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Exploring the effect of digital finance on financial inclusion in Uganda, a reflection from Lira City

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Abstract

Purpose – The study aims to discuss financial inclusion (FI) as a facilitator of digital financing with intension of solving challenges relating to financial exclusion.

Design/methodology/approach – Both descriptive and correlation research designs were used to understand the nexus between digital finance (DF) and FI. The study collected data from 300 respondents, which included vendors and dealers in agricultural produce, who were selected purposively and randomly.

Findings – The study found a significant contribution of DF to FI and the variations in FI due to mobile money (MM) and Internet banking are significant. MM and smartphones are very often used in performing commercial transactions due to easy accessibility compared to ATMs, the Internet and agent banking, which is always restricted.

Research limitations/implications – The study only focused on how DF platform affect financial inclusiveness in Lira City and did not explore other financial services.

Social implications – The quickest and widest adoption of MM by rural communities is mostly a factor of user-friendliness, which seem to be lacking in other bank applications or products.

Originality/value – The study offers a significant insight on challenges related to the financial inclusiveness, which is a global concern by many economies.

Keywords Digital finance, Financial inclusion, Mobile Money transfer, Internet financial products, Branchless banking

Paper type Research paper

Introduction

Digital finance (DF) has been welcomed by the world economy as a catalyst for advancing a trustworthy and widely accessible financial system. A good number of the global population are financially excluded, and the potential of the economically excluded in rural areas can be unlocked through meaningful and reliable digital financial technology (DFT), thereby lowering their susceptibility to income shocks. Developing nations have embraced the use of

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digital technologies to provide their population with inclusive finance (World Bank, 2018). The stimulation of automation and computing would help enterprises to digitalize their financial services (FS), which would be advantageous for small business owners, the government and the economy (Badruddin, 2017). Globally, the creation of cutting-edge financial goods, such as mobile platforms, has gained popularity to increase financial inclusion (FI). According to Vidyashree and Rathod (2018), the application of DFT ensures accuracy, speed and efficiency in company processes and also demonstrates that the demand for technology and innovation in the banking industry is gaining increasingly urgent attention. According to Jungo, Madaleno, and Botelho (2021), most Sub-Saharan African populations are concentrated in a variety of geographical areas and share several common traits, social values and economic standing but are financially exclusive and at a relatively low degree of economic development, and specifically, the adults did not have access to FS and goods, according to Mukherjee and Sood (2020).

Despite all attempts to make FS and products more inexpensive and accessible for the general public, FI for the general public is still very low (Oumarou & Celestin, 2021). In their study on the macroeconomic effects on mobile money (MM) in Uganda, Mawejje and Lakuma (2019) revealed that it is still difficult to acquire affordable and high-quality FS and goods in the country's fiercely competitive and expanding economy. Although financial exclusion has been significantly reduced due to DF, there is still a huge gap to be closed before reaching worldwide FI (World Bank, 2018). Inclusive financing has been a burning issue in the developing economies and a major United Nations (UN) goal (Senyo, Karanasios, Gozman, & Baba, 2022). According to Kooli, Shanikat, and Kanakriyah (2022), the barriers to the original traditional financial system have continued to fall, resulting to a substantial increase in the FI that has been recognized as a trigger in achieving the 2030 SDGs (Allen, Demirguc-Kunt, Klapper, & Peria, 2016). According to The World Bank (2020), the four generic barriers that affect financial inclusivity can be identified to include demand factors, structural, institutional and educational, while no single structure can apply above all.

The global challenge facing FI has remained a priority for world economies, and Uganda is not an exception, where most citizens lack access to FS. The location and growth of Lira City in Northern Uganda offer an idiosyncratic situation for studying the effect of digital financial services (DFS) and its impact on the economy. The circumstance why DF has been seen as promoting FI has been unclear since local studies have underlooked its complexities. In spite of the existence of more DF platforms like digital banking and MM, inequalities in access to finances have continuously increased (Uganda Bureau of Statistics (UBOS), 2022). This study intends to address how these digital platforms have affected the access, quality and usage of FS among the vulnerable communities in Lira City. In rural areas, Northern Uganda and Lira City to be specific, the community has continued to suffer from the limited access to the banking services and DFS, resulting from the exorbitant cost in the technical support, maintenance and establishment of physical branches. This study would make a significant contribution in addressing MM services, digital payments, financial literacy on the digital financial platforms and education; especially if the widening gaps in the digital technologies are not fully addressed, the citizen would still remain financially excluded. The study explored the various DFS being adopted and also established the relationships between DF and FI in Uganda.

