The Impact of Digital Finance on Household Welfare Outcomes: lessons from Zambia

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Abstract:
Despite the steady rise in the adoption of digital finance in Africa and its impact on economicwell-being in society, there is limited research on what drives its adoption and uptake, especially withregard to emerging economies in Africa. On this premise, based on Fin scope's 2020 cross-sectional dataset, documentation, and key informant interviews, this paper seeks to empirically investigate theimpact of digital finance on the economic well-being of poor households who have limited access totraditional financial services in Zambia. The study uses binary logistic econometric analysis to investigatethe impact of digital finance on household welfare indicators in Zambia. The results reveal that householdsize, age, annual income, gender, national identity card, access to savings, ownership of a phone, holding abank account, region of residence, amount sent using digital finance, the amount received using digitalfinance, and household welfare significantly impacted the use of digital finance. The study used estimatedregression coefficients, standard errors of the coefficients, and the statistical significance of each covariate.The study reveals an exponential transformation of the regression coefficients (odds ratio) and somediagnostic tests on the fit of the regression model. The fit of the final model over the null model wasexamined using the likelihood-ratio test. The study recommends policy formulation in the areas of gender-sensitive interventions, financial inclusion, literacy, and telecommunications infrastructure, supportinginnovative gender-sensitive regulatory technologies, investment in social protection, and povertyalleviation programs.

Keywords: Household Welfare, Digital Finance, Impact, Binary Logistic Model

I. INTRODUCTION:

Financial inclusion is a wide strategy for long-term development that includes remittances, transfers, goodsand service payments, savings, loans, and insurance (Allen et al., 2014). Financial inclusion hashistorically been linked to the use of formal financial system banking services. Inclusion in the financialsystem can be described in a variety of ways. Demirgüç-Kunt and Klapper (2012) stressed the need toprovide affordable financial services to societies' disadvantaged and low-income groups. Connectivity todigital technology, notably mobile phones, internet access, and biometric authentication, allows a widerrange of financial services, such as online and mobile phone banking, as well as digital credit for theunbanked. Digital financial services have the potential to be more convenient and affordable thantraditional banking services, allowing low-income and destitute people in developing nations to save andborrow in the formal financial system, earn a return, and smooth their spending. This has the potential toimprove people's lives and economic outcomes.Digital financial services include mobile banking, internet banking, and mobile money services. Mobilemoney is a type of financial transaction that takes place via a mobile network using a subscriberidentification module (SIM)-enabled device, such as a cellular phone (Donovan, 2012). Unlike mobilebanking, which allows money to move from one place to another via a mobile network provider, mobilemoney allows money to travel from one location to another without the need for a mobile network provider(de Bruijn et al., 2017). Mobile money involves the delivery of a range of financial services using a mobilephone and a mobile network operator.Since the early 2000s, mobile phone use in sub-Saharan African countries has increased dramatically.According to World Bank data, mobile phone subscriptions in sub-Saharan Africa increased at an annualaverage pace of 208 per cent in 2012 (Fanta et al., 2016). Zambia has a high rate of mobile phoneadoption, more than 63 per cent of the adult population possessing one in 2017 Fernandes G, &SridharD.(2017) In 2018, 11.3 million individuals out of a population of 16.4 million owned a mobile phone Thegrowing popularity of mobile phones has paved the way for the proliferation of digital financial servicessuch as mobile money. Mobile money services are now possible thanks to a collaborative effort by mobilephone consumers and mobile network operators (Chikumbi& Siame, 2018). Convenience, timeliness, accessibility, cost, and security have all boosted the appeal of mobile money. According to a Finscopereport (2015), the number of financially integrated people in Zambia increased significantly from 37.3 percent in 2009 to 59.3 percent in 2015 (Bank of Zambia, 2016).More financially disadvantaged familieshave been reached through the use of mobile money services as the number of mobile service providers inZambia has grown (Chikumbi& Siame, 2018). This study focuses mainly on the digital finance-associatedattributes on the demand side and the impact on livelihoods. The study will be essential for the successfulenhancement and implementation of digital finance in Africa. It is hoped that the findings will be useful inbuilding an information base necessary for use when considering how to make and amend policy strategiesaround digital finance..

II. THE OBJECTIVE OF THE STUDY:

The primary objective of the study is to evaluate the impact of digital finance on the economic well-being of poor households who have limited access to traditional financial services.

Specific Objectives:

1. To identify the household welfare factors impacted by digital finance services.
2. To investigate the extent to which these identified household welfare factors are impacted by digitalfinance use
3. To propose appropriate policies for financial inclusion and poverty reduction based on the results of theimpact of digital finance on household welfare.

