusion are, however, gradually being compensated by the rapid expansion of digital financial services, particularly mobile money. Between 2014 and 2017, the share of the adult population with a mobile money account increased by nine percentage points, much higher than the corresponding increase of four percentage points in institutional account ownership (Demirgüç-Kunt and Klapper, 2020). By 2021, 33% of adults in Sub-Saharan Africa had a mobile money account, compared to a global average of 10% (Demirgüç-Kunt et al., 2022). In developing countries generally, the growth of digital payments is outpacing that of traditional account ownership. According to the latest Global Findex Survey of 2021, 64% of adults in developing countries – 84% of bank account holders – transacted digitally at least once in 2021 (Demirgüç-Kunt et al., 2022). This tremendous progress is providing opportunities even to those previously excluded from traditional financial services.

For Africa specifically, the mobile revolution presents unexploited potential to scale up financial inclusion through digital financial technologies. For example, between 2010 and 2020, mobile phone subscriptions per 100 inhabitants in Africa increased from 45% to 83%, according to the World Development Indicators. Indeed, the fact that 54% and 43% of adult male and female Africans, respectively, without a bank account had a mobile phone in 2017 (Demirgüç-Kunt and Klapper, 2020) is indicative of available room for leveraging digital financial services to revolutionize financial inclusion on the continent. Among unbanked adults, 95 million received cash payments for agricultural produce while some 65 million relied on semi-formal savings channels (Bille et al., 2018). In Eastern Africa, average rates of mobile broadband subscriptions increased almost three-fold from 8.8% in 2015 to 21.4% in 2019 (Figure 1). Many of the sub-regional economies experienced substantial growth rates in Internet access, with top performers being Seychelles, Kenya, Rwanda and Djibouti. This trend presents opportunities for the expansion of Internet banking and credit card payments in the region, but that potential needs to be tapped with the right set of policy and regulatory measures and product innovations.

Figure 1: Active mobile broadband subscriptions per 100 inhabitants in Eastern Africa



Source: World Bank TCdata360 based on ITU database, accessed 12th May 2022

In Rwanda, the complementarity between financial inclusion and digital financial services is at the center of development policy. Several policy measures have been put in place to promote financial inclusion and digital financial services in the country's bid to present itself as the financial hub for Africa and enhance payments' efficiency. As a result, financial inclusion in the country increased from 48% in 2008 to 93% of the adult population in 2020, according to the latest Finscope Survey (NISR, 2020). The adoption pace of digital financial services is also promising, with the rate of digital financial inclusion increasing from 46% in 2016 to 66% in 2020 (AFR, 2021). Similarly, at the macro level, electronic payments as a share of GDP increased from 26.7% in 2017 to 54.0% in 2021, according to the mid-term review of the National Strategy for Transformation (NST1). However, this falls short of the targeted 80% by 2024, implying that greater effort is needed in boosting the DFS trend. As the country strives to substantially reduce cash-based payments and position itself as Africa's financial hub, it is important and timely to deliberate upon what needs to be done to further promote the supply, adoption and usage of digital financial services. The policy question indeed motivates the study, which attempts to present the progress made so far, challenges and opportunities for further promotion of DFS in Rwanda. Guiding and promoting policies to boost

digital financial services requires tracing the development path of the country's digital financial service ecosystem as a crucial first step. Precisely, undertaking a comprehensive study of the country's digital financial landscape is instrumental in exploring opportunities and identifying challenges in using digital financial platforms to foster payments efficiency and financial inclusion for all, including marginalized groups of people such as women, persons with disabilities, refugees and poor farmers. This study seeks to undertake a comprehensive review of the digital financial services ecosystem in Rwanda, a country targeting to position itself as East Africa's financial hub.

The main objective of the study is to undertake a comprehensive assessment of Rwanda's digital financial services ecosystem to identify enabling factors, lessons and best practices, challenges and opportunities for improvement. The specific objectives of the study are:

- To examine patterns, trend and recent developments in Rwanda's digital financial services.

- To identify best practices, enabling and constraining factors (policies, regulations, technology, infrastructure, network coverage, etc) in the digital financial services ecosystem; and

- To make actionable recommendations for resolving identified challenges to the development, uptake and usage of various digital financial services in the country.

The study will explore the following hypotheses:

Hypothesis 1: *The proactive government policy on digital payments and financial inclusion is gradually providing a conducive environment for digital financial services to thrive.*

Hypothesis 2: *The growing rates of mobile phone subscriptions and Internet access are steadily boosting access to and utilization of digital financial services, particularly mobile money.*

Hypothesis 3: *Limited customer-centric innovations, low incomes, limited knowledge and awareness, low digital literacy and limited interoperability constrain DFS development.*

The hypotheses will be tested through mostly a mixed-methods approach, combining analysis of available secondary quantitative data and primary qualitative data to answer three main research questions:

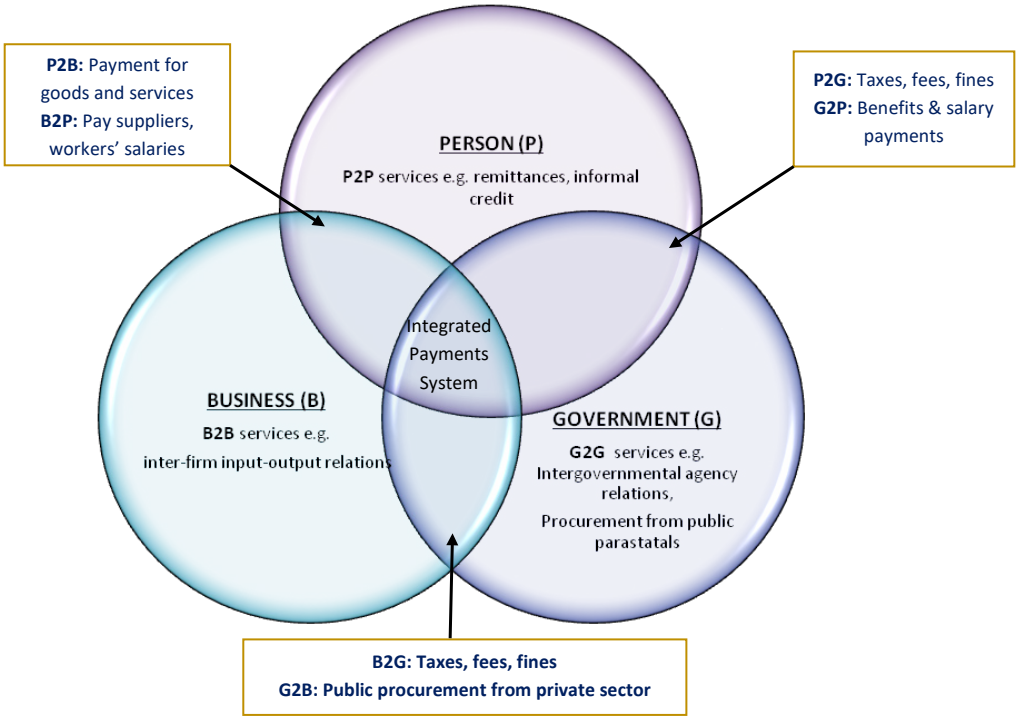
- How have digital financial services evolved in Rwanda over the past decade or so?
- What are the main drivers of the evolution of digital financial services in the country?
- What are the key challenges to the development of DFS and how can they be addressed to leverage digital financial services for greater financial inclusion?

The rest of the paper is organized as follows. The following sub-section provides the conceptual framework of DFS, including main players and their interactions at the transactional level. This is followed by literature review on financial inclusion and DFS in Section 2. Section 3 provides background information on financial inclusion and DFS in Rwanda while the methodology and data are elaborated in Section 4. Section 5 presents the results while conclusions and policy implications are discussed in Section 6.

Conceptual framework – Structure of the DFS ecosystem

Digital financial services can facilitate transactions between people (P), businesses (B), and governments (G) as illustrated in Figure 2. The services are categorized as person-to-person (P2P) transactions between two or more individuals, for example in the form of personal remittances and informal credit. Another type of service is person-to-business (P2B), which involves transactional transfers from individuals to business entities, mostly in the form of customers paying for goods and the services of merchants. In turn, businesses make transfers to individuals in the form of salaries and other benefits, categorized as business-to-person (B2P) services. Person-to-government (P2G) services, on the other hand, involve individuals paying for public services like birth certificates, marriage certificates, taxes, fees and fines. Businesses also pay for government-issued services such as trading licenses and different types of business-related taxes in the form of business to government (B2G) transactions. In turn, government makes transactions with individuals in the form of salaries and welfare grants, categorized as government to persons (G2P) services. Government also transacts with businesses, especially the former paying for goods and services supplied by the latter, categorized as government to business (G2B) transactions. Finally, government institutions such as ministries and delivery agencies and parastatals transact among themselves, a transaction type categorized as government-to-government (G2G).

Figure 2: The digital payments ecosystem



Source: Munyegera (2017). The move towards a less cash-intensive economy: What options are available to Rwanda?

2. Literature review

The literature on financial inclusion and digital financial services is divided into two main strands. The first literature strand concerns studies that examine the demand- and supply-side determinants of financial inclusion. Demand-side factors include income, which influences an individual's affordability of financial products (Balliester, 2021; Tinta et al., 2022; Oyelami et al., 2017; Sanderson et al., 2018; Soumare et al., 2016; Zins and Weil, 2016). In other words, individuals with higher levels of income are more capable of affording financial products and services and in turn more likely to access and use them. Being employed and belonging to the highest income category was indeed found to increase the likelihood of having an account and saving with financial institutions in Ethiopia (Mossie, 2023). In many developing countries, unaffordability of financial products due to low incomes is exacerbated by the high cost of financial services, especially those offered by traditional service providers, such as banks, and long distances to service providers (Munyegera and Matsumoto, 2016; 2017; Prina, 2015). Using the World Bank's Global Findex database for 37 Sub-Saharan African countries, Zins and Weil (2016) found financial inclusion rates to be higher among richer and older African males with higher levels of education. Education and literacy levels are also quite important, whereby the more educated and literate are more likely to use financial products and services (Oyelami et al., 2017). Financial literacy training could indeed stimulate the cognition of the rural poor to make informed decisions, including uptake of financial products (Bongomin et al., 2018). Other demand-side determinants include attitudes that influence an individual's decision to use certain financial services (Han and Sherraden, 2009), employment status, marital status, household size, and degree of trust in financial institutions (Soumare et al., 2016).

Among the supply-side constraints is the lack of innovative financial products that address the specific needs and requirements of various customer segments (Munyegera and Matsumoto, 2017; Yawe and Prabhu, 2015; Cull et al., 2021). In many developing countries, financial institutions lack the prerequisite product development practices that would propel financial sector broadening and deepening to address customer needs (Iheanachor et al., 2021). In some countries, this is exacerbated by lack of policy and regulatory support needed to drive financial inclusion and digital financial services. Long distances to service points further imply high opportunity and transportation costs especially in rural communities (Munyegera and Matsumoto, 2016; 2018). In Rwanda, the average time to reach a bank was 21 minutes for the three districts of Kigali City, much lower than over 40 minutes for other districts outside Kigali (NISR, 2020). Other supply-side limitations include cumbersome documentation

associated with some formal financial service providers such as banks, which discourages many potential users (Allen et al., 2016). Financial inclusion is further influenced by the level of interest rates and bank innovations (Oyelami et al., 2017) and availability of paved roads and Internet infrastructure (Siddik et al., 2016).