Literature review

Digital finance

According to Ozili (2018), "digital finance (DF)" is any good, service, infrastructure and technology that enables both businesses and individuals to access their credit, savings and/or payment facilities online without having to visit a bank branch to do so. According to Rasheed, Siddiqui, Mahmood, and Khan (2019), DFS presents a chance for enterprises to perform better by utilizing digital services at a cheaper cost. DFS would act as compliments to employed groups, educated and the wealthy as a substitute for those marginalized who could not easily

access the established and formal FS (Mothobi & Kebebotsamang, 2024). Customers' trust in online banking is growing, which is important for developing technology (Kaur, Ali, Hassan, & Al-Emran, 2021), and the same study highlights how slowly developing nations are progressing in contrast to wealthy economies in adopting digital technologies for their FS. The widespread acceptance of digital tools and mobile devices has raised individual FI rates (Bill & Melinda Gate Foundation, 2019).

To better protect consumers from the pervasive fraudsters, FI advocates and proponents of DFS should improve already existing digital consumer protection regulations on the mobile platform (Okello & Ntayi, 2020). Additionally, DF shields people and businesses from the risk of having fake money circulate in the community and enables them to receive payments as quickly as possible (Ozili, 2018). The interactions in digital networks would greatly improve the financial remittance with ease and accessibility. According to the IMF (2021a, b), the financial access survey revealed that DFS has a significant presence of ATMs and bank branches access points across the less-developed countries. By attracting various consumer demographics and most financial transactions, savings and mobile access to FS are significant drivers that demonstrate how much financial institutions care about the FI of the community (Thomas & Hedrick-Wong, 2019). Through the widespread usage of mobile phones, digital payment technologies (DPT) have improved financial accessibility for communities (Chu, 2018). The implementation of DPT has opened chances to combat terrorism and money laundering by allowing customers to apply data protection analysis and raising concerns about data privacy and consumer protection (Michaels & Homer, 2018). The current debate centers on digital financial inclusion, which has encouraged previously financially excluded people to engage in the financial system (Mhlanga, 2020).

Mobile money transfer (MM)

According to Murendo, Wollni, De Brauw, and Mugabi (2018), MM is a platform that is built on mobile devices that enables users to make financial transactions using their phones. Mobile users can receive money on their cell phones and send money online thanks to MM technology, which is an electronic wallet service. Peruta (2017) reveals that the MM platform intends to extend FS to the most underserved communities. According to Finscope's (2018) estimation, MM services are used by about 56% of the population who use formal FS, and these services have increased their wealth, economic growth and sustainability. The MM system provides the community with two services, is viewed as a driving force for FI and presents a financial opportunity for service providers and agents due to the developing market. The MM agents who participated in these transactions profited greatly in the unpolluted markets. IMF (2019) posits that most financial activities involving money transfers, credit payment accessibility and micro insurance are now more convenient. Senyo and Osabutey (2020) demonstrate how the advent of MM technology provides its customers with a range of services that are incredibly practical, affordable and available. By joining the wider digital network, MM platforms influence the social debt service provided by local communities, as demonstrated by Rodima-Taylor and Grimes (2019). In order to move their funds, the unorganized sector has joined this MM network in lowering the dangers and uncertainties involved in financial transactions.

Financial transfers can now be made through MM transactions, which are a practical and effective way that allows for a variety of services, including service fees, money transfers and microcredit availability (IMF, 2019). The regulatory framework and supportive infrastructure in a country play a key role in the adoption and acceleration of MM diffusion, and this would drive FI among the poor households at a low cost (Lashitew, Van Tulder, & Liasse, 2019). Wieser, Bruhn, Kinzinger, Ruckteschler, and Heitmann (2019) established that Ugandan households that are poorer have fewer MM networks, and this significantly impacts the financial inclusivity of the community. Considerably, the smallholder farmers have been encouraged to save using MM, and these have resulted in increased savings among the farmers

as long as they are guaranteed of interest in their savings (Bastista & Vicente, 2020). According to Bastian, Bianchi, Goldstein, and Montalvao (2018), in the study on female business owners in Tanzania, it was established that there were positive effects on MM saving that empowered women financially. MM services have reached quite a large population given that approximately 25% use bank accounts, and this indicates that MM transfers increase FI by 13% (Hamdan, Lehmann-Uschner, & Menkhoff, 2022). MM transfer has positively impacted FI, and this was moderated by the reinforcement of social networks among the community (Okello, Ntayi, Munene, & Malinga, 2018). These led to the development of the first hypothesis.