III. LITERATURE REVIEW:

Indicators of Household Welfare and Poverty (Concept, Causes and Measurement):

According to Ajakaiye and Adeyqe (2001), the origins of the theory of poverty may be found in the codification of the poor laws in medieval England and the groundbreaking empirical research conducted by Booth and Rowntree at the turn of the twentieth century. The primary focus of the poverty discussion in the 1960s was on income levels, which were represented in broad economic measures such the gross national product per person. The focus on relative deprivation emerged in the 1970s as a result of Runciman and Townsend's work in the UK which helped redefine poverty as the inability to satisfy minimal nutritional or other criteria. The idea of poverty was later expanded to include not just a lack of resources but also a failure to meet social expectations (Ajakaiye&Adeyqe, 2001). The term "basic needs" was created as a result of the International Labour Organization groundbreaking work in the 1970s. Amartya Sen popularized the idea of the right to food, and the United Nations Development Programme created the concept of "human development", referring to the denial of possibilities and opportunities to live in dignity (Ajakaiye&Adeyqe, 2001). Nutrition, housing, water, healthcare, access to productive resources including education, labour skills, and tools, and political and civic rights to participate in choices affecting socioeconomic situations are examples of basic goods (Streeten&Burki, 1978). Poor access to financial and agricultural resources (productive resources) causes extreme poverty, unemployment, undernourishment, and other problems.

Many hypotheses have been put forward to explain the mechanics of poverty. According to the vicious cycle hypothesis, based on traditional Western conceptions of reality, a person's income must increase sufficiently to free them from the poverty trap before they may escape their current state of poverty (Blackwood & Lynch, 1994). According to Streeten (1990), income-based measures of poverty are inadequate because they do not take into consideration differences in family factors (i.e., size of the household, children-adult distribution, etc.). In these respects, income per adult equivalent may be thought of as the perfect indicator, but the availability of data restricts its application. The income fractile metric also has the flaw of ignoring both the direction of interfacial mobility and the length of time spent in each fractile. Additionally, income flow is less stable than consumption flow. Furthermore, it is critical to distinguish between poverty that lasts a lifetime and adversity that is just brief. Despite the fact that some inequality issues have negative effects on poverty, it is advised against overstretching the absolute/relative debate around the definition of poverty. Measures of poverty based on income fractiles are insufficient. Contrary to expectations, increasing income may result in absolute poverty by altering either the commodity space or the capacity space. It is recommended that life expectancy be used as an integrative term rather than institutional monitoring for the Physical Quality of Life Index, which is at best a measure of life's quantity rather than its quality. With the issue of data limitations in mind, a set of monitoring indicators are proposed. While considering the perspectives of both donors and receivers, the institution’s needs of monitoring are examined and several alternative institutional procedures are suggested (Streeten, 1990).

State of Financial Inclusion in Zambia:

In Zambia, the majority of adult residents have had difficulty gaining access to financial goods and services. According to Finscope Zambia (2009), 63 percent of Zambian people lack access to any type of official or informal financial product to manage their financial affairs. Despite the small number of people who have access to financial products and services, flaws can still be found, such as banks' restricted reach and the wide difference in interest rates on deposits and loans. Because there is a lack of access to financial services, the Bank of Zambia has made financial inclusion one of its strategic goals to guarantee that there is increased access for all . From 21.3 percent in 2005 to 40.2 percent in 2016. Financial inclusion in Zambia has nearly doubled. The Zambian Financial Sector Development Plan, which was completed in 2015, was instrumental in this achievement. Yet Zambia does less well than other nations with lower-middle incomes in terms of account ownership, ease of access to bank branches, and use of financial services. The most often mentioned obstacles are a lack of cash, expensive fees, lengthy travel, and a lack of faith in the financial industry. Zambia is dedicated to adopting comprehensive national plans for financial inclusion and financial education in order to further its goal of achieving universal access.Using information from the 2005, 2009 and 2015 FinScope surveys, the researcher used quantitative techniques in the form of descriptive statistics. MS Excel was used to analyse the data, and as a result, tables and graphs were produced. The key findings of Finscope (2019) reveal that informal financial services, which are normally not the major target of policy action, make up a sizeable portion 59 per cent of the data. Furthermore, 62 per cent of Zambians are still not able to use the official banking system, and this percentage is significantly higher in rural regions. Disparities in terms of gender, age, and service types are also mentioned and examined. We offer specific suggestions to direct future policy evaluation and development.In Zambia, banking is mostly centred on the metropolitan areas with a high level of commerce. Currently, the provinces of Lusaka and Copperbelt are home to more than 60 per cent of all commercial bank branches. Altogether, the nation is home to 322 service centres and 19 commercial banks. The bank in Zambia with the greatest number of branches serving rural regions is NATSAVE Bank, which is controlled by the government. The bank was established in order to "provide financial services to all sections of the country, especially the rural areas" (NATSAVE is present across the majority of Zambia's rural areas, but most commercial banks are concentrated in the country's primarily metropolitan areas, making for relatively limited access to banking services among the country's adult population. Out of the 14 million Zambians, just 13.9 per cent of the adult population

used banking services in 2009, according to FinScope Zambia. These banking services included bank credit, transactional banking, and savings accounts or other savings products. Lusaka and Copperbelt, two metropolitan provinces, accounted for 60.4 per cent of all banking clients in the nation, whereas in the remaining provinces, containing 67.6 per cent of Zambia's population, just 39.6 per cent of people banked. There have been shown to be several underlying causes of Zambia's low levels of financial inclusion.