Studies in the second literature strand explore the development of digital financial services, including their drivers and the role of DFS in promoting greater financial inclusion by addressing some of the challenges of traditional financial services. These studies reveal that the rapidly expanding financial technologies (fintechs) are boosting financial inclusion especially in Sub-Saharan Africa (Demir et al., 2022; Durai and Stella, 2019). By quantifying progress made in digital financial inclusion, Khera et al. (2022) reveal substantial advancement in DFS in emerging and developing economies, including Africa. Macro-level evidence indeed stresses that digital financial inclusion is not only boosting overall access to and usage of financial services but also stimulating growth (Khera at al., 2022). The authors find DFS to be specifically higher among countries where usage of financial services is high, but access is relatively low, presenting an unexploded opportunity that is leveraged by digital solutions. Mobile money is particularly driving financial inclusion even in countries with traditionally low levels of access to financial services (Donovan, 2012; Munyegera and Matsumoto, 2017; Amoah et al., 2020). Moreover, digital financial services present a potential opportunity to narrow the gender gap in financial inclusion that is highly prevalent in many African countries. Indeed, countries with higher levels of mobile money account ownership have smaller gender gaps in financial inclusion (Kim, 2022). For persons with disabilities, digital technologies provide a range of channels – voice, text, video – through which to access and use services and hence reduce communication barriers (Raja, 2016), an opportunity that could be leveraged upon to promote financial inclusion. These observations point to the urgent need for policy and regulatory measures coupled with product innovations and investments to boost access to and usage of traditional and digital financial services by marginalized groups such as women and persons with disabilities. At the macro level, the increasing usage of DFS in tax payments is improving taxation by identifying taxpayers more easily, communicating with them better, enforcing and monitoring compliance, and ultimately reducing compliance costs (Santoro et al., 2022; Mpofu and Mhlanga, 2022).

Despite the large and growing body of literature on financial inclusion and DFS, the empirical focus on Africa is still limited. For Rwanda, specifically, a comprehensive mixed-methods analysis of the country's DFS landscape is critically lacking. There are a couple of reports and anecdotal results on the trends and drivers of DFS without empirically grounded mixed-methods examination of the drivers of access and usage, and challenges and opportunities. In Mumporeze and Prieler (2017), for example, the focus was not only solely qualitative but was quite limited in representativeness as it focused on families with computers. This study attempts to narrow the knowledge gap in the literature by examining the trends and determinants of DFS development in the country using administrative data from the National Bank of Rwanda and Finscope Survey data from the National Institute of Statistics of Rwanda (NISR), complemented by qualitative data from key informant interviews.

3. Financial inclusion and DFS in Rwanda

Rwanda has proactively pursued financial sector development and digital financial services as key tools for national development. The Financial Sector Development Strategic Plan (2018-2024) emphasizes broadening, deepening and developing the financial sector to accelerate economic growth, efficient allocation of resources and improved wealth creation (MINECOFIN, 2017b). This is synergetic to the Rwanda National Payment System – Towards a Cashless Rwanda (2018-2024), which aims at modernizing and digitizing different levels of payments in the country. The National Strategy for Transformation (NST1, 2017-2024) sets a target of increasing the value of electronic transactions as a share of GDP from 26.9% in 2017 to 80% (MINECOFIN, 2017a). Along with this is a target of achieving 60% digital literacy among youth aged 16-30 years, which is anticipated to play an enabling role in the digital transformation of financial and other services. Additionally, the Rwanda Fintech Strategy (2022–2027) was enacted to position Rwanda as a regional financial centre and promote customer-centric financial inclusion and financial sector development by enabling a thriving fintech ecosystem. Other policies and regulations have been established to promote and streamline digital payments, including but not limited to the National Financial Education Strategy of 2013 meant to boost financial literacy; Law No. 061/2021 of 14/10/2021 governing the payment system; the law on anti-money laundering / combating the financing of terrorism (AML/CFT), that was enacted in Rwanda in 2020; Regulation No. 41/2022 of 13/04/2022 governing the regulatory Sandbox, requiring all payment providers (banks and Mobile Network Operators' schemes) to be interoperable.

The policy and regulatory efforts are complemented by initiatives by Mobile Network Operators (MNOs), who have been instrumental in developing digital payments platforms, especially since the introduction of mobile money by Mobile Telephone Network (MTN) in 2010. The number of active subscribers and number and value of mobile money transactions have all grown over the decade 2011-2021 as presented in the descriptive analysis in later sections of this paper. The frequency of usage of mobile money also increased; the proportion of users who use the service at least once a week more than doubled from 6% in 2016 to 13% in 2020. Similarly, 30% of mobile money users used it several times a month, an increase in usage from 17% in 2016 (NISR, 2020).

The strategic initiatives by government and non-government stakeholders to promote financial inclusion and digital financial services are gradually paying off. According to the FinScope Survey of 2020, the proportion of the adult population with

access to formal and informal financial services increased from 48% in 2008 to 93% in 2020 (NISR, 2020). Between 2016 and 2020, the uptake of non-bank financial services increased from 65% to 75%, majorly driven by mobile money, Umurenge savings and credit cooperative organizations (SACCOs) and insurance companies. Mobile money is the most popular form of DFS, whose penetration rate increased from 39% of the adult population in 2016 to 60% in 2020 (NISR, 2020).

Umurenge SACCOs have proved instrumental in expanding financial access for the poor, farmers, rural population and informal sector players, with account holding increasing from 2.0 to 2.4 million adults between 2016 and 2020 (NISR, 2020). Established in 2008, Umurenge SACCO is a government programme to introduce a savings and credit cooperative organization (SACCO) at every administrative sector to stimulate savings and provide credit to rural residents, in response to the urban concentration of banking services.[1] The proportion of borrowing adults whose main source of credit was Umurenge SACCOs increased from 2% in 2012 to 5% in 2016 (NISR, 2016), rising further to 9% in 2020 (NISR, 2020). The report further indicates that 86% of the adult population in the country saved money in the 12 months preceding the survey while 76% borrowed money over the same period. Regarding remittances, 45% of adults sent money, 83% of which was sent using formal platforms – mostly mobile money. However, only 35% of the adult population in the country have a bank account and a mere 17% of adults either have or use medical insurance products, although 88% have limited coverage under the public health insurance scheme – *Mutuelle de Sante*.

As the level of financial inclusion rises, along with it is the share of consumer transactions conducted digitally or through cashless channels. Several milestones have so far been reached in the country's journey to a more "cashless" economy especially since the introduction of the Rwanda Integrated Payments Processing System (RIPPS) in 2011. Earlier stages of digital payments in Rwanda focused mainly on P2P transactions dominated by personal remittances. This was especially the case when, for example, MTN mobile money had just been introduced in the country in 2010. The range of product offerings increased gradually to include more sophisticated transactions such as merchant payments. The introduction of MoMo Pay by MTN Rwanda in 2018 was a move meant to make digital payments cheaper, safer, faster and more convenient (*The New Times*, March 2018). Several other developments happened over time to cover a variety of B2B and P2B payments, including bulk transactions such as payment of school fees. The digital payment of taxes was launched by Rwanda Revenue Authority (RRA) on 5th October 2013 with the support of the World Bank, in a move that would later enable taxpayers declare and pay for taxes electronically through mobile banking, mobile money, Internet banking and mobicash. This is complemented by *Irembo*, a government-owned platform established in 2015 to digitize the delivery of public services, including declaration, requests for and/or payment of certificates, land titles, driving permits, etc and fines and penalties including traffic offenses. As of June 2023, 103 public services are being offered online via the platform and an additional 400 services are slated for digitization by June 2024. These two initiatives have so far been instrumental in facilitating person-

to-government (P2G) and business-to-government (B2G) digital payments in terms of electronic payment for licenses, penalties, government-issued certificates, taxes and other public service fees.

Innovations across sectors – for example Tap and Go in the transport sector, payment of school fees using mobile money, etc – have further triggered a gradual behavioural shift from cash towards electronic payments, a phenomenon heightened by the COVID-19 pandemic. The Tap and Go facility that was introduced in Rwanda in 2015 by AC Group Limited has ever since enabled bus companies recover 30-40% of previously lost revenue and facilitated over 298 journeys.[2] Such innovations have indeed contributed to the development of digital person-to-business (P2B) and business-to-business (B2B) transactions as individuals and businesses are increasingly using non-cash payment systems to pay for goods and services of various providers. Mobile money in general has substantially expanded the range of services since its establishment by MTN Rwanda in 2010. The platform is now used to facilitate person-to-person (P2P) transfers, including sending and receiving remittances, airtime purchases, bill payments, cash deposits and withdrawals, savings and several person-to-business (P2B) and business-to-business (B2B) transactions such as electronic purchase of goods and services including school fees, airline tickets, insurance, among others. While merchant acceptance remains relatively lower in Rwanda compared to regional comparators such as Kenya, the trend is promising. Between 2021 and 2022, for example, the number of merchant payment transactions performed through mobile point-of-sale (POS) increased by 57% from 100 million to 157 million (National Bank of Rwanda, 2023). The number of mobile POS registered an 11% increase from 4,339 in 2021 to 4,835 in 2022 while card-based POS increased by 211% from 45,739 to 142,351, a trend expected to boost merchant payments (National Bank of Rwanda, 2023).

E-commerce is another evolving aspect of Rwanda's DFS ecosystem. In 2021, *RwandaMart*, the first online sales channel in the country, was launched by the Ministry of ICT and within a year of its operation, 180 SMEs had been onboarded, 100 of which have an active storage space on the platform (GIZ, 2022). There are other online marketplaces such as *SokoMall, Iduka Online, Kassha*, *Vuba Vuba*, etc which sell a varying range of products from groceries to food, personal and household items, among others, accepting payments via mobile money, bank transfers, debit cards, etc. There are also sector-specific online marketplaces such as e-soko, linking buyers and sellers of Rwandan tea, coffee and emerging value chain products. In the health sector, Babyl connects patients with health practitioners, enabling digital prescriptions that are paid for electronically using credit cards, debit cards and mobile money. In 2019, there were 26 B2C e-commerce platforms, 80% of which were classified sites while the rest were online shopping malls (UNCTAD, 2023). More recent statistics from the Ministry of Trade indicate that the figure rose to 62, and that the products and services provided include: groceries, food and beverages; personal hygiene and beauty products; baby products; health products and pharmaceuticals; appliances and electronics; office products; fashion; arts and crafts; home and garden tools;

agriculture/farm inputs; construction tools; automobiles; utilities; ICT and logistics services; dry cleaning and laundry services; renovations and maintenance services; business directory services; tourism services; online shop development; and digital addressing services (UNCTAD, 2023).

Digital financial services in Rwanda are gradually evolving to expand the range and nature of services, gradually moving from the original focus on personal transfer services, especially remittances. Currently, users of MTN Mobile Money and Airtel Money can access digital credit in terms of small loans whose amounts are determined by an algorithm that factors in the customer's history of mobile money transactions. The Device Financing Programme jointly managed by MTN Rwanda and Bank of Kigali is another initiative to provide digital credit to low-income customers to enable them buy smartphones and pay in reasonable installments.[3]

The mid-term review of NST1 conducted in 2021 reveals that electronic payments amounted to 54% of gross domestic product (GDP), more than double the rate in 2017. Although this progress is remarkable and commendable, it falls short of the targeted 80% of GDP by 2024. About 38% of adults used mobile money services in 2020 and the range of services offered via the platform expanded tremendously. Financial institutions are leveraging upon improved policy and regulatory environment and market development to innovate into products that either directly link to or share financial information with mobile wallets. The move is meant to enable faster and more convenient payments that do not require the use of physical cash. The growing complementarities between traditional and digital financial accounts is indeed boosting not only DFS but conventional financial services. For example, a considerable part of the increase in uptake and usage of banking services from 26% in 2016 to 36% in 2020 was attributed to digital financial services (NISR, 2020). The contributions by ATM/debit card usage, mobile banking Internet banking and credit cards were 46%, 40%, 32% and 7%, respectively.

Muti-stakeholder efforts to improve the fintech landscape in Rwanda are meant to increase the supply of digital payment products and services in Rwanda. The Rwanda Fintech Strategy (2022-2027) was drafted by the Ministry of Information and Communication Technology and Innovation (MINICT) with a tripartite objective of supporting fintech development, maximizing fintech contribution to economic growth and socio-economic transformation and mitigating potential fintech risks (MINICT, 2022). This builds on earlier initiatives including the fintech regulatory sandbox developed by the National Bank of Rwanda in 2018 to provide start-ups and existing companies with temporary approvals to test new DFS approaches before undergoing the full authorization and licensing processes. Other multi-holder efforts include the *FinTechHub*, a virtual accelerator that entails financial and technical support to address growth challenges of fintech start-ups and help them meet regulatory requirements (Ndayambaje et al., 2022). Although still small, the number of fintechs in Rwanda grew from 17 in 2014 to 44 in 2019 (UNCDF, 2019), rising further to 75 in 2022 (MINICT, 2022). According to the global fintech ranking report of 2021, Rwanda ranked 61st out of 83 countries in terms of fintech development, relatively better than Uganda (64th) and

Ethiopia (86th) but lagging behind Kenya's 31st position (FINDEXABLE, 2021). At the city level, Kigali was ranked 166th out of 170 cities, having declined 34 points from the 2020 rank. This could reflect existing challenges to fintech development, which are making the city a less preferred destination for fintechs and calls for the implementation and streamlining of fintech and DFS development policies and regulations.