H1. MM has no statistical significant effect on FI.

Internet financial products

Yang, Yu, and Huang (2020) posit that Internet financial products provide Internet-based transactions and wealth management. These products promote social benefits and narrow the inequality space. The usage of MM stands at 27.9%, compared to Internet financial services at 6.6% (OECD, 2020) and 9% usage of Internet banking (IB) services among adults compared to the 7% of adults that used MM services in Lebanon. The reports focused on app-based banking, Internet and mobile banking (MB). Durai and Stella (2019) listed the FS promoted by the Internet, which include third-party payment, online lending, direct sales of funds, online insurance and banking, all of which cut down the cost of transactions and enhance the feasibility of transactions. There is a wide gap between those in the formal banks and those without and DFS would help bridge the existing gaps, specifically to the underserved areas that would enhance FI (The World Bank, 2020). According to Eton, Fabian, and Ejang (2022), financial institutions should require all bank customers to use IB.

The demand of FS has expanded and the financial institutions have also added value on their services that makes the Internet financial products to present a better network from the traditional products (Manser, Peltier, & Barger, 2021). The increased value addition and network effect would automatically scale up the use of internet FS in the market (Chen, Hu, & Ben, 2021). According to Kang and Yang (2023), Internet financial platforms and the basic services be improved and optimized to support the user loyalty. The expansion and gain in the adoption of digital financial products have contributed to increased financial literacy a cross Sub-Saharan Africa, and these have empowered clients in the making of financial decisions (McKinsey Global Institute, 2016). This led to the development of the second hypothesis.

H2. IB has no statistical significant effect on FI.

Branchless banking (BB)

Durai and Stella (2019) used the term "mobile banking," while Haider (2018) used "mobile financing" to refer to branchless banking (BB). According to Haider (2018), BB also includes smart cards, point-of-sale devices and digital technology-based biometric identification cards. BB (agent banking) is one of the pioneering financial innovation in the new millennium (Chowdhury, 2018). The BB service allows clients to carry out cash-in and cash-out transactions through bank agents, ATMs, telecom agents and cash merchants (Digital Finance Service Indicators, 2019). The role of BB in Uganda is very crucial in the expansion of FS, and it has been established that by 2020, over 27 million Ugandans had registered MM accounts, which exceeded those with traditional bank accounts (The World Bank, 2020). ATMs and card networks promote cash withdrawals and payments outside the banking hall (Feyen, Frost, Gambacorta, Natarajan, & Saal, 2021). These services help customers to switch from one bank account to another without search costs, cutting down the marginal costs of opening bank accounts with multiple banks. When the banks invest in BB, it encourages FI, improves long-term profitability and payment rates of customers and enhances efficiency in productivity (Mohamed & Elgammal, 2024). The efficiency of BB is attributed to the ability in achieving a

huge or large number of transactions with a lower cost associated to the transactions, (Prior & Mora, 2019).

However, the penetration of BB network is higher in cities, municipalities and peri-urban centers, and substantial efforts should be made in increasing adequate number of agents in the rural areas and ensure their liquidity to meet the needs of the community (Berger, 2020). The dominance of MM transactions that account for over 50% of most transactions in Uganda has demonstrated that BB is really a dormant force on money transfer (Bank of Uganda, 2021). The adoption of digital borrowing and lending by the BB significantly improved financial empowerment for small business enterprises by providing financial inclusivity to those who access credit. The long distances of bank branches and absence of ATMs in the rural communities in Uganda have affected the livelihood of the individuals receiving the remittances, and this affects FI (Wieser *et al.*, 2019). There has been an attempt to increase the usage of electronic payments in all sectors of the economy, while there is limited evidence to substitute it away from cash (Bech, Faruqui, Ougaard, & Picillo, 2018). There is glaring evidence to show that BB is very significant for the financial inclusiveness of women who are faced with restrictions in mobility (World Bank Group, 2018). According to Ashraf (2022), the attitudes, norms and perceived behavior factors are positively significant in influencing the rural poor bounded by rational intention toward BB behavior. Considerably, Demirguc-kunt, Klapper, Singer, Jake, and Hess (2018) revealed that there seem to be fewer bank branches, and therefore, a significant proportion of the population do not have bank accounts, making financial transactions costlier in the remote and underserved areas and thus posing a challenge. These led to the development of the third hypothesis.