Factors Influencing Households' Access to Digital Finance:

The demands of persons with limited access to financial services can be better met by combining digital finance with financial inclusion. Factors and methods of the growth of digital financial inclusion in urban and rural regions were compared by Liu and colleagues (2021). The sample included 1,607 Chinese counties from 2014 to 2019; the study utilized the panel threshold method and fixed-effect model (Ye, et al., 2021). The researchers' findings show that, firstly, the industrial economy and government involvement are common factors influencing the growth of digital financial inclusion in urban and rural areas, though to varying degrees. However, secondary schooling only affects those in rural regions. The drivers of digital financial inclusion are mediated by industrial upgrading and indirect finance, although indirect finance is only relevant for metropolitan regions (Liu et al., 2021). Finally, the link between financial development and digital financial inclusion exhibits a threshold effect. The factors that affect urban and rural digital financial inclusion fluctuate depending on the level of financial development. These results are anticipated to improve access to financial services in urban and rural regions for more inclusive and sustainable futures, in line with the growth of digital financial inclusion under the trend of supporting creative digital finance in China (Liu et al., 2021).Liu et al., (2021) suggested that active online social connection among rural families encourages engagement in digital finance, which also broadens and deepens the use of digital finance. Traditional offline social connection, meanwhile, has a minor role. Online social connection affects involvement in digital finance through contextual interaction. Furthermore, in endogenous relationships, social norms, common topics of interest, and word of mouth are unimportant. Additionally, online social connection plays a complementary role to offline social interaction in fostering engagement in digital finance According to Anane and Nie (2022), access to digital financial services is influenced by six primary determinants. Firstly, adoption intention and its relationship with perceived risk are significantly influenced by effort expectation (EE), highlighting the special roles that risk and EE play in the adoption process. The use of ICT has been positively influenced by EE, according to empirical research by Gupta et al. (2008) that examined ICT adoption behavior in a government agency in a developing nation. The adoption of digital financial services is significantly influenced by EE.The second important variable influencing consumers' desire to embrace mobile banking technology is awareness. According to research, women's participation in table banking groups will significantly increase their knowledge of and enthusiasm for mobile payment services. The third influencing factor is enabling circumstances or facilitating circumstances (FC). The term "facilitating circumstances" in this context refers to the digital financial services providers' readiness to make infrastructural and technology resources available to digital financial services consumers. According to Karakostas et al. (2005), the current technical infrastructure is seen as a source of competitive advantage since it enables businesses to find and use customer information while developing successful and long-term one-to-one relationships. Research makes the case that electronic business applications like online banking and mobile banking will become more viable as underlying digital infrastructures become more open and accessible (Gerrard & Cunningham, 2003; Tan & Teo, 2000). Consequently, digital financial services are more likely to be accessed by internet consumers.The fourth factor is transaction costs. Finance has benefited from digital innovation in several ways, including increased system connection, lower transaction costs, and the emergence of new business models. Financial inclusion may be increased, and digital financial services can become more accessible with lower transaction costs. Electronic payments have brought services closer to customers, encouraging them to improve banking performance. Consumers' propensity to use financial services and digital technology extends beyond whether they are more affordable or appealing; instead, customers take security and privacy issues into account. Lack of confidence and dissatisfaction are the main reasons for consumers to switch financial institutions (Jüngerr&Mietzner, 2020; Maier, 2016). Lack of disclosure on the effective application of security controls on servers and mobile devices reduces customers' confidence and makes them less willing to embrace financial technology. Finally, internet banking has advanced quickly, yet underdeveloped nations are still unwilling to use this technology. Individuals with strong self-efficacy think that using digital payments is easy and user-friendly. These ideas either directly or indirectly influence how consumers use digital financial services technologies.