The focus of fintechs in Rwanda is payments, clearing and settlement services provided by 22 fintechs (29% of fintechs in the country) while others provide deposit lending (16 fintechs or 21%), insurance (5 fintechs or 7%), savings (5 fintechs), capital raising or alternative finance (4 fintechs) and one fintech provides crypto assets (MINICT, 2022). In terms of customer segments, the most popular services offered by fintechs in Rwanda are B2P, provided by 56% of fintechs, followed by B2B (36%), G2P (4%), B2G (3%) and P2P (1%). As the fintech industry in Rwanda evolves, there are several lessons to learn from Kenya where the ecosystem has advanced quite rapidly. Currently, existing fintech innovations in Kenya include but are not limited to *Tuula*, an e-commerce solution for smallholder farmers; *Turaco*, which uses mobile technology as a channel to provide credit and insurance solutions mainly for healthcare financing; *Abacus*, which provides capital market support services; and *ChamaPesa*, which provides data for investment decision-making with emphasis on informal financial groups (Yogesh, 2021).

Digital credit is one aspect of the DFS ecosystem that is evolving at a rather slow pace in Rwanda relative to regional comparators. Several platforms are available to provide digital credit, for example MoKash by MTN Rwanda, which offers credit to its users up to 500,000 Rwandan Francs (approximately US$ 420). However, the rate of adoption is relatively low when compared to the borrowing propensity at the country level as reported in the FinScope 2020 Survey. For example, while a considerable proportion of respondents borrowed money, including from village savings and loans associations (VSLAs), Tontines and Ikibina (39%) and from family members and friends (24%), only 6% and 5% of borrowers received a loan via mobile money and commercial banks, respectively (Access to Finance Rwanda, 2021). During a similar period (2019), 56.6% of Kenyan adults claimed to have borrowed from any source, including 13.6% who borrowed digitally (FSD, 2019). In 2021, the FinAccess Survey for Kenya indicated that 18.3% of adults used *Fuliza*, a digital credit facility operated by selected banks through Safaricom (Central Bank of Kenya, 2022). Similarly, the proliferation of m-insurance in Rwanda remains quite low; only 0.3% of insurance users reported having received claims or paid premiums using mobile money (Access to Finance Rwanda, 2021).

As various DFS platforms evolve over time in Rwanda, the need for interoperability of payments across different service providers becomes quite important, which warranted the establishment of the Rwanda National Digital Payments System (RNDPS). The system was meant to support interoperable payments in phases, starting with P2P (money transfers and requests to pay), P2G in form of collections, merchant payments (P2B) and bulk disbursements (B2B) while cash-in and cash-out transactions at off-us agents would be supported in later phases (National Bank of Rwanda and

Access to Finance Rwanda, 2018). In 2022, RSwitch supported the development of *eKash*, a platform to promote the interoperability of payments across mobile money systems of MTN Mobile Money Rwanda Ltd and Airtel Mobile Commerce Ltd (RSwitch, 2022). As the initiative is in its early stages, its potential to boost digital payments is yet to be observed amidst low awareness and concerns about the high costs of inter-provider transactions.

While the progress made in Rwanda regarding promotion of digital financial services is commendable, a lot remains to be done to realize the country's aspiration to have a more cashless economy and present itself as the financial hub of Africa. This makes it imperative to undertake a comprehensive assessment of not only the progress made so far but also the prevailing challenges and opportunities to further develop DFS in the country. This paper therefore attempts to address this need by examining the trends and patterns of various DFS indicators and examining the enabling and constraining factors from both the supply and demand sides of the DFS ecosystem.

4. Methodology and data

This study uses a mixed-methods approach to examine the trends, drivers, challenges and opportunities for promoting digital financial services in Rwanda. Quantitative data comes from two complementary sources: payments statistics from the National Bank of Rwanda and survey data from the Finscope 2020 survey. This is the source of data used for two quantitative analytical approaches: descriptive and regression analysis. Descriptive analysis is used to ascertain trends and patterns in DFS in Rwanda while regression analysis is used to identify the demographic, socio-economic, geographical and other determinants of DFS uptake. Qualitative data was collected through key informant interviews administered to sector stakeholders using semi-structured questionnaires. The qualitative data was used to supplement quantitative findings by providing the necessary explanations for observed trends and patterns in DFS and challenges and recommendations to promote the same.

Descriptive analysis of secondary quantitative data

Two complementary data sources are used for this analysis. The first source was payment statistics gathered from the National Bank of Rwanda covering the number of service providers or agents, number of subscribers, number of transactions and transactional value for mobile money, mobile banking, Internet banking, point of sale (POS), credit cards and debit cards. The data allows for examination of the trend of these digital payment products over the decade 2011-2021. The data from the Central Bank are supplemented by survey data from the Finscope Survey of 2020. The survey was conducted between September and November 2019, by the Centre for Economic and Social Studies (CESS) in partnership with the National Institute of Statistics of Rwanda (NISR) and with funding from FinMark Trust (FMT). It is the most comprehensive survey on financial inclusion in the country, covering12,480 individuals randomly selected from 158,386 and 780 villages. The survey covers detailed socio-economic, financial inclusion and digital financial services modules.

Regression analysis

The descriptive analysis of DFS trends and patterns is supplemented by regression analysis to ascertain the determinants of DFS product adoption. The analysis was based on the Finscope Survey of 2020 as described in the preceding sub-section. Focusing on mobile money, credit cards, mobile banking and Internet banking as outcomes of interest, Probit regression models are estimated separately, linking each outcome to potential covariates. The choice of Probit models is motivated by the binary nature of the outcome variables that take a value of one when an individual adopts the respective DFS product and zero otherwise. Indeed, the linear regression models such as Ordinary Least Squares (OLS) are inappropriate in estimating binary response models (Stephenson et al., 2008). An individual's decision to adopt a particular DFS product is modelled as a latent variable DFS_i^*, which in turn depends on a set of determining factors as follows;

$$DFS_{id}^* = \beta_0 + \beta_1 X_{1id} + \beta_2 X_{2id} + \cdots + \beta_k X_{kid} + \gamma_d + \varepsilon_{id} \quad (1)$$

Where $X_1, X_2, \ldots, X_k$ represent covariates deemed instrumental in influencing the value of the latent variable. The covariates included in the model are as follows: age of the respondent, measured in number of complete years since birth; education level, which is a categorical variable with cases for primary 1-3, primary 4-6, secondary 1-3, secondary 4-6 and university and tertiary; household size, measured as number of individuals living in the household; and a dummy variable for rural/urban residence status. Subscripts *i* and *d*, respectively, represent the individual and their province of residence while the parameter γ_d represents dummies for the province of residence (Kigali City, Northern Province, Southern Province, Eastern Province and Western Province). The variables are based on intuition, logic and usage by previous literature. The inclusion of a gender dummy is motivated by previous evidence on the gender gap in (digital) financial services where females have been reported to lag male counterparts (Adegbite and Machethe, 2020; Fanta and Mutsonziwa, 2016; Swamy, 2014; Lotto, 2022). Empirical evidence from Sub-Saharan Africa points to an eight-percentage point gender gap in usage of fintechs, part of it being attributed to differences in attitudes such as willingness to use new financial technologies (Chen et al., 2023). The inclusion of age is motivated by the notion that younger people are generally more tech-savvy (Niehaves and Plattfaut, 2011). Education is considered to have an enhancing effect on income (Baum et al., 2013) and digital literacy (Nikou et al., 2022; Marsh, 2021) both of which are considered prerequisites for affordability and capacity to operate digital products. Income has also been included in previous literature, which indicates its influence on the affordability of digital platforms and digital financial products (Aduba, 2021). In this study, income is controlled for as a categorical variable with two values; 30,000-100,000 Rwandan Francs and

above 100,000 Rwandan Francs, which are compared to those earning 0-30,000 Rwanda Francs. This is based on data limitations as the FinScope Survey did not capture income of respondent as a continuous variable. Other covariates included based on previous literature include marital status (Soumare et al., 2016) and employment status (Meli et al., 2022).

Location (province) fixed effects are captured by γ_d while ε_{id} is an error term. The latent variable is, however, unobservable and only the outcome (adoption decision) is observed. The outcome, however, can be deduced from the value of the latent variable as expressed in equation (2):

$$\boldsymbol{DFS_i} = \begin{cases} 1 \; if \; \boldsymbol{DFS_i^*} > 0 \\ 0 \; otherwise \end{cases} \quad (2)$$

The β coefficients in equation (1) represent the partial effects of each covariate on the probability that an individual uses the respective digital financial product or service within six months prior to the FinScope Survey. The covariates include age of the respondent, education level, household size, rural/urban residence status, and location (province) characteristics.

Primary data collection

Based on the findings of the document review and secondary quantitative data analysis, any additional information gaps will be bridged through key informant interviews targeted to different stakeholders in the public, private and non-profit sectors, prioritizing those directly involved in the (digital) financial ecosystem at the demand, supply, regulatory and other levels of the ecosystem. The information collected from this exercise will help to concretize the findings of the desk-based activities and seek stakeholders' insights on the challenges and recommendations to promote digital financial inclusion in Rwanda in its pursuit of digital transformation and positioning as Africa's financial hub. Table 1 provides an indicative list of stakeholder/respondent categories along with required information and data collection methods to be applied. A tentative list of guiding questions for stakeholder interviews is also provided in the appendix.

Table 1: Structure of the primate data collection exercise

S/N	Stakeholder category	Required information	Data collection method/tools	Sampling technique
1	Government institutions National Bank of Rwanda MINECOFIN NISR Ministry of ICT	• Policies and strategies in place to boost (digital) financial inclusion • Trends of (digital) financial inclusion indicators • Challenges (so far) in boosting digital financial services • Opportunities and recommendations regarding leveraging digital financial services for greater financial inclusion	Key informant interviews using semi-structured questionnaires, and examination of any available, supporting documents and statistics	Purposive sampling based on official's knowledge, experience and duties within the respective institution
2	International organizations (development partners) UNDP UNCDF MasterCard Foundation	• Funding instruments, past/ongoing/planned programmes and strategies to boost (digital) financial inclusion • Opportunities, challenges and recommendations to promote inclusive digital financial services	Key informant interviews using semi-structured questionnaires, and examination of any relevant documents	Purposive sampling based on official's knowledge, experience and duties within the respective institution
3	**Private sector** PSF (ICT Chamber), fintech firms, financial institutions, payment service providers, ICT innovating companies, Kigali International Financial Centre	• Innovative (digital) financial products on the market • Experience (including opportunities and challenges) developing (digital) financial products • Existing market (structural), policy and regulatory challenges to private sector innovations necessary to boost digital financial services • Suggested recommendations	Key informant interviews using semi-structured questionnaires	Purposive sampling based on official's knowledge, experience and duties within the respective institution
4	**Other stakeholders** Access to Finance Rwanda (AFR), civil society, faith-based and other organizations	• General insights on the opportunities, challenges and recommendations to boost (digital) financial inclusion and how to leverage DFS for greater financial inclusion, particularly for marginalized groups of people	Key informant interviews using semi-structured questionnaires	Purposive sampling based on official's knowledge, experience and duties within the respective institution

Qualitative data was analyzed using the six-step thematic analysis approach introduced by Braun and Clarke (2006) as illustrated in Figure 3. Upon completion of the data collection exercise, responses were examined in detail to identify similarities and differences, code responses, develop themes along which to characterize the subject matter and finally tabulate and/or visualize the responses according to the established themes.

Step 1: Familiarization: The text responses will be thoroughly read, and any audio recordings transcribed to familiarize with the stakeholder responses (data).

Step 2: Coding: Sections of the data/responses will be highlighted to come up with shorthand labels or codes that describe the content of the data.