H3. BB has no statistically significant effect on FI

Challenges of digital finance

According to ADB (2016), the number of users of DF platforms has decreased due to a lack of knowledge about using these methods and illiteracy in financial channels. There were few incentives for low-income people, and customers are worried about the security of their finances to adopt DF. According to Aboagye and Anong (2020), to support the sustainability of the MM ecosystem, DF users faced several issues, including fraud and system hacking, infrastructural problems and consumer protection. According to Ketterer (2017), inadequate infrastructure and regulatory frameworks may be to blame for the high costs and poor quality of individual consumers' digital connectivity, which have a negative impact on their ability to access FS. Igoni, Onwumere, and Ogiri (2020) posit that security-related difficulties, insufficient digital infrastructures and subpar research are some of the problems hindering DF's expansion and development. According to Rasheed, Siddiqui, and Rahman (2018), the FS sector has been hesitant to adopt digital technology due to high transaction costs, limited network coverage and a lack of knowledge. Many financial institutions have started using DTs around the world, but this is hindering their operations because most clients, particularly in developing nations, are not yet digital (Alameda, 2020). The conventional financing options provided by the current banking system have not fulfilled their current obligations as anticipated and display several restrictive elements that have resulted in an inadequate supply of FS meant to address the problems faced by underprivileged citizens (Sapovadia, 2018). According to Aboagye and Anong's study in Ghana, the incorporation of MM appeared to be addictive for many users and had a transforming effect on those who had been first shut out of the formal financial system.

Financial inclusion (FI)

FI is described by the United Nations (2016) as a sustainable method of offering FS to the economically formal poor. An integrated FI index covering FI use, access and traditional interventions has been created by the IMF (2021a, b). FI is thought to promote access and

assignment of services delivered by the financial sector (Raichoudhury, 2020). Although the expansion of FS is a crucial objective for the world economy, The World Bank (2020) projects that two billion people remain unbanked and without access to formal financial institutions. According to Sharma, Khan, and Thoudam (2019), most of the world's poor people lack access to FS that could enable them to achieve their basic needs. According to Lenka and Barik (2018), financial institutions must give unbanked individuals access to FS that encourage economic expansion. The adoption is supported by providers of FS, including bank branches, ATMs, MM branches and bank branches. Financial service providers should encourage their clients to use affordable, secure and risk-averse DFS (Eton, Mwosi, Okello-Obura, Turyehebwa, & Uwonda, 2021). Financial stability improves when people have access to savings and payment systems, whereas stability would deteriorate if more people had access to credit (Feghali, Mora, & Nassif, 2021).

Lacovoiu (2018) demonstrates that financial institutions are not just concerned with the community's FI through their ability to draw in a variety of customer demographics, but also with the attitudes of the public and their authorities. To expand excluded people's engagement in formal finance, policymakers, financial institutions and governments should encourage innovative solutions (Giron, Kazemikhasragh, Cicchiello, & Panetti, 2021). The same study's authors, Giron *et al*. (2021), make the case that policymakers should create new incentives for their fiscal policies so that least-developed countries can empower people who are not financially inclusive and provide them with access to income-generating opportunities. Musau, Muathe, and Mwangi (2018) opine that those financial institutions should create policies that guarantee their stability and competitiveness while considering the actions that guarantee FIs' stability in the financial sector.

Digital finance and financial inclusion

The three main advantages of digitizing FS are their accessibility, cost and product market compatibility (IFC, 2018). The advent of digital financial tools would enable unbanked customers to receive FS that might lead to FI (Chua, 2018). According to PSDU (2018), MM has mostly fueled FI in Uganda's economy, while GSMA (2017) reveals that those nations with greater cellphone penetration rates and limited FI see DF as the only way to end both financial and social exclusion. The organizations that offer FS such as insurance and credit institutions have benefited from the operation of MM, and these have hugely impacted FI (IMF, 2019). According to Ayyagari and Parahoo (2018), financial institutions have been developing new FS to suit the growing demand from their clients, which has resulted in the connection between banks and mobile phones. Lu, Wu, Li, and Nguyen (2021) opine that digital technology is making it possible for individuals to have better access to the FS offered by international banks by overcoming the traditional long-distance channels of information transmission. By decreasing paperwork, shortening lines in teller halls and enabling banks to reduce their branches and retain fewer employees, DF lowers the operating expenses of financial institutions (IFC, 2018).