Development of Digital Finance in Zambia:

In 2015, just percent of adult Zambians had an active digital financial account (UNCDF, 2019). Despite having seen one of the continent's earliest launches of mobile money services, the industry was stagnating. It was said that mobile money was caught in what was referred to as the "sub-scale trap", meaning that Zambia's market was too small and its population too scattered to be a mobile money success story. The Zambian digital banking ecosystem underwent substantial transformation in 2019, however, expanding quickly and exceeding the expectations of both domestic and international audiences.Ndimbwa and Qutieshat (2022) assert that the Bank of Zambia has played a significant role in the advancement of digital financial services. A significant advancement was the National Payment Systems Directives on Electronic Money Issuance, which were released in 2015 and amended in 2018 (Bank of Zambia, 2016). With the help of a distributor or agent, non-commercial banks are now able to offer e-money services including issuing, distributing, and redeeming money. Additionally, these regulations make it simpler for e-money accounts to comply with know-your-customer regulations (World Bank, 2014. The enabling environment for the spread of digital financial services would unquestionably be strengthened by the completion of the national payment switch (NPS). The Bank of Zambia-managed Zambia Electronic Clearing House (ZECH), which manages the NPS project, has reached a significant milestone. ZECH reached a significant milestone in June 2019 when all domestic ATM transactions became interoperable.

In Zambia, the development of digital financial services is being hampered by a number of problems. Inadequate mobile and internet access, lack of a digital identity, and insufficient digital skills are all topics covered in this study. Additionally, the five areas stated below must be improved for Zambia to fully benefit from the promise of digital financial services. Expansion of the mobile money market, the creation of new services, and the supply of adoption incentives are all being hampered by the absence of complete interoperability. However, off-net transactions are possible. Users cannot make direct payments to the mobile wallets of other mobile network providers. Agents provide mobile money services as one of various business lines in several nations where mobile money is booming. Zambia's digital finance industry has undergone a transformation and is prepared for the upcoming wave of innovative, inclusive digital finance solutions (UNCDF, 2019).

The role of digital finance in development and poverty alleviation:

Although providing access to the poor continues to be a significant problem for financial institutions, access to finance is frequently highlighted as a crucial component of sustained poverty reduction. Therefore, there is a lot of confidence in digital financial inclusion's ability to transform. However, there is little research on the link between digital financial inclusion and poverty. Using survey data from 1,900 rural households, Ye, Y., et al. (2022). sought to understand how farmers' susceptibility to poverty in China is affected by digital financial inclusion. The asset-based vulnerability model is used by the researchers to quantify vulnerability to poverty, which they define as the possibility of poverty in the future. According to their study, 35.63 percent of farmers use digital banking services. According to their estimates, farmers' use of digital financial services helps reduce their vulnerability. Wang and He (2020) also discovered that these impacts mostly depend on farmers' capacity to manage risk, or, more specifically, on reducing their susceptibility brought on by risk. Further research demonstrates that, compared to traditional banks, ICT businesses' digital financial services have a greater influence on farmers' vulnerability. For other developing nations where financial exclusion is a serious concern, the lessons learnt from China's digital financial inclusion are invaluable (Wang & He, 2020).The influence of fintech on eradicating poverty in Chinese areas is examined by Ye et al. (2022). To represent the technical innovation of finance, the researchers first collect data using word frequency analysis and web crawler technology, only then developing a Fintech index for each province. The empirical results show that fintech significantly reduces poverty, notwithstanding variations in the growth of the fintech index among provincial regions. The advancement of financial technology benefits efforts to reduce poverty in a variety of ways (Mushtaq & Bruneau, 2019). Fintech and poverty reduction have become highly attractive partners through financial inclusion. Because it can reach financially disadvantaged communities, fintech has sped up the growth of financial inclusion (Muneeza et al., 2018). Fintech is advantageous to the growth of inclusive finance since it can provide consumers with affordable, practical, and secure financial services.

Low-Income Population and Household Digital Finance Accessibility:

According to Fernando (2017), there has not been a dearth of demand at the low end of the market to explain the unequal expansion of financial services in emerging nations. Indeed, households with low incomes desire access to financial services. Fernando (2007) cites supply-side explanations for access issues, stating that, firstly, conventional financial institutions have not yet entered the low end of the market; secondly, the high (transaction) costs are incompatible with the needs of potential low-end clients; thirdly, the low end of the market is not yet well-served by the products; and fourthly, the low end of the market is not yet well-served by the providers (Fernando, 2007). In most emerging economies, just a small portion of the population—often no more than 20 to 30 per cent—is served by the financial sector. Most families lack access to basic financial services, and low-income households in rural regions especially lack such access.. They ought to enhance their financial infrastructure and pursue more lenient policies towards international investment.Digital financial inclusion typically refers to underprivileged and excluded people having digital access to and usage of formal financial services (Lauer & Lyman, 2015). Due to the popularity of M-PESA, a payment technology breakthrough that was launched in Kenya in 2007 (Beck et al., 2014) the phrase "digital financial inclusion" started to gain notice. Mobile money is mostly used for online transactions in Kenya (Hove &Dubus, 2019). There is evidence for both positive (Beck et al., 2018) and negative (Suri & Jack, 2016) associations between this payment method and economic activity in a number of recent studies. However, digital financial inclusion in China goes beyond a payment method. It is acknowledged as a new financial format that consists of three fundamental businesses: digital payments, finance, and investments made online.