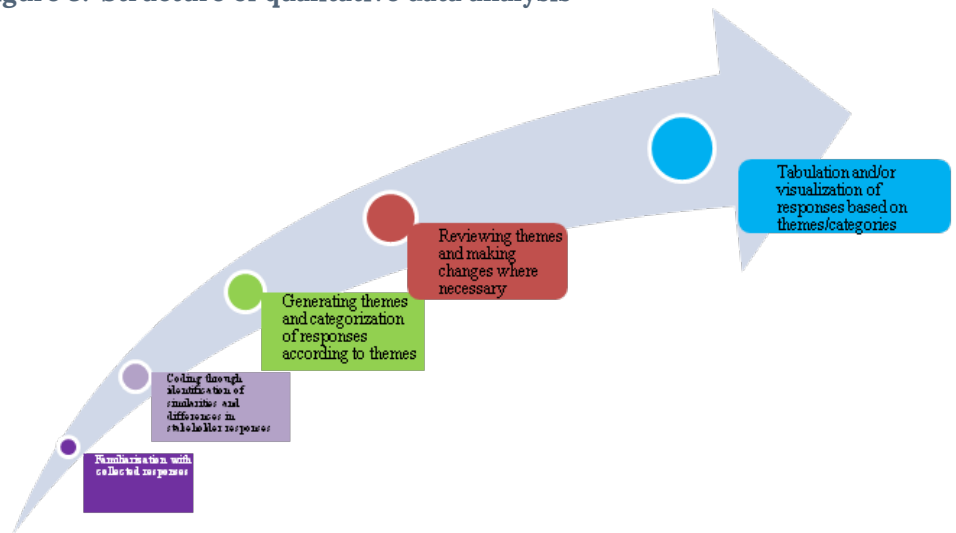
Step 3: Generating themes: The established codes will be examined to identify patterns from which themes will be generated. The themes represent more broadly grouped or categorized codes that carry similar or closely related information.

Step 4: Reviewing the themes: The themes will be scrutinized to ascertain how accurately they represent the data/responses. Where necessary, modifications will be made to improve data representation.

Step 5: Defining and naming themes: This will entail clearly indicating what each theme in the final list of themes represents and exactly how it helps to understand the underlying data/responses.

Step 6: Representation and writing: The data will then be tabulated or visualized based on the established themes to better illustrate and summarize the responses. The final task will be to write the findings, clearly making sense of the responses in line with the topic.

Figure 3: Structure of qualitative data analysis



Source: Braun and Clarke (2006), using thematic analysis in psychology

5. Results

This section presents the main findings of the study, combining results from the desk review of relevant literature, analytical results from secondary quantitative data and results from primary qualitative data from stakeholder consultations. The section first presents the trend of digital financial services in Rwanda based on a combination of administrative data from the National Bank of Rwanda and the Finscope Survey of 2020. The section further presents econometric results on the demand-side determinants of adoption and usage of digital financial services and enabling and constraining factors to the development of DFS in the country. The analysis focuses on four main types of DFS, namely: Internet banking, mobile banking, mobile money, card-based payments, which are so far the most common or increasingly promising drivers of cashless payments in Rwanda. Besides, these are the focus in most reports and statistics on payment systems published by the National Bank of Rwanda.

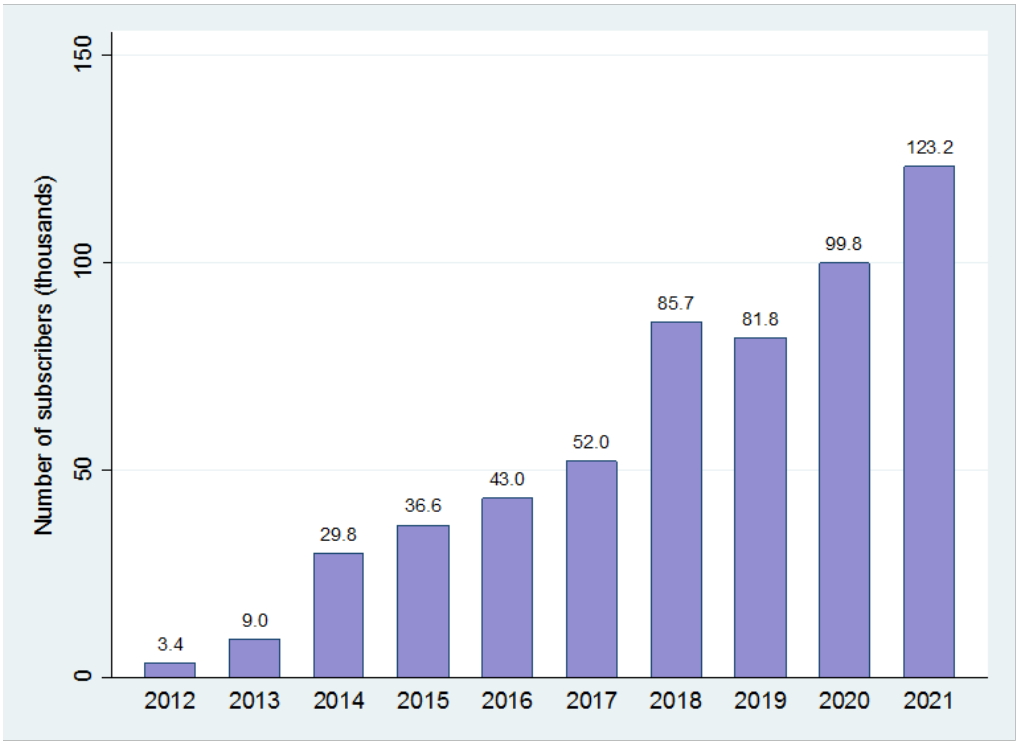
Trend of digital financial services

The demand for and supply of DFS products in Rwanda is on a positive trajectory. Findings from the descriptive analysis below reveals that Rwanda has registered remarkable progress in the number of subscribers, number of transactions and value of transactions of mobile banking, Internet banking, card-based payments and mobile money over the decade 2011-2021. The uptake of credit and debit cards is relatively low but growing while the number of point-of-sale (POS) transactions increased consistently over the analysis period. Growth in mobile money transactions was particularly high, expanding over 200-fold between 2011 and 2021. The increase in DFS adoption was sharper during the COVID-19 years, confirming anecdotal claims of the pandemic's enabling effect especially during lockdowns. The descriptive results, however, reveal prevailing preference for cash as a means of making essential transactions, an opportunity that could be leveraged upon to further promote DFS through policy, regulatory and product innovations.

Internet banking

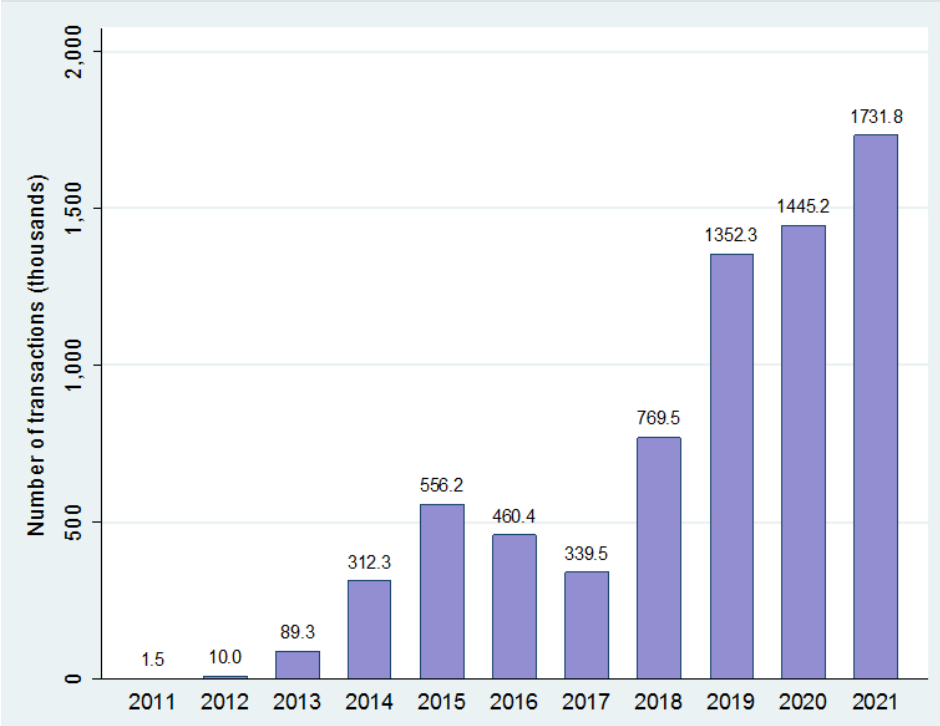
Internet banking exhibited a positive trend, with the number of subscriptions increasing over 38-fold between 2011 and 2021 (Figure 4) while transactional volume rose from a mere 1,500 to 1.7 million (Figure 5). Over the same decade, the corresponding value of Internet banking transactions increased from 0.7 billion Rwandan Francs (RWF) to 3.4 trillion RWF (Figure 6).

Figure 4: Number of Internet banking subscribers in Rwanda, 2011-2021



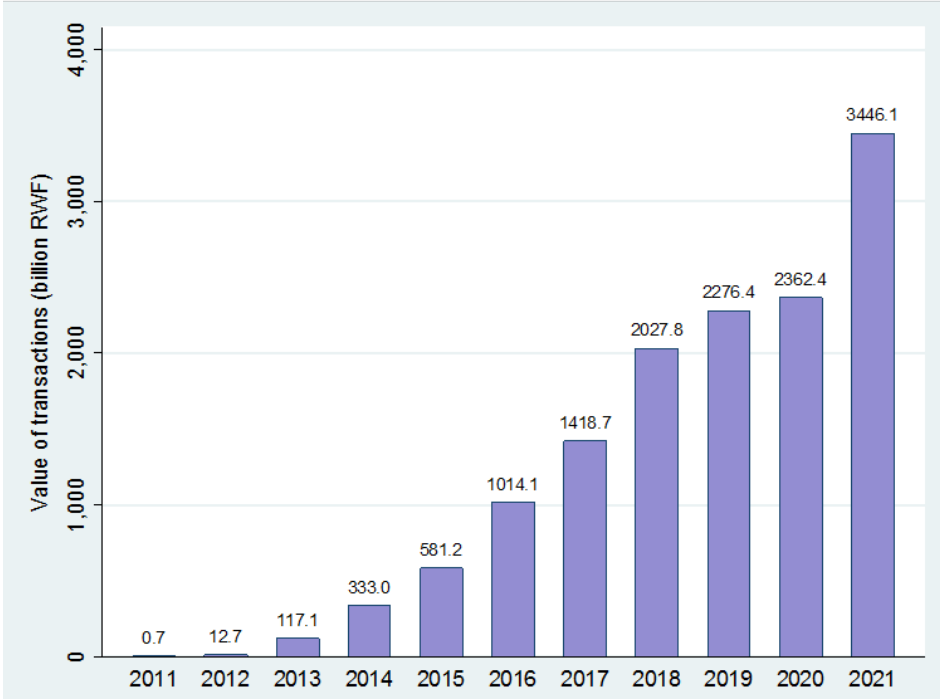
Source: National Bank of Rwanda payment statistics – Internet banking