DFT, like digital banking and MM, has expanded the financial reach among the population (Willige, 2023). According to Ahmad, Green, and Jiang (2020), DT supports financial transfers and payments that aid in the collection of user data that can be used to support credit history in financial lending. This viewpoint aligns with Senou, Ouattara, and Houensou's (2019) idea that the unique effects of mobile phone use and internet connectivity usage have a huge impact on FI in developing countries. Therefore, this justifies governments' increased efforts to encourage the accessibility, affordability and availability of FS that speed up FI. Isabwa (2021) states that the banking industry should construct suitable MB platforms to improve FI and give unbanked people access to FS that spur economic growth. According to Arnold and Gammage (2019), DFT and FI are not automated; thus, citizens must make a variety of parallel investments to maintain control over their income and savings. According to Lu *et al*. (2021), the policies and plans of many economies have resulted in banking system

reforms that have accelerated the transition to digital financial systems and have enabled the achievement of the FI aim. AFI (2018) demonstrates that adopting fintech technologies has excellent prospects for removing FI obstacles and bridging the utilization gap for bank accounts by leveraging the advantages of rising mobile technology usage. DFT would be an effective instrument to encourage FI among the financially excluded, but there should also be a program to alleviate the strict banking standards in the community. According to Ouma, Odongo and Were (2017), the growth of MB in rural areas is proof that MB has helped FI in developing nations like Sub-Saharan Africa. Mobile technology's ability to access credit has increased FI. This postulation is reinforced by Sinha and Highet (2017), who maintained that the use of mobile technology in developing nations fosters the development of an effective and efficient financial system that allows the financially excluded to participate in society.

MM has strengthened national and international efforts to increase FI among the rural poor despite running into numerous roadblocks that prevent it (Siano, Raimi, Palazzo, & Panait, 2020). Oumarou and Celestin (2021) posit that the population's precise use of MM services and distribution among them is a sign that they have adopted the proper digital financial access. According to Lyons, Kass-Hanna, Liu, Greenlee, and Zeng (2020), the chosen international FI plans would offer a variety of FS to the poor and vulnerable, helping them to create a more financially inclusive and resilient society. Due to the diverse social and economic backgrounds of users, FS providers and managers must create more products and services that improve FI through MM (Senyo, Osabutey, & Kan, 2020). There have been decreased associated financial expenses by financial institutions involved in supplying the FS and products, which has led to increase FI (Pham, Nguyen, & Nguyen, 2019).

Despite the factual evidence that indicates that DFS have the potential to address the persistent financial exclusion challenges in the developing economies, Grzybowski, Lindlacher, and Mothobi (2023) revealed that there has been less usage of MM in the areas that are less developed. According to Achugamonu, Alexander, Gershon, Ajibola, and Lawrence (2020), the usage of digital financial platforms has led to rural people being financially cut off from the official financial network, whereas according to Aker, Prina, and Welch (2020), the low adoption of MM in Niger drastically affected the FI of the community. Murendo *et al.* (2018) noted that the level of social networks has been a major factor that would affect the adoption of MM among households in Uganda, and this explains the gap in the financial inclusivity in the community. In the study conducted by Pelletier, Khavul, and Estrin (2020), it was established that if MM is used through the banking systems, it would yield a greater multiplier effect in the economy, thus improving the FI. According to Banna and Alam (2021), DFS brings stability in the banking sector. The DF platforms like MM and digital banking serve as a key financial access metric since the ownership marks a step toward financial mainstreaming (Shaikh, 2024).

The existence and entry points to mobile access to digital platforms offer a groundbreaking chance to advance financial access that enables more people to participate actively in the economy (World Bank, 2023). In improving the social network, the Bank of Uganda (2023) focused more on the reduction of financial exclusivity specifically to the formal financial service provider while broadening the quality and usage of formal financial products. According to Okello, Ntayi, Munene, and Akol (2017), social networks play a partial mediation relationship between financial intermediation and FI of the rural poor household in Uganda. Eton, Odubuker, Ejang, Ogwel and Mwosi (2019) established that the strides to promote financial accessibility are highly commendable, whereas Nagaaba, Batamuriza, Basuta, and Owomugisha (2025) revealed that financial institutions, funding interventions and the Government of Uganda need to embrace the appropriate FS that can be afforded by the vulnerable poor.