Impact of Digital Finance on Financial Inclusion:

For the poor and financially excluded, digital finance such as mobile money services has been shown to be critical for inclusive finance and poverty reduction. This is due to the fact that mobile network service providers have been shown to be reliable (Donovan, 2012). However, they cannot do it on their own; they need to cooperate with agents and customers. Mobile Network Operators s employ agents to communicate with the product's end consumers. This is a crucial aspect of their business plan. A licensed dealer who provides consumers with mobile money services is known as an agent. Agents profit from a large subscriber base, a strong technology infrastructure, airtime distribution channels, and strong brand loyalty, to name a few (Ngambi, 2016). Customers' cash is turned into electronically stored value, which is then re-converted as needed (Chikumbi& Siame, 2018). The agents profit from increased commission, cost savings, accessibility, the privacy of users' information and transactions, appropriateness, and convenience (Donovan, 2012) The benefits that agents and clients receive have an impact on the effectiveness of mobile money services. Consumers have access to bill payments, money transfers (both sending and receiving), airtime purchase, cash-out points, value storage (storing money), and money transfers from a bank account (Fanta et al., 2016).

IV. THEORETICAL FRAMEWORK:

Levine (2005) argued that economic growth helps to eliminate poverty over time and may be predicted to improve the welfare of most households. Finance indirectly alleviates poverty by promoting economic growth. Financial development disproportionately raises the income growth of the lowest income quintile and decreases the fraction of persons living on less than a dollar per day, according to econometric data (Beck et al., 2006; Honohan, 2004). According to Demirgüç-Kunt, Asli and Klapper, Leora F.(2012) human capital is fundamentally distinct from the physical type, implying that measuring the simultaneous accumulation of these components in a dynamic model of development and inequality has conceptual advantages. Human capital is defined as being embodied in persons, and investment in human capital is expected to be characterized by declining marginal returns at the individual level. Because all people have the same natural skills, the economy-wide return on investment in human capital is maximized by spreading the investment evenly among all people (Kunt& Levine, 2009). Diminishing returns to physical capital do not materialize at the level of individual capital ownership, according to Kunt and Levine (2009), since physical capital is not embodied in persons. Human capital is a different story. As a result, distributing capital ownership among multiple persons does not always optimize economy-wide returns on investment in physical capital (Kunt& Levine, 2009). Galor&Moav (2004), on the other hand, show that the linkages between finance, inequality, and growth alter with time. The researchers make two crucial assumptions. The first is that as income rises, so does the marginal inclination to save. The second is that throughout the early phases of economic growth, the rate of return on physical capital accumulation is larger than that on human capital, before reversing in later stages of development (Kunt& Levine, 2009). As a result, inequality attempts to encourage growth by allocating resources to those who have a greater marginal propensity to save during the early phases of development. Financial development that enhances gross domestic product (GDP) will tend to exacerbate inequality at this early stage (Kunt& Levine, 2009). As economic development progresses dispersed human capital becomes increasingly important for future growth.

V. CONCEPTUAL FRAMEWORK:

An examination of the available literature on branchless banking/digital finance and the adoption of its technology has led to the development of the conceptual framework displayed in Figure 1. This has been adapted from Coetzee (2010), who argued that understanding key conditions on both the supply and demand sides, such as institutional factors, economic factors, commercial viability, a favorable regulatory environment, and technology adoption, is necessary to effectively comprehend drivers of financial product uptake. The suggested study's conceptual framework of drivers that are expected to impact the acceptance of digital finance is shown in Figure 1. The goal of the research is to ascertain the impact of digital finance on the household welfare of low-income populations. As shown in Figure 1, this study assumes that socioeconomic, environmental, institutional, legal/regulatory, financial, economic, and geographical risk, financial illiteracy, and business viability factors all influence the individual drivers as to the take-up of digital finance. It is expected that the use of digital finance technology will enhance access to financial services that are affordable and easily accessible, and thereby have a lasting impact that supports economic growth and the development of a stronger financial market that will be inclusive and accessible to all limit their economic prospects (Kunt& Levine, 2009). At this later stage, inequality hurts growth because, for the same average income per capita in the economy, greater inequality implies that fewer people can afford education, thereby slowing growth. Financial imperfections exert a particularly pernicious effect on inequality at higher levels of development as human capital becomes increasingly important (Kunt& Levine, 2009).