Figure 5: Number of internet banking transactions, 2011-2021



Source: National Bank of Rwanda payment statistics, Internet banking

Figure 6: Value of Internet banking transactions (billion RWF), 2011-2021

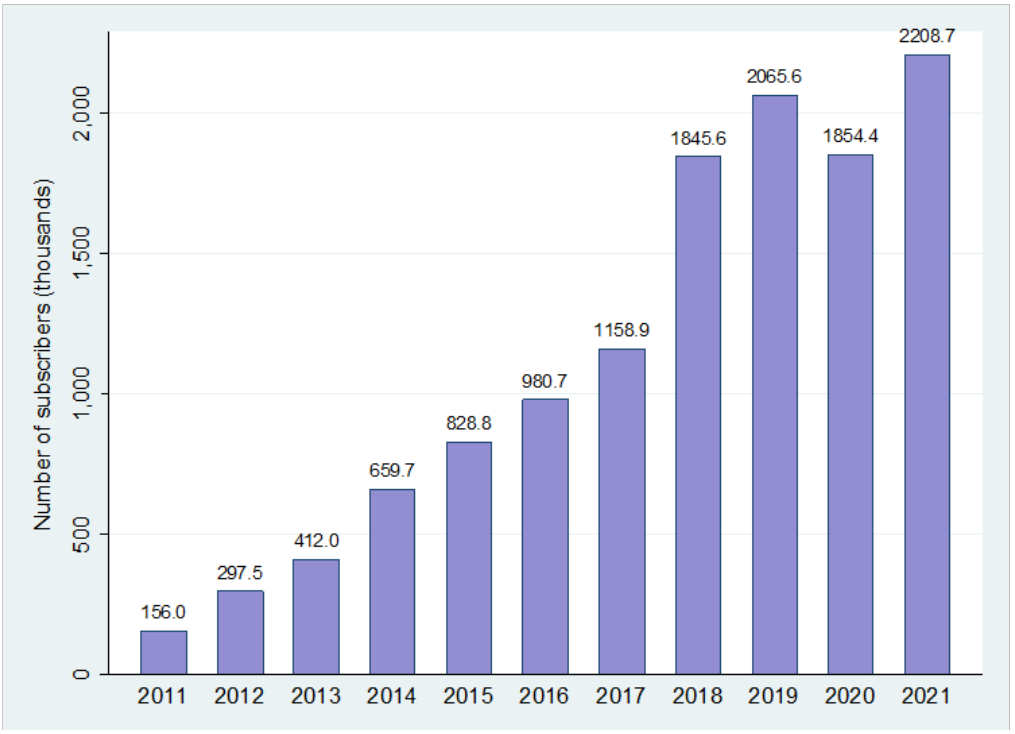


Source: National Bank of Rwanda payment statistics – Internet banking

Mobile banking

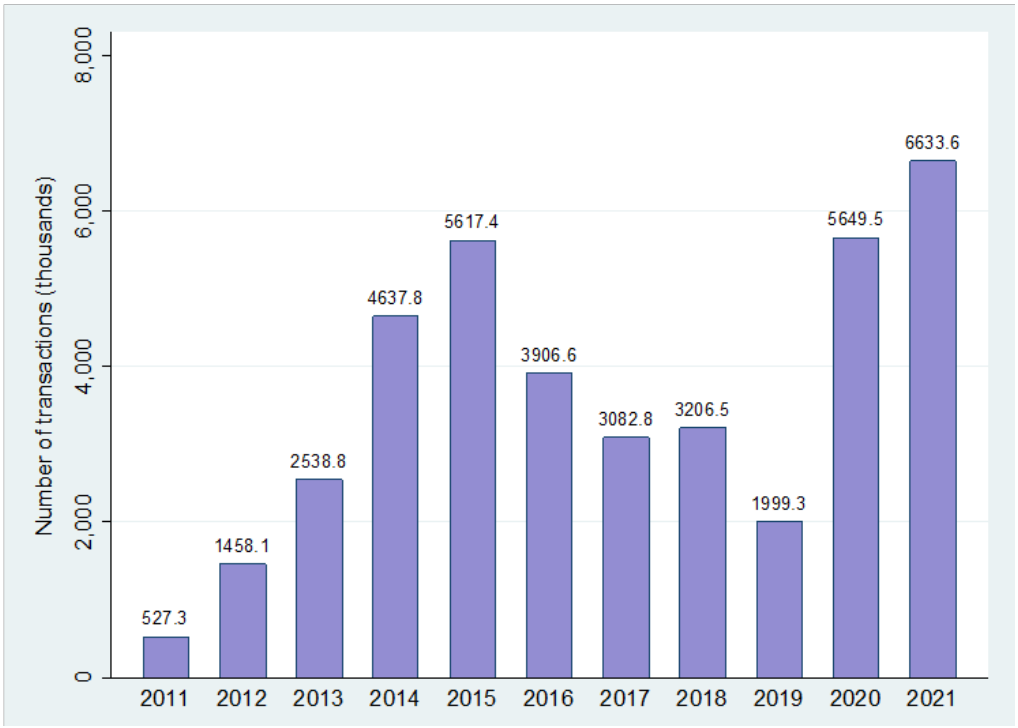
Mobile banking, which entails the use of mobile phones to make banking transactions, increased steadily between 2011 and 2019 before declining slightly in 2020 and subsequently recovering in 2021 (Figure 7). The number of transactions fluctuated over the same period, with a remarkable recovery during and post-pandemic (Figure 8). Regarding transactional value, the trend was positive throughout the decade, but relatively modest prior to the pandemic. As Figure 9 reveals, growth in the value of mobile banking transactions registered a phenomenal increase of over three-fold from 85.5 billion RWF in 2019 to 277.1 billion RWF in 2020, maintaining a positive trend to reach a remarkable 519.4 billion RWF in 2021.

Figure 7: Number of mobile banking subscribers in Rwanda, 2011-2021



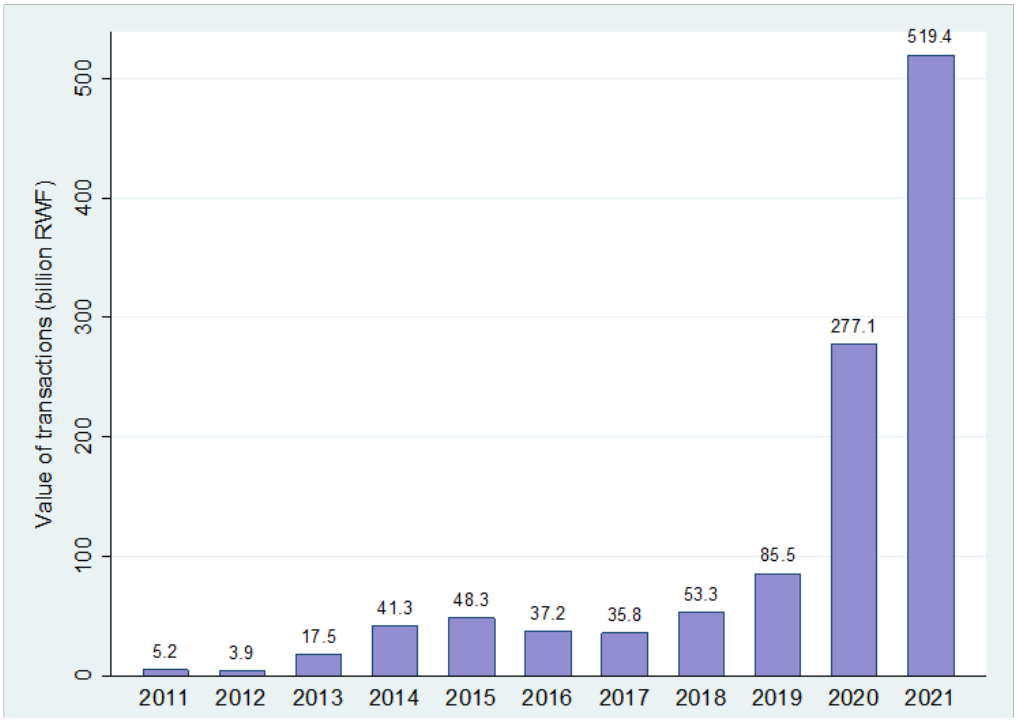
Source: National Bank of Rwanda payments statistics – mobile banking

Figure 8: Number of mobile banking transactions in Rwanda, 2011-2021



Source: National Bank of Rwanda payments statistics – mobile banking

Figure 9: Value of mobile banking transactions (billion RWF), 2011-2021



Source: National Bank of Rwanda payments statistics – mobile banking

Mobile money

Mobile money is the most popular mode of digital financial payments in Rwanda, like in many developing countries particularly in Africa. Table 2 shows remarkable progress in terms of uptake and usage of mobile money over the 12-year period since the product was introduced for the first time in the country. The number of registered mobile money users grew consistently between 2010 and 2019 but declined thereafter during and post-pandemic. The table further reveals a critical difference between the number of registered users and active users, implying that a substantial number of registered users leave their accounts dormant without any active transactions. While the reasons for this phenomenon are not quite clear, there is a potential opportunity in increasing transactions – both volume and value – among registered users through innovative product offerings by mobile network operators. During the 2010-2021 period, the volume of mobile money transactions increased consistently, with an even exponential rate of increase in 2020 and 2021. Overall, transactional volume grew from 0.8 million in 2010 to 914 million in 2021. Between 2019 and 2020, the number of transactions almost doubled from 378.8 million to 701.3 million, rising even further to 914.9 million in 2021. This is perhaps reflective of the enabling effect of the COVID-19 pandemic, which rendered transactions through physical interactions unfeasible.

While the number of active mobile money subscribers reduced slightly between 2019 and 2020, the value of transactions increased by almost three-fold over the same period. This is perhaps indicative of the possibility that the enabling effect of the COVID-19 pandemic for digital financial services worked mainly through either triggering new payment transactions or increasing the value per transaction for already existing users of mobile money.

Table 2: Trend of mobile money payments in Rwanda, 2010-2021

Year	No. of registered subscribers	No. of active subscribers	No. of agents	No. of transactions	Value of transactions (million RWF)
2010	231,000	N/A	290	829,379	8,355
2011	639,673	N/A	1,387	3,420,885	51,024
2012	1,440,541	N/A	3,085	22,191,674	161,808
2013	2,538,681	1,697,775	8,745	5,714,777	330,378
2014	6,480,449	1,760,438	25,482	104,773,115	691,477
2015	7,663,199	2,522,096	40,467	168,612,455	1,093,497
2016	9,735,694	3,333,349	59,952	205,687,966	1,040,459
2017	9,079,983	3,774,438	83,531	251,361,153	1,384,686
2018	11,067,077	4,662,206	107,858	299,941,137	1,808,944
2019	15,923,248	4,700,987	98,359	378,847,720	2,349,788
2020	15,701,257	4,688,124	131,178	701,300,425	7,176,221
2021	15,360,011	5,125,090	124,373	914,928,988	10,439,129

Source: National Bank of Rwanda payment statistics – mobile payment

Card-based payments

This sub-section presents the trend of card-based digital payments, focusing specifically on debit cards, credit cards and point-of-sale (POS) merchant terminals. As revealed in Table 3, the number of credit cards increased between 2011 and 2015 but stagnated thereafter until 2019. After suffering a contraction during the pandemic (which was surprising, given the positive trend of other DFS products), the number of credit cards more than doubled to reach 5,155 in 2021, up from 2,236 in the preceding year. The number of debit cards increased between 2010 and 2017, with an irregular trend thereafter. The trend for POS terminals was rather positive and consistent, expanding by over 1,800% during the 2011-2021 decade. The table further reveals that demand responded to this supply growth, as the number of POS transactions rose exponentially from slightly above 3,800 in 2011 to over 5.7 million in 2021. The increase was even sharper in 2020 and 2021, perhaps reflecting the positive influence of the COVID-19 pandemic. Correspondingly, the value of POS transactions increased consistently by over 30 times (approximately 3,354%) from 6.4 billion RWF to 221.1 billion RWF over the same period.