Methodology

The study adopted both descriptive and correlation research designs to understand the nexus between DF and FI. A descriptive design is a study design that describes and summarizes the populations and situations characteristics, while correlation design is used to examine the relationship between two or more variables under study. The choice of the descriptive design was driven by the need to understand the adoption of DF among the market vendors and dealers in agricultural products, who sell to and buy from the low-income subpopulation. The choice of the correlation design was driven by the need to understand any existing causal relationships between the dimensions of DF and FI. This study was conducted among market vendors and dealers in agricultural produce in Lira City East and Lira City West divisions. The choice of market vendors and dealers in agricultural products was driven by the nature of the businesses and the clientele customer-supplier population.

The study collected data from 180 vendors and 120 dealers in agricultural produce, who were selected purposively and randomly. Purposive sampling was adopted because it would support in-depth insights, and the respondents were relevant and were experts in the specific business under study, since they had knowledge as market vendors and produce dealers. It was also cost-effective because they were easily accessible. Additionally, adopting random sampling would eliminate sampling bias, enabling everyone within the study group to have an equal chance of participating in the study, and generalization of the findings would allow for inference to the bigger population. The key produce dealers in two city divisions were identified based on their sizes from large, medium to small and the types of the agricultural produce they were dealing in and location. A comprehensive list was generated from the target group from their association leaders, and this list helped the researchers to randomly chose the respondents without bias. The reason for the choice of both sampling techniques was to generate more understanding about the market vendors and produce dealer experiences if DF has any impact on FI.

Data analysis was both descriptive and inferential; descriptively, the study used counts and percentages to portray the use of DF. Descriptive statistics supported the study in summarizing the data and also enabled the researcher to identify patterns, while the inferential statistics helped in making references, testing hypotheses and generalization of results. Inferentially, the study used hierarchical multiple regression to measure the causal relationships of DF dimensions on FI. Hierarchical multiple regression was used to examine the relationships between the independent variable and a single dependent variable. The adoption of hierarchical multiple regression was driven by the need to measure the variation in FI due to clients' characteristics, which covertly affect FI.

Results and discussion

From gender participation, 59.1% of the participants were men and were the majority, whereas 40.9% were women. Age distribution indicates that 41.9% fell in the 31 to 40 years' age group and constituted the majority. Marital status participation indicates that 60.7% were married and included the majority. In terms of education, 40.6% of the participants were educated beyond high school and constituted the majority. The variations in the use of different channels in performing financial transactions are summarized in Table 1.

Table 1. Channels used to perform financial transactions

Variable list	Never	Often	Very often	Total
1. Internet	21.8%	41.9%	36.4%	100.0%
2. Mobile money	26.3%	18.2%	55.5%	100.0%
3. ATMs	29.9%	30.8%	39.3%	100.0%
4. Smart phone	32.8%	16.2%	51.0%	100.0%
5. Agent banking	58.1%	20.5%	21.4%	100.0%

Source(s): Field data, 2024. Authors' own work

The findings on the use of digital channels to perform financial transactions indicate that 55.5% very often use MM, 51.0% very often use smartphones, 39.3% very often use ATMs and 36.4% very often use the Internet. Generally, the percentage of participants who very often use digital channels to perform financial transactions ranged from 21.4 to 55.5%, with agent banking at the lowest extreme. Besides MM, there is some evidence that smartphones are very often used in performing financial transactions. The frequent use of MM can be attributed to no restriction of operational times, convenience, minimal impact by Internet connectivity, most shops accept payments through mobile money application (MOMO) app and MM transfers and accessibility of the agents, among others. On the other hand, the low usage of agent banking in performing financial transactions can be attributed to low trust in the communities. The lack of trust is attributed to several factors such as inaccessibility due to distance, restricted operational times due to security issues and over-controlled by the Bank of Uganda.

This study used hierarchical multiple regression to understand whether FI in Uganda is facilitated by digital financing (MM, IB, and BB). Before running the hierarchical regression, normality and linearity tests were conducted, as presented in Table 2.

The study used the Analysis of Variation (ANOVA) to test the suitability of the model, as presented in Table 3.

The ANOVA indicated by F (4, 303) = 22.054; $p < 0.05$) shows that the model is a good fit for the data. Table 4 shows the hierarchical model for FI. R^2 is the change in FI explained by the predictor variables. R^2 change is the extra change in FI when clients' characteristics are introduced in the model. B represents the unstandardized coefficients, while Beta represents the standardized coefficients when all the variables are expressed in comparable units, as shown in Table 4.

The hierarchical model was used since it helps in improving prediction and the identification of key predictor, and in this case, three predictor variables were entered: MM, IB and BB. The model was statistically significant F (3, 304) = 16.826 and $p < 0.01$), explaining 13% of the variations in FI. These statistics indicate that all three DF products significantly contributed to the model.