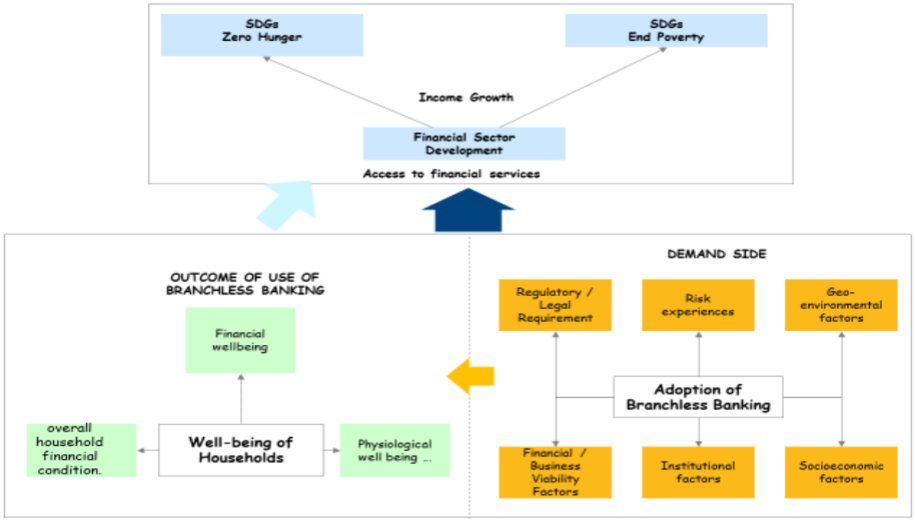

Figure 1. Conceptual Framework

Methodology:

An interpretative research technique was used to investigate how digital finance contributes to well-being. Interpretive research emphasizes the social construction of knowledge, which makes it subjective (Walsham, 2006). Interpretive studies seek to comprehend events from the perspective of those who are directly involved in them (Myers, 1999). This study benefits from interpretive research since it enables a more in-depth examination of the meanings that digital finance users place on the service, as well as its influence on well-being and human development. To effectively achieve the research objective set out in this paper, the research undertook an empirical study to gather evidence countrywide in Zambia, using Finscope data accessed from the

Zambia Statistical Agency. Furthermore to ensure we had consistency the qualitative exploratory research strategy was used for key informants, restricted and localized in Lusaka. To ensure triangulation, the study used a quantitative research design using the Finscope data set .Semi-structured interviews were used to acquire primary qualitative data from key informants, while the bulk of the study relied on the Finscope dataset as secondary data.

Analytical Techniques:

To effectively address the first two objectives of this study, binary logistic regression was applied as described below. The empirical estimation model employed to explore the correlation of the use of digital finance services and household welfare outcomes was based on the logistic model specified below.

Logit (p)= log (p/ $(1-p)$) = $PROB\ \{yi = 1\} = \phi\ [\alpha + \beta 1\text{DF use}i + \beta 2\ Xi + \varepsilon i\ ]$ (1)

The above equation is transposed in terms of probabilities as shown below:

$PROB\ \{yi = 1\} = \phi\ [\alpha + \beta 1\text{DFUse}i + \beta 2Xi + \varepsilon i\ ]$ (2)

where

- yi is the dependent variable denoting the g individual impact of digital finance
- ϕ denotes the logistic distribution's cumulative distribution function
- DF_$usei$ is the independent variable denoting the use of digital finance
- Xi are additional control variables: household size, age, annual income, gender, national identity card, access to savings, ownership of phone, holding a bank account, region of residence; amount sent using digital finance e, and the amount received using digital finance.
- εij is the standard error for individual

Below are the study variables

Table 1. Study variables used in the econometric models

Variable name	Variable definition
	Dependent variables
Digital finance adoption (Mobile money user)	1 if an individual adopts digital finance (mobile phone-based money) services, 0 otherwise
	Outcome variables
Independent variables	
Years	Age of the household head
Income	Income from digital finance activities
Area (type of area)	Dummy: 1 = urban, 0 = rural (-,+)
Gender (gender of household head)	Dummy: 1 = male, 0 = female (+,-)
Income (monthly income)	Amount in kwacha (+)
Access to savings	Access or not: 1 = yes, 0 = otherwise (+)
Owner of bank account	Have or have not dummy: 1 = yes; 0 = no (+)
Legal/regulator	Have national ID or not: 1 = yes; 0 = no (+)
Ownership of phone	Have or not dummy: 1 = yes; 0 = no (+)

Empirical Research:

Household Socio-Economic and Demographic Characteristics:

Demographic and socioeconomic characteristics of the respondents, such as age, gender, level of education, Poverty Probability Index (PPI), annual income and household size were analysed using descriptive statistics.