Table 3: Trend of card-based transactions in Rwanda: 2011-2021

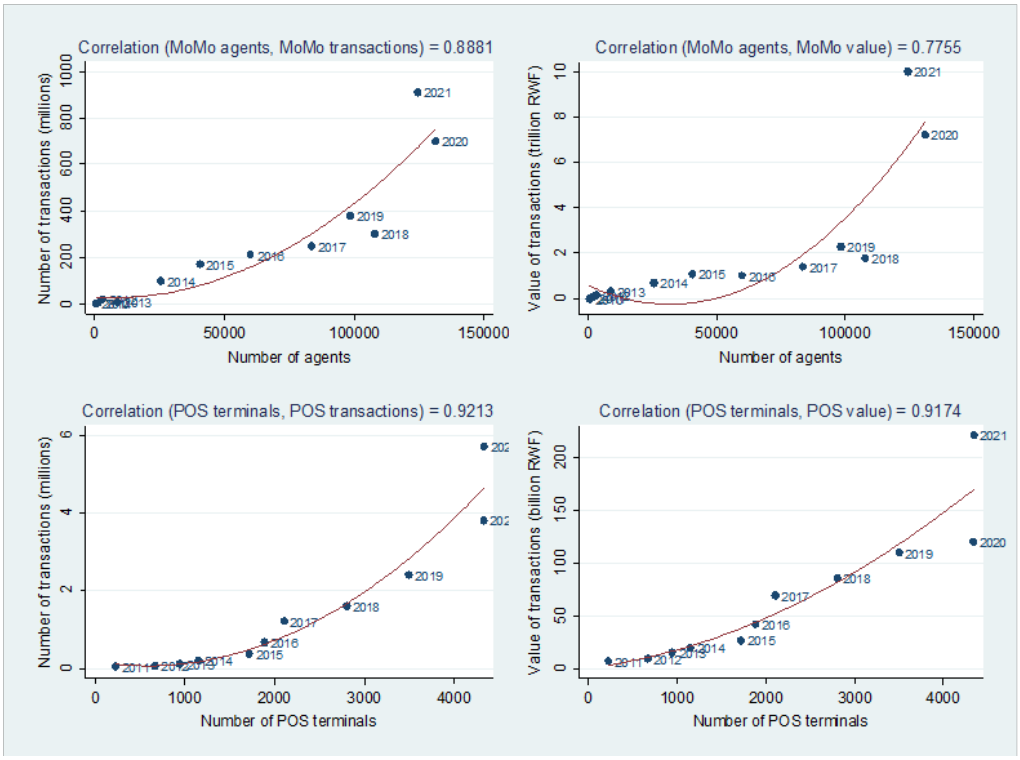
Year	No. of ATMs	No. of POS terminals	No. of debit cards	No. of credit cards	No. of ATM transac-tions	No. of POS transac-tions	Value of ATM transac-tions	Value of POS transac-tions
2011	167	227	115,200	516	1,976,376	38,440	122,536	6,438
2012	292	666	389,269	418	5,753,163	63,757	180,567	9,034
2013	333	946	487,498	845	7,774,053	111,570	260,585	14,718
2014	354	1,152	638,869	2,540	7,488,707	185,441	310,009	19,233
2015	380	1,718	657,904	3,485	7,505,815	373,029	354,049	26,625
2016	400	1,885	746,458	3,668	8,183,116	660,746	406,235	41,500
2017	406	2,104	754,806	3,679	9,408,701	1,213,853	493,038	68,994
2018	383	2,801	883,735	3,638	9,585,002	1,588,639	529,825	85,424
2019	383	3,497	555,243	3,687	10,057,769	2,402,627	578,060	109,565
2020	334	4,335	471,898	2,236	9,203,942	3,780,051	678,911	119,912
2021	337	4,339	686,309	5,155	12,856,390	5,738,049	1,079,762	221,089

Source: National Bank of Rwanda payment statistics – card-based payments

Correlation between demand and supply of DFS

To ascertain whether demand responds to supply of digital financial products, Figure 10 presents the correlation between the number of service providers or centres and the volume and value of transactions. Specifically, the figure presents correlations between number of mobile money agents and the volume and value of mobile money transactions. Similarly, correlations are presented for the number of POS terminals and the transactional volume and value. A clear pattern emerges where, for both mobile money and POS, the increasing availability of service providers and centres (mobile money agents and POS terminals) is associated with a corresponding increase in the number and value of transactions over the 2011-2021 decade. Without any claims of causality on either side, the results reveal that demand and supply are strongly correlated for digital financial products with the case study of mobile payments and POS transactions.

Figure 10: Demand responds to supply of digital financial products



Source: National Bank of Rwanda payment statistics

The descriptive analysis presented in this section are supplemented by statistics from the Finscope Survey of 2020, specifically focusing on the four main measures of DFS presented earlier. Mobile money is the most adopted DFS product in the sample, representing 57% of adults, while adoption propensities for credit cards, mobile and Internet banking were 0.16%, 12% and 7.6%, respectively. Overall, approximately 59% of adults in the sample had at least one of the four DFS products in 2020. Despite the

promising trend of DFS adoption, however, the Finscope Survey of 2020 reveals that cash is the most preferred method of payment for many people in Rwanda (Table 4). There is also unexploited potential for the expansion of digital payments: among mobile phone owners, 99% use cash to pay for food, drinks and groceries; 85.8% use cash to pay for utilities; 77.5% pay for education using cash and 96.6% still use cash to pay for healthcare services.

Table 4: Shares (%) of payment methods for expenditure items

Expenditure item	Cash	Bank transfer/ online payment	Credit, debit/ ATM card	Mobile money	Others
Food, drinks and groceries	99.76	0.06	0.04	0.03	0.12
Water, electricity, gas, paraffin	88.21	3.72	0.06	7.94	0.08
Education	80.38	18.32	0.64	0.34	0.28
Health	96.88	2.86	0.09	0.10	0.06
Savings, investment, retirement	92.20	5.78	0.27	1.20	0.51
Leisure and entertainment	79.33	6.29	0.19	14.19	0.00
Farm inputs	99.43	0.21	0.02	0.06	0.00

Source: Author illustration based on Finscope 2020 data

Regression results – Determinants of DFS adoption

This section presents the Probit marginal effects indicating the determinants of the likelihood of adopting DFS products with a focus on mobile money, credit cards, mobile banking and Internet banking. As revealed in Table 5, education is a key determinant of the adoption of all four DFS products, with the adoption likelihood significantly higher among individuals with primary education and above relative to those without any formal education. This finding could be reflective of the relatively higher levels of literacy, including digital and financial literacy, among more educated individuals (Marsh, 2021). Education and literacy are clearly crucial in influencing an individual's capability to use DFS products in Rwanda, given that service menus are often provided in one or a combination of the three major languages: English, French and Kinyarwanda. It therefore requires an individual to be able to read and comprehend service menus. Qualitative information from key informant interview (KIIs) reveals that financial service providers generally do not provide technical support on how to operate their DFS products, implying that the less educated and illiterate are often discouraged as they perceive these products to be meant for those with relatively higher education and literacy levels. Income is clearly an enabler of DFS adoption, as individuals with incomes 30,000 Rwandan Francs and above are significantly more likely to adopt DFS products, especially mobile money, mobile banking and Internet banking.

The gender influence on the adoption of DFS products is also visible, as females are significantly less likely than males to use mobile money, credit cards, mobile banking and Internet banking. The finding corroborates existing evidence on the gender digital divide globally (Gray et al., 2017; Omotoso et al., 2020) and in Rwanda (Mumporeze and Prieler, 2017) and gender gap in overall financial inclusion (Lotto, 2022; Fanta and Mutsonziwa, 2016). Available evidence indicates that women in Rwanda lag behind men with regard to usage of digital technologies, which is attributed in part to lower levels of self-esteem and confidence, education, income and heavy domestic responsibilities (Mumporeze and Prieler, 2017). The authors further find that Rwandan women start using computers at a later age than men and are hence less familiar with basic software and the Internet. Culturally, where digital devices are available in a household, they are often dominated by men and boys at the expense of women and girls. Additionally, women in the country have lower rates of mobile phone ownership (Blumenstock and Eagle, 2010) and financial literacy owing to differences in socio-demographic and psychological factors such as education, happiness, depression and openness (Grohmann and Schoofs, 2021). Finally, geography is instrumental in shaping DFS adoption whose likelihood is significantly higher among urban than rural residents. This finding is corroborated by qualitative responses from KIIs, which indicated that the unreliable phone network and limited coverage of Internet in rural areas implies limited DFS options for rural residents. Similarly, the relative probabilities of adopting DFS products are significantly lower among residents of other provinces compared to Kigali City. The geographical divide in DFS adoption is partly attributable to supply constraints, especially inadequacy of telecommunications infrastructure in rural areas and the relative urban concentration of payment service providers and financial institutions. The last column of the table presents determinants of adoption probability for any of the four DFS products presented in the first four columns. In other words, the binary outcome variable in column 5 takes a value of one if an individual is a user of any of the DFS products – mobile money, credit card, mobile banking and Internet banking – and zero otherwise. A similar pattern of results is observed as in the previous columns, where mainly education, income and urban residence are key enablers of DFS adoption while female gender, residence in other provinces besides Kigali are key limiting factors.

Table 5: What drives the adoption of DFS products? – Probit

Variables	(1)	(2)	(3)	(4)	(5)
	MoMo Account	Credit Card	Mobile Banking	Internet Banking	Any DFS
1 if female	-0.0505***	-0.00308	-0.0129**	-0.0159***	-0.0867***
	(0.00844)	(0.00191)	(0.00537)	(0.00414)	(0.00985)
Age	0.00698***	0.000405	0.00272***	0.00291***	0.0208***
	(0.00163)	(0.000330)	(0.000996)	(0.000749)	(0.00189)
Age squared	-0.000105***	-2.69e-06	-2.21e-05**	-2.62e-05***	-0.000239***
	(1.82e-05)	(3.48e-06)	(1.09e-05)	(8.10e-06)	(2.06e-05)

1 if married	0.0110	0.00144	0.0151**	0.0139***	0.0335***
	(0.00941)	(0.00214)	(0.00593)	(0.00452)	(0.0109)
Household size	0.00132	0.000700	0.00138	0.000604	0.00203
	(0.00217)	(0.000455)	(0.00135)	(0.00103)	(0.00261)

continued next page

Table 5 Continued

Variables	(1)	(2)	(3)	(4)	(5)
	MoMo Account	Credit Card	Mobile Banking	Internet Banking	Any DFS
1 if urban resident	0.0644***	0.00696***	0.0503***	0.0337***	0.143***
	(0.00884)	(0.00208)	(0.00578)	(0.00456)	(0.00980)
Full-time job or business	-0.0146*	0.00177	0.00938*	0.00440	0.0475***
	(0.00846)	(0.00196)	(0.00543)	(0.00416)	(0.00985)
Education Primary 1-3	0.138***	0.00120	0.0245*	0.0322***	
	(0.0183)	(0.00458)	(0.0129)	(0.0116)	(0.0139)
Education Primary 4-6	0.168***	0.00690*	0.0481***	0.0372***	0.253***
	(0.0140)	(0.00384)	(0.00983)	(0.00823)	(0.0121)
Education Secondary 1-3	0.252***	0.0117*	0.0972***	0.0839***	0.297***
	(0.0211)	(0.00685)	(0.0171)	(0.0160)	(0.0108)
Education Secondary 4-6	0.278***	0.0187**	0.155***	0.105***	0.358***
	(0.0220)	(0.00843)	(0.0198)	(0.0175)	(0.00926)
Education Univ & Tertiary	0.191***	0.0236**	0.250***	0.137***	0.363***
	(0.0260)	(0.0103)	(0.0261)	(0.0220)	(0.00990)
Income 30-100K	0.148***	0.00366	0.0584***	0.0392***	0.229***
	(0.0145)	(0.00327)	(0.00999)	(0.00785)	(0.0125)
Income 100K+	0.160***	0.0183***	0.145***	0.0896***	0.319***
	(0.0187)	(0.00559)	(0.0152)	(0.0123)	(0.0146)
Southern province	-0.197***	-0.00284	-0.0422***	-0.0196***	-0.217***
	(0.0115)	(0.00264)	(0.00723)	(0.00570)	(0.0244)
Western province	-0.181***	-0.00420	-0.0535***	-0.0299***	-0.194***
	(0.0116)	(0.00266)	(0.00697)	(0.00546)	(0.0249)
Northern province	-0.201***	-0.00267	-0.0547***	-0.0199***	-0.264***
	(0.0103)	(0.00294)	(0.00677)	(0.00593)	(0.0254)
Eastern province	-0.176***	-0.00102	-0.0314***	-0.0118**	-0.147***
	(0.0114)	(0.00278)	(0.00736)	(0.00584)	(0.0250)
Observations	12,384	12,384	12,384	12,384	12,384

Robust standard errors in parentheses. Asterisks ***, ** and * indicate significance of regression coefficients at 1%, 5% and 10% levels respectively.

Further discussions on DFS development in Rwanda

This sub-section presents further insights on the development of DFS in Rwanda, mainly focusing on the main factors that have so far enabled the development of digital financial services in Rwanda, particularly during the previous decade between 2011 and 2021 and existing challenges to DFS development in the country.