When clients' characteristics were introduced at Step 2, the total variation explained by the model was about 22%, i.e. F (4, 303) = 22.054; $p < 0.01$). The introduction of clients' characteristics in the model explained an additional 9% of the variations in FI after controlling for MM, IB and BB (R^2 Change = 9%, F (1, 303) = 32.505; $p < 0.05$). In the final model, three

Table 2. Correlations, descriptive statistics and reliability and ($N = 308$)

Variable list	FI	CC	MM	IB	BB
Financial inclusion (FI)	1				
Client characteristics (CC)	0.360**	1			
Mobile money (MM)	0.350**	0.231**	1		
Internet banking (IB)	0.279**	0.099	0.437**	1	
Branchless banking (BB)	0.119*	−0.031	0.169**	0.422**	1
Range	2.83	3.40	3.67	3.40	3.00
Mean	3.7493	3.5610	3.7219	3.6922	4.2162
Std. deviation	0.61546	0.76267	0.92196	0.66052	0.68192
Cronbach alpha	0.691	0.606	0.724	0.539	0.773

Note(s): Statistical significance: *$p < 0.05$ *and* **$p < 0.01$

The correlations among the predictor variables (clients' characteristics, mobile money, internet banking, and branchless banking) were weak to moderately strong, ranging from ($r = -0.031$; $p < 0.05$) to ($r = 0.422$; $p < 0.05$). These correlations suggest that the data had no problem with multicollinearity

Secondly, clients' characteristics, mobile money, internet banking, and branchless banking were statistically associated with financial inclusion, ranging from ($r = 0.119$; $p < 0.05$) to ($r = 0.360$; $p < 0.05$). The statistics suggest that the data are reliable if used to run a multiple regression

Source(s): Authors' own work

Table 3. ANOVA[a]

Model		Sum of squares	Df	Mean square	F	Sig.
1	Regression	16.560	3	5.520	16.826	0.000[b]
	Residual	99.728	304	0.328		
	Total	116.288	307			
2	Regression	26.222	4	6.555	22.054	0.000[c]
	Residual	90.066	303	0.297		
	Total	116.288	307			

Note(s): a. Dependent variable: financial inclusion
b. Predictors: (constant), branchless banking, mobile money and Internet banking
c. Predictors: (constant), branchless b, mobile money, Internet banking and client characteristics
Source(s): Authors' own work

Table 4. Hierarchical regression model for financial inclusion

	R	R^2	R^2 change	B	Standard for Error (SE)	Beta	t	p-value
Step 1	0.360	0.129**						
Mobile money				0.188	0.039	0.282	4.782	0.000
Internet banking				0.143	0.060	0.153	2.387	0.018
Branchless banking				0.006	0.053	0.006	0.104	0.917
Step 2	0.466	0.217**	0.087**	1.753	0.262		6.684	0.000
Mobile money				0.143	0.038	0.214	3.722	0.000
Internet banking				0.133	0.057	0.143	2.340	0.020
Branchless banking				0.028	0.051	0.031	0.557	0.578
Client characteristics				0.240	0.042	0.297	5.701	0.000

Note(s): Statistical significance: *$p < 0.05$ *and* **$p < 0.01$
Dependent: Financial inclusion
Source(s): Authors' own work

predictor variables appeared to be statistically significant in explaining variations in FI. Clients' characteristics explain the highest value (Beta = 0.30; $p < 0.05$) compared to MM (Beta = 0.21; $p < 0.05$) and IB (Beta = 0.14; $p < 0.05$). Apparently, BB ($p > 0.05$) does not have a significant contribution in FI.

Discussion

The dominance of MM as the very often used financial service agrees with Finscope (2018), which estimated that around 56% of the population accessing formal FS use MM services. In Uganda, MM takes precedence over other forms of DF because of its convenience and accessibility. Consistently, the findings agree with IMF (2019) and Senyo and Osabutey (2020), who commend the importance of MM in money transfers, debt settlement and micro insurance. In Uganda, the population owning MM accounts outweighs the one owning formal bank accounts, a view that coincides with Rodima-Taylor and Grimes (2019). While MM is cherished by all population categories, it has highly facilitated the inclusion of the unbanked population. The informal sector has joined this network to transfer their finances, reducing the risks and uncertainties associated with money transactions. Besides MM, Internet banks significantly influence FI by narrowing the inequality space. This feeds into Yang *et al.* (2020) and OECD's (2020) revelation about the steady rise in app-based banking and the Internet. While the literature provides numerous examples of app-based banking such as third-party payment, online lending, direct sales of funds, online insurance and banking (Durai & Stella, 2019), there