Gender:

The table 2 below shows that 50 per cent were female respondents; 41.94 per cent were digital finance users and 8.06 per cent were not. A total of 50.14 per cent were male respondents, 41.22 per cent using digital finance services and 8.92 per cent not. This implies that there is a significant difference between the gender of the household head at 1 per cent. It is important to note that due to our traditional Zambia cultural set up, men tend to own more assets than their female counterparts, meaning that access to, or the impact of, digital finance is expected to be less among women. That said, it is important to note that digital finance use has a greater impact on the male-headed household than the female due to the socioeconomic dynamic between the two genders.

Age:

The results indicate that the difference between individuals with access to digital services and those without with regard to age was statistically significant at a 1 per cent significance level. This indicates that people who use digital financial services tend to be older than those who do not. This means that over time, households headed by older persons tend to be more actively engaged in economics than their younger counterparts without any means of production.

Table 2. Characteristics of the sample households by age

		Mean age	Chi-squared	Df	Pearson's R
Digital finance user	Yes	38	1891410.0*	77	-0.43***
	No	31			

***, ** and * represent 1%, 5% and 10% level of significance, respectively.

Poverty Probability Index (PPI)

Table 3. Characteristics of the sample households by Poverty Probability Index (PPI)

		Poverty					Chi-squared	df	Pearson's R
		PPI1	PPI2	PPI3	PPI4	PPI5			
Digital finance user	Yes	7.93	21.11	24.86	26.08	3.05	319200*	4	-0.237***
	No	4.00	6.46	3.66	2.42	1.03			

***, ** and * represent 1%, 5% and 10% level of significance, respectively.

The Poverty Probability Index (PPI) can be defined as a poverty measurement, PPI1 and PPI2 being linked with low income and low financial inclusion, while PPI3, PPI4 and PPI5 are associated with high income and inclusion It is clear that higher PPI translates into a greater likelihood of being impacted by digital finance services, statistically significant at 99% significance level.

Table 4. Binarylogit regression results

Variable	Coefficient	*SE*	*Wald*	*P > |Z|*	*Exp (B)*
Household size	-0.75	.05	2211.902	<.001	0.927
Age	0.32	0.0	0.015	<.001	1.032
Annual Income	0.07	0.0	4676.791	<.001	0.993
Gender	-1.63	.025	4129.175	<.001	0.197
National Identity card	-1.18	0.037	1032.049	<.001	0.306
Access to Savings	-1.18	0.37	1032.049	<.001	3.030
ownership ofPhone	0.44	0.025	310.614	<.001	1.545
Holds a Bank account	0.96	0.05	442.463	<.001	2.599
Region of Residence	-2.58		2211.902	<0.01	0.076
Amount sent using Digital Finance	0.18	0.05	1512.2857	<.001	1.999
Amount received using Digital finance	-0.00	0.00	345.661	<.001	0.999
Constant	1.48	0.12	146.612	<.001	4.403

***, ** and * represent 1%, 5% and 10% level of significance, respectively.

The results of the specified logistic regression model, with multiple categorical independent variables, are presented in Table 4. The table shows the estimated regression coefficients, the standard errors of the coefficients, and the statistical significance of each covariate. It also shows an exponential transformation of the regression coefficients (odds ratio) and some diagnostic tests on the fit of the regression model. The fit of the final model over the null model was examined using the likelihood ratio test. The final fitted logit model significantly improves upon the null model. The results of the binary logit model above show household size, age, annual income, gender, national identity card, access to savings, ownership of phone, holding a bank account, region of

residence, amount sent using digital finance, amount received using digital finance, and household welfare are all significantly impacted by the use of digital finance. This answers the first objective of the study, which was to identify the household welfare factors impacted by digital finance services. The significant variables in the equation are household size, age, annual income, gender, national identity card, access to savings, ownership of phone, holding a bank account, region of residence, amount sent using digital finance, and amount received using digital finance.

Table 4 shows the results of the binary logistic regression coefficients of household welfare factors impacted by digital finance services in Zambia. A positive sign on the variable's coefficient indicates that higher values of the variable reduce the likelihood of household welfare factors being impacted by digital finance services, and vice versa. The results show that age, annual income, ownership of phone, holding a bank account, amount received, and amount sent were all positive; however, gender, national identity card, access to savings, region of residence, and amount sent using digital finance all had a significant negative effect in terms of household welfare factors impacted by digital finance services.

The results of the econometric analysis are presented table 4 to address the second objective, which was to investigate the extent to which the identified household welfare factors are impacted by digital finance use. In the full model, the following independent variables such as age, annual income, ownership of the phone, holding a bank account, amount received, and amount sent have a lower impact factor. Where as Gender, national identity card, access to savings, and region of residence, with p values of less than 0.05, are deemed to contribute significantly to the predictive ability of the model.