Enabling factors

Based on desk review and stakeholder consultations, the willingness of government to support the digital transformation of payments has been a major contribution towards the achievement in DFS registered in the country so far. Particularly since 2008, promoting electronic payments has been a key development policy tool for the Government of Rwanda to move towards a more cashless economy. The policy and regulatory frameworks described in Section 3 have indeed provided a conducive environment for digital financial services to thrive by guiding interventions and product innovations. The government has indeed not only enacted policies and regulations but proactively consumed DFS products. This is seen in the introduction of electronic declaration and payment of taxes and several other public fees by Rwanda Revenue Authority in 2014, which has substantially boosted person-to-government (P2G) and business-to-government (B2G) payments, shifting from cash to digital and electronic platforms such as mobile banking, mobile money, Internet banking and *mobicash*. Another government initiative to boost digital payments is the digitization of the payment of cash transfers to the beneficiaries of the Vision Umurenge Programme (VUP). Initiated in 2019 by the Local Administrative Entities development Agency (LODA) with support from Access to Finance Rwanda, the initiative entailed upgrading the Monitoring and Evaluation Information System (MEIS) of the former to include, among other features, electronic payroll approvals by national and local government officials. Eventually, from 2020, all VUP beneficiaries are being paid electronically through their mobile wallets, a move that has boosted government-to-person (G2P) payment transactions.

The growth of digital financial services has also been enhanced by increased access to both features and smartphones, which has boosted mobile money, mobile banking and Internet banking transactions. Innovations by financial institutions and mobile network operators (MNOs) are also expanding product offerings, including linking mobile money wallets to bank accounts to facilitate mobile banking. Indeed, since 2010 when mobile money was introduced in Rwanda, a considerable number of people who were excluded even from basic traditional financial services got the opportunity to conduct digital payments through mobile money while bank users managed to conveniently access their accounts and make quicker transactions via mobile banking. The device financing programme of Bank of Kigali and MTN Rwanda is further easing access to both digital credit and smartphones, easing financial and

technological constraints to accessing and using digital financial services especially for last-mile customers. The connect Rwanda campaign that involved distribution of smartphones to low-income households in 2022 is anticipated to further boost the adoption of digital financial services, particularly mobile money. Finally, the growing penetration of the Internet especially in urban areas has enabled the gradual growth of Internet banking and card-based transactions.

Constraining factors or challenges

Despite the achievements registered so far in developing digital financial services in Rwanda, several challenges keep the country away from realizing its full cashless potential. One of the most critical limitations as identified through both desk review and key informant interviews with stakeholders is the low level of digital literacy, which was estimated at 20% of the adult population aged 15 years and above in 2020 (according to the NST1 mid-term review), against an NST1 target of 80% by 2024. Some consulted stakeholders believe the inadequacy of technical institutions that provide practical IT training is partly responsible for the digital skills gap that keeps a considerable proportion of the adult population away from using DFS. Respondents generally believe the low level of digital literacy is more critical among women, who in addition have lower access to digital devices and are held back by what some respondents termed as "*technophobia*". Jointly, these challenges constrain women's adoption of DFS, corroborating and explaining the quantitative finding of the paper (sub-section 5.3) that DFS adoption and usage rates are much lower among females relative to males.

The low level of development of DFS products in the market was also cited by respondents as a key constraint to DFS development, which was blamed majorly on the limited digitization of financial services offered by microfinance institutions and other service providers who indeed ought to be the entry point to the digital economy for their clients. Some respondents believe financial service providers are unwilling to conduct research into innovative products that suit specific needs of various customer segments, but rather rely on copying and pasting models that have been used in other countries. It was also revealed by KIIs that some financial institutions have not embraced partnerships with fintechs as a necessary condition to expand their DFS product range.

Relative to comparators such as Kenya and Ghana, the fintech industry in Rwanda is evolving quite slowly especially in terms of investment and product development. According to a report by the East Africa Venture Capital Association (EAVCA), Rwandan fintechs generated investment funds worth only US$ 165,000 between 2010 and 2017 compared to US$ 204 million raised by Kenyan fintechs, partly owing to investors' perceived low market potential in Rwanda (EAVCA, 2018). The relatively lower number of fintech incubators and accelerators further implies that the services provided to fintechs are generic, which in turn curtails the breadth and depth of product

innovations (EAVCA Africa, 2018). Nonetheless, the report acknowledges the potential for Rwanda to benefit from future fintech growth given the rapid adoption of mobile phones and the Internet.

The low level of awareness of digital financial products and their functionalities and benefits further constrain the adoption and usage of DFS. The Finscope 2020 report reveals that despite the increasing popularity of mobile money, 28% of adults in Rwanda are unaware of this product (NISR, 2020). Similarly, 60% and 74% of adults reported having no knowledge whatsoever about credit/bank cards and Internet banking, respectively. This is corroborated by findings from key informant interviews in which the respondents partly attributed low awareness to the limited outreach by digital financial service providers, which is detrimental to both popularity of the digital platforms and/or public know-how of their respective functionalities. There are also low levels of trust in digital financial products, motivated partly by security concerns about money laundering, fraud and related actual and/or perceived risk. Consultations with stakeholders revealed that some potential users of DFS platforms choose to transact using cash as they fear losing their money through cyber-attacks on electronic payments. This concern reflects two related issues; the actual security risks that need to be addressed collectively by regulators and digital financial service providers; and the generally low levels of sensitization on the safety features and measures associated with the respective digital payment platforms. Additionally, information gathered through KIIs reveals that there is a mentality among the general population in Rwanda that financial transactions of high amounts are better or more safely made either in cash or via the traditional banking systems, which are perceived to be relatively safer channels. The combined issues of awareness, trust and insecurity reflects a gap in the way financial institutions protect their clients from fraud, promote their digital financial products, and educate potential clients on the functionalities of these products and services.

The high transactional costs also discourage potential users of digital financial products. Some stakeholders expressed concern over the double charging of both sender and receiver of mobile money transactions as being quite prohibitive to potential users of the service. Others mentioned that low-income earners are particularly sensitive to cost and are hence less willing to adopt DFS products which they perceive to be prohibitively expensive. The observation corroborates the regression results in sub-section 5.3, which indicate a lower likelihood of adopting DFS products such as mobile banking and Internet banking among individuals with relatively lower income levels. While some respondents believe the high cost is only a perceived myth among the public – even those who could afford DFS products – others acknowledged high cost as a credible impediment, partly attributed to lack of competition and exacerbated by limited interoperability among the DFS products of different service providers. Although the interoperability policy enacted in 2014 clearly guides on swift transactions

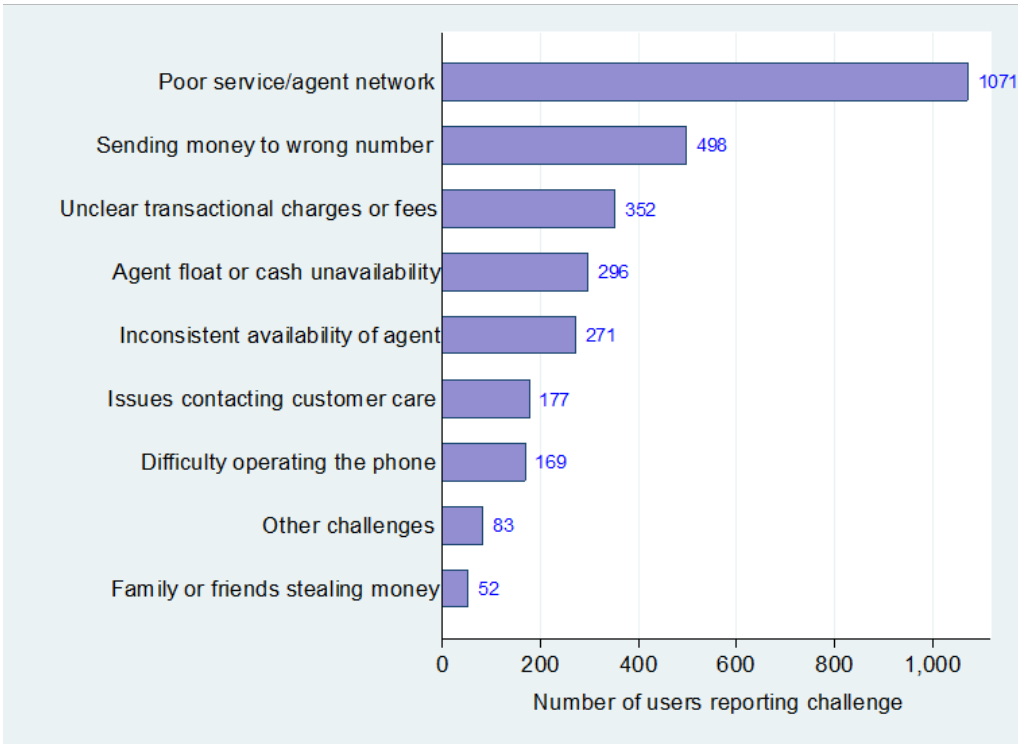
across payment systems operated by various providers (National Bank of Rwanda, 2014), some respondents perceive its implementation among financial institutions and payment service providers to be rather slow. Similarly, the interoperability principles of the Rwanda National Digital Payments System (RNDPS) established in 2018 were quite slowly implemented. For example, payments across mobile money wallets of MTN and Airtel were not interoperable until 2022 when eKash was developed by RSwitch.

Some sector experts believe the dominance of regional and international financial service providers slows interoperability as critical decisions are taken at the regional or headquarter levels. Other respondents mentioned the hesitation of some payment service providers to join the RNDPS as a key hindrance to the operationalization of interoperability principles. Sector experts believe some financial and payment service providers either do not understand interoperability or other policies and regulations, while others lack the technical capacity to put in place compliance requirements. There are recent initiatives by Mobile Money Rwanda and Airtel Money to interlink their transactions for cheaper and instant payments. However, these initiatives remain largely unknown by users of both platforms and full benefits are yet to be realized. Rwanda could perhaps learn from the case of Tanzania, where the Tanzania Instant Payment System (TIPS) was introduced and implemented to facilitate real-time payments across different bank and non-bank digital payment service providers.

The insufficient digital infrastructure is a key constraint; for example, the low coverage and unreliability of Internet especially in rural areas critically impedes the adoption and effective usage of Internet banking. According to interviews with sector experts, the issue of poor infrastructure disproportionately affects rural areas. This partly explains the quantitative finding in sub-section 5.4 that the rate of DFS adoption is lower among rural relative to urban respondents of the Finscope Survey. Another key issue is the limited customer-centric product development by digital financial service providers, which has constrained the availability of digital financial services that are suited to the special needs of key client segments, for example women and persons with disabilities. The fear of "visibility" of electronic payments for tax purposes is another hindrance to DFS adoption, as one respondent from a government institution mentioned during interview that: "*People don't like to disclose their businesses to avoid paying taxes to RRA*". Such sentiments hold back on merchant acceptance of digital payments and curtail the growth of P2B transactions. Regarding digital credit, some financial service providers are hesitant to provide the service while those who have dared have fallen short of consumer expectations. "I used to deposit a minimum of 400,000 Rwanda Francs on a monthly basis onto my mobile money account, but I was shocked to hear that I could only borrow 150,000 Rwanda Francs from MoKash!", exclaimed a male respondent from a non-governmental organization (NGO). Respondents hence believe financial service providers are either not regularly updating customer transaction data or are using "unfair" algorithms that imply low borrowing limits even for frequent and high-value users.

Figure 11 provides a summary of the common challenges that are specific to mobile money, as reported by its users in the Finscope 2020 Survey. The most common challenges relate to the poor quality of mobile money service or agent network, the fear of losing money by sending it to unintended recipients and unclear transactional charges or fees.