are several examples in Uganda, which may include cash advance, prepared cards and MOMO MM transfer for MTN. This study has established that BB is the least dominant in influencing FI. BB in Uganda favors the elite class compared to the illiterate, who constitute the majority of Uganda's unbanked population. Besides, branchless banking helps customers to switch from one bank to another without physically presenting themselves in the banking hall (Haider, 2018; Digital Finance Service Indicators, 2019; Feyen *et al.*, 2021). Several studies have documented the significant effects of DF on FI (see, for example, Senou *et al.*, 2019; Lu *et al.*, 2021; AFI, 2018; Sinha & Highet, 2017; Ouma *et al.*, 2017; PSDU, 2018; GSMA, 2018). Specifically, Private Sector Development Uganda (PSDU) and Group special mobile association (GMSA), which focused on Uganda, confirm that the application of DF allows unbanked customers to access FS, thereby reducing financial and social exclusion. The aggregate contribution of MM and IB is strongly supported by Senou *et al.* (2019), who conclude that Internet connectivity usage and mobile phone proliferation have a very significant impact on FI in developing countries. Like in the rest of the world, the penetration of Internet connectivity in the banking sector is highly proliferated by customers' characteristics such as level of education, acquaintance with digital technologies, location and income level, though in rare cases. Income may thwart some people from securing smartphones, which run most of banking apps. The arguments championed in existing literature (Arnold & Gammage, 2019; Achugamonu *et al.*, 2020; Lyons *et al.*, 2020; AFI, 2018) are that for developing countries to meet the target of FI, the barriers to increased use of mobile technology should be broken to bring the rural community on board, which remains relevant.

Conclusion and policy implications

The search for knowledge in the DFS and FI has attracted wide attention among scholars globally. Despite the influence of DFS in enhancing financial inclusivity among the community, empirical studies on the role of BB have been scanty. The study has found a significant contribution of DF service to FI in Lira City, Uganda. MM and smartphones are very often used in performing commercial transactions compared to ATMs, IB and agent banking. The variations in the usage of these financial products can be explained more from the perspective of acquaintance and then convenience and cost. One would also argue from the point of accessibility that the majority of citizens have smartphones rather than bank accounts, and this makes it easier to use a phone than go to the bank. The variations in FI due to MM and IB are significant; however, clients' characteristics are responsible for additional variations in FI. In the context of the unbanked population in Lira City, this study provides evidence that whereas clients' characteristics are not a financial product or a channel of financial transaction, they are essential in promoting FI. From a banking perspective, most bank application developers would argue for the convenience and use friendliness of these applications. However, the quickest and widest adoption of MM by the rural communities of Uganda is mostly a factor of user-friendliness, which seems to be lacking in other bank applications or products. If the current unbanked population is to be financially included, the new application should address the basic financial needs of the unbanked population. From a policy perspective, the government, through the Ministry of Finance, should sponsor the development of cost-free and user-friendly bank applications to attract the unbanked population. The government should also develop policies that would protect the privacy of the users of MM or DFS. Adequate infrastructure that supports the information technology should be enhanced to address the network issues that affect the transaction process or delays in remitting money once the transaction has been done. The findings also confirm the importance of digital infrastructures in the improvement of quality services and enhanced FI.

Research contribution

The DFS practitioners should be cognizant that they should be able to be competitive in the current digital world since the world is now being driven by information and communication

technology. The rise in digital revolution has created new way of doing business among the digital service providers, and for any business dealing in financial service, digitalization of their products is the way to go. The largest gains in competitiveness come from uneven access to information and digital financing would play a cardinal role in making access to finance much easier for economic growth of a country. The study dynamic would provide also some significant revelations on efficacy of DF as catalyst for access to finance. The service providers would benefit from the digital payments since it enabled clients to make secure and easy payments of goods and services at a reduced cost. Digitalization of FS has improved financial literacy and education both to the clients and service providers.

Limitations of the study

In our opinion, the category of respondents was not exhaustive enough for the study; however, we could have adopted a much wider category of respondents to enable a comprehensive analysis that would help us generalize our findings. The study could have also adopted a theory or theoretical framework that would have assessed the effect of DFS on FI. The study was done in Lira City, and generalizing the findings would be a challenge. Therefore, we recommend that future researchers should focus on these challenges and replicate the study in other regions to establish how DFS would affect FI.

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