Therefore all 11 variables are significant, having with p = .000, and all have an effect on the probability of being impacted by digital finance. In computing, the probability of cases falling into a specific category and the β values for age, annual income, ownership of phone, holding a bank account, and amount sent using digital finance are significant and positive, indicating that increasing the influence will increase the odds of impact by digital finance where as for phone ownership, holding a bank account, amount received variables for β coefficient reduced the odds of impact by digital finance.However, gender, national identity card, access to savings, region of residence, amount sent using digital finance are significant and negative, indicating that decreasing their influence will decrease the odds of impact by digital finance use to some extent.

Moving to the Exp (β) (odd ratio) values in Table 4, it is important to note that each of the independent variables shows an increase (decrease) if the ratio is greater (less) than one. From the Exp (β) values above, only age, access to savings, ownership of the phone, holding a bank account, and amount sent using digital finance are clearly greater than one, indicating that they have higher odds for predictors independent variables for the outcome variable impact of digital finance use. The Exp (β) values for access to savings (3.03) and holding a bank account (-2.59) show greater odds of predicting the impact of digital finance than other predictors, while gender and region have a weak relationship with the outcome variable impact of digital finance use.

Table 5. Model summary

	Model Summary		
Step	-2 2log likelihood	Cox & Snell squared	Nagelkerke R squared
1	511779.952	0.260	0.43

NORMALITY:

In terms of the normality test, results indicate that residuals were normally distributed at a significance of 1 per cent. The calculated Jarque-Bera (JB) coefficient was 2.9, which is less than 5.99. Therefore JB = 2.9 < 5.99 and the *p*-value of the JB statistic = 0.4535 > 0.05, and the null hypothesis was not rejected. Hence, we can conclude that residuals are normally distributed.

Table 6. Omnibus tests of model

		Chi-squared	df	sig
Step 1	Step	23,859.290	11	<.001
	Block	23,859.290	11	<.001
	Model	23,859.290	11	<.001

Table 7 Multicollinearity Test

Variable	Variance inflation factor (VIF)
Age	1.223
Annual income	1.611
Household size	1.611
Amount sent	1.324
Amount received	1.452
Mean	1.442

Source: Finscope (2020)

In terms of the variance inflation factor (VIF), the larger the VIF value, the more collinear the variable *X*i is. As a rule of thumb, if the VIF of a variable exceeds 10, there is a multicollinearity problem. From the VIF values displayed above, we can conclude that none of the continuous explanatory variables considered had any significant multicollinearity problem as the VIF mean value is 1.44.

Table 8. Contingency coefficients for dummy variables

Variables	Gender	Access to savings	Bank ownership	National identity card	Phone ownership	Region
Gender	1	-.044	-.227	.047	-.062	0.36
Access to savings		1	-.037	-.229	-.161	-.201
Bank ownership			1	-.105	-.115	-0.14
National identity card				1	.189	.049
Phone ownership					1	.017
Region						1

Source: Finscope data (2020)

HETEROSCEDASTICITY TEST:

Econometric experts such as Gujarati (2003) state that one key of the fundamental assumptions in regression analysis is that the errors *(ui)* have a (constant) variance *σ2*. Therefore, if errors have no constant variance, then heteroscedasticity exists. It is important to note that when a model has the presence of heteroscedasticity, the estimated parameters of a regression leading to it being inefficient though consistent. In our case, the binary dependent variable models, such as the logistic model, require that such a check is done, especially since the data are from sectional FinScope data. To ensure that the model is robust, all variables were checked using a robust standard error test. The results indicate a serious heteroscedasticity problem in the model as such variables were retained in the analysis.

LIMITATIONS:

The primary limitation of the study is its use of FinScope's 2020 secondary data, as it depends solely on information provided by the respondents. The quality of the final product is heavily dependent on the data collected, though the research applied scientific approaches to address any bias.

IMPLICATIONS:

The implications of the research findings, as highlighted above, are that age, annual income, ownership of the phone, holding a bank account, amount received, and amount sent are household welfare factors positively impact by digital finance . However, gender, national identity card, access to savings, region of residence, and amount sent using digital finance all had a significant negative effect in terms of household welfare factors impacted by digital finance services. However, for a deeper understanding of digital finance in the supply-side environment in terms of digital finance impact on household welfare factors .It is important that in depth study should be conducted as illustrated in the framework in Figure 1 above. All stakeholders should collaborate to ensure that the target of a digital economy by 2030 is actualized through promoting development of the policies, environmental enablers, and appropriate social behavior change through enhanced financial literacy.

FUTURE RESEARCH:

It is important to note that the development of interventions going forward should be accompanied by evidence-based research in the area of access to digital finance for ease of adoption and acceptance by users

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