Figure 11: Common challenges reported by mobile money users



Source: Author illustration based on Finscope 2020 data

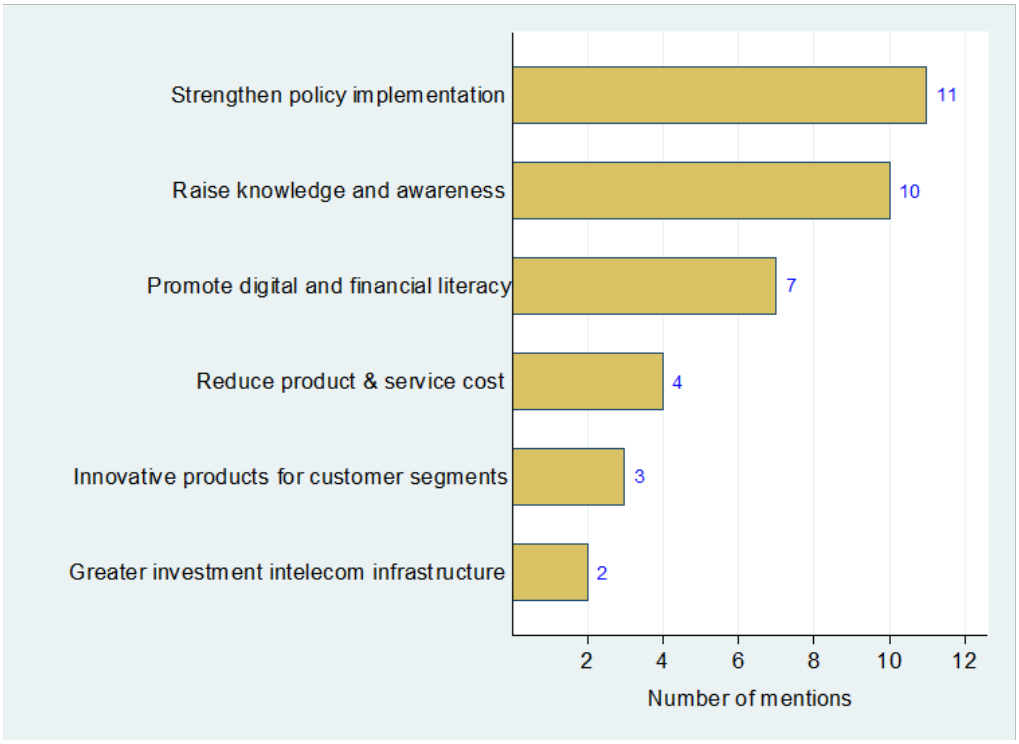
6. Conclusion and recommendations

Rwanda's journey in the digital transformation of payments towards a more cashless economy is characterized by tremendous evolution of policies and innovations meant to promote the availability and uptake of digital financial services. The digitization journey has seen major milestones from the establishment of an integrated payment system in 2011 (RIPPS) for the faster processing of inter-bank transactions to the enormous list of transactions enabled by mobile money, mobile banking, Internet banking and credit and debit cards. Several policy initiatives have triggered product innovations and a gradual behavioural shift towards digital payments, with substantial increases in electronic payments as a share of GDP. The high rates of mobile phone ownership, rapid uptake of mobile money, introduction of electronic tax payment systems and the growing adoption of internet are among the key drivers of the positive trend on digital financial services in Rwanda. However, a greater share of the population still use cash as their preferred payment channel while paying for food and groceries, medical, education and other services, according to the Finscope Survey of 2020. The key challenges limiting the country from realizing full digitization potential include low rates of digital and financial literacy, insufficient digital financial infrastructure including low and/or poor Internet coverage especially in rural areas, limited interoperability among digital platforms of different service providers, and low awareness levels among the general population regarding DFS.

Recommendations

The findings of the study carry several policy implications and lead to several recommendations for various stakeholder categories. The main recommendations made by stakeholders during key informant interviews are highlighted in Figure 12, while the subsequent narrative elaborates in detail all the recommendations and suggestions to further promote the development of DFS.

Figure 12: Stakeholder recommendations to promote digital financial services in Rwanda



For policy makers and regulators:

1. ***Strengthen the implementation of policies and regulations.*** Discussions with sector stakeholders through key informant interviews revealed that further development of DFS in the country would require strengthening the implementation of (digital) financial inclusion policies and tightening the enforcement of key regulations especially on interoperability, anti-money laundering and cyber security as a means of easing and reducing the cost and risk of digital financial platforms and products. While stakeholders are generally optimistic about the newly updated National Financial Education Strategy to be implemented between 2023 and 2027, they suggested a strong and coordinated implementation approach at the national and local levels, with specific digital and financial literacy initiatives targeted to certain groups such as women, youth, persons with disabilities, refugees, among others. Sector experts also

reiterated the need for policy makers and regulators to extend appropriate support to the consumers of various regulations to ensure they understand exactly what it takes to comply. Some respondents emphasized the need to regularly review (digital) financial policies to make them more inclusive. Overall, there is need to critically review the dissemination mechanisms of policies and regulations from the national to local and sectoral levels and to ensure strict adherence to the DFS-enhancing provisions and effective implementation of targeted interventions.

2. ***Explore the possibility of mandatory regulation for MSMEs to accept at least one DFD product.*** To promote the adoption and usage of DFS in buying and selling goods and services, there is a need to expand the range of DFS transactions beyond personal transfers. Some stakeholders suggested enacting a policy or regulation that would make it mandatory for each merchant – particularly micro, small and medium enterprise (MSME) – to accept at least one form of digital payment for their respective goods and services. In this regard, Rwanda could learn from Malawi where merchant acceptance of at least digital payment channel is part of the business licensing requirements (The Times Group, 2018).

3. ***Scale up the interoperability through API regulations and popularization of RNDPS.*** Discussions with sector stakeholders revealed untapped potential to promote interoperability of mobile money, digital wallets and bank accounts and suggested an enabling environment that allows open application programming interfaces (API) for seamless information sharing and inter-provider transactions. Lessons were suggested from countries such as Zimbabwe and Ghana where merchant payments can be made from virtually all digital platforms, including mobile wallets, card and bank accounts. Some stakeholders urged the National Bank of Rwanda to proactively engage and work with financial institutions to address structural barriers to their embracement of the Rwanda National Digital Payments System (RNDPS), including through mandatory regulation or capacity building or a combination of these approaches.

4. ***Pursue proactive measures to boost digital and financial literacy.*** Mainstreaming financial inclusion and DFS-related policies with specific interventions to disburse digital skills and enhance product innovations relevant to youth, women, persons with disabilities and other marginalized groups would further boost inclusion and equity in DFS. Some respondents of KIIs suggested establishing digital literacy programmes and/or technical schools jointly operated by government, financial institutions and MNOs as a means of boosting digital and financial literacy for all, raising awareness and contributing to the NST1 target of achieving 80% electronic payments by 2024.

5. ***Explore regulatory sandboxes for new products and services.*** Respondents expressed a critical need for policy makers to provide an enabling environment for product innovations, including regulatory sandboxes to test new products before they are rolled out in the market.

6. ***Explore and scale up public-private partnership for investment in telecom infrastructure*** and public-private partnerships to invest in improving the telecommunications and other DFS infrastructure especially in rural areas as a critical step in boosting overall DFS development in the country.

For financial and payment service providers:

7. ***Use a human-centric and data-driven approach to design appropriate products.*** Providers of DFS need to use a human-centric approach in the development of products to proactively innovate into products that best suit the financial needs of the last-mile customers. This calls for investment in research and data analytics to understand the needs and challenges of various customer segments.

8. ***Embrace the national drive to promote interoperability.*** The consulted stakeholders urged financial institutions to acknowledge their role in realizing interoperability, leveraging it as a tool to promote the adoption and usage of their respective services and products. To this effect, stakeholders urged financial institutions to embrace the recently established Rwanda National Digital Payments System (RNDPS) and work with the National Bank of Rwanda, Access to Finance Rwanda, RwandaSwitch and other sector players to undertake step-by-step implementation of interoperability provisions of the system. Some respondents suggested that big financial institutions ought to establish open APIs that can be accessed by fintechs or other DFS providers to stimulate competition and enhance information flow for seamless payments across different DFS platforms.

9. ***Proactively boost financial literacy and awareness of existing products and services.*** Other stakeholders suggested capacity building interventions in form of rigorous training of trainers for agents of DFS providers (for example mobile money agents), who would then transfer their acquired skills to the clients they interface with during the process of making electronic transactions. Digital payment service providers, including financial institutions and MNOs, also need to step up their outreach and awareness-raising campaigns regarding DFS products and their functionalities to boost uptake and consumer trust in the same. This includes investing in joint campaigns and programmes with government institutions such as the National Bank of Rwanda and non-governmental stakeholders to build the financial and digital capacity of different groups of people through financial education, promotions and other outreach approaches.

For development partners:

10. ***Expand technical and financial support to financial and payment service providers.*** The main recommendation for development partners is to engage other stakeholders in providing technical and financial support for the promotion of technological innovations by payment service providers and fintechs. Some KII respondents also revealed a need to facilitate financial service providers, including making finscope and other relevant data available in user-friendly format for informed decision-making and promoting understanding of the prevailing DFS market development challenges. There were also suggestions for capacity-building programmes for the country's fintechs to enhance the faster development of relevant products that suit market realities.

Notes

1. https://www.rca.gov.rw/cooperatives/about-saccos.

2. https://www.acgroup.rw/?page_id=26

3. https://en.igihe.com/news/article/mtn-rwanda-bank-of-kigali-partner-to-launch-device-financing.

4. https://therwandapost.com/rwanda-finally-rolls-out-mobile-money-interoperability.

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Appendix

Appendix 1: Trend of digital financial services in Rwanda, 2012-2020

Indicator	2020	2016	2012	Growth (2016-2020)	Growth (2012-2020)	Growth (2012-2016)
DFS financial inclusion	2.1m	1.1m		191%		
	(30%)	(18%)		(67%)		
DFS transactions in past 12 months	66%	46%		43%		
No. of ATM card users	797,771	207,563	96,475	285%	727%	115%
No. of credit card users	127,077	5,283	2,075	2,306%		
Mobile banking users	692,159	180,493		283%		
Internet banking users	550,630	15,316		3,495%		
MoMo penetration (%)	60%	39%		53.8%		
Banked adults using digital platforms (%)	25%	6%		317%		
Share of e-payments in GDP (%)	72.8%	20.4%	1.3%	257%	5,500%	1,469%

Source: Finscope reports (2020, 2016 & 2012); Monetary Policy and Financial Stability Statements

Appendix 2: Sample questions for discussion during stakeholder consultations

Part 1: Government institutions (policy and regulatory bodies)	
Q1	What policies, regulations, strategies and interventions have been used to boost digital financial services in Rwanda?
Q2	How have these efforts so far boosted digital financial services over the past decade or so?
Q3	How does the government work with the private sector to develop innovative products? Please highlight some best practices?

Q4	Besides policies and regulations, what are other main enabling factors to the recent developments in digital financial services?
Q5	What key challenges still stand in the way of realizing the policy agenda of digitizing payments towards a cashless economy?
Q6	What is being done or could be done better to leverage digital financial services for greater (and inclusive) financial inclusion?
Part 2: Private sector (financial institutions, payment service providers, MNOs, etc.)	
Q1	As a stakeholder in the DFS ecosystem, what has been your role/contribution to the development of DFS in Rwanda?
Q2	Please highlight some of your transformative products that have been instrumental in boosting digital financial services
Q3	Do you intend to roll out new products or services that promote digital financial services – especially for marginalized people?
Q4	What can be done (by different stakeholders) to address prevailing challenges and promote digital financial services?
Part 3: Development partners and local non-profit organizations including women's organizations	
Q1	To what extent is the promotion of digital financial services prioritized in your programming?
Q2	Do you have specific interventions targeting digital financial access among marginalized people (women, persons with disabilities, etc.)?
Q3	What are the main challenges to realizing a "cashless economy" in Rwanda and how can these be addressed?

Appendix 3: List of institutions for covered by key informant interviews

S/N	Name of institution	Category of institution
1	National Bank of Rwanda (NBR)	Government
2	Ministry of Finance and Economic Planning (MINECOFIN)	Government
3	Gender Monitoring Office (GMO)	Government
4	National Women's Council (NWC)	Government
5	National Council for Persons with Disabilities (NCPD)	Government
6	I&M Bank	Private financial institution
7	Bank of Kigali	Private financial institution
8	Urwego Bank	Private financial institution
9	Cogebanque	Private financial institution
10	Ecobank	Private financial institution
11	Umutanguha Microfinance	Private financial institution
12	Access to Finance Rwanda (AFR)	Local NGO
13	National Union of Disability Organizations in Rwanda (NUDOR)	Local NGO
14	Profemmes twese Hamwe	Local NGO
15	Rwanda Union of Little People (RULP)	Local NGO
16	Rwanda Union of the Blind (RUB)	Local NGO
17	Organization for Integration and Promotion of People with Albinism (OIPPA)	Local NGO

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